LINDA CROCKETT LINGLE
Mayor

DAVID W. BLANE
Director

LISA M. NUYEN
Deputy Director

COUNTY OF MAUI
DEPARTMENT OF PLANNING
250 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

November 24, 1997

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OFC. OF ENVIRON. QUALITY CONTROL

VIA FACSIMILE: 586-4186

Mr. Gary Gill, Director
Office of Environmental Quality Control
State Office Tower, Room 702
235 South Beretania Street
Honolulu, Hawaii 96813-2437

Dear Mr. Gill:

RE: Final Environmental Impact Statement (EIS) for Maui Electric Company, Ltd., Waena Power Generation Station at TMK 3-8-003:001, Pulehu, Island of Maui, Hawaii (EIS 970001)

The Maui Planning Department has reviewed the Final Environmental Impact Statement for the above-referenced matter and hereby accepts the final document which was transmitted to your office on November 7, 1997 for publication in the Office of Environmental Quality Control (OEQC) Bulletin.

If you have any questions, please contact Ms. Colleen Suyama, Staff Planner, of this office at 243-7735.

Very truly yours,

Lisa M. Nuyen
for DAVID W. BLANE
Director of Planning

DWB:CMS:jso
c: Lisa M. Nuyen, Deputy Director of Planning
Clayton Yoshida, AICP, Planning Program Administrator
Colleen Suyama, Planner
Mark Willey, CH2M Hill
Ed Reinhardt, Maui Electric Company, Ltd.
Project File
General File

1997 FEIS MAUI
WAENA POWER GENERATING STATION

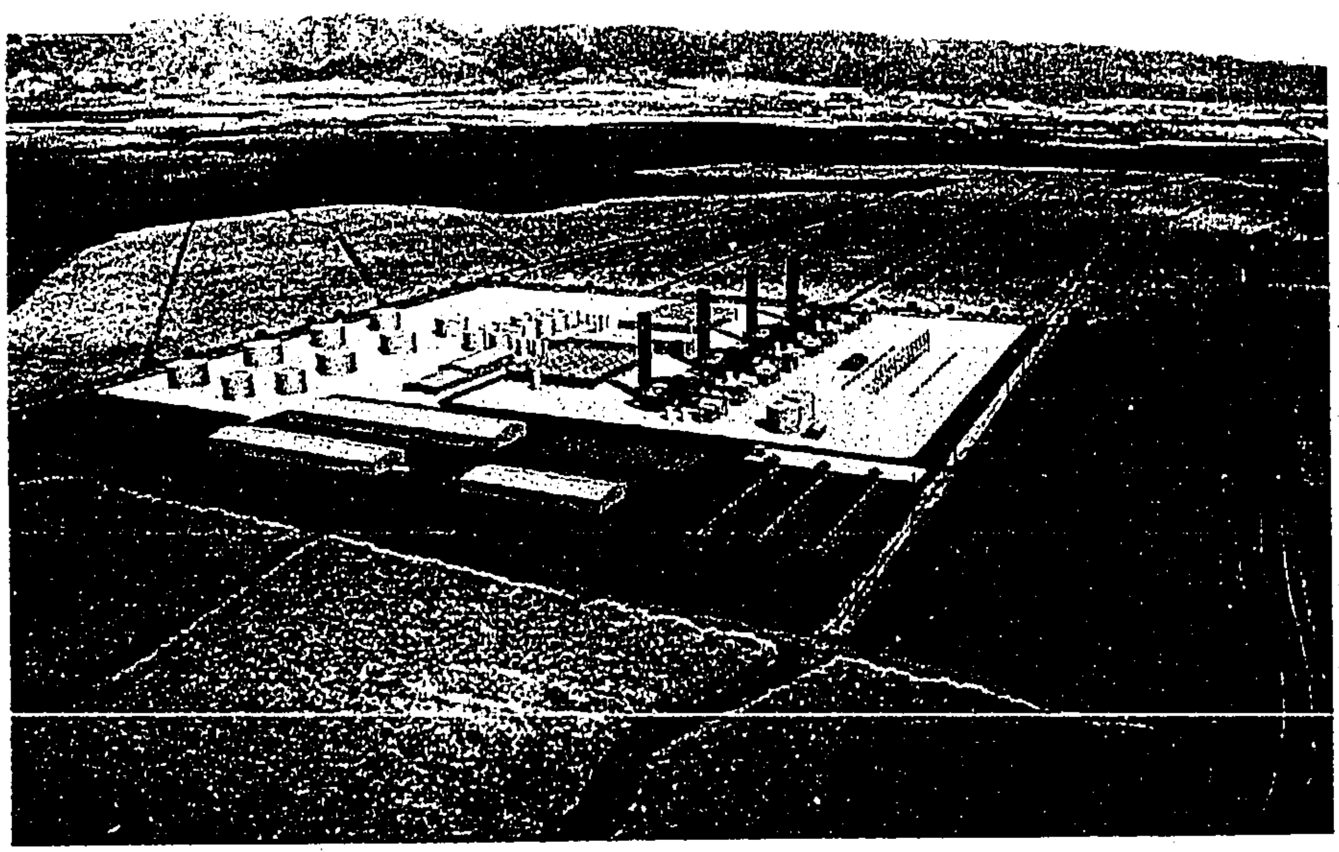
FINAL ENVIRONMENTAL IMPACT STATEMENT

FILE COPY

MAUI ELECTRIC COMPANY, LIMITED'S

WAENA GENERATING STATION

WAILUKU AND MAKAWAO DISTRICTS – ISLAND OF MAUI



MAUI ELECTRIC COMPANY, LIMITED

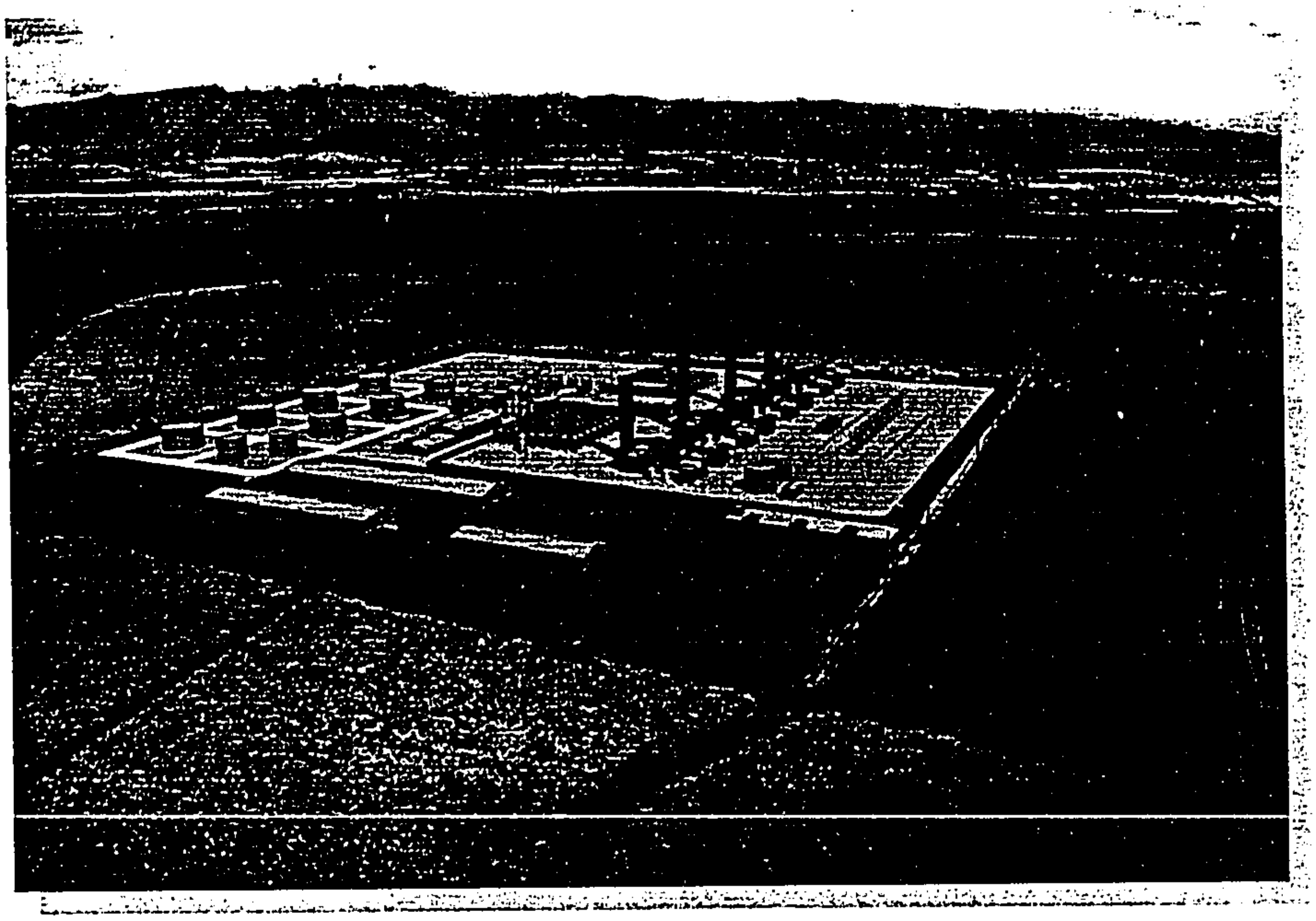
NOVEMBER 1997

FINAL ENVIRONMENTAL IMPACT STATEMENT

MAUI ELECTRIC COMPANY, LIMITED'S

WAENA GENERATING STATION

WAILUKU AND MAKAWAO DISTRICTS - ISLAND OF MAUI



MAUI ELECTRIC COMPANY, LIMITED

NOVEMBER 1997

Final
Environmental Impact Statement
Maui Electric Company, Limited's
Waena Generating Station
Wailuku and Makawao Districts - Island of Maui

Submitted by:

Maui Electric Company, Limited
PO Box 398
Kahului, Hawaii 96733-6898

William A. Bonnet, President

Document Prepared by:

CH2M HILL, INC.
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814
Mark R. Willey, Project Manager

Accepting Agency:

Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793
Mr. David Blane, Director

November 1997

This Final Environmental Impact Statement and all ancillary documents were prepared under the direction of the signatory and the information submitted, to the best of the signatory's knowledge, fully addresses the document content requirements as set forth in Hawaii Administrative Rules Title 11, Chapter 200-17 and 11-200-18 as appropriate.

Executive Summary

Summary of Project Data

Applicant:	Maui Electric Company, Limited Mr. William A. Bonnet, President PO Box 398 Kahului, Maui, Hawaii 96733-6898
EIS Accepting Authority:	Maui County Department of Planning Mr. David Blane, Planning Director 250 South High Street Wailuku, Maui, Hawaii 96793
EIS Approving Agency:	Mayor, County of Maui
Agent for Applicant:	CH2M HILL, INC. Mr. Mark R. Willey, Project Manager 1585 Kapiolani Blvd., Suite 1420 Honolulu, Hawaii, 96814
Project Parcel:	TMK 3-8-03:23, and 3-8-03:24
Parcel Size:	65.7 acres
Parcel Ownership:	Fee-simple, Maui Electric Company, Limited
Surrounding Landowners:	County of Maui Alexander & Baldwin - Hawaii
State Land Use Designation:	Agricultural
County Community Plan Designation:	Agricultural
County Zoning Designation:	Interim

Summary of Project Description

Maui Electric Company, Limited (MECO) proposes to design, construct, and operate a 232-megawatt (MW) electrical generating station on 65.7 acres of land located along Pulehu and Waiko Roads in central Maui. Related 69-kilovolt (kV) transmission lines from the site to substations at the Paia Sugar Mill and Puunene Sugar Mill are also proposed as a part of this project. Distribution lines (12 kV) may also lead to the proposed generating station to Puunene. In addition, MECO may relocate its existing transmission and distribution base yard from its location in Kahului to the new facility. Usable portions of the site may be available for future plant expansion or be made available on an interim or long-term basis for energy-related activities until needed by MECO.

The facility is planned for 232-MW of power generation capacity to be constructed in four phases. The initial phase of the plan will develop a 58-MW generating capacity, consisting of two 20-MW combustion turbines (CTs), two heat-recovery steam generators (HRSGs), and an 18-MW steam turbine generator. The initial 20-MW CT is planned to be operational by the year 2004 with the first 58-MW unit scheduled for completion by the year 2006.

Future phases will be implemented at later dates; the exact timing of the subsequent units will depend on future load growth, power availability through independent power purchase agreements, and unit retirements. Developing the proposed project in phases will provide the flexibility to meet existing demand without overbuilding and to evaluate future improvements in technology should they become available. Site preparation for these subsequent phases will be performed during the initial Phase I construction.

Summary of Need for the Project

MECO is the legally franchised utility responsible for the production, purchase, transmission, distribution, and sale of electricity on the islands of Maui, Molokai, and Lanai. MECO's total firm capacity for the island of Maui, after completion of its second 58-MW expansion at Maalaea in the year 2001, will be 254-MW from MECO-owned plants. MECO is proposing to construct a new power generation facility in central Maui to accomplish the following:

- Maintain an adequate system margin-of-reserve generating capacity
- Increase overall system reliability
- Replace older generation facilities scheduled for retirement
- Provide additional capacity to meet projected demand for electric service

Peak power demand by MECO's customers increased an average of 5 percent per year between 1983 and 1996, rising from 95.4 MW to 174.8 MW. MECO considers this growth rate to be above average and anticipates a somewhat slower growth rate in the future (approximately 2.6 percent per year), reaching approximately 299.3 MW without demand-side management measures (266.5 MW with DSM programs implemented) by the year 2016. In order to meet this need, MECO has examined their existing generation resources and determined that there will be a shortfall in their system reserve margin by the year 2004. In order to meet the forecasted demand for electricity, MECO has determined that additional generation will be required through the year 2016. The proposed Waena Generating Station is planned to meet this demand.

Summary of Alternatives Considered

Several alternatives have been considered for the proposed Waena Generating Station including no action, energy conservation, deferred retirement of older units, alternative technologies, alternative sites, and independent power producers.

Alternative technologies considered included biomass conversion, geothermal, hydroelectric, solar, wind, ocean thermal, and coal. MECO analyzed the availability of each of the alternative sources, as well as alternative fuel sources to No. 2 diesel, and determined that none of them would be able to address or meet the immediate generating needs.

Alternative sites considered included over 20 sites identified since 1989. Areas examined included sites in Olowalu, Ukumehame, near Waikapu, and the old Puunene Airport as well as the locations of existing power plants and sugar mills. In 1995, MECO conducted a series of public meetings and presentations to gather input to use in determining a preferred site. Based upon the site analyses performed and input received, MECO determined that the selected 65.7-acre site at the intersection of Waiko and Pulehu Roads is the most appropriate for the proposed Waena Generating Station. The selection of this site is based upon the following factors:

- The site had the least impact on air quality of those considered.
- The site had the least impact on biological resources of those considered.
- The site had the least impact on area traffic and transportation of those considered.
- The site had the least infrastructure costs of those considered.
- The site had the best location of those considered in relationship to the existing MECO generation and transmission systems.

Summary of Potential Impacts

The proposed project will have no significant adverse effects on air quality, geology, water resources, plants, animals, archaeological resources, visual resources, area traffic, or infrastructure. The project is compatible with the existing land uses in the area and will have no adverse impact upon residential or commercial areas. The construction and operation of the facility will provide benefits to the local population, as well as the entire island, by increasing overall system reliability and by providing the necessary electricity to meet projected growth in the population and economy.

The site will result in the removal of approximately 66 acres of prime agricultural lands from active production, however, this represents a very small percentage of the over 36,000 acres of Hawaiian Commercial and Sugar Company (HC&S) land in production. Overall agricultural production on the Island of Maui is not anticipated to be impacted from the project as HC&S is actively expanding their production acreage in other areas of the island.

In addition, the power produced by the facility will aid in further expansion of agricultural endeavors and diversification on the Island of Maui.

Because of the local topography and lack of other structures in the vicinity, the facility will be visible from areas located on the slopes of Haleakala. However, the long distances between the facility and potential viewers will reduce the apparent size of the generating station and the facility will not represent a dominant feature of the landscape.

Short-term construction related impacts will be associated with air-borne particulate matter (fugitive dust), exhaust emissions from on-site construction equipment, increased construction vehicle traffic, and construction noise. These impacts will be temporary in nature and given the distance from the site to the nearest sensitive receptors, do not represent an adverse impact. A summary of potential impacts is shown in Table ES-1.

Summary of Mitigation Measures

Mitigation measures to reduce environmental impacts address both short-term and long-term impacts. Short-term mitigation measures include performing construction activities in compliance with applicable air and noise regulations in order to minimize potential fugitive dust and noise. Measures to mitigate long-term impacts include:

- Adherence to appropriate building codes and standards
- Compliance with applicable federal and state air quality and permitting regulations
- Compliance with applicable federal, state, and county water withdrawal, injection, and sanitary wastewater regulations
- Installation of hooded security lighting to minimize impacts to migratory birds
- Compliance with federal, state, and county archaeological regulations and agreements
- Provision of landscaping and appropriate buffers to screen the facility as much as possible
- Compliance with federal, state, and county solid waste and hazardous waste disposal regulations

Summary of Compatibility with Land Use Plans and Policies

The proposed Waena Generating Station is generally consistent with the Hawaii State Plan and applicable Functional Plans. The facility is also compatible with the goals and objectives of the Maui County General Plan and with the provisions and standards of the Wailuku-Kahului Community Plan and the Maui County Zoning Ordinance. The project is also consistent with the State Land Use Commission standards and criteria for redesignation of lands from "Agricultural" to "Urban." The site is located below the underground injection control (UIC) line and is not located within the County Special Management Area.

Table ES-1
Summary of Potential Impacts

RESOURCE	IMPACT
Air Quality	Adverse Impact ([illegible])
Soils and Geology	No Impact
Natural Hazards	No Impact
Groundwater Resources	No Impact
Surface Water Resources	No Impact
Biological Resources, Flora	No Impact
Biological Resources, Fauna	No Impact
Archaeological and Cultural Resources	No Impact
Land Use and Ownership	No Impact
Prime Agricultural Land	Adverse Impact ([illegible])
Population and Employment	Beneficial Impact (significant)
Visual Resources	Adverse Impact ([illegible])
Noise	No Impact
Infrastructure, Traffic	Adverse Impact ([illegible])
Infrastructure, Electrical System	Beneficial Impact (significant)
Infrastructure, Other	No Impact
Public Safety and Community Services	No Impact

Legend:
- Beneficial Impact (significant)
- Beneficial Impact (not significant)
- No Impact
- Adverse Impact (not significant)
- Adverse Impact (significant)

Summary of Unresolved Issues

Unresolved issues are those that cannot be answered at the present time or are unanswerable. Because the proposed Waena Generating Station has not been designed, several engineering-related issues remain unresolved, including design and type of drainage improvements, locations of groundwater withdrawal and injection wells, and best available control technology for air emissions control. These issues will be fully resolved to comply with all applicable federal, state and county rules and regulations during the preliminary engineering and design phases of the project and submitted to the appropriate federal, state and county agencies for approvals.

In addition to the design-related issues, a long-term unresolved issue associated with the proposed project is the development of alternative energy sources. Development of alternative energy technologies is expected to reduce our current reliance on fossil fuels eventually, although the timing of such a transition remains unclear. Full development of the proposed project, therefore, may be affected by the rate of development of alternative technologies.

Summary of Necessary Permits and Approvals

Construction and operation of the proposed Waena Generating Station will require the three following land-related approvals:

- County redesignation of the project site in the Wailuku-Kahului Community Plan from "Agricultural" to "Heavy Industrial"
- State Land Use Commission redesignation of the project site from "Agricultural" to "Urban"
- County rezoning of the project site from "Interim" to "Heavy Industrial"

In addition to the major land entitlements, several federal, state, and county permits will be required for construction and operation of the facility, including air quality permits; water withdrawal and injection permits; and building, grading, and stormwater permits. Table ES-2 contains a list of the permits currently identified as required for the proposed project.

Table ES-2
List of Potential Permits and Approvals
for the Proposed Waena Generating Station and Transmission Lines

Permit/Approval	Agency	Timeframe Application	Timeframe Approval
County of Maui			
Environmental Impact Statement Acceptance	Planning Department/Mayor	3/97	12/97
Community Plan Amendment	Planning Commission/Council/Mayor	12/97	7/98
Change in Zoning	Planning Commission/Council/Mayor	12/97	12/98
Height Variance	Board of Variance & Appeals	3/02	7/02
Combustible and Flammable Liquid Tank Installation*	Public Works	3/02	7/02
Driveway Permit/Work in County Road ROW	Public Works	3/02	7/02
Flood Hazard Certification or Determination	Public Works	3/02	7/02
Building, Grading and Stormwater Management Permits	Public Works	3/02	7/02
State of Hawaii			
Land Use District Designation Reclassification	Land Use Commission	10/97	5/98
Noise Variance for Construction*	Department of Health	3/02	7/02
Prevention of Significant Deterioration/Covered Source Air Permit*	Department of Health	1/99	12/01
Test/Supply Well	Commission on Water Resource Management/Department of Land & Natural Resources		
Well Construction Permit*		6/00	12/00
Pump Installation Permit*		9/00	1/01
Underground Injection Control	Department of Health		
Permit to Construct*		3/02	6/02
Permit to Operate*		6/03	9/03
Approval for Domestic Wastewater Treatment*	Department of Health	6/03	9/03
NPDES	Department of Health		
Construction Dewatering*		3/02	7/02
Facility Stormwater Discharge		3/02	7/02
Authority to Perform Work on State Highway ROW	Department of Transportation	3/02	7/02
Public Utilities Commission General Order 7 Approval*	Public Utilities Commission	1/99	12/99
Federal			
Determination of No Significant Hazard to Air Navigation	Federal Aviation Administration	6/97	6/97
Prevention of Significant Deterioration*	Environmental Protection Agency	1/99	12/01

* Time frame indicated is for installation of the first DTCC unit. Each subsequent DTCC unit may/will require additional permits.

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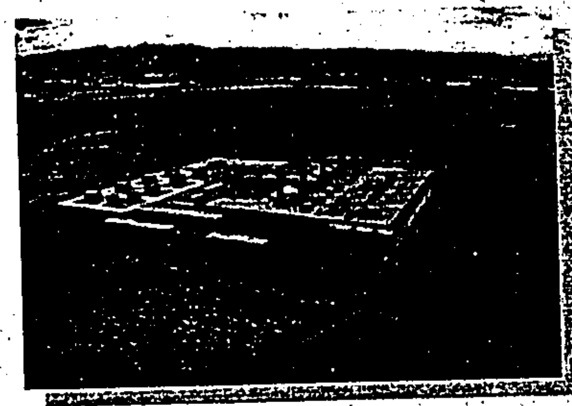
mg/l	milligrams per liter
μg/m³	micrograms per cubic meter
μl/l	microliters per liter
BACT	Best Available Control Technology
bpd	barrels per day
CAA	Clean Air Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO	carbon monoxide
CT	combustion turbine
DBEDT	State Department of Business, Economic Development, and Tourism
DOH	Department of Health
DSM	demand-side management
DTCC	dual-train combined-cycle
EIS	Environmental Impact Statement
EPA	US Environmental Protection Agency
F	Fahrenheit
FGD	Flue gas desulfurization
GEP	Good Engineering Practice
gpd	gallons per day
gpm	gallons per minute
H_2SO_4	sulfuric acid
HC&S	Hawaiian Commercial and Sugar Company
HRSG	heat-recovery steam generator
ICE	In Concert with the Environment
IPP	independent power producer
IRP	Integrated Resources Plan
kV	kilovolt
kWh	kilowatt-hour
LAER	Lowest Achievable Emission Rate
LOS	level of service
MECO	Maui Electric Company, Limited
mgd	million gallons per day
mph	miles per hour
MW	megawatt
NAAQS	National Ambient Air Quality Standards
NELHA	Natural Energy Laboratory of Hawaii Authority
NESHAP	National Emissions Standard for Hazardous Air Pollutants
NO_x	nitrogen oxide
NPS	National Park Service
NSPS	New Source Performance Standard

NSR	New Source Review
OTEC	ocean thermal energy conversion
Pb	lead
PICHTR	Pacific International Center for High Technology Research
PM	particulate matter
PM_{10}	particulate matter less than 10 microns in diameter
PPA	purchase power agreement
ppm	parts per million
ppmv	parts per million by volume
ppmw	parts per million by weight
PSD	prevention of significant deterioration
PUC	Public Utilities Commission
RTDM	Rough Terrain Dispersion Model
SAAQS	State Ambient Air Quality Standards
SCR	selective catalytic reduction
SO_2	sulfur dioxide
TPY	tons per year
TSP	total suspended particulates
UIC	underground injection control
VOC	volatile organic compounds
WECs	wind energy conversion systems



CHAPTER ONE

INTRODUCTION

Chapter 1
Introduction

1.1 Project Data

Applicant:	Maui Electric Company, Limited Mr. William A. Bonnet, President PO Box 398 Kahului, Maui, Hawaii 96733-6898
EIS Accepting Authority:	Maui County Department of Planning Mr. David Blane, Planning Director 250 South High Street Wailuku, Maui, Hawaii 96793
EIS Approving Agency:	Mayor, County of Maui
Agent for Applicant:	CH2M HILL, INC. Mr. Mark R. Willey, Project Manager 1585 Kapiolani Blvd., Suite 1420 Honolulu, Hawaii, 96814
Project Parcel:	TMK 3-8-03:23 and 3-8-03:24
Parcel Size:	65.7 acres
Parcel Ownership:	Fee-simple, Maui Electric Company, Limited
Surrounding Landowners:	County of Maui Alexander & Baldwin - Hawaii
State Land Use Designation:	Agricultural
County Community Plan Designation:	Agricultural
County Zoning Designation:	Interim

1.2 Scope of this EIS

This Environmental Impact Statement (EIS) is for Maui Electric Company, Limited's (MECO's) proposed Waena Generating Station to be located on 65.7 acres along Pulehu and Waiko (sometimes referred to as Waikapu or Upper Division) Roads in central Maui. This document has been prepared for the County of Maui Planning Department to support an application for a redesignation of land use within the Wailuku-Kahului Community Plan.

The purpose of this document is to identify and assess environmental and social impacts that could result from the proposed project. This document has been prepared and processed in accordance with the requirements of Chapter 343, Hawaii Revised Statutes (HRS) as implemented under Hawaii Administrative Rules (HAR) Title 11, Chapter 200. This process requires a detailed analysis of the subject property and the proposed action.

The proposed Waena Generating Station is master planned for 232 megawatts (MW) of power generating capacity to be constructed in four phases. The initial phase of the master plan will develop a 58-MW generating capacity, consisting of two 20-MW combustion turbines (CTs), two heat recovery steam generators, and an 18-MW steam turbine generator. Phase I will begin with the first 20-MW CT operational by the year 2004. Completion of the first 58-MW dual-train combined-cycle (DTCC) unit is scheduled for the year 2006.

Future phases will be implemented at later dates; the timing of the subsequent units will depend on future load growth, power availability through independent purchase agreements, unit retirements, and environmental considerations. Developing the proposed project in phases will provide the flexibility to meet existing demand without overbuilding. Although subsequent phases will be installed at later dates, the entire 65.7-acre site will be developed during installation of the first DTCC unit to facilitate later unit additions.

This EIS analyzes the project in terms of the current master plan for 232-MW of power generation and related facilities.

1.3 Proposed Government Action

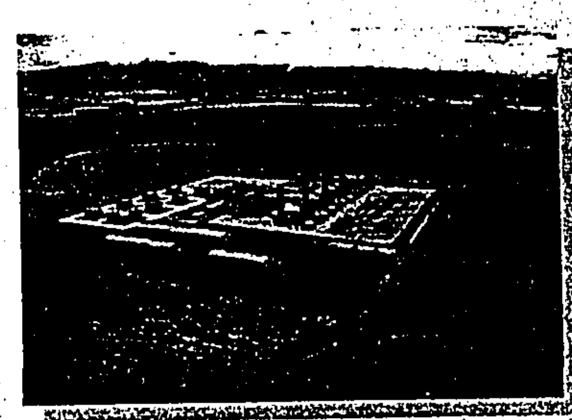
MECO is requesting that the County of Maui grant a land use redesignation within the Wailuku-Kahului Community Plan for the subject parcel from "Agricultural" to "Heavy Industrial." In addition, MECO will request a change in the existing State Land Use designation from "Agricultural" to "Urban" and in the existing County of Maui Zoning classification from "Interim" to "Heavy Industrial."

1.4 Significant Changes from the Draft EIS to the Final EIS

In accordance with HAR 11-200-18(5), this Final EIS has been written to allow the reader to easily distinguish changes made to the text of the Draft EIS. Additions to the text of the Draft EIS are indicated as underlined text within this Final EIS document. A summary of the significant changes to the text of the Draft EIS are as follows:

- Revision of the site size from approximately 67 acres to 65.7 acres (approximately 66 acres)
- Clarification of the project site TMK designation to parcels 3-8-03:23 and 3-8-03:24.
- Addition of an estimated timeframe for permit application and approval to Table ES-2.

- Modification of Table 3-1 to clearly indicate site development schedule for property.
- Addition of a topography map, identified as Figure 4-2, and revisions to subsequent figure numbers.
- Addition to Figure 4-3of two Hawaiian Commercial & Sugar Company wells near the Puunene Sugar Mill.
- Identification of preliminary drainage impacts in Section 4.6.
- Clarification on the projects anticipated impact to the Hawaiian Hoary Bat in Section 4.7.
- Reference to the State Historic Preservation Division's finding of "no effect" in Section 4.8.
- Addition of the project's conformance with the State of Hawaii's Coastal Zone Management Act in Section 5.3.
- Addition of material related to the Public Comment Meetings in Section 7.4 and Appendix K
- Addition of public comment letters received on the Draft EIS and responses in Section 7.4.
- Addition of the full fuel transport study in Appendix A.
- Minor editing changes as indicated in document by underlined text.



CHAPTER TWO

PURPOSE AND NEED

Chapter 2
Purpose and Need

2.1 Background

2.1.1 Service Area

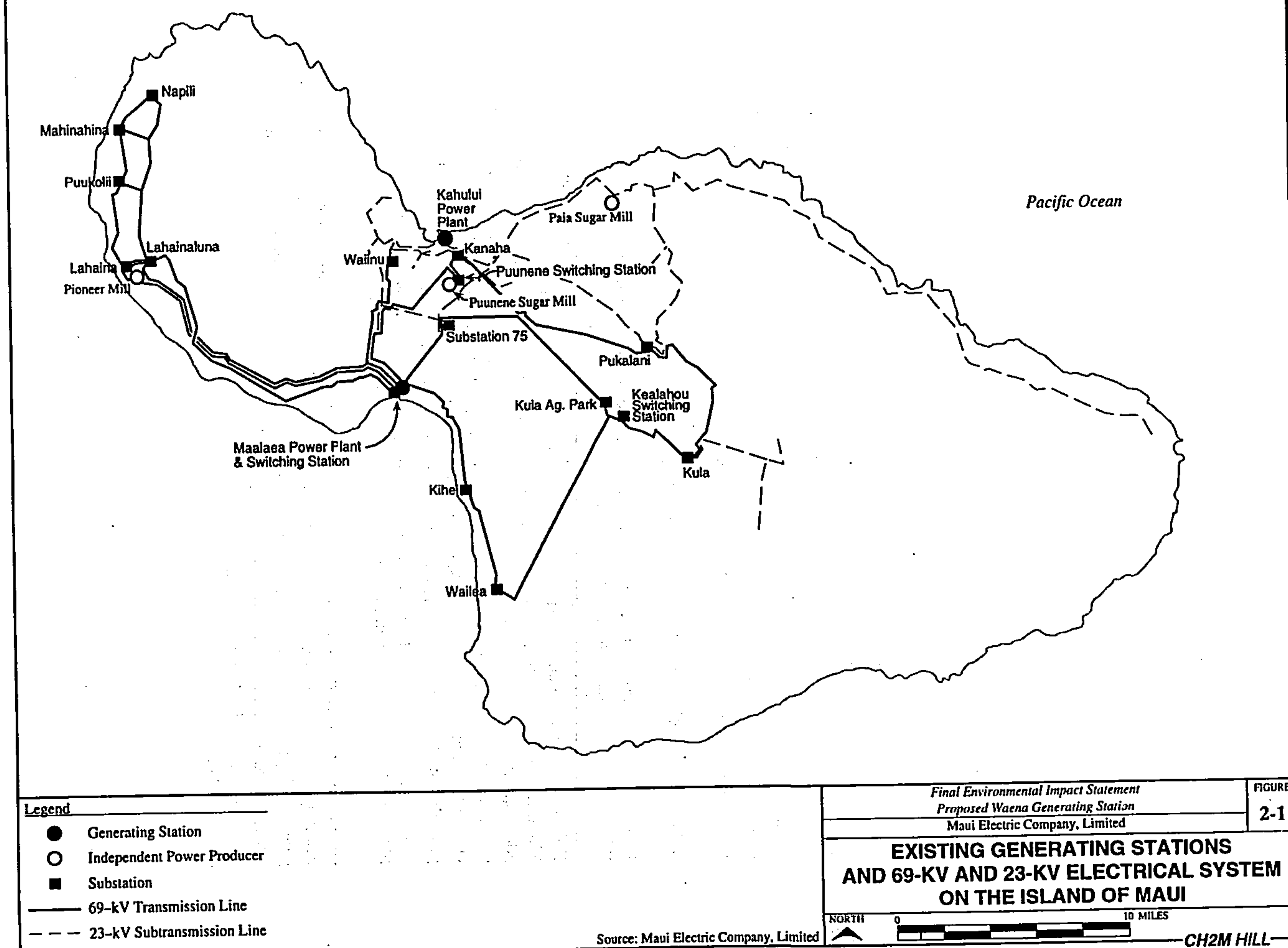
Maui Electric Company, Limited (MECO) provides nearly all the electrical service to the residents and businesses of the tri-islands (Maui, Molokai, and Lanai) which make up Maui County. Each island has its own generation and transmission system. The islands' electrical transmission systems are not interconnected at this time.

On the Island of Maui, MECO serves a population of over 91,000 residents with approximately 43,940 metered accounts. Maui County is the fastest growing county in the state. The County's population grew by 43.8 percent from 1970 to 1980 and 41.6 percent from 1980 to 1990. The Island of Maui's population increase during the same period was even greater. From 1970 to 1980, Maui's population grew by 62.4 percent and increased by 45.4 percent during the period 1980 to 1990. MECO is responding to this growth by planning for additional generation and transmission capacity to meet the demand for power.

2.1.2 Existing Generation Resources

Figure 2-1 illustrates the location of the existing power generation facilities on Maui and the interconnecting transmission system. Table 2-1 lists the generating units within the MECO system on Maui. MECO presently owns and operates 22 generating units on Maui, 4 at Kahului and 18 at Maalaea. MECO is currently in the process of expanding its capacity at Maalaea with the construction of two additional combustion turbines and a steam turbine. In addition, MECO purchases electrical energy from two independent power producers (IPPs). One agreement is with Hawaiian Commercial and Sugar Company (HC&S) that commits HC&S to provide 16 megawatts (MW) of firm capacity through the end of 1999. This firm power normally supplements MECO's own generating capacity. MECO also holds an interchange and stand-by power agreement with Pioneer Mill Company for 8 MW. This power is available only when the mill is producing electricity in excess of its own needs.

Generating units are designed for and operated along three modes: baseload, cycling, and peaking. Baseload units are best suited for continuous operation, have higher efficiency, and generally higher capital costs. These units tend to be larger in capacity than the peaking units, and comparable or slightly larger than cycling units. In areas of the country where power demand is large, coal, natural gas, and even nuclear power provide much of the baseload demand.



Source: Maui Electric Company, Limited

Final Environmental Impact Statement
Proposed Waena Generating Station
Maui Electric Company, Limited

FIGURE 2-1

EXISTING GENERATING STATIONS AND 69-KV AND 23-KV ELECTRICAL SYSTEM ON THE ISLAND OF MAUI

CH2M HILL

Table 2-1
Existing and Planned MECO-Owned Maui Generating Units

Unit	Type	Operation	Normal Capacity (MW)	Reserve Capacity (MW)
Kahului 1	Steam Boiler	Baseload	5.9	5.9
Kahului 2	Steam Boiler	Baseload	6.0	6.0
Kahului 3	Steam Boiler	Baseload	12.7	12.7
Kahului 4	Steam Boiler	Baseload	13.0	13.0
Maalaea 1	Int. Combust.[3]	Peaking	2.7	2.7
Maalaea 2	Int. Combust.[3]	Peaking	2.7	2.7
Maalaea 3	Int. Combust.[3]	Peaking	2.7	2.7
Maalaea 4	Int. Combust.[3]	Cycling	5.6	6.16
Maalaea 5	Int. Combust.[3]	Cycling	5.6	6.16
Maalaea 6	Int. Combust.[3]	Cycling	5.6	6.16
Maalaea 7	Int. Combust.[3]	Cycling	5.6	6.16
Maalaea 8	Int. Combust.[3]	Cycling	5.6	5.6
Maalaea 9	Int. Combust.[3]	Cycling	5.6	5.6
Maalaea 10	Int. Combust.[3]	Baseload	12.5	12.85
Maalaea 11	Int. Combust.[3]	Baseload	12.5	12.85
Maalaea X1	Int. Combust.[3]	Peaking	2.7	2.7
Maalaea X2	Int. Combust.[3]	Peaking	2.7	2.7
Maalaea 12	Int. Combust.[3]	Baseload	12.5	12.5
Maalaea 13	Int. Combust.[3]	Baseload	12.5	12.85
Maalaea 14[1]	CT[4]	Baseload	20.0	20.0
Maalaea 15[1]	Steam Turbine	Baseload	18.0	18.0
Maalaea 16[1]	CT[4]	Baseload	20.0	20.0
Maalaea 17[2]	CT[4]	Baseload	20.0	20.0
Maalaea 18[2]	Steam Turbine	Baseload	18.0	18.0
Maalaea 19[2]	CT[4]	Baseload	20.0	20.0

[1]Maalaea units 14, 15, and 16 are components of MECO's first 58-MW DTCC Unit
[2]Maalaea units 17, 18, and 19 will be components of the planned second 58-MW DTCC Unit
[3]Internal Combustion
[4]Combustion Turbine
[5]Capable of being used as baseload units

Source: Maui Electric Company, Limited

Cycling units are designed to be capable of withstanding the thermal and mechanical stresses of regular start-ups and shutdowns, as well as continual changes in output power requirements. Cycling units generally have a higher operating cost than baseload units, but lower capital costs.

Peaking units are relatively small generating units (compared to baseload and cycling units) that can be quickly brought on and off line. These units are normally operated daily to cover the daily peak (about 3-4 hours per day). Capital costs for these units are low, but fuel and maintenance costs are higher.

Combined-cycle units, consisting of one or more combustion turbines (CTs), one or more waste heat boilers to make use of the exhaust heat, and a steam turbine generator to make electricity from the exhaust gas, are generally used to provide either baseload or cycling generation. The CTs offer quick starting capability while the waste heat boilers and steam generator are used to improve unit efficiency.

2.1.3 Existing Transmission and Distribution Resources

As power is generated on Maui, transformers step up the voltage to either 23 kilovolts (kV) or 69 kV. The power is then transmitted through the 23-kV and 69-kV transmission grids. These higher voltages allow for more efficient transmission of large amounts of power over long distances to the substations at major load centers. Local area distribution substations reduce the voltage from 69 kV and 23 kV to MECO's 12-kV and 4-kV local distribution voltage. Distribution feeders typically fan out from the 12-kV and 4-kV distribution substations along streets and roads either overhead or, where necessary, underground. Finally, individual customers are connected to the distribution system through small step-down distribution transformers sized for the particular load and voltage required by the customer. These transformers are located on poles or pads near the facilities they serve.

The 69-kV system consists of approximately 96 miles of overhead lines and the 23-kV system consists of 137 circuit miles of overhead lines. The overhead transmission system is designed to withstand most environmental hazards and remain continuously in service.

2.2 Project Purpose and Need

2.2.1 Project Objectives

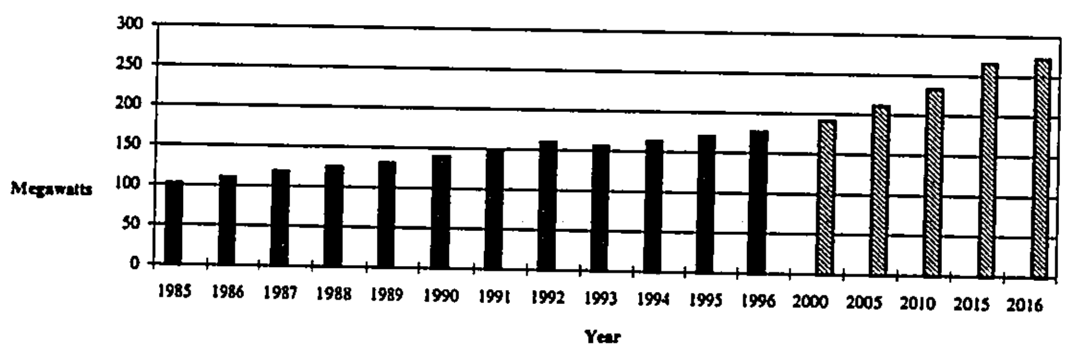
MECO is the legally franchised utility responsible for the production, purchase, transmission, distribution, and sale of electricity on the islands of Maui, Molokai, and Lanai. MECO's total firm capacity for the Island of Maui, after completion of its second 58-MW expansion at Maalaea in the year 2001, will be 254 MW from MECO-owned plants. MECO is proposing to construct a new power generating facility in central Maui to accomplish the following:

- Maintain an adequate system margin-of-reserve generating capacity
- Increase overall system reliability
- Replace older generation facilities scheduled for retirement
- Provide additional capacity to meet projected demand for electric service

2.2.2 Peak Demand

Peak power demand by MECO's customers increased an average of 5 percent per year between 1983 and 1996, rising from 95.4 MW to 174.8 MW. MECO considers this growth rate to be above average and anticipates a somewhat slower growth rate in the future (approximately 2.6 percent per year), reaching approximately 299.3 MW without demand-side management measures (266.5 MW with DSM programs implemented) by the year 2016. Figure 2-2 shows the actual electrical consumption and estimated evening peak demands following DSM implementation from 1985 to 2016.

Figure 2-2 - Actual and Projected Peak Electrical Demand for Maui, 1985 - 2016



Projected estimates include reductions for DSM programs

Source: Maui Electric Company, Limited

2.2.3 Resource Planning

The need for additional generating capacity has been identified through a process referred to as resource planning. MECO continuously reviews its system capacity to meet the forecasted demand. During the resource planning process, the following issues are evaluated:

- Existing and forecasted demand for energy and capacity
- Existing and forecasted fuel prices
- Impacts of Demand-Side Management (DSM) and conservation and energy efficiency programs on the demand for energy

- Existing firm capacity
- Maintenance and retirement schedules of generating units
- Existing Purchase Power Agreements (PPAs) from IPPs
- Proposals for future PPAs from IPPs

Power produced by IPPs is classified as either firm capacity or as-available capacity. Firm capacity is power that is always readily available on demand by MECO's system operator, such as power produced by a combustion turbine. As-available, however, refers to power that may be available only on an intermittent basis. Electricity from wind farms is considered "as-available" energy due to the fact that it is available only when the wind is blowing sufficiently to generate energy. The power produced by the Pioneer Sugar Mill is also considered "as-available" due to the fact that it is produced only when the mill is operating and only the excess energy, which can vary, is sold to MECO. MECO's resource planning can only evaluate producers of firm capacity in evaluating system needs.

Table 2-2 presents MECO's resource plan for scheduled unit additions and retirements for the next 20 years. The plan calls for the retirement of 17 older generating units, or 112.64 MW of power, over the next 20 years. HC&S is assumed to continue providing power to MECO through the end of 1999, at which time the current purchase power agreement expires.

When considering the need for additional generation capacity, MECO must not only consider if its total capacity meets the projected need, but must also allow itself an adequate reserve margin. This reserve margin must account for lost production should generating units be off-line for scheduled maintenance when, at the same time, the system's largest unit (29 MW) experiences an unexpected loss.

In earlier resource planning efforts, MECO identified a need for additional generating capacity to meet forecasted demand beginning in 1996. MECO is currently adding additional units at its Maalaea facility to be able to meet demand forecasted through 2003. Following the Maalaea additions, the plant will have expanded to its full land capacity. In addition, the existing Kahului facility is currently built to land capacity and has very limited space for additional generation. Replacing or repowering existing units at the Kahului and Maalaea Power Plants is not currently feasible due to the high costs involved.

Previous studies have recommended the acquisition of a new generating station site. The *MECO Generation Expansion Study for Maui* prepared in April 1993 recommended that MECO pursue acquisition of land for a new generating site. The *MECO Integrated Resource Plan*, filed with the Public Utilities Commission (PUC) in December 1993, updated the *Generation Expansion Study* and showed that additional generation at a new site would be required in 2004 based on projected demand-side management programs. The requirement for new generation is based upon the need to maintain an adequately sized reserve margin.

Table 2-2 MECO Resource Plan: Power Facility Additions and Retirements for the Island of Maui							
Year	Annual Forecasted Peak[1] (MW)	Annual Forecasted Peak with DSM[2] (MW)	Unit Description	Action	Size (Gross MW)	Year-End System Generation Capacity (MW)	Year-End System Reserve Margin (MW)[3]
1996	174.8	na	Entire System	Existing		211.99	37.19
1997	184.5	183.0	DSM Begins			211.99	28.99
1998	190.3	187.4	Maalaea 17	Add	+20.0	231.99	44.6
1999	194.8	190.0	HC&S PPA	Expires	-16.0	215.99	26.0
2000	199.5	192.7	Maalaea 19	Add	+20.0	235.99	43.3
2001	205.1	196.3	Maalaea 18 Maalaea 1	Add Retire	+18.0 -2.7	253.99 251.29	57.7 55.0
2002	210.5	199.7	Maalaea 2 & 3	Retire	-5.4	245.89	46.2
2003	216.0	203.3	Maalaea 4 & 5	Retire	-12.32	233.57	30.3
2004	221.7	207.3	Waena 1 CT Kahului 3	Add Retire	+20.0 -12.7	253.57 240.87	46.3 33.6
2005	227.5	211.5	Waena 2 CT Maalaea 6 & 7 Kahului 1	Add Retire Retire	+20.0 -12.32 -5.9	260.87 248.55 242.65	49.4 37.1 31.1
2006	232.9	215.4	Waena 3 HRSG Kahului 2	Add Retire	+18.0 -6.0	260.65 254.65	45.3 39.2
2007	238.4	219.5	Waena 4 CT Maalaea 8	Add Retire	+20.0 -5.6	274.65 269.05	55.2 49.6
2008	244.1	223.7	Maalaea 9	Retire	-5.6	263.45	39.7
2009	249.9	228.4	Waena 5 CT Maalaea 10	Add Retire	+20.0 -12.85	283.45 270.60	55.1 42.2
2010	255.8	233.4	Waena 6 HRSG Maalaea 11	Add Retire	+18.0 -12.85	288.60 275.75	55.2 42.4
2011	262.6	239.5	Waena 7 CT	Add	+20.0	295.75	56.2
2012	269.6	245.8	Maalaea X1 & X2	Retire	-5.4	290.35	44.5
2013	276.8	252.4	Waena 8 CT	Add	+20.0	310.35	58.0
2014	284.2	259.1				310.35	51.3
2015	291.8	266.0				310.35	44.4
2016	299.3	272.8	Waena 9 HRSG Kahului 4	Add Retire	+18.0 -13.0	328.35 315.35	55.6 42.6

[1]Based on the MECO Forecast Planning Committee's 1996-2016 Peak Forecast (July 31,1996). Recorded peak shown for 1996

[2]Assumes all demand-side management programs presented in MECO's Integrated Resource Plan are approved by the Public Utilities Commission for 1997.

[3]Based on Annual Forecasted Peak with DSM in place.

Source: Maui Electric Company, Limited

The information contained in Table 2-2 reflects MECO's latest resource plan, which still shows a need for additional generation by the year 2004 with the anticipated impacts of demand-side management programs included.

2.2.4 Parallel Path Planning

Independent power producers provide power that is incorporated into MECO's grid. As a contingency against IPP project delays, MECO pursues parallel path planning for the installation of its own capacity. This contingency planning is terminated only when the IPP has met agreed-upon milestones and will meet the commercial operation date established in its contract with MECO. Such milestones include demonstrating the availability of a fuel source, potential for permit approval, financial viability, commitment to purchase major plant equipment, and agreement for an interconnection of the facility with the MECO grid.

It is not appropriate for MECO to use IPPs as parallel path planning for MECO's own units. This is because the IPP, unlike MECO, does not have a legal obligation to serve the public and, therefore, could back out of its commitments. MECO cannot incorporate IPP proposals into its resource planning until a contractual purchase power agreement has been negotiated between the IPP and MECO. A PPA is subject to PUC approval.

A back-up plan would not be economically feasible for an IPP, since IPPs usually need to have signed, firm contracts in place with the utility in order to receive financing for a project. The experience of a 3-year delay in the delivery of 25 MW of power from Puna Geothermal Venture, an IPP on the Island of Hawaii, to the Hawaii Electric Light Company illustrates why a utility must continue to plan for both near-term and long-term power generation independently of IPP proposals. For example, if an IPP were to be awarded a contract and commence work on the project but, for some unforeseen reason, its proposed facility were delayed beyond the agreed upon start date, the public utility would have to be prepared with alternative generating capacity to serve the public.

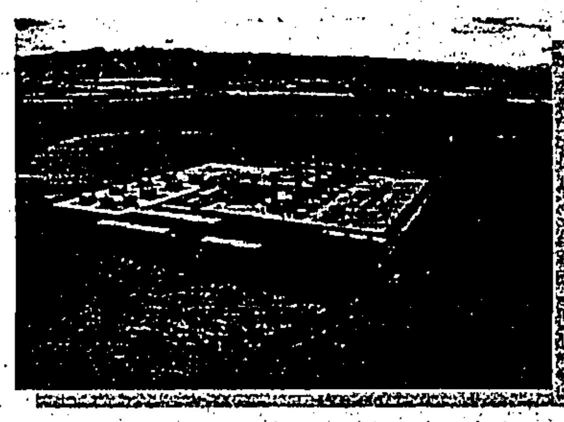
Currently, MECO purchases electrical energy from two IPPs. One PPA is with HC&S that commits HC&S to provide 16 MW of firm capacity through 1999. This firm power normally supplements MECO's own generating capacity. However, because this PPA expires at the end of 1999, together with MECO's need to pursue parallel path planning in the event this contract is not renewed, the 16 MW supplied by HC&S has been removed from MECO's resource plan beginning in 2000. However, even if HC&S and MECO continue the current PPA, the power provided through the agreement would not offset the identified need for additional generation on Maui.

MECO also holds Power Exchange and Stand-by Agreement with Pioneer Mill Company. The existing agreement is for the purchase of 8 MW of standby power at MECO's request. However, this power is available only when the mill is producing electricity in excess of its own needs. Because Pioneer Mill Company has had problems fulfilling this agreement, it cannot be relied upon to meet customer demand and cannot be included as a part of MECO's firm capacity. In addition, The Pioneer Mill Company is faced with a continual drop in bagasse supply due to falling sugarcane production and it does not have plans for altering the energy production capabilities of their mill.

2.3 Conclusion

Peak power demand on the Island of Maui is forecasted to increase steadily over the next 20 years. In order to meet this need, MECO has examined their existing generation resources and concluded that there will be a shortfall in their system reserve margin by the year 2004. In order to meet the forecasted demand for electricity, MECO has determined that additional generation will be required through the year 2016. The proposed Waena Generating Station is planned to meet this demand.

In February 1996, MECO submitted to the PUC its *Application and Certificate of Service* requesting approval to commit funds in excess of $500,000 for the acquisition of the site to support the construction of the proposed Waena Generating Station. Within that docket (No. 96-0039), MECO stated their need for the project based upon their recent resource plans as outlined above. In its *Decision and Order No. 14674*, the PUC agreed with MECO as to the need for additional generation on the Island of Maui and found MECO's request for funds to acquire the site both reasonable and in the public interest. As an outcome of that decision, MECO purchased the site in November 1996 and is proceeding with requests for land use approvals for the proposed Waena Generating Station.



CHAPTER THREE

PROPOSED ACTION AND ALTERNATIVES

Chapter 3
Proposed Action and Alternatives

3.1 Proposed Action

3.1.1 Project Description

Maui Electric Company, Limited (MECO) proposes to design, construct, and operate a 232-megawatt (MW) electrical generating station on 65.7 acres of land located along Pulehu and Waiko Roads in central Maui (see Figure 3-1). Related 69-kilovolt (kV) transmission lines from the site to substations at the Paia Sugar Mill and Puunene Sugar Mill are also proposed as a part of this project. Distribution lines (12 kV) may also lead from the proposed generating station to Puunene. In addition, MECO may relocate its existing transmission and distribution base yard from its location in Kahului to the new facility.

The Waena Generating Station will be built in four 58-MW phases, with the first 20-MW combustion turbine scheduled for operation by the year 2004. Completion of the first 58-MW dual-train combined-cycle (DTCC) unit is planned for 2006. Usable portions of the site may be available for future plant expansion or be made available on an interim or long-term basis for energy-related activities. However, Hawaiian Commercial & Sugar Company (HC&S) easements, transmission line corridors, leach fields, and other supporting urban uses will limit the amount of usable area available to non-MECO activities.

To accomplish this project, MECO intends to request changes in the Wailuku-Kahului Community Plan designation from "Agricultural" to "Heavy Industrial," in the State Land Use designation from "Agricultural" to "Urban," and in the Maui County Zoning Code from "Interim" to "Heavy Industrial."

3.1.2 Project Location

The site, owned by MECO, is located north of Waiko Road at its intersection with Pulehu Road and is identified as TMK parcels 3-8-03:23 and 3-8-03:24 (see Figure 3-2). The site is currently leased to HC&S for sugar cane cultivation. Lands immediately surrounding the site are owned by Alexander & Baldwin-Hawaii and are used for sugar cane cultivation. Across Pulehu Road from the site are a sanitary landfill, owned and operated by the County of Maui, and a quarry, operated by Ameron HC&D. Both the landfill and the quarry have proposed expansion.

3.1.3 Project Components

A conceptual site layout for the proposed generating station indicating those elements to be built during the first phase, as well as the layout of the station following its full build,-out can be seen in Figure 3-3. Major components of the proposed project include:

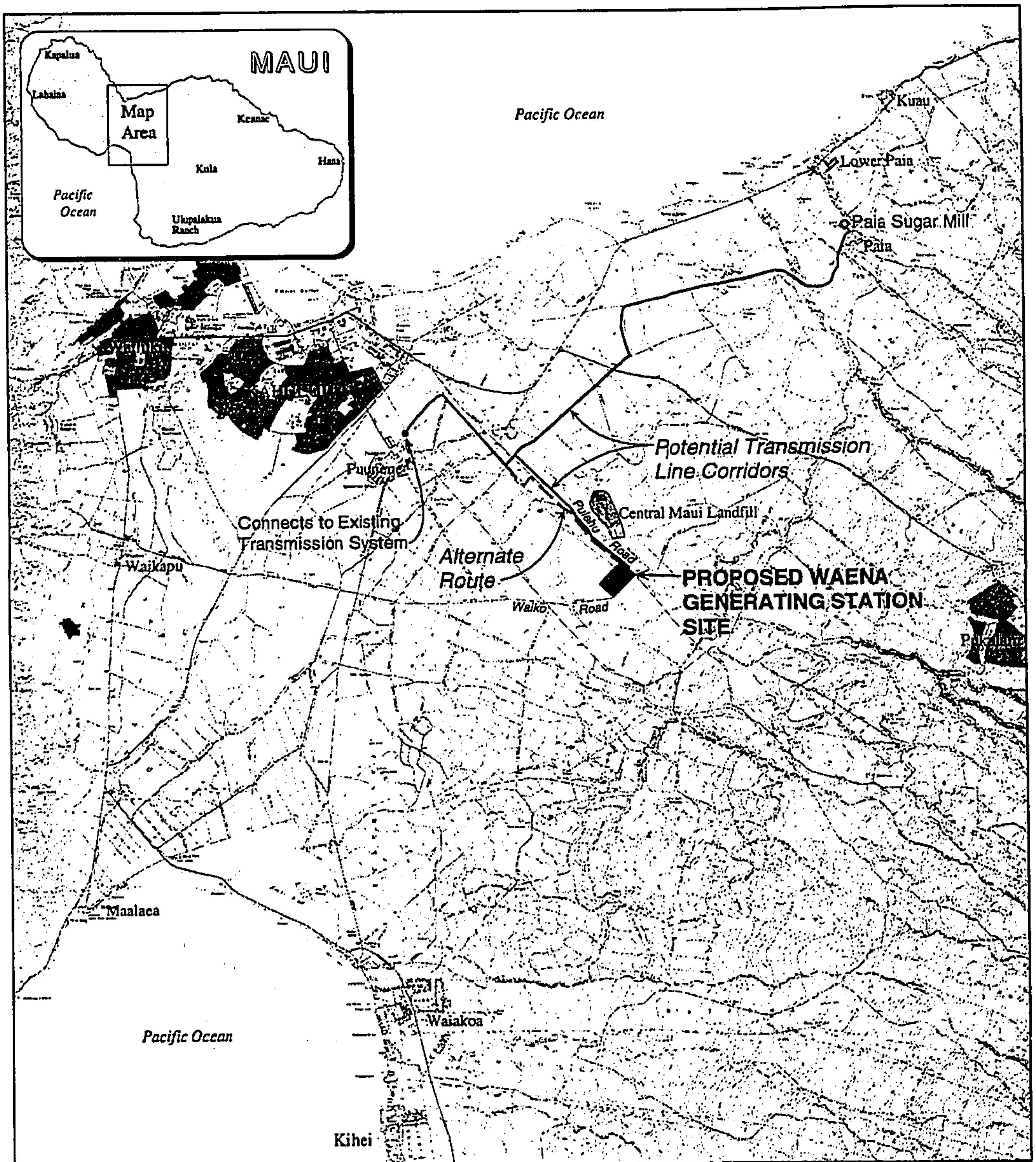


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FIGURE 3-1

PROPOSED WAENA GENERATING STATION SITE AND POTENTIAL TRANSMISSION LINE CORRIDORS

NORTH 0 1 2 3 4 MILES

Source: Maui Electric Company, Limited

CH2M HILL

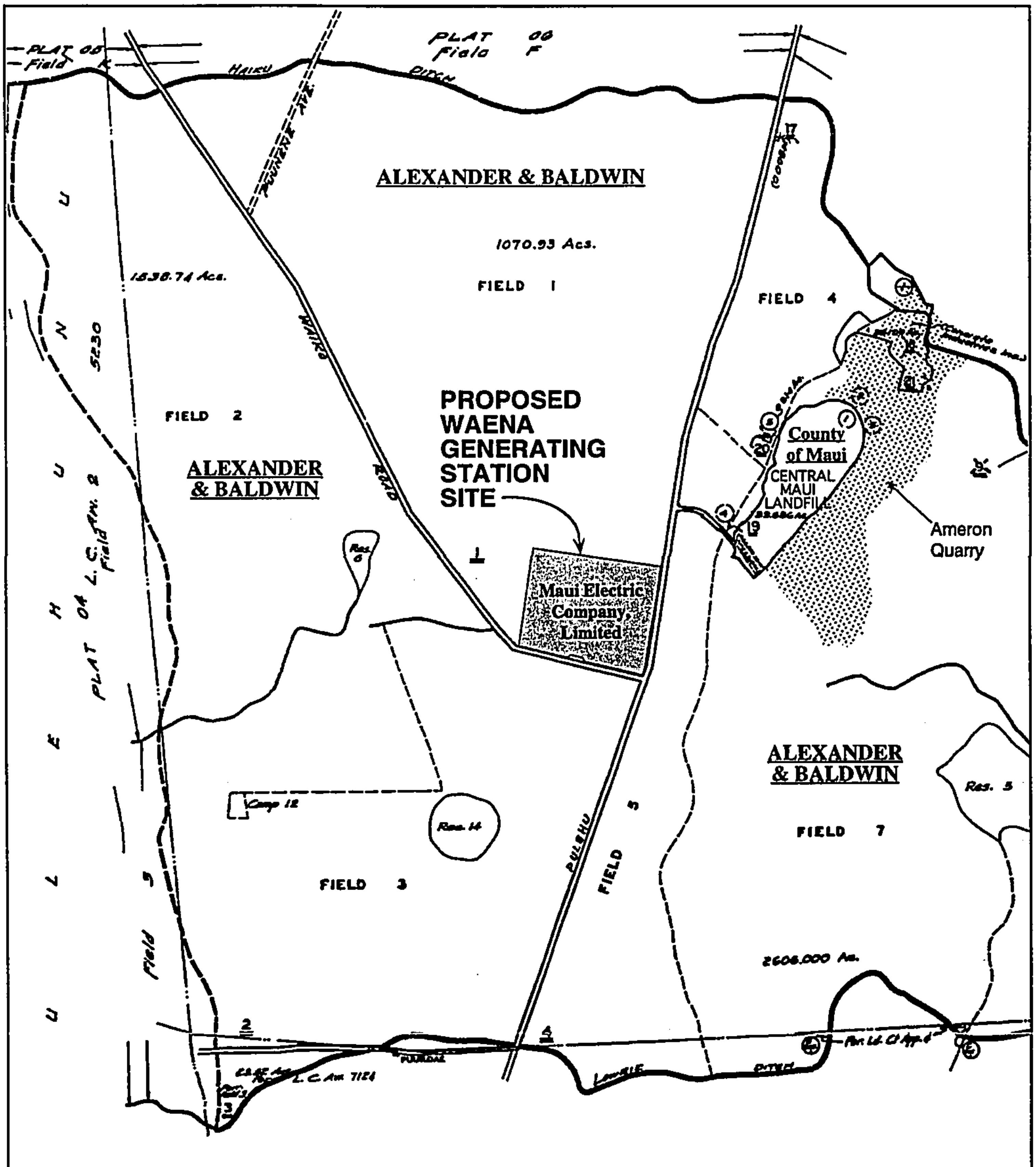

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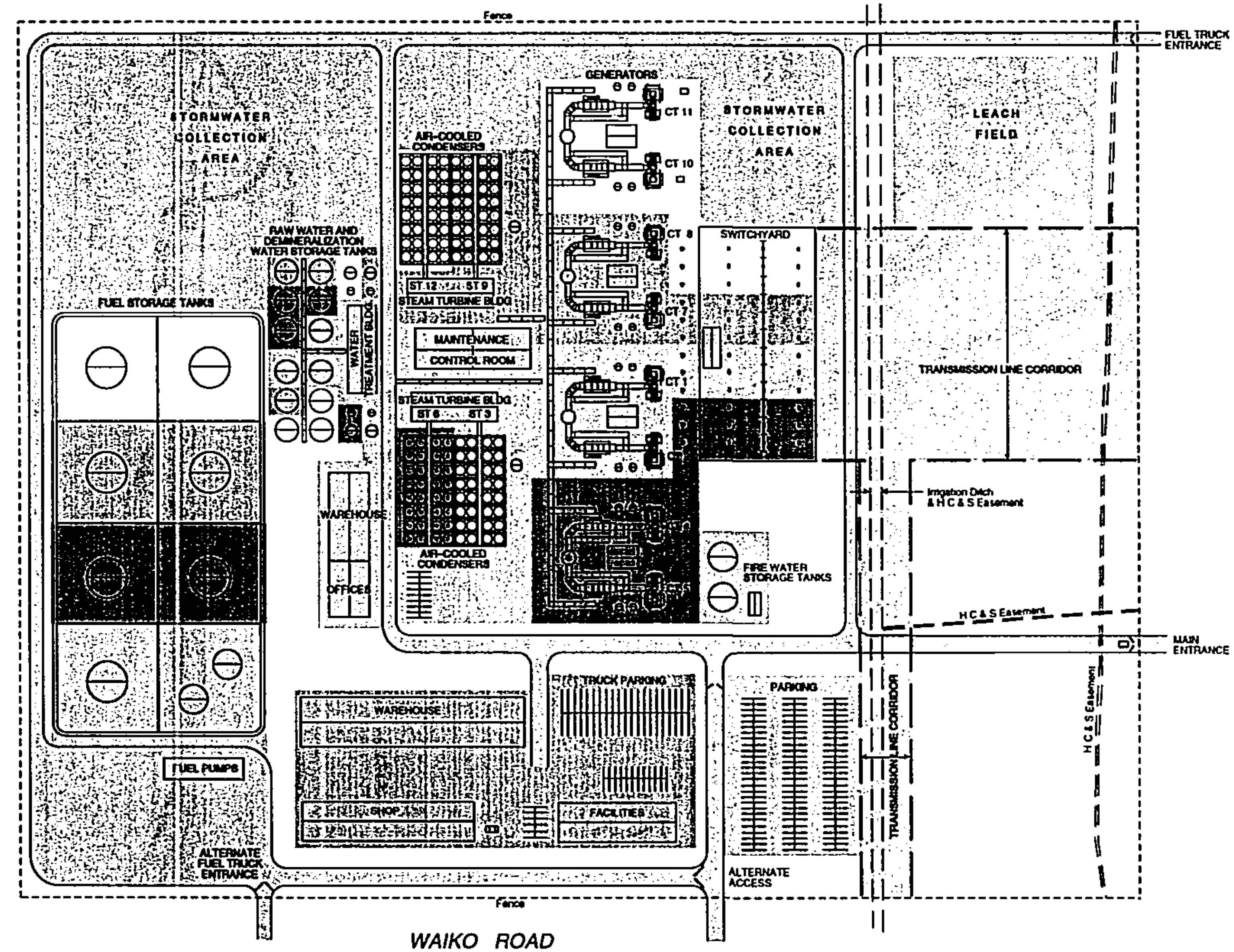
FIGURE 3-2

SURROUNDING LAND OWNERSHIP

Source: Tax Map Key 3-8-03: portion of 01

NORTH 0 2000 4000 FEET

CH2M HILL



PROJECT SCHEDULE (YEAR)

- DTCC 1/Site Development (2006)
- DTCC 2 (2010)
- DTCC 3/Transmission and Distribution Facilities (2016)
- DTCC 4 (2020)

Note: DTCC = Dual-Train Combined-Cycle Combustion Turbine
Source: Maui Electric Company, Limited, 1997

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FIGURE 3-3

CONCEPTUAL SITE LAYOUT

NORTH

NOT TO SCALE

CH2M HILL

- Four diesel oil-fired 58-MW dual-train combined-cycle (DTCC) units, exhausted to four two-flue 150-foot-tall stacks
- Four steam turbines
- Four steam condensers
- Four control houses
- A control room, including control equipment, offices, file room, kitchen, restrooms, showers, lockers, and meeting room
- Fire protection system
- Supply wells
- Water treatment facility
- Wastewater treatment facility
- Injection wells
- Water and air laboratory
- Maintenance shop
- Warehouse and storage areas
- Relay building
- Switch yard
- Fuel storage tanks
- Fuel storage tank berms
- Fuel unloading area
- Administration building
- Leach field
- Related 69-kV transmission line corridors
- Possible 12-kV distribution line corridors
- Possible gasoline storage area
- Possible transmission and distribution warehouse/offices
- Possible transmission and distribution storage and parking area

The simple-cycle combustion turbine (CT) consists of three components: a compressor, a combustor, and a turbine, which is coupled to a generator. With a simple-cycle, combustion-turbine configuration, heated exhaust gas is vented out through the stack. However, the efficiency of a simple-cycle configuration can be increased by feeding the exhaust gas (1,000° F) into a heat-recovery steam generator (HRSG) to utilize the waste heat, normally called a combined-cycle configuration. In the DTCC configuration, the hot exhaust gas from two combustion turbines is used to make steam. This steam then drives a steam turbine generator and additional power is produced with essentially no additional consumption of fuel. The configurations of a simple-cycle CT and dual-train combined-cycle system are shown in Figure 3-4.

The four DTCC units will be arranged with the stacks generally running perpendicular to the prevailing trade winds. The stacks will be 150 feet tall. Each unit will consist of two combustion turbine generators, two heat-recovery steam generators, and one steam turbine generator. A steam turbine building will be provided for the first two DTCC units with another steam turbine building provided for the last two units. The air cooled condensers for the steam turbines will be located adjacent to the steam turbine buildings. The maintenance building and control room will be located between the two steam turbine buildings. The initial phase of the generating station will require two transmission corridors that connect the new switchyard and generating units with the adjacent MECO electrical transmission grid. As the station is further developed, two new 69-kV transmission lines will be constructed to connect with the Puunene and Paia Sugar Mill substations. Distribution lines may also be added to these corridors in the future as demand requires. The routing of these transmission line corridors is shown in Figure 3-1.

3.1.4 Fuel Transport and Handling

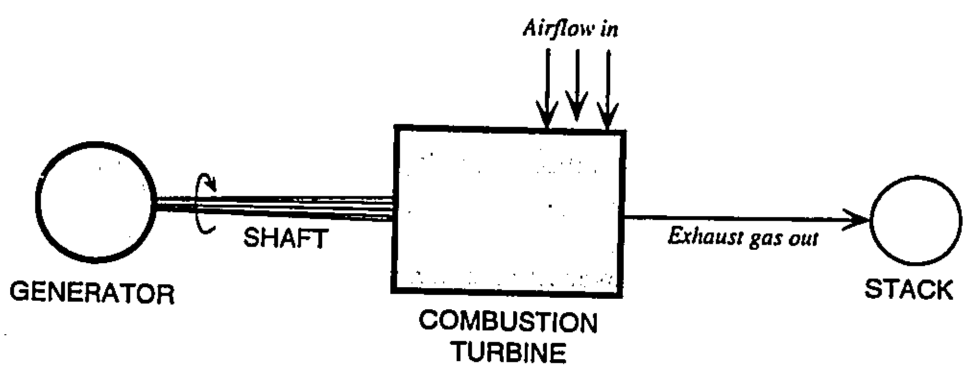
The combustion turbines will be fueled by No. 2 diesel fuel. The fuel will be transported by tanker trucks from Kahului Harbor over Hobron Avenue, Hana Highway, and Pulehu Road to the project site. A 30-day supply of fuel is routinely stored at a generating site. Approximately 44 fuel tanker truck trips per day may be required to provide fuel to the generating station at full build-out. Approximately 11-12 fuel trips per day are estimated at the completion of Phase I in 2006. The deliveries generally average about 9,000 gallons per truck. Fuel trucks will unload at a site location designed to contain any spilled fuel.

The feasibility of delivering fuel to the site through a pipeline from Kahului Harbor was examined as an alternative to trucking. However, costs of the pipeline are estimated at over $10 million more than trucking over the anticipated 28-year life expectancy of the pipeline. In addition, the difficulties and delays anticipated with permitting a fuel pipeline from Kahului Harbor to the site do not make it a reasonable alternative to provide fuel within the needed time frame. Excerpts from the pipeline analysis study are contained in Appendix A.

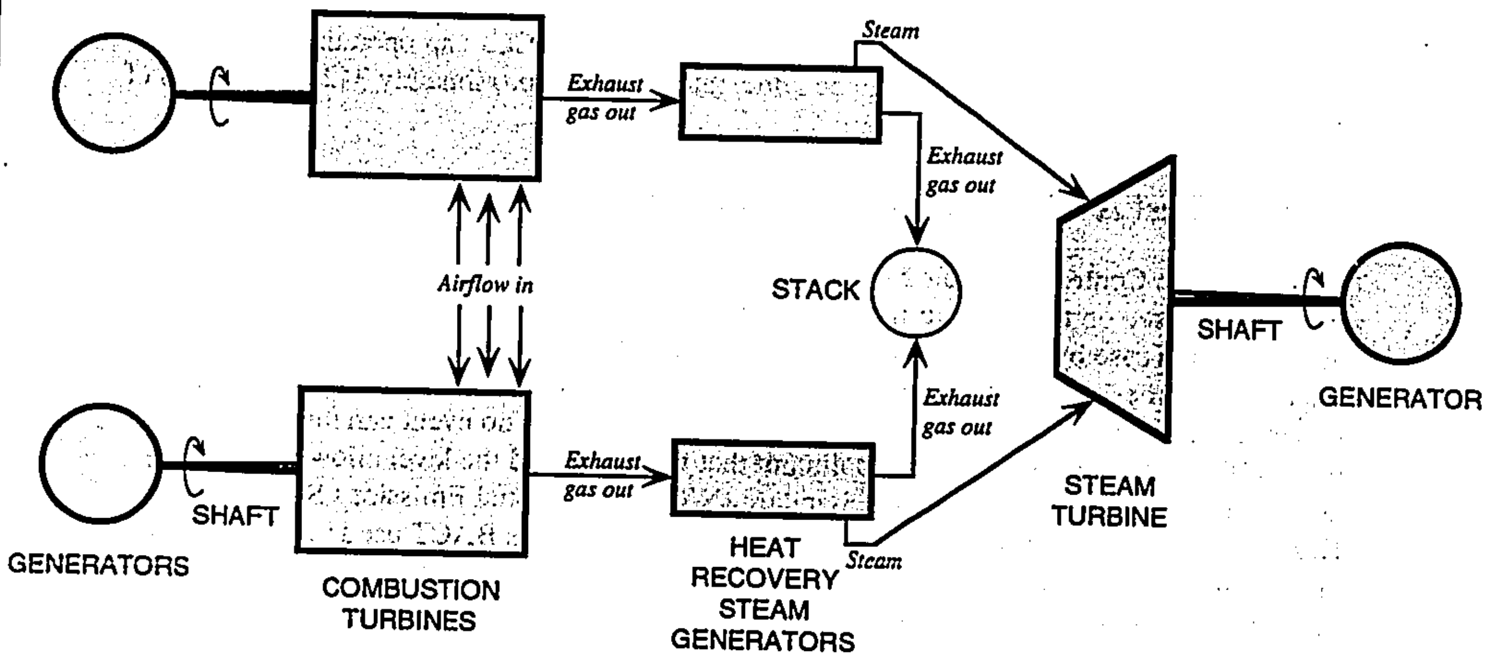
Fuel for the proposed generating station will be stored in nine cylindrical steel tanks. Two of the fuel tanks, initially installed with the first combustion turbine, will be 50 feet in diameter and approximately 36 feet high. These tanks will hold approximately 529,000 gallons of fuel each. The other seven fuel tanks will be 80 feet in diameter and approximately 36 feet high and will hold approximately 1.35 million gallons of fuel each.

All storage tanks will be placed on impervious surfaces and within berms designed to contain any leakage or spills. Bermed areas will be equipped with oil-water separators to remove any oil before disposal. Waste oil will be shipped offsite for processing and disposal.

SIMPLE CYCLE: 20 Megawatts



DUAL-TRAIN COMBINED-CYCLE: 58 Megawatts



Source: CH2M Hill

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FIGURE 3-4

TURBINE CONFIGURATIONS

CH2M HILL

MECO takes a variety of best management practice precautions to ensure that fuel spills do not occur and that, if any fuel were to spill, it would be promptly contained. Fuel is delivered to the site by tanker truck. Fuel unloading occurs on an impervious unloading area, and the unloading operation is monitored by the driver. Connecting hoses contain check valves to prevent release of fuel when not fully connected. Any minor spills or drips are collected and recycled.

Fuel storage tanks have a high-level alarm to prevent overfilling and a visible gauge that is monitored by the driver during the unloading operation. The fill point on the gauge is well below the point at which the high-level alarm is triggered. Storage tanks are located within an impervious containment area that has sufficient capacity to contain the entire contents of the storage tank within its area. The tanks are cathodically protected to prevent any internal corrosion. As a precaution, bottom draw samples from the tanks are taken regularly and analyzed for contaminants that might indicate a corrosion problem in the tank.

In addition, MECO employees are trained in the proper procedures for detecting and controlling fuel leaks. New employees receive training before starting work in fuel handling positions.

When operating under baseload conditions, each new combustion turbine consumes approximately 39,000 gallons of fuel per day. When operating in a peaking or intermediate cycle mode, a 20-MW CT will typically consume 10,000 to 20,000 gallons of diesel fuel per day. At full build-out, a 232-MW generating station using DTCCs and operating under continuous baseload conditions would be anticipated to use approximately 312,000 gallons of diesel fuel per day.

3.1.5 Best Available Control Technology

Best Available Control Technology (BACT) is defined by the Clean Air Act as "an emissions limitation...based on the maximum degree of reduction for each pollutant...which the review authority, on a case by case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable...through the application of production processes or available methods, system, and techniques...." In no event can the application of BACT result in emissions of any pollutant that would exceed the level allowed by an applicable New Source Performance Standard (NSPS) or National Emissions Standard for Hazardous Air Pollutants (NESHAP). This section summarizes BACT used in other utility projects in Hawaii which may be appropriate for use at the proposed Waena Generating Station to control the following air pollutants:

- sulfur dioxide (SO_2) and sulfuric acid mist (H_2SO_4)
- particulate matter ($PM_{2.5}$ and PM_{10})
- carbon monoxide (CO)

- hydrocarbons/volatile organic compounds (VOC)
- nitrogen oxide (NO_x)

It must be made clear that specific BACT for this project has not yet been determined and will not be determined until such time as the State of Hawaii Department of Health (DOH) and US Environmental Protection Agency (EPA) review the design-specific elements and modeled air emissions through the air quality permit process. Because the first unit at the proposed generating station is not scheduled for operation until 2004, the control technologies discussed below as BACT may be superseded by other emission control methods. The final generating station design will reflect the necessary BACT requirements once the appropriate technologies have been determined by the DOH and U.S. EPA.

In general, BACT is identified through knowledge of the industry and previous regulatory decisions for other identical or similar sources. These alternatives are rank ordered by stringency into a control technology hierarchy. The hierarchy is evaluated starting with the "top," or most stringent, alternative to determine economic, environmental, and energy impacts and to assess the feasibility or appropriateness of the alternative as BACT based on site-specific factors. If the top control alternative is not applicable, or if it is not technically or economically feasible, it is rejected as BACT and the next most stringent alternative is then considered. This process continues until a control alternative is determined to be both technically and economically feasible for a particular air pollutant.

3.1.5.1 BACT for Sulfur Dioxide and Sulfuric Acid Mist

Sulfur dioxide emissions are produced during the combustion of fuels containing sulfur. In addition to SO_2, H_2SO_4 mist is emitted from all combustion sources that fire sulfur-bearing fuels. Controls which remove SO_2 are potentially applicable to H_2SO_4 mist. Two control options available:

- Flue gas desulfurization (FGD) systems, including sodium scrubbing, dual alkali scrubbing, and dry scrubbing
- Limitation of fuel sulfur content

FGD systems are an effective method for decreasing SO_2 emissions from the combustion of relatively high-sulfur fuels in boilers. However, there are no known applications of FGD to combustion turbines. This is generally attributed to the fact that excess air flow through the turbines already lowers the SO_2 content of the flue gas below what would make an FGD system efficient. In addition, exhaust temperatures of combustion turbines are generally higher than what the FGD system can tolerate.

Combustion turbine systems generally utilize low sulfur fuels to limit SO_2 emissions. This also helps prevent corrosive damage to the turbine blades. Distillate fuel available for use in combustion turbines on Maui already has a maximum sulfur content of 0.4 percent by weight. The use of 0.05 percent fuel would require special shipments from the mainland U.S. at additional costs. Because the benefit of firing 0.05 percent fuel rather than 0.4 percent fuel is considered minimal in terms of reduced air emissions, the higher incremental cost effectiveness does not make it an attractive option as BACT for SO_2 and H_2SO_4. Alternative fuels, such as naphtha, are discussed later in this chapter.

3.1.5.2 BACT for Particulate Matter

Emissions of particulate matter from combustion turbines result primarily from inert solids contained in the fuel and unburned hydrocarbons that form particles. These particles pass through the turbine and are emitted in the exhaust gas.

Essentially, all of the PM emissions from CTs are less than 1 micron in diameter. Emission rates are low because the CT achieves high combustion efficiencies, and in general, burns clean fuels. In addition, they are designed and operated to combust the fuel as completely as possible to attain the highest possible thermal efficiency.

Two technologies are generally employed to control PM emissions: electrostatic or fabric filters and combustion techniques/design. The emissions reductions from either of the two filters are generally similar to the PM emission rate of a properly designed and operating combustion turbine.

No application of electrostatic precipitors or fabric filters exists for CTs because of the high exhaust rates and low particulate emissions associated with the units. Also, fabric filters can experience clogging and are considered technically inferior to the use of combustion techniques/design for controlling PM.

3.1.5.3 BACT for Carbon Monoxide

Two control techniques are applicable to reduce CO emissions: catalytic oxidation and combustion technology/design. Catalytic oxidation is a post-combustion CO reduction technology (it treats the exhaust gas downstream of the gas turbine). The combustion technology/design option is a direct result of the design and operation of the CT.

In catalytic oxidation, the turbine exhaust gases pass through a catalyst bed (typically platinum/rhodium) where CO is oxidized to carbon dioxide (CO_2) and water vapor. Hydrocarbons are also oxidized to CO_2 and water vapor. However, SO_2 will also be oxidized to SO_3, producing a visible plume with high levels of SO_3 and H_2SO_4 mist. In addition, the cost effectiveness of the method ranges between $3,500 and $5,000 per ton of CO removed, making it economically prohibitive when compared to other techniques.

With combustion technology/design, the generation of CO is minimized by obtaining good combustion efficiency in the CT unit. Good combustion requires a proper air-to-fuel ratio and a turbine design that adequately accounts for time, temperature, and turbulence conditions within the combustion zone. Combustion technology/design has been applied nationwide and is an acceptable method to use as BACT for CO.

3.1.5.4 BACT for Volatile Organic Compounds

Although there are no known required applications of add-on technologies for VOC control on oil-fired CTs, the catalytic oxidation process discussed above can reduce VOC/hydrocarbon emissions. However, the catalytic oxidation process can produce additional sulfuric acid mists. Technology/design of the CT is more commonly used to minimize VOC emissions.

3.1.5.5 BACT for Nitrogen Oxide

Nitrogen oxide emissions from combustion turbines are classified by their formation mechanisms as either thermal NO_x or fuel NO_x. Thermal NO_x is created by the high temperature reaction of nitrogen and oxygen in the combustion air. It is a function of the combustion chamber design and the turbine operating parameters, including the flame temperature, residence time at flame temperature, combustion pressure, and air/fuel ratios in the primary combustion zone. Fuel NO_x is formed by the gas-phase oxidation of fuel-bound nitrogen. Fuel NO_x is largely independent of the combustion temperature and the nature of the organic nitrogen compound. Its formation depends on fuel nitrogen content and combustion oxygen levels. Two control technologies are currently available and applicable to reduce NO_x emissions: wet injection and selective catalytic reduction (SCR).

Wet injection. In wet injection control, either demineralized water or steam is injected into the gas turbine combustion chamber. The moisture acts as a heat sink, reducing the peak flame temperature and therefore reducing the formation of thermal NO_x. Injection patterns vary among turbine and individual combustor designs and moisture may be injected in either a liquid or vapor state. The wet injection concept and fundamentals, however, are generally common among designs.

Turbine design is the single most influential factor affecting the NO_x emissions level achievable with water injection. The practical extent to which NO_x formation can be retarded by wet injection is defined by flame stability considerations and the associated efficiency of the CT. Achievable NO_x reductions via wet injection are strongly influenced by the details of the combustor design and the basic combustion characteristics of the fuel. For a given turbine design, the water-to-fuel ratio may be increased with accompanying decreases in NO_x formation until cold spots and flame instability impede the safe, efficient, and reliable operation of the units. NO_x concentration is reduced with relatively little loss in combustion efficiency until a point of maximum moisturization is reached. Addition of more water beyond this point results in rapidly decreasing combustion efficiency and relatively little reduction in NO_x emission. Operation at excessive water-to-fuel ratios causes very high carbon monoxide and hydrocarbon emissions due to incomplete combustion of the fuel. High water-to-fuel ratios can also cause excessive erosion of turbine parts.

Selective Catalytic Reduction. SCR is a post-combustion NO_x control technology that has been extensively applied to natural gas-fired combined-cycle CT operations. In this process, ammonia is injected into the exhaust gas upstream of a catalyst bed. On the catalyst surface, the ammonia reacts with NO_x from the combustion turbine to form molecular nitrogen and water vapor.

Optimum NO_x reduction occurs at catalyst bed temperatures between 500° F and 750° F. Below this optimum temperature range, the catalyst activity is greatly reduced, allowing unreacted ammonia to slip through. Above 850° F, ammonia begins to be oxidized to form additional NO_x. The ammonia oxidation to NO_x increases with increasing temperature.

The use of SCR for combined-cycle operations that use natural gas is well established. However, little operating experience exists for the use of SCR with simple-cycle and combined-cycle operations that rely on diesel as the primary fuel source. While optimum catalyst operating temperatures can be attained by locating the SCR catalyst in the boiler section of the HRSG, the impact of the resulting ammonium salt formation and deposition on the HRSG components can reduce reliability and thermal efficiency. Also, the operational demands of the DTCC units require that they be able to function independently as simple-cycle units. As a result, if SCR technology is required for the proposed units when operating in either mode, the SCR must either be placed upstream of the HRSG, out of the boiler section of the HRSG, or two separate SCR systems must be utilized, one in the HRSG and one in the bypass duct.

Because of the unknowns associated with using SCR in applications with high temperatures, sulfur-bearing fuels, and cycling duty, MECO conducted a demonstration project to determine the technical feasibility of SCR for diesel-fired CTs. The demonstration project included program planning, bench-scale catalyst evaluation and selection, pilot unit design and construction, and pilot unit operation and testing. The project lasted approximately 2 years and was completed in 1996. The results of the project are currently being reviewed by the DOH and the U.S. EPA. Several issues remain unresolved following the demonstration project. Some of the issues which will need to be addressed before use of SCR on oil-fired DTCC units are discussed below.

Heat-Recovery Steam Generator. Use of SCR would significantly impact the designs of the HRSG. Sulfur released from the diesel fuel during combustion oxidizes and reacts with the ammonia, forming ammonium bisulfate and other sulfate solids. These solids are extremely corrosive and deposit onto the HRSG surfaces, where they corrode the HRSG tubes.

Results of the SCR demonstration program at the Maalaea Power Plant indicate that significant corrosion of HRSG tubes and tube fins takes place due to deposition of ammonium bisulfate and ammonium sulfate. Materials testing conducted on the heat exchanger showed relatively high fin corrosion rates, and it is estimated that some of the tubes in an HRSG would have to be replaced after about five years of operation.

In order to minimize the corrosion, the ammonium bisulfate compounds would need to be removed from the tube surfaces by high pressure washing. Water washing of the tubes would produce wastewater containing high concentrations of metals, including some in high enough concentrations to be classified as hazardous by the Resource Conservation and Recovery Act (RCRA). In order to minimize the corrosion of the tubes, it is estimated that the ammonium bisulfate deposits would have to be washed off of the HRSG as often as every 3 to 4 months. The frequency could change once actual operating experience is gained. Final design of the HRSG would also impact the estimated cleaning frequency.

Wastewater Treatment. Use of a high pressure washing procedure could result in an estimated 5,000 to 10,000 gallons of wastewater produced during a single wash. The wastewater produced would need to be stored in a wastewater storage tank on site, and treated prior to disposal. Metals present in the wastewater would be removed by precipitation. The pH of the wastewater would have to be raised to approximately 9.0 to 11.0, requiring the use of sodium hydroxide. The metals would precipitate as complexes, resulting in a significant reduction in the concentration of the metals in the wastewater.

The wastewater would be transferred from the wastewater storage tank to a reaction tank, where the pH would be adjusted using caustic to achieve the desired pH. As the pH is adjusted, the precipitating solids would coagulate, forming a sludge. The metal sludge would then be removed from the water by clarification and filtration. The sludge would be dewatered for disposal.

The resulting wastewater would then be processed through an air stripper to remove ammonia. After final treatment, the wastewater would be stored in a treated wastewater storage tank prior to disposal in an injection well. Analysis of the treated wastewater would be performed to verify pH and metal concentrations are within permitted limits. If the treated wastewater is not within the permitted limits, the water would be returned to the wastewater treatment system for additional treatment.

Ammonia Transport and Storage. The use of SCR for NO_x reduction would require over 12,000 gallons of anhydrous ammonia to be stored on site. This would require the construction of additional storage facilities at the proposed generating station over and above those currently planned. In addition, there are currently no facilities in Hawaii which manufacture ammonia in sufficient quantities for SCR application. Therefore, ammonia would have to be transported from the mainland. The two types of ammonia generally considered for use are anhydrous ammonia (concentrated ammonia vapor), and aqueous ammonia (a solution of ammonia in water).

Aqueous ammonia is frequently used in SCR applications because it is easier to store and handle than anhydrous ammonia. However, since aqueous ammonia is diluted, it has to be transported and stored in greater volume. In addition, the dilution process requires large amounts of highly purified water, adding even more to the costs. As a result, the transport of sufficient quantities across the ocean would be very expensive. If aqueous ammonia were to be used, failure of a system component could result in the ammonia evaporating and being released to the atmosphere as a mixture of ammonia and water vapor.

Transportation of anhydrous ammonia, while it may be less costly than aqueous ammonia due to volume, presents more potential hazards since the ammonia has to be stored and transported in pressurized vessels. Leaks in ammonia transfer lines or supply systems could result in toxic vapor release. Therefore, the pressurized systems have to be monitored closely. If a system component should fail using anhydrous ammonia, the ammonia released to the atmosphere would be more concentrated and hazardous than a release of aqueous ammonia.

In the event of an ammonia release, the potential dangers are primarily related to exposure effects on the skin, eyes, nose, throat and respiratory tract. Skin contact with ammonia can cause severe irritation and burns. Contact with ammonia by the eyes or by inhalation is very irritating and can cause damage at concentrations above 130 to 200 parts per million (ppm).

3.1.6 Project Schedule and Cost

To accomplish the 2004 commercial operation date for the first combustion turbine, the engineering effort will need to commence by late 2000. Construction duration is estimated to last approximately 3 years and employ between 50 to 60 workers during peak construction. The engineering effort for the second combustion turbine is scheduled to commence by 2002 and achieve commercial operation by 2005. Commercial operation of the first steam turbine is scheduled for 2006, completing the first of the 58-MW DTCCs.

The initial phase of the plant will employ between 10 to 12 new employees, expanding to 46 new employees by full build-out. The estimated costs for construction of the initial Phase I are approximately $105.4 million. Cost of construction of the entire Waena Generation Station project is estimated at approximately $417.6 million. Table 3-1 shows the breakdown of costs and schedule by phase for the proposed generating station facility and accompanying transmission lines. It is estimated that the cost to ratepayers for the first DTCC will be an additional 1.76 cents per kilowatt-hour (kWh) in 1997 dollars.

The lengthy build-out schedule for the proposed generating station and MECO's concept of constructing no more than 20 MW at any given increment, allows MECO the flexibility to alter the project configuration and generation type in the future should new technologies and/or more fuel efficient and economical generation methods become available. Although the DTCC units will be installed over time, site preparation and development of the entire 65.7-acres will be performed during the initial DTCC I installation. Site development during the installation of the first DTCC unit will include full grading of the site and the installation of necessary infrastructure, such as drainage improvements, domestic wastewater systems, and roads, to support all four DTCC units.

Table 3-1 Project Cost and Schedule (1997 dollars)				
Project Component	**Acreage**	**Cost**	**Construction Start**	**Operation Date**
Land Costs	65.7	$1,847,648	n/a	1997
DTCC 1/Site Development	65.7	$105,370,000	2002	2006
DTCC 2	0	$96,857,000	2005	2010
Transmission Lines	n/a	$10,419,000	2003	2004-2020
Transmission & Distribution Facility	0	$5,900,000	2014	2016
DTCC 3	0	$100,318,000	2009	2016
DTCC 4	0	$96,848,000	2013	2020
Total Project Cost		$417,559,668		

Source: Maui Electric Company, Limited

3.2 Alternatives

3.2.1 No Action

Under the No Action Alternative, the Waena Generating Station would not be built. As a result, the additional generating needs identified in the Resource Plan (Table 2-2) would not be met. MECO considered the following issues in evaluating the No Action Alternative:

- Resource Planning has identified the need for additional units to the system beginning in the year 2004.

- Development of Demand-Side Management (DSM) energy programs will not offset the need for unit additions beginning in the year 2004.

- Lack of specific commitment, power purchase agreements, or generation facility data do not allow for the inclusion of any IPP resource proposals into the resource plan at this time. The firm power contract with HC&S expires at the end of 1999 and its renewal is uncertain. Thus, IPPs cannot be looked upon to meet or replace the need for additional units beginning in the year 2004.

- The scheduled retirement of older generating equipment can be deferred for a short time in order to accommodate permitting delays, however, this action does not ensure continued operating reliability nor offset the identified need for additional units beginning in the year 2004.

MECO concluded that the No Action Alternative would not allow it to meet its franchise agreement to provide reliable power to its customers. Therefore, MECO cannot consider the No Action Alternative a viable alternative and has not evaluated it further.

3.2.2 Conservation and Energy Efficiency

MECO is developing a long-range energy plan that evaluates both the supply and the demand sides of energy. The process, integrated resource planning, is designed to evaluate conventional and alternative energy resources, along with energy conservation and efficiency (DSM) programs for the purpose of meeting forecast energy demands.

DSM resource options are specific programs designed to reduce energy consumption. Examples of DSM programs are the use of high-efficiency lamps, heat pumps, solar water heaters, and high-efficiency motors.

Demand and energy reductions provide benefit to MECO and its customers by reducing the amount of fuel burned (or energy consumed) at the power plants and by deferring the requirement for additional power plants. In other words, DSM can be a substitute for the need for new generation capacity.

MECO has already developed DSM programs and has developed a 20-year, long-range *Integrated Resources Plan* (IRP), combined with a 5-year action plan, which was approved by the PUC in 1996. Conservation and energy efficiency programs are major elements in MECO's IRP to meet the future requirements of its customers in a cost-effective manner. The public participated in the planning through advisory groups formed by MECO. The objective of the program was to develop aggressive and achievable DSM programs that:

- Substitute for the need for new generation capacity
- Are evaluated in the context of IRP
- Reflect the operational and contractual characteristics of the system
- Provide service for all customer sectors
- Build the capabilities of MECO and market to support DSM programs
- Capture lost opportunity resources

In order to meet these objectives, MECO has selected a number of DSM programs to promote as part of its IRP. The programs are divided between "resource" programs operated to acquire capacity and energy resource and "service" programs operated to provide marketing impetus to the DSM program and offer special services to low-income customers. The DSM resource technologies include the following:

- **Commercial HVAC.** Commercial buildings use large amounts of electrical energy to cool spaces and control humidity. This measure attempts to influence customers to purchase higher efficiency equipment than they normally would to reduce the electrical energy consumption and peak capacity requirements of the cooling plant.

- **Commercial Lighting.** The largest use of electrical energy in the commercial sector is for providing lighting. This measure encourages customers to retrofit their existing lighting systems with high efficiency electronic ballast, high performance lamps, and reflectors that allow fewer lamps to provide similar effective lighting levels. The measure is also intended to influence decisions made when constructing new commercial buildings.

- **Commercial Refrigeration.** While a small market, refrigeration systems used in grocery stores, cold storage facilities, and refrigerated warehouses are large electrical energy users. This measure promotes high efficiency refrigeration equipment to reduce electricity use, peak capacity requirements, and customer bills.

- **Commercial Water Heating.** The objective of the commercial water heating measure is to influence the choice of commercial customers (hotels, restaurants, etc.) close to the time that they choose to replace their water heating equipment. The measure promotes the use of high efficiency water heaters (e.g., heat pumps) as well as the use of solar water heating.

- **Industrial Motors.** This measure targets customers who have significant motor loads. High efficiency motors can reduce energy use by a modest amount.

- **Custom Rebate.** The purpose of the custom rebate measure is to provide a mechanism to develop energy efficiency opportunities that otherwise might go undeveloped. Customers can identify opportunities in their facilities, develop a proposal, and present it to MECO. MECO then evaluates the proposal, determines if it is a cost-effective application, and establishes a cost-sharing arrangement with the customer.

- **Commercial and Industrial New Construction.** This measure promotes the design of electrical efficiency for commercial and industrial new construction. The measure prescribes several types of equipment and offers incentives on prescribed technologies as well as provides design assistance to encourage builders to exceed construction conventions. As a part of the measure, MECO offers community training on building designs and development for constructing more energy efficient models.

- **Residential Water Heating.** The residential water heating market represents one of the largest users of electrical energy and capacity on the island. The residential water heating measure promotes the use of high efficiency water heating technologies such as solar water heating and heat pump water heaters. Since there are also customers who may not be capable of installing either a heat pump or a solar system, efficient electric resistance water heaters are also being offered. Also, low flow shower heads, water heater thermal insulation blankets, and hot water pipe insulation are offered to further reduce hot water consumption as well as conserve water.

These DSM technologies have been bundled together to form DSM resource programs based upon the common end-uses and market segments that they address. These programs include the:

- Commercial and Industrial Energy Efficiency Program
- Commercial and Industrial Customized Rebate Program
- Commercial and Industrial New Construction Program
- Residential Efficient Water Heating Program

In addition to the four resource programs listed above, two service programs were included in the DSM action plan. The first is an educational program which includes public information, school education, and other activities to build awareness of energy efficiency and MECO's DSM program offerings. This program includes the continuation and expansion of the successful In Concert with the Environment (ICE) program currently operated by MECO. In addition, a low income program has been created to offer additional incentives and specialized marketing within the residential water heating program.

Altogether, these programs are projected to provide peak-demand saving of 1.5 MW in their first year of implementation (see Table 2-2) and 14.4 MW of energy savings by the year 2004. However, because energy efficiency and peak capacity reductions have not been comprehensively pursued by any organization in Hawaii to date, there is considerable uncertainty about how to structure the DSM programs. Therefore, monitoring of the implementation process will be important. Programs will need to be adjusted as the implementation process moves forward. MECO expects to update its DSM program plans annually to optimize program implementation and energy savings.

MECO considers its DSM program one of the most aggressive and dynamic in the United States. As a result of their DSM programs, MECO anticipates an approximate 10 percent reduction in the peak electrical demand over its 20-year plan. MECO has included this anticipated reduction in demand in its resource plan, which still indicates a need for additional generation by the year 2004.

3.2.3 Deferred Retirement of Existing Units

MECO's generation planning criteria require MECO to be able to meet the daily system peak demand should the largest available unit fail while units are off-line for scheduled maintenance. Currently MECO is installing additional units at its Maalaea Power Plant to reach this required level of reserve margin. However, as demand for electricity grows and the reserve margin diminishes, MECO cannot rely on the use of older units to operate reliably over an extended period of time even with the most optimistic appraisal of what MECO could achieve through its DSM programs.

Many factors affect the decision to retire a generating unit. Violation of MECO's generation unit addition planning criteria reserve margin is evaluated in determining whether or not a MECO generating unit should be retired. In addition, any one or a combination of the following factors are evaluated:

- Parts availability
- Reliability
- Operations and maintenance expenses

The availability of major parts and components of the generating unit is critical in maintaining the generating unit for operations. Units are considered for retirement if parts are not readily available or will take an unreasonable amount of time to be manufactured and delivered to MECO. As units become older, the likelihood that parts cannot be purchased becomes greater, increasing the down time for these units for maintenance and repair as new parts then must be specially made.

Reliability of the unit must also be taken into account. A generating unit that is constantly out of service reduces the generation reserve margin.

Operations and maintenance expenses are another factor considered before a unit is retired, including fuel efficiency and the cost to keep the unit "available" to meet the dispatcher's needs. Generally, high-speed diesel generators are costly to maintain and operate (unless used for stand-by or peaking duty only), which results in a higher overall kilowatt costs.

Although MECO could defer retirement of its generating units until they can no longer be operated, without newer replacement generation in the short term, breakdowns in the older units become more likely. This could result in rolling blackouts or brownouts. It is MECO's responsibility to provide reliable service to the public, and MECO will not assume such a risk. Consequently, the deferment of retirement of existing units is not a reasonable alternative. The initial service date of the existing MECO units and their planned retirements are shown in Table 3-2.

3.2.4 Alternative Technologies

The County of Maui, State of Hawaii, and MECO have policies of reducing dependence on fossil fuels for energy by promoting development of natural renewable resources. Alternative energy sources being developed or in use in the State of Hawaii include biomass conversion, geothermal, hydroelectric, solar, wind, ocean thermal energy conversion, and coal. These technologies are expected to play an increasing role in energy production in the State of Hawaii. However, the timing of their technological development and commercial availability to provide cost-efficient firm generating capacity on the Island of Maui do not make them technically or economically viable options at this time.

Table 3-2
Planned Retirements of Existing MECO Units

Unit	Type	Normal Capacity (MW)	Service Date	Scheduled Retirement
Kahului 1	Steam Boiler	5.9	1948	December 2005
Kahului 2	Steam Boiler	6.0	1949	December 2006
Kahului 3	Steam Boiler	12.7	1954	December 2004
Kahului 4	Steam Boiler	13.0	1966	December 2016
Maalaea 1	Diesel	2.5	1971	December 2001
Maalaea 2	Diesel	2.5	1972	December 2002
Maalaea 3	Diesel	2.5	1972	December 2002
Maalaea 4	Diesel	5.6	1973	December 2003
Maalaea 5	Diesel	5.6	1973	December 2003
Maalaea 6	Diesel	5.6	1975	December 2005
Maalaea 7	Diesel	5.6	1975	December 2005
Maalaea 8	Diesel	5.6	1977	December 2007
Maalaea 9	Diesel	5.6	1978	December 2008
Maalaea 10	Diesel	12.5	1979	December 2009
Maalaea 11	Diesel	12.5	1980	December 2010
Maalaea X1	Diesel	2.5	1987	December 2012
Maalaea X2	Diesel	2.5	1987	December 2012
Maalaea 12	Diesel	12.5	1988	December 2018
Maalaea 13	Diesel	12.5	1989	December 2019
Maalaea 14	CT	20.0	1992	December 2023
Maalaea 15	Steam Turbine	18.0	1993	December 2023
Maalaea 16	CT	20.0	1993	December 2023

Source: Maui Electric Company, Limited

As a part of the IRP, MECO identified and assessed a wide range of commercial and developing resources appropriate for consideration as potential supply-side resource options. The IRP is available at public libraries. The results of these assessments are discussed below.

3.2.4.1 Biomass Conversion

Biomass conversion involves cultivating and harvesting plants as a natural energy alternative to fossil fuels. Biomass can be used as a fuel for combustion to produce thermal energy which is then converted to electrical power.

In Hawaii, the biomass resources currently used for electric generation are agricultural residues, chiefly bagasse, the fibrous waste associated with the sugar cane process. The amount of agricultural residues available for electric power generation is determined by the volume and type of agricultural crops, competing uses (e.g., erosion control and nutrient recycling), and constraints on traditional means of disposal (e.g., field burning). The primary agricultural residues on Maui are the sugar cane trash and bagasse from the sugar plantations and pineapple waste. However, bagasse is the only resource currently being used as a fuel in direct combustion electricity generation. In 1991, cane production on Maui was 1,894,420 tons, which resulted in 571,684 tons of bagasse. Almost all of this resource is already used through direct combustion to produce steam for factory processing and electricity generation.

Biomass energy systems are currently operating at the Puunene and Paia Sugar Mills owned and operated by HC&S, and at the Pioneer Sugar Mill at Lahaina, owned and operated by the Pioneer Mill Company. All are cogeneration facilities. As of 1991, the total generating capacity from these three sugar mills was approximately 60.3 MW. However, these mills used over 60 percent of the electricity to run their own processes, leaving only 40 percent to be sold to MECO. Because these plants have a contractual commitment higher than what can be normally produced by available bagasse, they must supplement electricity production with fossil fuels. As the reduction in sugar cane production increases, these mills will be forced to increasingly supplement their electrical generation with alternate fuels.

To date, there are no known dedicated biomass to electricity facilities in the United States. All existing biomass to electricity plants use waste products (i.e., wood waste, agricultural wastes, etc.) to power their facilities as part of a cogeneration process.

MECO was a participant with the Pacific International Center for High Technology Research (PICHTR), the County of Maui, State of Hawaii, and other parties on a National Renewable Energy Laboratory study to examine biomass to electricity applications for Hawaii. The determination of the parties was that biomass facilities would be too costly at this time.

MECO is also following the progress of the PICHTR and State of Hawaii project development of a biomass gasifier demonstration at the Paia Sugar Mill. This 100 ton per day facility is to demonstrate the latest gasifier technology which would improve the efficiency of current biomass technologies.

A stand alone, biomass generating facility of the size required to produce MECO's required 232-MW of electricity would cost over $870 million (in 1997 dollars) and would require over 60,000 acres of cropland designated for fuel production. By comparison, the generation portion of the proposed Waena Generating Station project is estimated to cost only approximately $400 million. Such high costs associated with the construction, operations, and maintenance of a biomass facility do not make it economically feasible to pursue as a viable alternative within the time frame of this project's need. Nor does the required land commitment make it a realistic option for stand-alone energy production on the Island of Maui at this time.

3.2.4.2 Geothermal Energy

Geothermal energy is natural heat energy from the earth that can be harnessed for electrical power generation. This energy may be found as steam, hot water, hot dry rock, or magma. Currently, only hydrothermal resources, which occur in hot water or steam systems, are being developed economically for electrical power generation. At this time, geothermal energy is only being produced on the Island of Hawaii.

As the second youngest island in the Hawaiian chain, Maui retains a high probability for possible geothermal energy production. Currently, the southwest rift subzone of Haleakala has been designated as the site for potential geothermal development. Exploration would be needed within the subzone to determine the viability of commercial geothermal operations. However, to date, Maui County has not developed its rules and regulations governing geothermal development.

Development of the geothermal resource has caused considerable controversy from local residents on Hawaii. This is the result of both religious objections and health and safety concerns, especially concerns about noise and sulfuric acid emissions.

Because of the lack of existing regulations and the controversy surrounding the use of geothermal energy in Hawaii, it was not considered a practical or feasible alternative for further evaluation.

3.2.4.3 Ocean Thermal Energy Conversion

An ocean thermal energy conversion (OTEC) plant uses the temperature difference between warm surface water and cold deep water to generate electricity. A minimum temperature difference of about 40° F is necessary to generate electricity. The movement of massive amounts of both deep cold and warmer surface waters is required. Depending on the onshore and offshore topography, infrastructure, and environmental considerations, OTEC plants can be designed as shore-based or offshore plants. Shore-based plants are appropriate for locations with steep offshore slopes and sufficient land area for infrastructure and generation equipment. Offshore plants can be floating platforms or tower-mounted structures. The electricity generated by offshore plants can be transmitted to shore through underwater cables.

Currently, OTEC technology is in the research and development stage. No commercial OTEC plants are currently operating. However, experimental plants demonstrating the OTEC concept have been constructed and tested in both the U.S. and Japan. The Natural Energy Laboratory of Hawaii Authority (NELHA) off Keahole Point on Hawaii has an open-cycle OTEC demonstration project which produces approximately 210 kilowatts (kW) of gross power. A closed-cycle 50-kW plant is also being operated at NELHA. However, the closed-cycle project has had problems with ammonia leakage in the flat-plate aluminum heat exchangers. Costs for OTEC facilities are high, with the capital costs of a 50-MW land-based facility estimated at over $300 million.

The best potential OTEC sites on Maui are along the southeastern shore and portions of the northeastern coast where a depth of 3,000 feet is accessible within two nautical miles of shore. However, the current economic and technical constraints on the construction of large-scale OTEC plants, including needed improvements in the design and construction of larger seawater pipes and larger turbines, do not make this an alternative which would be economically feasible or technically available within the time frame for required energy needs outlined by MECO. Therefore, this alternative was not considered further.

3.2.4.4 Fuel Cells

Fuel cell technology produces energy by creating a reaction within an electrolyte substance using a combination of heat and a chemical agent, usually hydrogen. Megawatt-scale fuel cell demonstration projects using phosphoric acid as the electrolyte and natural gas as the fuel source are operating in Japan. Applications of this technology within the U.S. are still limited and testing is still being conducted using various liquid and gaseous fuels.

Other types of fuel cells are also being demonstrated in the Untied states. Molten carbonate fuel cells are operating in the City of Santa Clara, California (2 MW) and at Miramar Marine Station (250 kW). A 200-kW proton exchange membrane fuel cell is being operated in Indiana.

In general, fuel cell power plants are characterized by high efficiency, minimal emissions, little noise, and small land requirements. A very clean fuel is required to avoid contamination and degradation of the fuel cell stack performance. An 11-MW phosphoric acid fuel cell plant would require approximately 1 acre of land and have a capital cost of between $28 and $34 million. A 200-kW phosphoric acid fuel cell plant would require approximately 1,200 square feet with a capital cost of approximately $1 million.

The development of a commercial fuel cell technology is still within the research stage. Because of this and fuel feed-stock availability, it cannot be considered a viable alternative for providing the immediate energy needs identified by MECO. However, should research develop a system which is economically comparable to existing fossil fuel technologies, fuel cell technologies may become viable for use in small-scale, dispersed generation systems within urban areas, where air quality and noise issues make the licensing of conventional power generation technologies difficult.

3.2.4.5 Wind Power

Wind energy conversion systems (WECs) convert wind energy into electricity by collecting the wind's kinetic energy with blades connected to a drive shaft that turns a turbine generator. Commercially available wind turbines include both horizontal and vertical axis rotation designs. Horizontal axis turbines generally have two to four blades mounted on a tower which allows clearance from the ground and elevates the rotor into stronger, less turbulent winds. Vertical axis turbines also have two to four blades. However, their rotors revolve around a centrally located tower, the axis of rotation being perpendicular to the ground.

Major commercialization of smaller wind turbines began in 1981. Since then, wind generating technologies have progressed to a point where the use of mid-size turbines (250-600 kW and larger) may be a more viable option. Installed costs can be between $1,050 and $1,280 per kW.

WECs depend upon an adequate wind resource to drive the system. Annual mean wind speeds of 13 to 14 miles per hour (mph) are necessary to substantiate development of a wind resource area. A minimum wind speed of 7 mph is necessary to start the turbines, which operate at maximum power generation at 30 to 35 mph. The turbines are generally stopped when wind speeds exceed 45 mph. Environmental impacts from wind systems include excessive noise, visual impacts, bird kills, and electrical interference to local television reception and telephone communications. In addition, large land areas are generally required for the turbines. Over 1,600 acres is estimated as required to contain enough turbines to produce 232 MW of power.

The Hawaiian Islands are very well suited to the development of wind energy technologies. Maui is dominated by the tradewinds, which blow approximately 70 percent of the year. Several utility-connected wind turbine machines have been installed on Maui in the past. Most were small units of less than 25 kW. Only one utility-scale unit has ever been installed on Maui, the 340 kW Windane machine at MECO's Maalaea facility, installed in 1984. This unit experienced a series of technical problems and was eventually suspended. MECO is currently negotiating with another wind developer for a large MW-scale wind farm installation on Maui.

As a part of the IRP process, MECO fully evaluated the alternative of a 10 MW wind farm in the Central Maui region near Maalaea. Cost of the 10-MW system was estimated at approximately $13.3 million. While wind energy is very desirable from the community standpoint, any wind energy production can be considered only supplemental to the overall generation system because it depends upon an intermittent resource. The intermittent character of the wind source potentially lowers the value of the power compared to the dispatchable (on demand) output of most conventional generating plants. Because of the high cost and intermittent nature of this alternative technology, as well as the large land requirements, system limitations, and visual intrusion associated with the vast number of turbines required to produce 232 MW of power, wind energy cannot be considered a feasible alternative to the proposed project.

3.2.4.6 Solar Power

Solar energy comes from the radiation of the sun, and can produce electrical power directly via photovoltaic cells or solar thermal electric systems. MECO has operated and maintained a 20-kV photovoltaic system at the Kihei High Technology Park since 1989. MECO also will be installing 1 kW photovoltaic systems on public high schools as part of its Sun Power for Schools project. No large-scale, commercial, solar-powered electric generating facilities are located in the State of Hawaii.

A photovoltaic plant consists of a number of photovoltaic modules mounted on structures known as arrays. Between 6 to 7 acres of land are estimated as necessary to house the arrays for each 1 MW of power production. This land must be relatively flat and should be located in an area receiving a high degree of sunlight and away from dust and salt spray. The cost of such a photovoltaic system is currently estimated at $8 to $10 million per MW.

In 1992, the State of Hawaii conducted an assessment of solar electric generating systems for Hawaii (DBEDT, 1992). The results of this study revealed that Hawaii's direct insolation (amount of direct sunlight) is lower than anticipated and that land costs are too high to make solar power cost-effective. In addition, MECO has recently evaluated a dish stirling technology for potential use, however, the high maintenance and low efficiency of the technology made it unfeasible.

Hawaii has a large existing market for the use of photovoltaic cells on residential and commercial structures. In addition, solar thermal energy is evident in solar water heater and heat pump heaters, of which Hawaii has the highest per capita installation in the U.S.

Although large-scale, solar-powered energy production has been shown to be technically feasible in some areas of the mainland southwest, they are not currently economical, especially if energy storage costs are included. In addition, they are land intensive (approximately 1,400-1,600 acres for 232 MW) and the high dust and salt content of the air within the Central Maui region would make development of a commercially-sized photovoltaic system impractical.

3.2.4.7 Hydroelectric Power

Hydroelectric power involves using water from streams or rivers for generating electrical energy. At present, MECO hydropower resources are run-of-the-river units owned by sugar mills and used to provide energy for the plantation and to MECO on an as-available basis. Therefore, they do not warrant consideration as firm capacity sources.

Development projects have examined potential sites for the development of hydroelectric power facilities on Maui, notably within the Waialuaiki Stream, Waihee River, the Hanawi and Kahuakuloa Streams, and the Honokohau Ditch. All the sites investigated would require the construction of diversion dams. Total estimated production for all the identified sites is less than 10 MW. In addition, MECO has conducted pumped storage hydroelectric feasibility studies for Maui as a part of its Integrated Resource Planning review process.

Because stream flow in many of Hawaii's streams and rivers is variable, power produced by hydroelectric facilities cannot be considered a part of MECO's firm power generation resources. In addition, the need to construct diversions and dams for use of the water makes this alternative technology impractical.

3.2.4.8 Coal-Based Technologies

Coal technology received extensive evaluation as an energy resource during MECO's preparation of its IRP. In developing its IRP, MECO was required to consider all supply-side and demand-side resource options, including coal technology, that are appropriate for Maui and are available in the planning horizon.

Coal is categorized as a commercial resource option. Commercial resources are those considered to be available for utility application within the current time frame and which also meet the following five criteria:

- Vendor availability
- Proven technology
- Utility scale
- Well-established capital and operating costs
- Resource availability

Several varying coal technologies were examined through the IRP process, including the use of pulverized coal, atmospheric fluidized bed combustion, pressurized fluidized bed combustion, and coal gasification. Of these technologies, only pulverized coal and atmospheric fluidized bed combustion are feasible and available for commercial installation at this time. Pressurized fluidized bed combustion and coal gasification are still under development.

Coal-powered plants require the delivery of large quantities of both coal and lime. These resources would need to be delivered to Maui by barges, which have a 15,000 ton capacity. The dock-site facilities would need to include a truck loadout station where coal would be loaded and transported to the plant site. The plant site coal handling facilities would include a truck unloading station and storage areas which would accommodate a 15-day supply; an additional 20-day supply is generally provided offsite.

The amount of fuel coal and lime required for one day's operation of a 232-MW pulverized coal facility is estimated at over 2,500 tons and 70 tons, respectively, with an atmospheric fluidized bed facility requiring slightly more coal per day (2,700 tons per day). Capital costs for such a coal-powered facility would be over $950 million (in 1997 dollars), far offsetting any price differentials realized by the use of the cheaper coal resource. Because of the need to create dockside resources and the large capital costs associated with this technology, it was not considered a practical alternative for providing baseload generation for Maui at this time. However, because of the incremental installation of the units at the proposed Waena Generating Station, and the potential ability of the units to utilize fuel made from coal gasification, the possibility exists that MECO could change to a coal gasification technology in the future should it become more economically and technically feasible.

3.2.5 Alternative Fuels

In addition to alternative technologies, MECO, through their IRP process, also investigated the availability and feasibility of using alternative fuels other than diesel and coal for use with their conventional generation resources. The alternative fuels looked at are discussed below.

3.2.5.1 Landfill Gas and Digester Gas

Landfills containing municipal solid waste can be managed to generate landfill gas as the waste decomposes. Typical landfill gas consists of 40 to 60 percent methane; 40 to 50 percent carbon dioxide; 1 to 5 percent air and inert gases; and trace amounts of hydrocarbons, volatile solvents such as benzene, organic sulfur compounds, hydrogen sulfide, and silicon-based compounds. Generally, methane production within landfills begins to increase after 3 years, leveling off when methane and carbon dioxide production equalize.

The quantity of landfill gas generated will vary from roughly 0.02 to 0.22 cubic feet per year per pound of waste, depending primarily on the amount of organic content, moisture content, temperature, and type of refuse deposited. Modern landfills with sophisticated liner and cap systems are drier than older sites and are typically more inefficient waste digesters and generate lower amounts of gas compared to older sites.

Digester gas is similar in composition to landfill gas except that it generally contains hydrogen sulfide. The gas is produced in an anaerobic digester. Typically, digester gas is used to fire boilers to produce heat to maintain digester temperatures within the treatment plant.

On Oahu, landfill gas has been used in small operations by Ameron HC&D, Inc. (3 MW) in connection with the Kapaa Landfill, where gas is collected to help power quarry activities. However, Maui's landfills lack sufficient size to produce a reliable source of landfill or digester gas for use within the MECO generation system. The tapping and use of potential landfill gas may best be handled by smaller operations, such as Ameron's existing quarrying activities adjacent to the Maui County landfill.

3.2.5.2 *Propane*

Propane is produced when crude oil is refined. It is also collected in natural gas processing plants. The amount of propane produced varies directly with the amount of crude oil products and natural gas produced. Propane must be further processed to remove hydrogen sulfide, methyl and ethyl mercaptans, and elemental sulfur. Propane is generally shipped by tanker or barge to Maui, then by truck to tank storage facilities. Although emissions from burning propane are less than emission when firing diesel fuel, the cost of propane is almost three times higher than the cost of conventional fuel. This high cost does not make the use of natural gas or propane a feasible alternative at this time.

3.2.5.3 *Ethanol*

Ethanol is a colorless, volatile, liquid also referred to as ethyl alcohol or grain alcohol. It is usually made be fermentation of food crops including sugar cane, sugar beets, corn, wheat, and potatoes. Ethanol is typically added to gasoline to form "gasohol."

Ethanol is generally more expensive than conventional fuels and runs approximately twice the cost of conventional gasoline. Because of the unavailability of large quantities of ethanol in Hawaii and its high cost relative to diesel, ethanol is not currently considered feasible as a fuel for utility power production.

3.2.5.4 *Methanol*

Methanol is also referred to as methyl alcohol or wood alcohol. It can be made from a variety of carbon-containing materials such as natural gas, liquefied petroleum gas, naphtha, residual oil, oil shale, coal, and biomass. Coal and biomass are elements which could be used to create methanol on Maui.

In general, methanol produced from either coal or biomass contains negligible amounts of sulfur and nitrogen, which results in reduced amounts of nitrogen oxides and sulfur oxides. However, the burn efficiency of methanol is only half that of conventional fuels, resulting in the need for greater methanol amounts and fuel storage space. In addition, methanol is highly corrosive, especially to plastic materials and fiber gaskets.

Because of the unavailability of large quantities of methanol in Hawaii, its corrosive nature, and its high cost relative to diesel, methanol is not currently considered feasible as a fuel for utility power production on Maui.

3.2.5.5 *Orimulsion*

Orimulsion is an asphalt emulsion produced by Bituminous Orinoco SA of Venezuela. It is a bitumen based fuel with properties similar to No. 6 fuel oil. Orimulsion is produced by combining bitumen with a mixture of approximately 30 percent water.

Orimulsion can be transported in vessels designed to transport No. 6 fuel oil and can be used in some power plants designed to burn No. 6 fuel oil without major modifications. However, the fuel is high in sulfur and ash content and creates excessive amounts of sulfur dioxide and particulate matter emissions when burned. When orimulsion is used as a feedstock for coal gasification, this excess sulfur can be separated out and the gas product has generally better thermal efficiencies and high yields than normal gasification of coal/water slurries.

At this time, the large amount of sulfur dioxide created from burning orimulsion would require extensive and expensive air emission control devices were it to be used in power production in Hawaii. These costs, in connection with the costs of transport and storage, do not make orimulsion a feasible alternative at this time. However, should the gasification of orimulsion become more economical, use of this resource could become more attractive.

3.2.5.6 Coal Slurries

Recent efforts have been made to decrease the cost of fuel for oil-fired power plants by mixing ground coal with either water or oil and an additive to help keep the coal in suspension. However, power plant applications of this fuel type have been limited, in general because significant modifications to existing plants are required beforehand.

The coal slurry can be prepared before shipping and pumped ashore through an underwater pipeline. Transportation from the onshore storage facility to the generating station would also be by slurry pipeline. Storage tank facilities would require agitation to prevent the coal particles from dropping out of suspension.

An advantage of a coal slurry over conventional coal is that as a liquid it can be handled as easily as a liquid fuel. In addition, the costs of coal slurries are less than conventional fuels. However, coal slurries are less efficient thermally than conventional fuels and capacity reductions of between 20 to 60 percent often result from the required conversion of existing units to burn coal slurry. In a newly designed plant, generation units and boilers would need to be sized sufficiently to produce the equivalent amount of power as conventional fuel-fired generators. As a result, the requirement to burn more slurry more than offsets the small differential in price between it and conventional fuels.

3.2.5.7 Municipal Solid Waste

As a general rule, waste-to-energy plants are considered primarily for waste reduction, with electric energy as a byproduct. The plant burns the waste material and the resulting ash material that requires landfilling is small. Municipalities that do not have sufficient space available for permanent waste landfilling, and where landfill tipping fees are high, are good candidates for waste-to-energy plants.

The performance of such plants is dependent on the quantity and characteristics of the available waste fuel as well as the design of the plant systems and equipment. Since waste-to-energy plants are designed primarily for waste reduction, and typically must compete for materials with other government-sponsored programs, such as recycling and composting, such plants cannot be dispatched to meet load demand and cannot be considered as firm power within the resource generation plans.

3.2.5.8 Naphtha

Naphtha is a light fraction fuel produced through the refinement of crude oil. It is generally used by the chemical industry in the production of ethylene. The availability of naphtha in Hawaii is highly dependent on the type of crude oil processed by the refineries and the quantities of light products (gasoline, jet fuel, naphtha) desired. Lighter oils yield more light products, whereas heavier crude oils yield less light products and require more refining.

If naphtha is used as a fuel for combustion turbines, some of the issues that need to be considered are the following:

- Fuel Availability
- Economics
- Low lubricity and viscosity
- Flash conversion to gas at low pressures
- Heavier than air qualities
- Temperature sensitivity
- Additional storage and cleanup requirements
- Hazardous classification

These considerations are addressed in more detail below.

Fuel Availability. Information from the State Department of Business, Economic Development, and Tourism (DBEDT) for the period 1991 to 1995 indicates a total average naphtha production of 3,000 to 6,000 barrels per day (bpd) in Hawaii. Actual exports of naphtha during that period ranged from approximately 450 to 3,500 bpd. Assuming that all naphtha produced in Hawaii were diverted away from current uses to this specific project, and given the fact that the Waena Generating Station could consume as much as 10,800 bpd of naphtha, it is clear that current naphtha production in Hawaii would be insufficient to support the project and that additional supplies would need to be shipped from refineries outside of Hawaii.

Economics. Because of its high demand in the chemical industry, the price for naphtha has varied considerably. The commodity price for naphtha over the last 10 years has ranged from a low of $125 per ton to a high of $365 per ton. The average price has been about $175 per ton. This equates to about $0.34 per gallon to $1.00 per gallon. In comparison, the cost of diesel fuel has remained a fairly constant $0.55 per gallon over the last few years.

Lubricity. One of the basic problems with naphtha is its low level of lubricity. This low capacity to lubricate means that naphtha can cause additional wear and tear on the generating equipment. The magnitude of this problem is such that corrective additives are not an economically viable solution when equipment is operated under continuous baseload conditions.

Since diesel has a higher level of lubricity, the diesel fuel system uses a more conventional application and does not require the special equipment that naphtha would for fuel control and flow division. Naphtha requires a system that eliminates components that would easily break down due to low lubrication.

Flash Point. Naphtha, unlike diesel fuel, will more easily vaporize and ignite at low air pressures. Because it has this low flash point, naphtha requires an alternative fuel to add stability, especially during system start-up. Diesel is typically used as a start-up fuel for naphtha. Low flash point fuels also have a tendency to be highly volatile. Therefore, it is necessary to provide for draining of naphtha fuel between the manifold valves and fuel nozzles after transferring to an alternative fuel to avoid any build up of vapors. This causes additional operational requirements for any facility using the fuel.

Since naphtha has a tendency to flash at low pressures, it is very sensitive to reductions in manifold pressure and temperature. When the system begins to slow down to accommodate lower load demand, the decreased pressure can cause the turbine to flame-out (lose ignition ability). The control system will then command the generator to shut itself down. The availability of the plant to operate well during low loads will be affected should the turbine begin to flame out. Since diesel is stable at low pressures, its use provides MECO a more reliable facility able to handle load swings.

Ventilation Requirements. Naphtha vapors, which are heavier than air, require additional fans in the bottoms of enclosures to remove them. The fuel skid and turbine compartment need to be equipped with special ventilation systems that vent the exhaust to a safe area for disposal. The venting system must maintain a slight vacuum in the hazardous areas to assure against leakage of the combustibles into non-hazardous areas. Hydrocarbon detectors may be required in some applications in both the hazardous areas and in the vent lines.

The ventilation requirements for a diesel fuel system typically require exhaust fans on top of the enclosures for the turbine and generator compartments with no special requirements for venting.

Temperature Considerations. Because naphtha is very sensitive to temperature, the fuel and piping must be maintained between 68° F and 140° F. Below 68° F, the fuel may wax (thicken), and above 140° F, the fuel may flash. A naphtha cooler is required prior to the booster pumps if the naphtha cannot be maintained below 140° F. Heat tracing of piping will be required if the temperature range cannot be maintained.

Diesel fuel is less sensitive to temperature and pressure and does not have the same considerations required for naphtha.

Storage and Cleanup. Most liquid fuels that are transported and stored become contaminated and require fuel treatment to assure that the fuel meets the engine requirements. The fuel treatment generally consists of filters in the fuel lines along with a centrifuge to remove any impurities. Both diesel and naphtha would require fuel treatment to meet the engine requirements.

The storage requirements for naphtha are greater than those for diesel. The heating value of naphtha and diesel per pound is approximately the same. Since naphtha has a lower specific gravity than diesel, the heating value on a volumetric basis for naphtha is lower than diesel. For the same duration of storage time, naphtha storage requires approximately 25 to 30 percent more volume than diesel storage. There are currently no storage or unloading facilities on Maui for naphtha fuel and no proposals are known at this time to construct any new storage facilities at Kahului Harbor to accommodate naphtha. In addition, existing barges used for MECO's interisland fuel transport are unable to accommodate naphtha.

Naphtha is stored in tanks with floating roofs that eliminate any air space for vapors to collect. Diesel storage tanks are typically fixed roof tanks with a floating suction since diesel vapors, which develop in the open air space at ambient temperatures, are not a concern. The cost of a floating roof tank typically is 20 percent more expensive than a fixed roof tank of the same capacity, thus the capital cost for fuel storage of naphtha is higher than for diesel storage. Since naphtha also requires a startup fuel, additional provisions for unloading and storing the startup fuel will be required if naphtha is burned. A September 1996 MECO analysis conducted for the Maalaea facility showed that using naphtha would cost approximately $3.3 million more each year due to the lack of infrastructure. Therefore, naphtha use for electric utility generation on Maui is currently not cost effective compared to No. 2 diesel.

The cleanup of a diesel spill does not require any special precautions. Diesel is very stable at ambient temperatures and has a flash point of 126° F. Naphtha, due to its low flash point, will produce vapors at temperatures greater than 0° F and precautions need to be taken during cleanup due to this high flammability and its health classification (see below). If left for a sufficient period of time, naphtha will completely vaporize. Since naphtha vapors are heavier than air, any containment would be filled with naphtha vapors and would be extremely hazardous to personnel.

Hazard Classifications. Hazard classifications for diesel and naphtha are determined by the National Fire Protection Agency (NFPA). Naphtha has a more severe hazard classification for health and flammability than diesel fuel and has the same rating for reactivity hazard classification.

Naphtha has a health classification of 1, which means that it is a material that, on exposure, would cause irritation, but only minor residual injury, including those requiring the use of an approved air-purifying respirator. Naphtha is only slightly hazardous to health and only breathing protection is needed.

Diesel has a health classification of 0, which means that, on exposure under fire conditions, it offers no hazard beyond that of ordinary combustible material.

Because of its low flash point, naphtha has a flammability classification of 4, which is the most flammable. The preferred method of controlling a fire is to stop the flow of material or to protect exposures while allowing the fire to burn itself out. Water is ineffective in controlling a naphtha fire.

Diesel has a flammability classification of 2, which indicates the material must be moderately heated before ignition will occur. Water spray may be used to extinguish diesel fires because the fuel can be cooled below its flash point.

Both diesel and naphtha have a reactivity classification of 0, which indicates materials that are normally stable, even under fire exposure conditions, and do not react with water.

Emissions. The sulfur content in naphtha is very low in comparison to diesel fuel. Naphtha has less than 0.10 percent sulfur content, while conventional diesel fuel has a sulfur content of approximately 0.40 percent. Because of this, naphtha will burn much cleaner than conventional diesel fuel and the sulfur dioxide emissions will be lower.

Conclusions. The choice of a fuel at a power plant is based upon the availability, price, and design and safety concerns of the fuel for the unit. The availability of diesel fuel in Maui is already well established. Although naphtha can provide cleaner emissions than diesel fuel in certain mainland U.S. applications, that is not the case for the Island of Maui. The lack of availability of naphtha for 232 MW of power production on Maui over the life of the project, the safety and design concerns, and the lack of existing storage and handling facilities at the harbor to accommodate the fuel do not make it a technically or economically feasible alternative to diesel fuel at this time.

3.2.5.9 A-21

A-21 is a proprietary fuel emulsion which according to A-55 Limited Partnership, developer of the fuel, has not been demonstrated in a combustion turbine. Additionally, since the fuel is made primarily of naphtha and water, the same considerations and concerns that make naphtha unfeasible (no storage facilities, lack of production capacity) also apply to A-21. Because A-21 is basically watered-down naphtha, larger quantities of A-21 would need to be combusted than naphtha in order to obtain the same heat input to the combustion turbines. This would require even more shipping and storage facilities than straight naphtha. Because of the greater capital costs involved with the additional storage facilities, as well as the other concerns with naphtha, this fuel is not a technically efficient or economically viable alternative.

3.2.6 Alternative Sites

Several siting studies and site assessments have been performed to determine the optimal location on the Island of Maui for the proposed Waena Generating Station. The locations of the alternative sites considered through the studies performed between 1989 and 1995 are shown in Figure 3-5.

3.2.6.1 1989 Site Selection Study

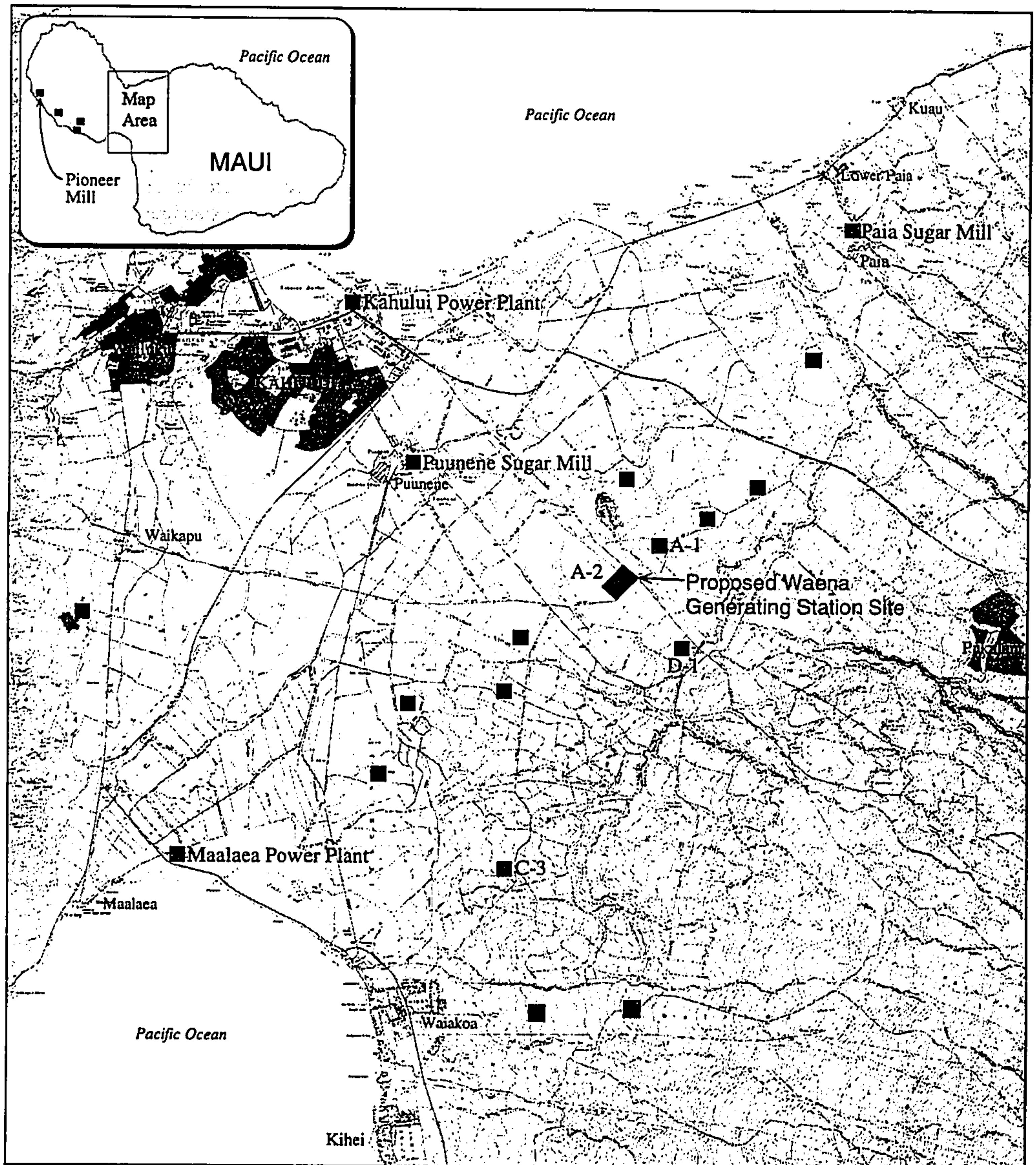
The initial island-wide study, *Site Selection Study, Maui Electric Company, Ltd.* (Stone & Webster) was performed in 1989 and assessed ten candidate sites island-wide. The ten candidates included sites in Olowalu, Ukumehame, near Waikapu, and the old Puunene Airport as well as the locations of existing power plants and sugar mills. This study identified three viable sites for future generation expansion, the Kahului Power Plant, Puuenene Sugar Mill, and the Maalaea Power Plant.

3.2.6.2 1991 Candidate Sites Report

A second generating facility siting study, the *Candidate Sites Report and Preferred Alternative Site/Technology Report* (Black & Veatch), was prepared in 1991. The report screened the Island of Maui for areas suitable for power plant development based on incompatible land uses, topographic slope, suitable land area, water availability, air shed availability, fuels logistics, transmission line integration, land uses, permitability, community acceptance, socioeconomics, and archaeology. As a result of the screening process, the Central Maui isthmus was identified as the most appropriate location for a new, stand-alone electrical generation facility. This report identified the Ameron Quarry, Puunene Airport, and Maalaea sites as the most feasible to consider and then evaluated these sites with varying technologies, including atmospheric fluidized bed combustion (coal), coal gasification, and combined-cycle combustion turbines. Following an evaluation of over 20 technical and environmental criteria, the report concluded that a combined-cycle combustion turbine arrangement at the quarry site would be most suitable for MECO's future baseload power generating station with the Puunene Airport site as an alternate.

3.2.6.3 1992 Site C-3 Environmental Assessment

In 1992, MECO further evaluated the preferred quarry and alternate Puunene Airport sites in coordination with the landowner for both sites, Alexander & Baldwin-Hawaii. Concerns raised by A&B-Hawaii resulted in the identification of an alternative site (identified as C-3 on Figure 3-5) approximately two miles southeast of the Puunene Airport site previously identified in the 1991 study. An environmental assessment conducted of the new alternative site (Belt Collins, 1992) concluded that it was a viable candidate for further consideration as a potential site for a Maui baseload generating station.



LEGEND

■ Alternative Generation Station Sites

Source: Maui Electric Company, Limited.

Final Environmental Impact Statement
Proposed Waena Generating Station
Maui Electric Company, Limited

FIGURE 3-5

ALTERNATIVE GENERATING STATION SITES CONSIDERED 1989 – 1996

NORTH 0 1 2 3 4 MILES

CH2M HILL

3.2.6.4 1992 Site C-3 Preliminary Site Assessment

Further evaluations of Site C-3 in 1993 examined the presence of hazardous materials and potential groundwater issues and determined the C-3 site acceptable from these standpoints. In addition, air quality analyses performed in 1993 found the Central Maui area acceptable for siting of a large baseload generating station (Trinity Consultants, 1993). However, the analyses also identified areas within the isthmus by the relative degree of difficulty perceived in obtaining air quality permits, with the areas north of the quarry stretching towards Kihei having the highest level of difficulty.

3.2.6.5 1994 Central Maui Siting Study

As a result of the air quality analyses and the unavailability of the C-3 site for purchase from A&B-Hawaii, a more comprehensive site identification and evaluation study covering Central Maui was performed in 1994. The *MECO Central Maui Siting Study* (Belt Collins, 1994) identified ten 50-acre candidate sites for initial evaluation based on environmental and technical factors such as air quality impacts, site soils, agricultural potential, visibility, and fuel transportation requirements. The executive summary of this report is contained in Appendix B.

The candidate sites were assessed against the evaluation criteria and given weighted scores depending on impact or ability to meet the evaluation criterion. The sites were then ranked by score. Six of the ten were selected as "finalist" sites and analyzed further. The other four sites were eliminated from consideration because they were either so similar to one of the six chosen as finalists that separate analyses would not have been meaningful, or they were clearly inferior to those six.

Three sites, identified on Figure 3-5 as Site A-1, A-2, and D-1, ranked highest among the remaining six candidate sites and were recommended for further analyses. Site C-3 (subject of previous discussions between MECO and A&B-Hawaii) scored considerably lower than other candidate sites due to air quality concerns, however, it was retained for further analysis based on the fact that it was the only one of the four sites not in sugar cane cultivation. Based on the results of the study and discussions with the State Department of Health, MECO identified the region around Sites A-1/A-2/D-1 as its primary area of interest. In the fall of 1993, MECO established meteorological monitoring stations to gather air quality and meteorological data representative of all four sites.

3.2.6.6 1995 Central Maui Siting Study

In 1995, MECO conducted a detailed environmental screening/site study of Sites A-1, A-2, and D-1 for comparison with the previously conducted site investigations of Site C-3. The *MECO Central Maui Siting Study* (Dames & Moore, 1995) evaluated the three sites in relationship to several environmental factors, including:

- air quality
- topography
- soils
- ground and surface water
- aesthetics
- noise
- traffic
- cultural resources
- hazardous materials
- botany
- engineering considerations
- natural hazards

Baseline surveys were conducted for each of the three sites and reports were prepared outlining anticipated impacts of a 232-MW baseload generating station located on each of the three sites. Weighted values were given to each site depending upon their assessment against the environmental criteria and scores for each site were computed. Table 3-3 shows the results of the analyses of the candidate sites. As a result of the analyses, Site A-2 was identified as the most preferred of the three candidate sites. The body of the Dames & Moore study, without appendices, is contained in Appendix B.

3.2.6.7 1995 MECO Generation Study

Following the 1995 Dames & Moore study, MECO performed a final site evaluation of Sites A-2, C-3, and D-1 (Stone & Webster, 1995) based upon more technical issues, such as constructibility, modeled impacts to air quality, proximity to wells, need for infrastructure improvements to adjacent roadways, overall project schedule, and costs. Site A-1, evaluated in the 1995 Dames & Moore study, was dropped from further consideration because Sites A-1 and A-2 were in the same air quality area and A-2 had ranked higher. Although Site D-1 previously had been found to be the least environmentally desirable of the three sites in the Pulehu Road area, it was retained as a final candidate site because it had been identified as having the best air quality in previous air quality analyses (Trinity Consultants, 1993). Site C-3 was included as one of the final sites as it was not being used for sugar cane production and the landowner had indicated that it was available.

The *MECO Generation Study, Central Maui 232-MW Generation Station* (see Appendix B for body of the report without appendices), utilized air quality modeling based upon the recently collected one-year's worth of meteorological data from sites C-3 and D-1. Data from D-1 was determined to be representative also of sites A-1 and A-2. Predicted air

Table 3-3 Preliminary Analysis of Candidate Sites				
		Site Score[1]		
Environmental Issue Area	**Weight**	**A1**	**A2**	**D1**
Land Ownership, Regulation, Use				
Land ownership	1	1	1	1
Existing candidate site land use	2	2	2	2
State Land Use designation	3	3	3	3
Community Plan designation	3	3	3	3
Zoning designation	3	3	3	3
Special Management Area	3	3	3	3
Existing/planned adjacent land use	2	6	4	2
Existing/planned regional uses	3	6	6	3
Air Quality	5	10	10	5
Soils	2	2	4	4
Groundwater				
Supply, availability	5	5	5	10
Supply, interference with existing source wells	3	3	3	3
Supply, quality	2	2	2	4
Disposal, proximity to supply wells	3	3	3	3
Disposal, regulation	4	4	4	8
Surface water (stormwater disposal)				
Quality	3	6	3	3
Disposal options	2	4	2	4
Regulation	3	6	3	6
Noise	3	3	6	9
Aesthetics (impairment of scenic views)	3	6	6	3
Biology	3	3	6	9
Cultural Resources	3	3	3	3
Topography	1	2	1	1
Natural Hazards	3	3	3	6
Hazardous Waste/Materials	5	5	5	5
Engineering Considerations				
Geotechnical	1	1	1	1
Transmission system	1	2	1	1
Fuel Delivery	1	1	1	2
Road improvement costs	1	2	1	1
Traffic/Transportation				
Traffic	3	6	3	3
Transportation	1	1	1	2
Sum of Site Scores (lowest is least constrained, most preferred)		**110**	**102**	**116**
Normalized Sums (100 is least constrained)		**92.73**	**100.00**	**87.93**
Overall Site Rank[2] (lowest is least constrained)		**2**	**1**	**3**

Notes:
[1] Site score is the product of a site's rank for a specific data factor times the assigned weight of the factor.
[2] Overall site rank is the rank order of the summed weighted ranks.

Source: Dames & Moore, 1995

emissions for the project were modeled at various stack heights to meet state ambient air quality standards, national ambient air quality standards, and federal Prevention of Significant Deterioration (PSD) increment limits. A series of community meetings was also held to allow area residents to discuss the proposed project and candidate sites.

Screening factors were scored for each site according to the evaluation criteria for that factor. Weights assigned each screening factor were then applied to the scores to achieve weighted scores. These weighted scores were then summed to achieve overall site scores, which were ranked from 1 to 3, with the lowest rank indicating the least constrained site. The results of this final site analysis are shown in Table 3-4. As a result of this site analysis, Site A-2 was considered the preferred site for the proposed Waena Generating Station due mainly to the fact that:

- the site had the least impact on air quality of the three
- the site had the least impact on biological resources of the three
- the site had the least impact on area traffic and transportation of the three
- the site had the least infrastructure costs of the three
- the site had the best location of the three in relationship to the existing MECO generation and transmission systems

As a result of the 1995 Stone & Webster study, which was based upon the previous studies performed since 1989, MECO selected Site A-2 along Pulehu and Waiko Roads as the site for the proposed Waena Generating Station described within this environmental document. The decision to select this site over other sites on Maui was primarily made on the results of air quality modeling, which determined the area in which a 232-MW generating station could be operated. Sites of existing power generation facilities were not chosen for the following reasons:

- **Kahului Power Plant.** This plant lies in a tsunami inundation zone and carries additional costs to comply with regulations and insurance associated with tsunami zones. The plant also is in close proximity to wetlands.
- **Maalaea Power Plant.** This plant is constrained from further expansion after the current dual-train combined-cycle system is installed in the year 2000. MECO has no further land available at the site for expansion.
- **Paia Sugar Mill.** MECO does not own this land and the site lies in an area considered extremely difficult to obtain necessary air quality permits for any plant expansion.
- **Puunene Sugar Mill.** MECO does not own this land and the site lies in close proximity to existing residential units. The site is also in an area considered extremely difficult to obtain necessary air quality permits for any plant expansion.

Table 3-4
Final Alternative Site Analysis

Environmental Issue Area	Weight	Raw Score A2	Raw Score D1	Raw Score C3	Site Weighted Score A2	Site Weighted Score D1	Site Weighted Score C3
Land Ownership, Regulation, Use							
Land ownership	1	2	2	2	2	2	2
Existing candidate site land use	2	3	3	1	6	6	2
State Land Use designation	3	3	3	1	9	9	3
Community Plan designation	3	3	3	3	9	9	9
Zoning designation	3	3	3	3	9	9	9
Existing/planned adjacent land use	2	1	1	1	2	2	2
Air Quality							
Compliance with AAQS/PSD Increment	5	1	2	3	5	10	15
Minimum Stack Height Required	5	1	2	2	5	10	10
Distance from Residential Receptor	5	1	1	3	5	5	15
Soils	2	2	2	1	4	4	2
Geology	1	1	1	1	1	1	1
Topography	1	1	1	1	1	1	1
Groundwater							
Supply, availability	5	1	1	1	5	5	5
Supply, interference with existing source wells	3	1	1	1	3	3	3
Supply, quality	2	1	2	1	2	4	2
Disposal, proximity to supply wells	3	1	1	1	3	3	3
Disposal, regulation	4	1	2	1	4	8	4
Surface water (stormwater disposal)							
Quality	3	1	1	1	3	3	3
Disposal options	2	1	2	2	2	4	4
Regulation	3	1	2	1	3	6	3
Noise							
Noise produced	2	2	2	2	4	4	4
Proximity to residential receptor	3	1	1	3	3	3	9
Aesthetics	4	1	1	2	4	4	8
Flora	3	1	1	2	3	3	6
Fauna	3	1	2	2	3	6	6
Cultural Resources	3	1	1	1	3	3	3
Natural Hazards	3	1	2	1	3	6	3
Hazardous Waste/Materials	5	1	1	1	5	5	5
Transmission and Distribution	1	1	1	3	1	1	3
Engineering Considerations							
Geotechnical	1	2	2	2	2	2	2
Fuel Delivery	2	1	1	1	2	2	2
Road improvement costs	1	1	1	3	1	1	3
Traffic	3	1	1	2	3	3	6
Transportation	1	1	2	2	1	2	2
Facility Capital	5	1	1	1	5	5	5
Infrastructure costs	1	1	2	3	1	2	3
Land costs	1	2	2	1	2	2	1
Sum of Site Scores (lowest is least constrained, most preferred)					129	158	169
Normalized Sums (100 is least constrained)					100.00	81.7	76.3
Overall Site Rank (lowest is least constrained)					1	2	3

Source: Stone & Webster, 1995

- **Lahaina Pioneer Mill.** MECO does not own this land and the site is considered too far away from fuel off-loading facilities. The site is also too close to existing residential areas and is too constrained for the construction of a 232-MW facility.

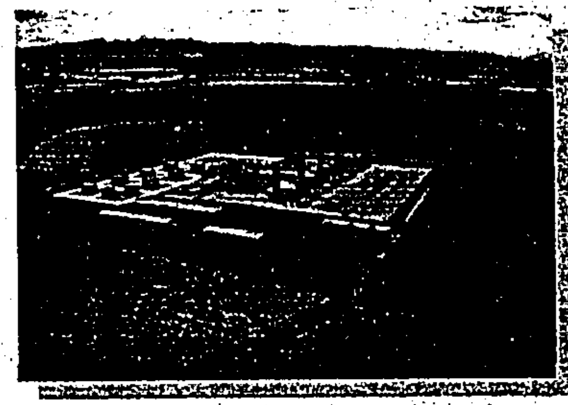
3.3 Conclusion

MECO has reviewed conservation and energy-efficiency efforts, the availability of independent power producers, and the possible retirement deferral of existing units and determined that these resources will be insufficient to meet the need for additional generation identified for the year 2004 on the Island of Maui.

MECO has also reviewed and analyzed alternative technologies and fuel sources for meeting this generation requirement and determined that although these technologies and fuels may play an increasing role in energy production and use, they are not now sufficiently developed or economically feasible to replace conventional methods of generating the amount of power needed. However, MECO will continue to monitor these technologies for possible use should they become cost-effective.

Finally, MECO has analyzed and reviewed several sites on Maui for a large stand-alone baseload generating facility and determined that the selected 65.7-acre site at the intersection of Waiko and Pulehu Roads is the most appropriate location for such a facility. The selection of this site is based upon the following factors:

- the site had the least impact on air quality of those considered
- the site had the least impact on biological resources of those considered
- the site had the least impact on area traffic and transportation of those considered
- the site had the least infrastructure costs of those considered
- the site had the best location of those considered in relationship to the existing MECO generation and transmission systems



CHAPTER FOUR

DESCRIPTION OF ENVIRONMENT AND PROBABLE ENVIRONMENTAL CONSEQUENCES

Chapter 4

Description of Environment and Probable Environmental Consequences

4.1 Introduction

This section describes the existing conditions and potential environmental effects of the proposed action and includes mitigation measures. The proposed action consists of construction and operation of a 232-megawatt (MW) diesel-fueled electric generating station and accompanying 69-kilovolt (kV) transmission lines and 12-kV distribution lines.

Potential impacts (both temporary and permanent) that could result from construction and operation of the generating station and transmission lines are described by topic in this section. *Potential impacts identified were examined with regard to the significance criteria* presented in Section 12, Chapter 200, Title 11 State Department of Health (DOH), Administrative Rules as authorized by Chapter 343, Hawaii Revised Statutes. None of the potential impacts identified would be significantly adverse according to the criteria. Nevertheless, in many cases mitigation measures are proposed to maintain the identified impact at a non-significant level.

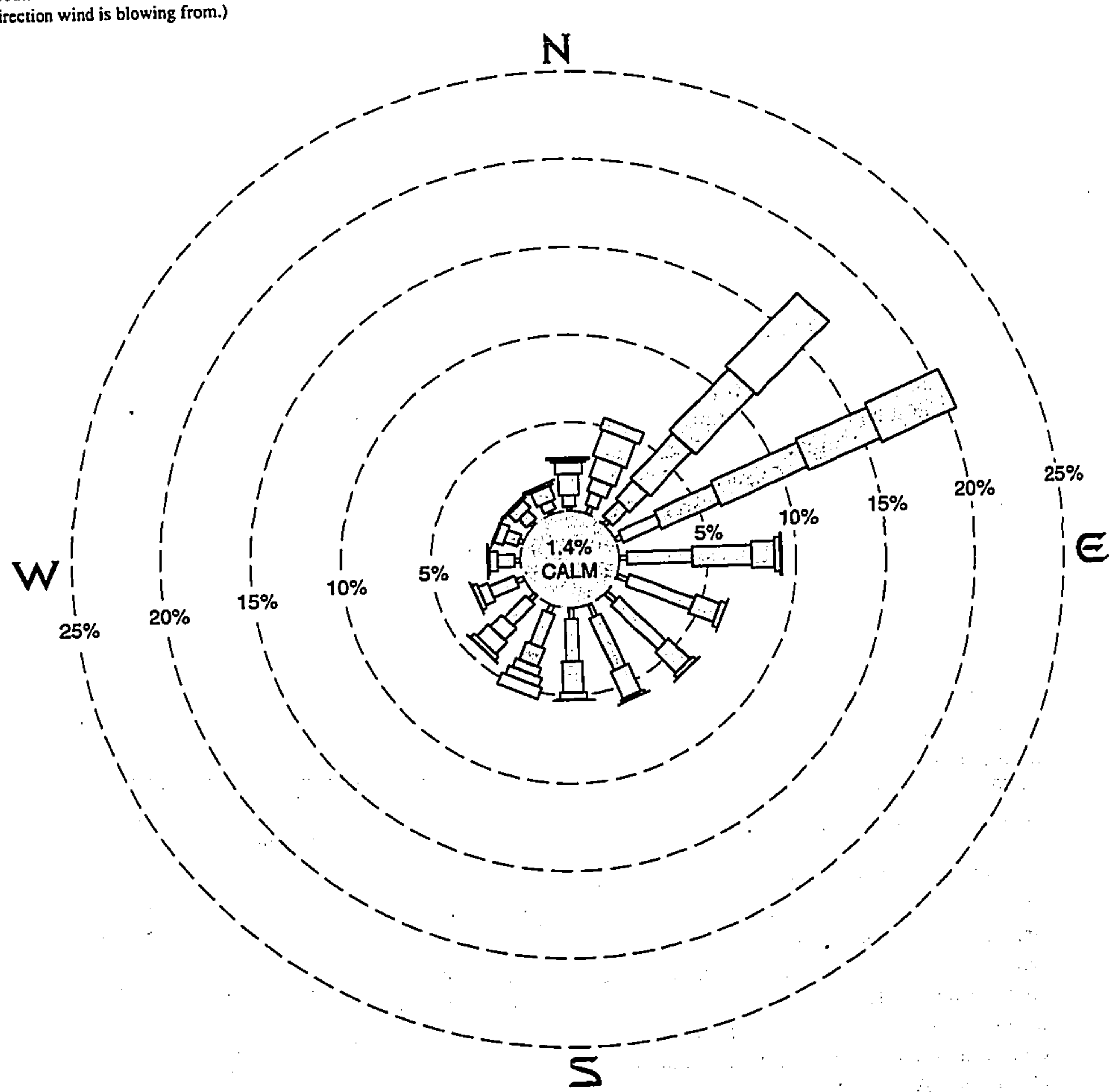
4.2 Climate and Meteorology

The climate of Maui is relatively uniform, characterized by moderate temperatures with rainy winters and moderately high humidity throughout the year. The range of average temperatures between January, the coldest month, and August, the warmest month, is 71.5° F to 79.2° F. Rainfall is normally relatively light and occurs mostly during the wet season from November through April. Annual rainfall in the project area is about 20 inches.

The Island of Maui is located in the trade wind belt, a region in the North Pacific dominated by a semi-permanent high pressure center north of Hawaii. Wind circulation around this high pressure area is clockwise and outward from the center, producing generally northeasterly wind flow over the Hawaiian Islands. Prevailing surface winds in the study area are from the east/northeast. These northeasterly tradewinds occur over 70 percent of the time, however, during "Kona" conditions, the prevailing direction changes to a south/southwesterly direction. Wind patterns vary on a daily basis, with tradewinds generally being stronger in the afternoon. At night the wind direction becomes easterly as "drainage" winds blow down from Haleakala. The normal trade winds, attenuated by the funneling effect of Haleakala and the West Maui Mountains, may attain speeds of up to 40 to 45 miles per hour (mph) through the Central Maui isthmus. Occasional strong Kona winds occur with the passage of storms during the winter months. Figure 4-1 shows the annual wind rose data for the project site as collected by MECO Monitoring Station 251.

MECO SITE 251

(Winds measured at 37 meters above ground level. Wind direction is the direction wind is blowing from.)



WIND SPEED SCALE (in knots and percent of total)

1-3	4-6	7-10	11-16	17-21	22-99
(7%)	(30%)	(22%)	(16%)	(12%)	(12%)

Source: Jim Clary & Associates, 1997

Final Environmental Impact Statement
Proposed Waena Generating Station
Maui Electric Company, Limited

FIGURE 4-1

WIND ROSE

NORTH

CH2M HILL

MECO Monitoring Station 251 was located approximately 1.2 miles to the southeast of the site and collected meteorological data for one year from February 1994 through January 1995. These data were recorded hourly according to U.S. Environmental Protection Agency (EPA) monitoring guidelines and the monitoring plan developed for this project. The data from Site 251 are used in the modeling analyses discussed in this chapter.

4.3 Air Quality

4.3.1 Existing Conditions

The air quality of a given location is a function of both the local meteorology and the amount of air pollutants emitted from sources in the area. Present air quality on Maui continues to be heavily influenced by agriculture, the airport, and motor vehicles, which are major sources of particulate matter, carbon monoxide, and hydrocarbon emissions.

Significant industrial sources of air emissions located within a few miles of the project site include:

- Puunene Sugar Mill, located about 2.5 miles to the northwest
- Kahului Airport, located about 3 miles to the north
- Kahului Power Plant, located about 4 miles to the northwest
- Paia Sugar Mill, located about 4.5 miles to the northeast
- Maalaea Power Plant, located about 5 miles to the southwest

While there are no on-site air quality data for the proposed project, an air quality monitoring station was operated at Maalaea Monitoring Station 235 between August 1993 and July 1994. The existing air quality is well within the National and State Ambient Air Quality Standards (NAAQS/SAAQS).

The data from Station 235 are a conservative estimate of the existing air quality at the proposed site because it is a post-construction site that is located close to the Maalaea Power Plant. Table 4-1 shows the existing concentrations of sulfur dioxide (SO_2), particulate matter less than 10 microns in diameter (PM_{10}), ozone (O_3), nitrogen dioxide (NO_2) and carbon monoxide (CO) measured at this station. Background concentrations at the project site, approximately 6 miles upwind from Maalaea, would be expected to be less.

Table 4-1 Maximum Background Concentrations of Selected Pollutants		
Pollutant	**Averaging Period**	**Maximum Background Concentration ($\mu g/m^3$)**
Sulfur Dioxide	3-hour 24-hour Annual	33.9 26.1 2.6
Particulate Matter less than 10 microns in diameter	24-hour Annual	63.6 19.0
Ozone	1-hour Annual	92.1 49.0
Nitrogen Dioxide	Annual	1.9
Carbon Monoxide	1-hour 8-hour	798 456
Monitoring Location: Maalaea Monitoring Station 235 Note: $\mu g/m^3$ = micrograms per cubic meter		

Source: October 23, 1995 letter from HECO to Hawaii Department of Health

4.3.1.1 Applicable Federal Regulations

Emissions of air pollutants are regulated at the federal level pursuant to the Clean Air Act (CAA). The following are major provisions of the CAA:

- National Ambient Air Quality Standards (NAAQS)
- New Source Review (NSR)
  - Prevention of Significant Deterioration (PSD) Program
  - Non-attainment Regulations
- New Source Performance Standards (NSPS)
- National Emissions Standards for Hazardous Air Pollutants (NESHAP)
- Good Engineering Practice (GEP) Stack Height Provisions

National and State Ambient Air Quality Standards. The NAAQS represent the maximum pollution levels considered to be acceptable, with an adequate margin of safety, to protect public health and welfare. These standards must be attained in all ambient areas that are accessible to the general public. The following are the six criteria pollutants for which NAAQS have been established: SO_2, NO_2, CO, O_3, PM_{10}, and lead (Pb). Rules have also recently been adopted to establish NAAQS for particulate matter less that 2.5 microns in diameter ($PM_{2.5}$).

Hawaii's State Ambient Air Quality Standards (SAAQS) are very similar to the NAAQS, although the State has more stringent standards for CO, O_3, and NO_2. Hawaii also has a standard for hydrogen sulfide (H_2S). Table 4-2 shows the national and state ambient air quality standards.

Table 4-2
Summary of State of Hawaii and Federal Ambient Air Quality Standards

Pollutant	Hawaii State Standard	Federal Primary Standard[a]	Federal Secondary Standard[b]
Carbon Monoxide			
1-hour	10,000 μg/m³	40,000 μg/m³	-
8-hour	5,000 μg/m³	10,000 μg/m³	-
Nitrogen Dioxide			
Annual (arithmetic)	70 μg/m³	100 μg/m³	100 μg/m³
Particulate Matter less than 10 microns in diameter			
24-hour	150 μg/m³	150 μg/m³	150 μg/m³
Annual (arithmetic)	50 μg/m³	50 μg/m³	50 μg/m³
Ozone			
1-hour	100 μg/m³	235 μg/m³	235 μg/m³
Sulfur Dioxide			
3-hour	1,300 μg/m³	-	1,300 μg/m³
24-hour	365 μg/m³	365 μg/m³	-
Annual (arithmetic)	80 μ/m³	80 μ/m³	-
Hydrogen Sulfide			
1-hour	35 μg/m³	-	-
Lead			
3 months (arithmetic)	1.5 μg/m³	1.5 μg/m³	1.5 μg/m³

[a]Designed to prevent adverse effects on public health.
[b]Designed to prevent adverse effects on public welfare, which include effects on comfort, visibility, vegetation, animals, aesthetics, and soiling and deterioration of materials.

Notes:
μg/m³ = micrograms per cubic meter

Source: CH2M HILL, 1993

New Source Review. The Prevention of Significant Deterioration (PSD) regulations (40 Code of Federal Regulations [CFR] 52.21) define a major source as any source that belongs to a list of 28 source categories that emit or have the potential to emit 100 tons per year or more of any pollutant regulated under the CAA, or any other source type that emits or has the potential to emit pollutants in amounts equal to or greater than 250 tons per year. The proposed Waena Generating Station would be classified as a major stationary source.

As stated in the *EPA Draft New Source Review Workshop Manual* (October 1990), the basic goals of the PSD regulations are: (1) to ensure that economic growth will occur in harmony with the preservation of existing clean air resources; (2) to protect the public health and welfare from any adverse effect which might occur even at air pollution levels better than the national ambient air quality standards; and (3) to preserve, protect, and enhance the air quality in areas of special natural recreational, scenic, or historic value, such as national parks and wilderness areas.

A PSD review is required for all pollutants from a major source showing significant net increases in emissions because of a modification and for which the project area is in compliance with the applicable NAAQS. Because the project area has been designated either attainment or unclassifiable for all the NAAQS, the PSD permitting process will be required. In addition, the PSD rules also require one year of pre-construction continuous air monitoring if certain *de minimis* levels are exceeded. *De minimis* refers to those levels below which the DOH may exempt a stationary source or modification from the air quality analysis pre-construction monitoring requirements.

Hawaii's attainment status for all criteria pollutants means that the non-attainment regulations do not apply to the proposed project.

The PSD regulations provide for the designation of all geographic areas into one of three classes:

- Class I applies to these areas where practically any deterioration in air quality would be significant.
- Class II applies to areas where moderate, well-controlled, and sited industrial growth would be permitted.
- Class III applies where industrial areas would be allowed to experience the greatest degree of air quality deterioration.

The DOH has designated the area around the project site as Class II. The closest Class I area is the Haleakala National Park, about 12 miles southeast of the project. The Class I and Class II PSD increments, the significant impact levels, and *de minimis* monitoring levels for sulfur dioxide, nitrogen dioxide, carbon monoxide, and PM/PM_{10} are presented in Table 4-3.

Table 4-3
Summary of Impact Levels, Monitoring Levels, and PSD Increment

Pollutant	Averaging Period	Significant Impact Levels (μg/m³)	*de minimis* Monitoring Levels (μg/m³)	PSD Increments Class I (μg/m³)	PSD Increments Class II (μg/m³)
Sulfur Dioxide	3-hour	25	-	25	512
	24-hour	5	13	5	91
	Annual	1	-	2	20
Nitrogen Dioxide	Annual	1	14	2.5	25
Particulate Matter	24-hour	5	10	8	37
	Annual	1	-	4	19
Particulate Matter less than 10 microns in diameter	24-hour	5	10	-	30
	Annual	1	-	-	17
Carbon Monoxide	1-hour	2,000	-	-	-
	8-hour	500	575	-	-

Notes:
μg/m³ = micrograms per cubic meter
The 3- and 24-hour PSD increments and NAAQS and SAAQS are not to be exceeded more than once per year. Annual NAAQS, SAAQS, and PSD increments are never to be exceeded.

New Source Performance Standards. NSPS are a set of national emission standards that apply to new, modified, or reconstructed stationary source categories that include the emission limitations that apply to a new, oil-fired combustion turbine:

- Sulfur dioxide—0.015 percent sulfur dioxide in the exhaust gas at 15 percent oxygen, or 0.8 percent sulfur fuel by weight
- Nitrogen oxide (NO_x)—75 parts per million (ppm) in the exhaust gas at 15 percent oxygen

National Emissions Standards for Hazardous Air Pollutants. The NESHAP regulations do not currently apply to fossil-fuel-fired power plants.

Good Engineering Practice (GEP) Stack Height Provisions. Section 123 of the Clean Air Act limits the use of dispersion techniques, such as merged gas streams, intermittent controls, or stack heights above GEP, to meet the NAAQS or PSD increments. The GEP stack height is defined under Section 123 as "the height necessary to insure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies or wakes which may be created by the source itself, nearby structures or nearby terrain obstacles." The EPA has promulgated stack height regulations under 40 CFR Part 51 which help to determine GEP stack height for any stationary source. The proposed stack heights of 150 feet satisfy all EPA and State requirements. This stack height will allow adequate dispersion, preventing excessive concentrations of air pollutants.

Lowest Achievable Emission Rate. Lowest achievable emission rate (LAER) is defined in the Clean Air Act as that rate of emissions for any source which reflects either:

> the most stringent emission limitation which is contained in the implementation plan of any State for such class or category of source...or the most stringent emission limitation which is achieved in practice by such class or category of source, whichever is more stringent.

LAER is applicable only to sources in non-attainment areas (places not meeting one or more of the ambient air quality standards) for the specific non-attainment pollutant. LAER differs from BACT in that the most stringent emission control technology achieved in practice with the particular type of emission source is required without regard to economic, energy, or other environmental impacts.

The EPA's July 16, 1997 adoption of new ambient air quality standards for $PM_{2.5}$ raises the possibility that certain areas in the State of Hawaii will not be in attainment with the new standards. Ambient air quality data will be gathered and analyzed over the next five years by the DOH to determine the status of attainment with the new standard. If the area surrounding the Waena Generating Station is found to be in non-attainment with the $PM_{2.5}$ standard, the Station will be subject to non-attainment permitting with respect to $PM_{2.5}$ and LAER for $PM_{2.5}$ will be required. If required, LAER for $PM_{2.5}$ will be determined at the time of air permitting of the new generating units. As stated in Section 3.1.5.2, nearly all of the PM emissions from CTs are less than 1 micron in diameter. Emissions are typically controlled by maintaining good combustion efficiency.

4.3.1.2 Applicable Hawaii Regulations

In addition to the federal regulations, the State of Hawaii regulates air pollution under Hawaii Administrative Rules (HAR), Title 11, Chapters 59 and 60.1; Hawaii State Ambient Air Quality Standards; and Hawaii Air Pollution Control Rules, respectively. The Environmental Management Division of DOH, Clean Air Branch, is responsible for implementing and enforcing both the state and federal air quality regulations.

4.3.2 Potential Impacts

The proposed project will ultimately consist of four 58-MW combustion turbine (CT) units. However, MECO's construction schedule calls for installing one unit at a time over a period of years. Each unit will be individually permitted as the time for its scheduled construction approaches. Therefore, for purposes of this impact evaluation, the two scenarios evaluated include: (1) operation of one unit and (2) operation of all four units. The impact data presented for a single unit may be used to project the impacts of operating two or three units prior to full build-out of the project. The term "unit" as used in the following sections refers to a 58-MW dual-train combined-cycle (DTCC) system consisting of two LM2500 combustion turbines.

The Integrated Gaussian Model (IGM) was used along with one year of on-site meteorological data collected at Station 251 to determine the potential air quality impacts of the proposed project for use in the previous siting analyses. The air quality report prepared for the 1995 Stone & Webster siting analysis is contained in Appendix C. Project impacts were determined for one 58-MW unit as well as for the total project of four 58-MW units.

The maximum and highest second-high predicted concentrations were used to evaluate PSD Class II Increment consumption. The worst-case combustion turbine configurations (100 percent operating load for SO_2 and 25 percent for PM_{10} and NO_x) were used in the analysis. All modeling was performed in accordance with the EPA modeling guidance that was applicable at the time the analysis was conducted.

The maximum potential emission increases for a single 58-MW unit are listed in Table 4-4. These emission increases are based on worst-case operations of 8,760 hours per year. On this basis, the proposed project is a significant source of NO_x, SO_2, CO, PM, PM_{10}, and sulfuric acid (H_2SO_4) mist. It is not a significant source for beryllium (Be), mercury (Hg), lead, or fluoride (F). Therefore, the project is subject to PSD review only for NO_x, SO_2, CO, PM/PM_{10}, and H_2SO_4 mist as follows:

- Application of Best Available Control Technology (BACT)
- Analysis of ambient air quality impacts from the project (PSD Class II increments for SO_2, PM/PM_{10}, and NO_2; NAAQS/SAAQS for SO_2, NO_2, PM/PM_{10}, and CO)
- Analysis of air quality and/or visibility impacts on Class I areas
- Analysis of air-quality-related values such as soils, vegetation, and visibility that are affected directly as a result of the project and general commercial, residential, and other growth associated with the project

4.3.2.1 Operational Air Emissions

The modeling analysis predicted the maximum ground-level concentrations for NO_x, SO_2, and PM_{10}. The *New Source Review Workshop Manual* states that the "preliminary analysis models only the significant increase in potential emissions of a pollutant from a new source...(to) determine whether the applicant must perform a full impact analysis." Because only one 58-MW unit will be permitted at a time, the emissions from one unit were used in the preliminary modeling. A full impact analysis is not required for a particular pollutant when emissions for that pollutant would not increase the ambient concentration by more than the prescribed significant impact level (SIL) as listed in Table 4-3.

Table 4-4
Potential Emissions Increases for One 58-MW Unit, Waena Generating Station

Pollutant	Emission Rate for One 58-MW Unit (tpy)	PSD Significant Emission Rate (tpy)	Emission Rate Subject to PSD Review
Nitrogen Oxide	371	40	Yes
Sulfur Dioxide	964	40	Yes
Carbon Monoxide	237 (4,166)	100	Yes
Volatile Organic Compounds	33 (2,608)	40	Yes
Particulate Matter	173	25	Yes
Particulate Matter less than 10 microns in diameter	173	15	Yes
Sulfuric Acid Mist	49	7	Yes
Beryllium	0.00035	0.0004	No
Mercury	0.0012	0.1	No
Lead	0.131	0.6	No
Fluoride	0.018	3	No

Notes: tpy = tons per year.

The estimated maximum emissions for a 58-MW unit are based on the operation of two General Electric LM2500 combustion turbines operated at ambient conditions of 59°F, 70 percent relative humidity, and atmospheric pressure of 29.92 inches of mercury. The maximum fuel flow is 13,306 lb/hr for both simple-cycle and combined-cycle operation. The assumed minimum fuel heat content is 18,460 Btu/lb lower heating value (LHV). The emissions are based on operation at 100 percent load unless otherwise denoted below.

The Unit potential emission rate for sulfur dioxide is based on peak load fuel flow rates and fuel sulfur content of 0.4% by weight. It is assumed that 100 percent of the sulfur is converted to sulfur dioxide.

The Unit oxides of nitrogen (NO_x) emissions are based on the molecular weight of nitrogen dioxide of 46 lb/mole and CT manufacturer data of 42 parts per million by volume (ppmv) at 15% oxygen, dry and assuming less than 0.015% fuel bound nitrogen. These data should be adjusted to accommodate an expected fuel bound nitrogen content of 0.1% by weight based on New Source Performance Standards Subpart GG. This is equivalent to 82 ppmv at 15% oxygen, dry.

The maximum Unit carbon monoxide and volatile organic compound (VOC) emissions are based on manufacturer's data for operation at a nominal 25 percent load. The emission rates shown in the table above for CO and VOC are provided in a x(y) format, where x is the emission rate at 100% load, and y is the emission rate at 25% load.

The Unit particulate emissions are assumed to be less than 10 microns aerodynamic mean diameter. The PM/PM_{10} emission rate of 19.7 lb/hr (86.3 tons/year) was provided by the manufacturer.

The Unit sulfuric acid mist emission rate is 0.038 lb/hr sulfur in fuel based on an EPA report *Health Impacts, Emission Factors for Noncriteria Pollutants Subject to De Minimis Guidelines and Emitted from Stationary Conventional Combustion Processes, EPA-450/2-80-74, June 1980.*

The beryllium, lead, and mercury emission rates for simple and combined cycles are based on fuel analysis with the following average in parts per million by weight: lead (1.12), beryllium (0.003), and mercury (0.01). These data were used in the PSD HI 87-01 and 90-02 analysis.

The fluoride emission rates for the simple and combined cycles are based on the average of two fuel analyses of 0.15 ppmw. This value was also used in the PSD HI 88-01 and 90-02 analysis.

Source: *BACT Assessment, Maalaea Power Plant Expansion Second Combined-Cycle Project, Radian Corporation, April 1994*

Maximum impacts based on one 58-MW unit were compared with the SILs in Table 4-5. An insignificant concentration means the impact of existing sources does not have to be evaluated. A concentration above an SIL means only that the impact of existing sources must be evaluated along with project emissions for that particular pollutant. Exceedance of the SIL does not mean that emissions from the project will cause harm. Only 3-hour and 24-hour SO_2 impacts were above the applicable SILs. Therefore, a Class II Increment Analysis including non-MECO sources was performed for SO_2. The Class II modeling determined the combined impact of the proposed MECO facility and increment consuming sources at all receptors where the proposed MECO facility had a significant impact. Table 4-6 contains the results.

Table 4-5
Comparison of Project Impacts with Significant Impact Levels (SIL)

Pollutant	Impact for One 58-MW Unit (μg/m³)	Significant Impact Levels (μg/m³)	Impact Significant
Nitrogen Dioxide Annual (arithmetic)	0.64	1	No
PM_{10} (Particulate Matter less than 10 microns in diameter)			
24-hour	2.83	5	No
Annual (arithmetic)	0.30	1	No
Sulfur Dioxide			
3-hour	38.5	25	Yes
24-hour	9.42	5	Yes
Annual (arithmetic)	0.97	1	No

Notes:
μg/m³ = micrograms per cubic meter

Source: Jim Clary and Associates, 1997

According to these modeling results, the proposed facility (from one to four 58-MW units) will be in compliance with Class II increments. The pollutant averaging period with the largest impact is 24-hour SO_2. The maximum 24-hour concentration for SO_2 will consume 79 percent of the Class II PSD increment when modeled with four 58-MW units. As stated earlier, this maximum ground-level SO_2 concentration is from all proposed units at the facility operating at 100 percent load. The total impact of the proposed project and existing sources is expected to be below the AAQS and the total impacts are shown to consume less than 100 percent of the increments.

On July 16, 1997, the EPA adopted new annual and 24-hour $PM_{2.5}$ standards at 15 μg/m³ and 65 μg/m³, respectively. $PM_{2.5}$ emissions are a subset of PM_{10} emissions and, therefore, would be less than PM_{10} emissions. The modeling presented shows that the PM concentrations will be below the PM_{10} SIL for one 58-MW unit. Compliance with the $PM_{2.5}$ standards will be assured in the air permitting process.

Table 4-6
Comparison of Maximum Predicted Sulfur Dioxide, Nitrogen Dioxide, and PM/PM_{10} Concentrations with Class II PSD Increments

Pollutant	Percent Increment Consumed with One 58-MW Unit	Percent Increment Consumed with Four 58-MW Units
Sulfur Dioxide		
3-hour	48.4	63.6
24-hour	61.3	78.8
Annual	na	na
Nitrogen Dioxide		
Annual	na	na
PM/PM_{10}		
Annual	na	na
24-hour	na	na

Notes:

The maximum concentrations were calculated using the IGM model, 1-year meteorological data from an on-site monitoring station, and existing source inventory.

Sulfur dioxide is based on one or four 58-MW units operating at an emission rate of 27.72 grams per second (g/s) per unit and 0.4% sulfur content.

Nitrogen dioxide is based on one or four 58-MW units operating at an emission rate of 10.66 g/s per unit.

PM/PM_{10} is based on one or four 58-MW units operating at an emission rate of 4.96 g/s per unit.

"Na" indicates that the maximum impact from proposed MECO sources is less than the significance level for all NO_2, PM, and annual SO_2.

Calculations are based on a stack height of 150 feet for one or four 58-MW units using one/four separate stacks.

Source: Jim Clary & Associates, 1997

The impacts from operational emissions modeled assumed the use of wet injection emissions control technology as BACT for NO_x, low sulfur fuel (0.4 percent sulfur by weight) as BACT for SO_2, and combustion control technology as BACT for VOC, PM, and CO. Use of other BACT alternatives, such as those discussed in Chapter 3, may result in lower emissions of the parameter compound than reported in these analyses. The use of the particular BACT for control of criteria pollutants will be determined in the PSD application process. Regardless of the BACT required through the PSD permit process, air emissions will meet all applicable standards and regulations.

4.3.2.2 Impacts on Haleakala National Park

The impact of the proposed Waena Generating Station on Class I areas also was evaluated. The only Class I area near the proposed facility is Haleakala National Park. The closest boundary of Haleakala National Park is more than 12 miles from the Waena Generating Station. As requested by the National Park Service (NPS), an analysis of SO_2, PM, and NO_x emissions to the park using the EPA Rough Terrain Dispersion Model (RTDM) was completed, an analysis of deposition impacts was made, and a plume visibility analysis with EPA VISCREEN model was performed.

The PSD Class I Increments are intended to serve a special function in protecting the air quality and other unique attributes in a Class I area and, as shown in Table 4-3, are substantially less than those for Class II areas. HAR Section 11-60.1-131 defines Class I areas (in part) as including international parks, national wilderness areas larger than 5,000 acres, national memorial parks larger than 5,000 acres, and national parks larger than 6,000 acres. Modeling methodology followed the procedures outlined in *Permit Application Guidance for New Air Pollution Sources* (Bunyak, 1993) and the RTDM was used to determine the impact of four 58-MW units from the Waena facility. Table 4-7 summarizes the predicted concentrations from the proposed Waena Generating Station. Since all predicted pollutant concentrations with all four 58-MW units operating would consume less than 27 percent of the protective Class I Increments, the plant will not have an adverse impact on Haleakala National Park.

At the request of the NPS, deposition values were calculated within the Class I area using procedures outlined in the EPA document *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 1 Report: Interim Recommendation for Modeling Long Range Transport and Impacts on Regional Visibility* (EPA, 1993). Deposition values represent the amount of chemical concentrations which may be deposited on plants and in the soil which could impact sensitive plant species. SO_2 and nitric acid (HNO_3) deposition levels were calculated based on the procedure contained in the *IWAQM Phase 1 Report.* The estimated SO_2 and HNO_3 deposition values are shown in Table 4-8. Currently, the NPS does not have any data on what deposition levels might lead to adverse effects at Haleakala National Park. In order to assess the potential impact on plant species within Haleakala National Park, the NPS will need to conduct detailed threshold analyses for the specific plant species and soil conditions found within the park.

Table 4-7
Comparison of Maximum Predicted Sulfur Dioxide, Nitrogen Dioxide, and PM/PM_{10} Concentrations with Class I PSD Increments

Pollutant	Averaging Period	Percent of Increment Consumed with Four 58-MW Units
Sulfur Dioxide		
	3-hour	24.8
	24-hour	26.6
	Annual	2.75
Nitrogen Dioxide		
	Annual	0.84
PM/PM_{10}		
	24-hour	3.73
	Annual	0.25

Notes:

The maximum concentrations were calculated using the RTDM model and 1-year meteorological data from an on-site monitoring station. Short-term concentrations are the highest second-high.

Sulfur dioxide is based on four 58-MW units operating at an emission rate of 27.72 grams per second (g/s) per unit and 0.4% sulfur content.

Nitrogen dioxide is based on four 58-MW units operating at an emission rate of 10.66 g/s per unit.

PM/PM_{10} is based on four 58-MW units operating at an emission rate of 4.96 g/s per unit.

Calculations are based on a stack height of 150 feet for four 58-MW units using four separate stacks.

Source: Jim Clary & Associates, 1997

Table 4-8
Class I Area Deposition Calculations

Modeled Pollutant	Averaging Period	Concentration (μg/m³)	Deposition Pollutant	Total Rate (μg/m³/s)	Deposition (μg/m²/yr.)	Deposition (kg/her/yr.)
SO_2	Annual	0.055	SO_2	1.73×10^6	8672.4	0.087
NO_x	Annual	0.021	HNO_3	9.07×10^5	45364.5	0.454

Notes:
The maximum concentrations are based on the RTDM modeling detailed in Table 4-7.

Source: Jim Clary & Associates, 1997

The *Permit Application Guidance for New Air Pollution Sources* establishes the NPS methodology for a Class I visibility analysis. The document recommends the use of the VISCREEN model as outlined in the EPA *Workbook for Plume Visual Impact Screening and Analysis* (1988). Therefore, the EPA VISCREEN model was used to determine the impact, if any, of the plume from the proposed Waena Generating Station on the visibility in Haleakala National Park. The total project emissions from four 58-MW units were considered for the analysis.

Level-1 and level-2 analyses were conducted in accordance with the *Workbook for Plume Visual Impact Screening and Analysis.* The first step, a level-1 analysis, determines the potential visibility impacts under the most restrictive meteorological conditions. If the level-1 analysis indicates a potentially significant impact, then a level-2 analysis is performed. Under the level-2 analysis, actual meteorological conditions are used to determine the worst-case conditions possible.

When the level-1 analysis was performed for the proposed Waena Generating Station, potentially significant impacts were identified. Therefore, a level-2 analysis was performed. The on-site meteorological data were used for this visibility analysis. The Haleakala National Park is downwind from the proposed site only when wind directions are between 290° and 315°. Therefore, wind vector data in sectors to the east-southeast, southeast, and south-southeast were used in the analysis. The worst-case plume dispersion conditions were determined following the EPA guidance. The results show that the proposed Waena Generating Station is not anticipated to exceed the Class I Area Screening Criteria inside Haleakala National Park. Appendix C contains the modeling conditions used and the results of the VISCREEN modeling.

The VISCREEN model assesses the visibility of a plume, not whether the plume contributes to reductions in general visibility. The conditions which usually promote regional haze are stagnant wind conditions and high levels of fine particles in the atmosphere. Particles and gas molecules which contribute to poor visibility and regional haze are categorized as primary and secondary. The NPS describes primary and secondary particles on its visibility protection Internet web page (www.aqd.nps.gov/natnet/ard/visprot.htm) as follows: "Primary particles, such as smoke or road dust, are emitted directly into the atmosphere. Secondary particles are formed in the atmosphere from primary gaseous emissions. Secondary particles of concern include ammonium sulfate formed from sulfur oxide emissions, nitrates formed from nitrogen oxide emissions, and carbon-based particles formed from hydrocarbon emissions."

Sulfates and carbon-based particles are the two largest contributors to reduced visibility. Nitrates have also been shown to be a major contributor to regional haze in southern California where there are high levels of automobile emissions. The NPS website on visibility protection describes the contributors to visibility impairment in different regions of the United States. In the Eastern United States, which is heavily industrialized, 60 to 70 percent of the visibility impairment can be attributed to sulfates. In the Pacific Northwest, where a significant amount of controlled fires and agricultural burning occurs, the carbon-based particles contribution to reduced visibility is typically 50 percent or greater.

The proposed Waena Generating Station is not located in a heavily industrialized area. Instead, the Central Maui area is predominately agricultural where a significant amount of cane burning occurs. The *Workbook for Plume Visual Impact Screening and Analysis* states that regional haze "is caused by multiple sources located throughout a region. A single emission source may contribute to such a problem but is generally not the sole (or even major) contributor." Primary sources of regional haze on the Island of Maui are cane burning, bagasse burning, automobiles, and volcanic emissions blown over from the Island of Hawaii. The proposed project is insignificant for PM and will emit relatively low levels of NO_x and SO_2. Because the facility will emit insignificant amounts of the constituents contributing to regional haze in Central Maui, the proposed Waena Generating Station is not expected to have any significant additive impact on regional haze.

4.3.2.3 Impacts Due to the Maui Vortex

A study was conducted to evaluate the potential impact of the Maui Vortex on emissions from MECO's proposed Waena Generating Station. Because of the location of the proposed plant, part of the plant's emissions (i.e., plume) could be entrained into the Maui Vortex. This plume entrainment may result in an accumulation of plant emissions in the vortex. The entire report describing the study methodology and findings is included in Appendix C.

The Maui Vortex is a cyclonic eddy that is formed by winds flowing through the central Maui isthmus that travel along the coast and encounter upwardly flowing winds along the slopes of Haleakala. The vortex is generally present during periods of regular tradewinds.

Past numerical models have indicated that the vortex is a semi-permanent feature. However, MECO's tower observations suggest that nocturnal drainage winds moving down the slope of Haleakala produce a nighttime stable mass of air near the project site which extends up between approximately 200 to 210 feet. This stable mass of air would tend to decouple any vortex aloft from the surface wind layers. Thus, the vortex would tend to dissipate at night, reducing the vortex persistence. In addition, because the proposed stack heights are only 150 feet, emissions would be dissipated through the stable air mass below 200 feet and would be unlikely to reach the vortex at night.

To determine if there could be any emissions impacts from the proposed project due to the interaction of the Maui Vortex, streamline analysis and a simple box model were conducted using a worst-case scenario of one month of continuously steady tradewinds with no nocturnal vortex dissipation. In addition, it was assumed that any emission entering the vortex would not leave the vortex, circulating within the vortex for the entire month. The results of these models showed the worst case concentrations of the significant criteria pollutants SO_2, PM_{10} and NO_2 to be insignificant (Table 4-9), well below the EPA's 24-hour significance levels concentrations.

Table 4-9 Worst-Case Concentrations within the Maui Vortex as a Function of the Number of 58-MW DTCC Units				
Pollutant	**Number of 58 MW DTCC Units**	**Emission Rate per Unit (lb/hr)**	**Worst-Case Concentration (μg/m³)**	**EPA 24-Hour Significance Level (μg/m³)**
Sulfur Dioxide	1	220	0.7	5
	2	220	1.4	5
	3	220	2.1	5
	4	220	2.8	5
Nitrogen Dioxide	1	84.6	0.3	Not Applicable
	2	84.6	0.5	Not Applicable
	3	84.6	0.8	Not Applicable
	4	84.6	1.1	Not Applicable
Particulate Matter less than 10 microns	1	39.4	0.1	5
	2	39.4	0.3	5
	3	39.4	0.4	5
	4	.934	0.5	5
Worst-Case Scenario Assumptions: Percent of Plume Entrained = 0.35 percent Vortex Volume = $4x10^{11}$ yds^3 Vortex Duration = 31 days				

Source: *Schroeder and Clary, 1997*

Major factors for these low concentrations are: (1) the small portion of the plant's plume that would actually be entrained into the vortex, and (2) the large vortex volume. In analyzing the predicted plume dispersion in relationship to the existing vortex, it was concluded that only 0.35 percent of the entire plume would enter the vortex winds. This small amount of emissions would then mix within a vortex whose volume approached 40 billion cubic yards.

4.3.2.4 Impacts to Vegetation

In response to comments from the Maui County Farm Bureau and farmers in the upcountry area, a separate study was conducted to evaluate the potential impact of ethylene and sulfuric acid (H_2SO_4) emissions from MECO's proposed Waena Generating Station on surrounding agricultural areas. The complete report is contained in Appendix C.

Impacts from Ethylene. Ethylene is a natural plant growth regulator used in agriculture on Maui and elsewhere to induce flowering of pineapple and ripening of bananas. Major sources of ethylene are fires, automobiles, and industry.

High concentrations of ethylene over extended periods of time have been known to cause adverse symptoms in plants, including a general reduction in growth, stimulation of lateral growth, leaf chlorosis and abscission, bud and flower abscission, and fruit chlorosis and ripening. The particular response any specific plant species may have to ethylene exposure is dependent upon the dose, exposure time, and biological sensitivity. The duration of applied ethylene necessary for an effect generally decreases with plant age. The threshold concentration for ethylene response is continuous exposure to 0.01 microliters per liter (μl/l) and the half maximal response continual exposure concentration for most physiological effects is between 0.1 to 1 μl/l.

In unpolluted air, ethylene ranges from 0.001 to 0.005 μl/l, with urban roadside levels of 10.8 μl/l and remote maritime locations being as low as 0.00004 μl/l. Ethylene is removed rapidly from the atmosphere by a number of mechanisms, including photochemical oxidation, photolysis, and reaction with other reactive species. Ethylene has a lifetime of generally 0.4 to 4 days. Although there are no established national standards for ethylene concentrations, recommended levels in California are 0.5 μl/l for 1 hour or 0.1 μl/l for 8 hours. The American Industrial Hygiene Association has set recommended 1-hour levels of ethylene at 0.25 μl/l for rural air and 0.5 μl/l for residential air. Recommended 8-hour concentrations are 0.05 and 0.1 μl/l for rural and residential air, respectively.

Ethylene concentrations were measured at three sites in and near the Maui Agricultural Park between March and August 1996. The sites were all located up slope from the site of the proposed generating station. The values ranged from non-detectable to 0.397 μl/l on a relatively calm day with some smoke in the area. The amounts detected were in the lower range expected for a rural area surrounded by a maritime environment with no major pollution sources in the vicinity.

Using the models associated with the impact analysis of the Maui Vortex (Schroeder & Clary, 1997), the study estimated that with all four DTCC units operating, it would take approximately 1,362,890 days for an ethylene concentration of 0.1 μl/l to be reached. It would take 1,363 days of continuous vortex with no loss of ethylene from the vortex to reach a plant response threshold concentration of 0.01 μl/l. Given ethylene's normal lifetime of only 0.4 to 4 days and the highly unlikely event of experiencing 1,363 days of uninterrupted tradewinds to produce a continuous vortex, the ethylene impacts from the proposed generating station are not expected to have any adverse impact upon the surrounding agricultural environment.

Impacts from Sulfuric Acid. Sulfuric acid is formed when sulfur dioxide compounds mix with water molecules in the atmosphere. SO_2 is commonly produced as the result of fossil fuel burning. In the Hawaiian Islands, a major source of SO_2 is volcanism. Generally background concentrations over remote oceans and clean continental air are less than 5 micrograms per meter cubed ($\mu g/m^3$). There is no known published data for Maui of H_2SO_4 concentrations. The level of SO_2 anticipated from the project is less than the EPA significance level of 5 $\mu g/m^3$.

The effects of H_2SO_4 on plants generally appear on the leaves as bleached brownish or yellowish spots or blotches with areas of dead tissue. Species sensitivity varies, with some species, such as beans, being very sensitive, while species such as corn and potatoes are quite tolerant. Exposure of plants to H_2SO_4 can cause damage with a threshold for growth reduction being 0.5 ppm.

The model developed for plume impact indicates that the time for H_2SO_4 concentration to reach 0.01 ppm is 274 days if it is assumed that 100 percent of the SO_2 is converted to H_2SO_4, and that no H_2SO_4 decay occurs. This infrequent and very low concentration is below the projected thresholds for plant chronic injury and concentrations would never reach acute plant injury concentrations. Vegetation would not experience any adverse impact from H_2SO_4 mist as a result of the operation of the proposed project.

4.3.2.5 Construction Air Emissions

Construction will produce two types of emissions: exhaust from vehicles and construction equipment and dust generated during site excavation and equipment movement. Equipment exhaust emissions will be small, localized, and transient. Dust emissions will be elevated during construction due to large-scale grading. As long as precautions are taken to water the site during dry or windy periods, construction emissions are not expected to be significant.

4.3.3 Proposed Mitigation

The proposed project will be permitted for construction and operation only if it demonstrates, to the satisfaction of state and federal regulatory authorities, that it fully complies with the applicable rules, regulations, and air quality standards. Mitigation measures will be determined by the DOH during the PSD permitting process and may include limitations on the allowable size of the facility, emission control technology requirements, or specification of fuel properties. Post-construction air quality monitoring will be performed continuously for at least one year after initial startup. As a requirement of this project a PSD permit application will be prepared and submitted to the DOH for each 58-MW unit. The PSD permit applications for this project will provide the following:

- Impacts of the proposed combustion turbine units
- Comparisons with applicable NAAQS/SAAQS
- Comparisons with applicable Class II increments
- Other potential impacts (such as soils, vegetation, and visibility)

4.4 Soils and Geology

This section summarizes the geotechnical report prepared by Pacific Geotechnical Engineers, which is provided as Appendix D.

4.4.1 Existing Conditions

4.4.1.1 Geology

The Island of Maui was formed by two shield volcanoes, the older West Maui volcano and the younger Haleakala volcano, which rises 10,025 feet above sea level. The West Maui volcano, also called the West Maui Mountains, appears to have passed through a stage of post erosional eruptions and the likelihood of future eruption from this volcano seems remote. Haleakala, however, appears to be in a stage of post erosional eruptions, the average frequency of which has been nearly one per 100 years during the last roughly 1,000 years. The last known eruption was recorded in 1790.

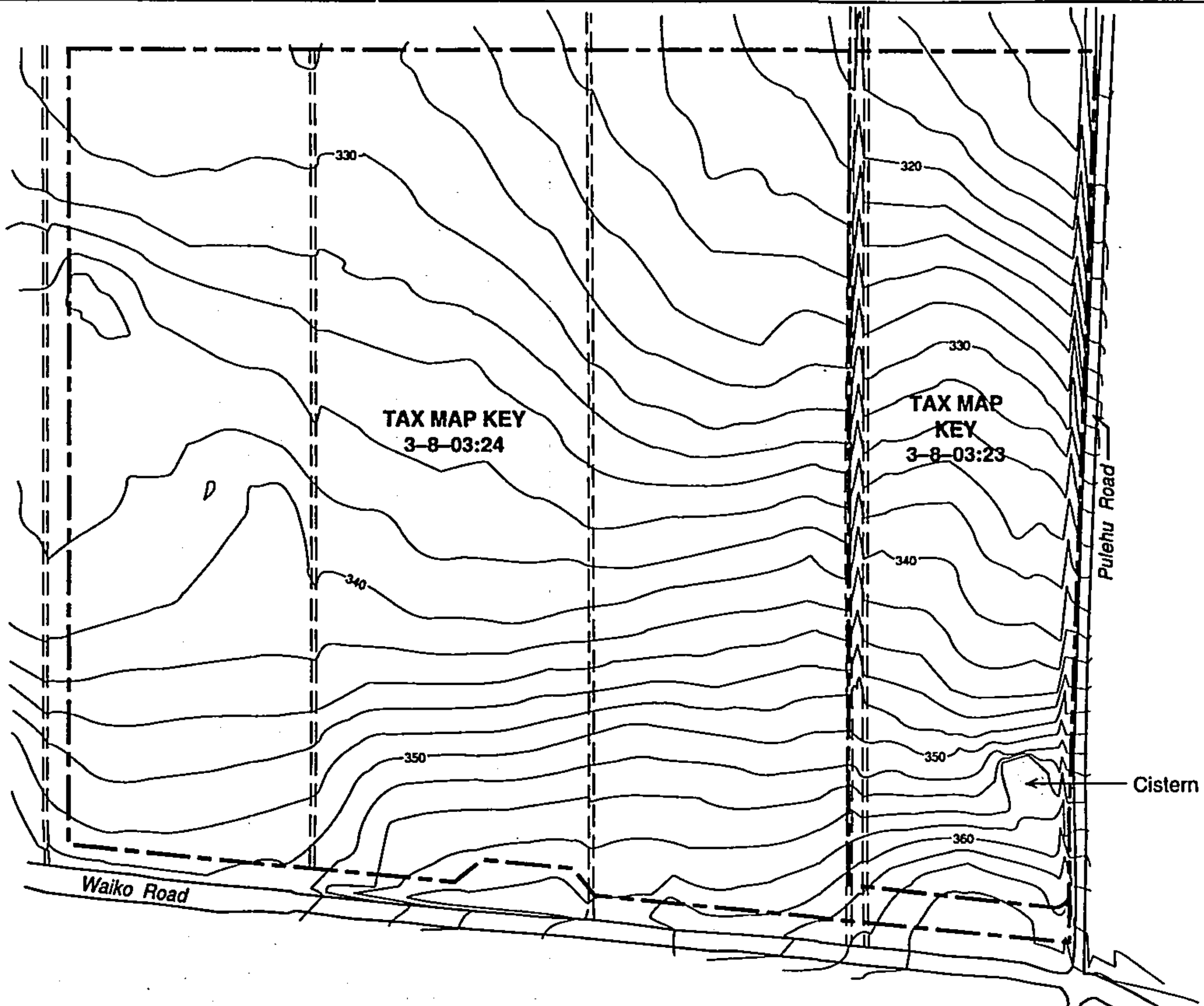
The site of the proposed Waena Generating Station is located on the west flank of the north rift zone of Haleakala on post caldera lava flows of the Kula Volcanic Series. The Kula flows are predominantly composed of the andesitic rock, Hawaiite, with lesser amounts of alkalic olivine basalt and ankaramite. Alkalic olivine basalt and ankaramite are typical of late stage, caldera filling eruptions which generally signal the approaching end of the volcanoes principal period of volcanism. These later stage eruptions also generally consist of magma with higher viscosity. The higher viscosity results in the predominance of a more viscous a'a lava rather the more fluid pahoehoe type lavas. The Kula eruptions produced a relatively thin cap of lavas overlying the main shield-building, predominantly tholeiitic lavas of the Honomanu Volcanic Series.

The lava flows at the ground surface in the vicinity of the proposed facility and transmission corridors have weathered to form a mantle of clayey and silty soil over the flows. In various areas of the proposed transmission corridors, the weathered lavas have been overlain by alluvial soils derived from the weathered lavas.

Elevations at the proposed generating facility site range from approximately +335 feet above mean sea level (MSL) on the western side nearer Puunene to +365 feet above MSL on the eastern side near the intersection of Waiko and Pulehu Roads. The average slope from the southeast to northwest across the site is about one degree. <u>Figure 4-2 shows the topography of the project site.</u>

4.4.1.2 Soils

The United States Department of Agriculture Soil Conservation Service (SCS) has classified the soils at the proposed generating station site as the Waiakoa Series, silty clay loam occurring on 3 to 7 percent slopes (WeB). This soil is generally stony, grading to hard bedrock within a depth of approximately 5 feet or so. Because the lava flows over the site are



LEGEND

640 Contour (feet)

Dirt Road

Property Boundary

Note: Contour interval at 2 feet
Source: Maui Electric Company, Limited

Final Environmental Impact Statement
Proposed Waena Generating Station
Maui Electric Company, Limited

FIGURE 4-2

TOPOGRAPHY

NORTH 0 200 400 600 FEET

CH2M HILL

the a'a rather than the pahoehoe type, voids such as lava tubes and gas blisters in the near surface portions of the bedrock are anticipated to be relatively infrequent. Runoff potential of this soil is slow to medium and the erosion hazard is slight to medium.

It is anticipated that these soils are underlain by hard andesitic a'a bedrock at relatively shallow depths on the order of 5 feet or so below the surface. Because of the undulating nature of the surface of a'a flows, the depth to a'a bedrock will vary across the site. As indicated in quarrying activities in the vicinity of the site of the proposed project, the underlying bedrock can range from 25 to 35 feet thick and consist of clinker zones above and below a massive, highly to moderately fractured a'a core.

Surface soils along the preferred and alternate transmission line corridors have been classified as the Molokai Series (M), Paia Series (Pc), Waiakoa Series (W), Ewa Series (E), Iao Series (I), Alae Series (A), Pulehu Series (Ps), and Rock Land (R). The Molokai and Paia soils, like the Waiakoa Series, consist of soils derived from weathered a'a lavas and volcanic ash. These soils are deeply weathered and their general soil profiles consist of silty clay loam at the ground surface grading to saprolite then to soft, highly weathered rock at a depth of approximately six feet.

The Ewa, Iao, Alae, and Pulehu Series consist of recent alluvial soils derived from the weathered a'a lava flows. The Alae soils also contain weathered volcanic ash. These soils range from loams to clays with varying amounts of sands, stones, and cobbles. The depth of these soils to the underlying bedrock is generally greater than 5 feet.

The subsurface conditions along the preferred and alternative transmission line corridors are anticipated to generally consist of clays and clayey silts underlain by hard andesitic bedrock. Along most of Pulehu Road, the corridor extends across the youngest a'a flows in the study area. Hard bedrock is anticipated to be present within about 3 feet below the existing ground surface. The remainder of the corridors cross over soils consisting of alluvium derived from surrounding a'a flows and weathered volcanic ash. Hard bedrock is anticipated to be present at depths greater than 5 to 6 feet below the existing ground surface.

4.4.2 Potential Impacts

Most of the structures at the proposed project site are anticipated to be constructed at or near existing site grades. Because of the gently sloping topography, some amount of grading, cutting, and filling will be needed to level the site. Such grading and filling can result in non-uniform foundation bearing conditions across the site.

Grading operations will also require some amount of rock excavation. Rock excavation can be accomplished using large bulldozers with rippers, hydraulic rock breakers, drilling and blasting, or by other suitable rock excavation methods. The selection of a particular excavation method will depend on factors such as rock hardness, strength, degree of weathering and fracturing, and joint and fracture orientation and spacing. Fill material in suitable quantities will need to be imported, one possible source being the neighboring Ameron HC&D quarry.

The surface soils appear to have moderate plasticity and may have some shrink and swell tendencies. In general, soils with these tendencies will shrink upon drying and swell and soften upon wetting. These volumetric changes could result in cracking of slabs-on-grade, lightly loaded masonry structures, and pavements. Overexcavation and replacement with non-expansive fills, in-place treatment, and thicker pavement sections can generally be used where such soils occur.

Because of the clayey nature of the surface soils, anticipated shallow bedrock conditions, and probable absence of saturated deposits, the potential for liquefaction of the site soils is anticipated to be low. Percolation rates in these soils are also anticipated to be relatively slow.

The installation of the proposed transmission lines will involve the drilling of pole foundations and the installation of concrete piers. It is anticipated that the piers for the poles may need to be installed to depths of approximately 10 feet or deeper. Along the majority of the corridor alignment, the drilled holes are anticipated to extend through the soil and penetrate to some depth into the underlying bedrock. Major geotechnical and geological concerns regarding the transmission pole installations are not anticipated.

4.4.3 Mitigation Measures

To reduce the potential for excessive differential settlements, the foundations for a particular structure should be supported on the same bearing materials, either completely on the natural surface soils or completely on the underlying bedrock. It is anticipated that lighter structures probably could be supported on shallow foundations in the surface soils. Heavier structures, such as the new generators, would need to be placed on foundations in the underlying lava flow. The geotechnical engineering properties of the site surface and subsurface materials will be evaluated in detail prior to construction to allow for appropriate structural design. A detailed topographic survey of the site will be prepared following harvest of the current crop of sugar cane in middle to late summer 1997.

4.5 Natural Hazards

4.5.1 Volcanic

Volcanic hazards from lava flows and ash-fall in the Hawaiian Islands have been quantified on classification maps based on coverage of different areas during specific time periods (Mullineaux, et al., 1987). The Island of Maui is divided into 5 lava flow hazard zones, with Zone 1 having the highest lava flow risk and Zone 5 having the lowest risk. The proposed site is located in Zone 5. Zone 5 includes areas that have not been affected by lava flows for at least 20,000 years.

Maui is divided into 3 hazard zones for volcanic ash-fall, with Zone 1 having the highest ash-fall risk and Zone 3 having the lowest risk. The site of the proposed Waena Generating Station is located in Zone 3. Zone 3 includes areas in which less than 1 centimeter of ash is expected to fall at an average rate of once per 1,000 years. This zone also includes areas where 10 centimeters or more of ash may fall at least once per 3,000 years.

4.5.2 Seismic

The majority of the earthquakes in Hawaii occur on the volcanically active Island of Hawaii and are generated by magma moving at shallow depth. These earthquakes seldom cause any damage. Occasional larger scale earthquakes are associated with structural readjustment within the volcano. On Maui, the most likely area to experience structural readjustment would be in the region of the most recent volcanic activity along the southeast and east rift zones of Haleakala.

In historic time, two larger scale earthquakes felt on Maui have occurred as a result of tectonic rather than volcanic activity. These earthquakes, both having magnitudes in the range of 7 on the Richter scale, occurred in 1971 and 1938 and are believed to have originated in the Molokai fracture zone. The Molokai fracture zone stretches from the Baja California coast towards the Hawaiian Islands, where it splits with one arm heading toward northeast Molokai and the other arm heading toward eastern Maui and continuing southwest of the islands.

The Uniform Building Code (UBC) is the accepted document by the County of Maui for the structural design of buildings and facilities to withstand earthquake forces. The Island of Maui is currently classified as seismic zone 2B according to the 1991 UBC. All proposed facilities will be designed in accordance with the applicable building codes as they apply to seismic hazards.

4.5.3 Extreme Winds

The mountainous topography of both east Maui (Haleakala) and west Maui tend to channel prevailing winds through the central valley area. This applies equally well to winds blowing from the general northeasterly or southwesterly directions, associated with trade winds or Kona storms, respectively. In addition to the channeling effects, the sloping terrain from the shoreline to higher elevations at the site will also tend to escalate the wind speeds.

Although the occurrences of hurricanes striking Maui are rare, winter Kona storms can bring winds approaching 60 mph. Studies done by Drs. Cheng, Chiu, and Schroeder of the University of Hawaii in 1995 to support the site selection process (Dames & Moore, 1995) indicate that extreme winds at the site could reach 148 mph during Iniki-class hurricanes and that mean annual fastest-mile wind speed is about 60 mph. The 25-year, 50-year, and 100-year fastest-mile wind speeds are estimated to be 63.2 mph, 65.5 mph, and 67.1 mph, respectively.

The UBC is the accepted document by the County of Maui for the structural design of buildings and facilities to withstand forces from extreme winds. All proposed facilities will be designed in accordance with the applicable building codes as they apply to wind.

4.5.4 Floods

According to the federal Emergency Management Agency's Flood Insurance Rate Map, the project site is located in Zone C, areas experiencing minimal flooding. According to the National Flood Insurance Program, Zone C areas are not considered to be flood plain areas.

4.6 Water Resources

A hydrogeologic survey was prepared for the proposed project by Water Resources Associates in May 1997. This section summarizes that report, which is provided in Appendix E.

4.6.1 Groundwater

4.6.1.1 Existing Conditions

The project area is located in a dry area, with the median rainfall amounting to only 17-20 inches a year. Rainfall in the central Maui isthmus is somewhat evenly distributed, averaging approximately 28 inches a year over an area of approximately 200 square miles. Rainfall ranges from a low of 15 inches a year in the southern isthmus southwest of the project site and gradually increases at higher elevations to 50 inches and more over Haleakala. With dry and windy conditions prevailing, only a small percentage of rainfall is able to percolate deep enough below the ground surface to become groundwater recharge.

The hydrogeology of the region and site vicinity is described below in terms of groundwater occurrence, movement, and quality.

Groundwater Occurrence. The State Commission on Water Resource Management has identified the Central Maui Basin as the Central Maui Hydrologic Sector and subdivided it into four aquifer systems, Kahului, Paia, Makawao, and Kamaole. The project site is located in the Paia Aquifer System. This system covers an area of 61 square miles and has an estimated sustainable yield of 8 million gallons per day (mgd).

All known groundwater resources in the Central Sector consist of basal water, occurring as a lens of less dense fresh-to-brackish (nonpotable) water floating upon denser salt water. In general, the basal aquifer has a chloride content higher than 250 milligrams per liter (mg/l) in all areas throughout the central isthmus and in all coastal areas from Paia to Kahului on the northern shores and from Maalaea to Makena on the southern shores of the Central Sector. Groundwater with a chloride content higher than 250 mg/l is classified as nonpotable. In specific localized zones, such as near the project site, where artificial recharge from excess irrigation dilutes and significantly lowers the chloride content of the basal water, the aquifer may yield groundwater having less than 250 mg/l of chlorides. However, because the recharge from excess irrigation is undependable and subject to contamination, such artificially recharged groundwater still is considered nonpotable and not suitable for potable water use. The nearest potable water to the project site has been found generally 1.5 miles inland from the coast from Paia and 4 miles inland from the coast at Kihei.

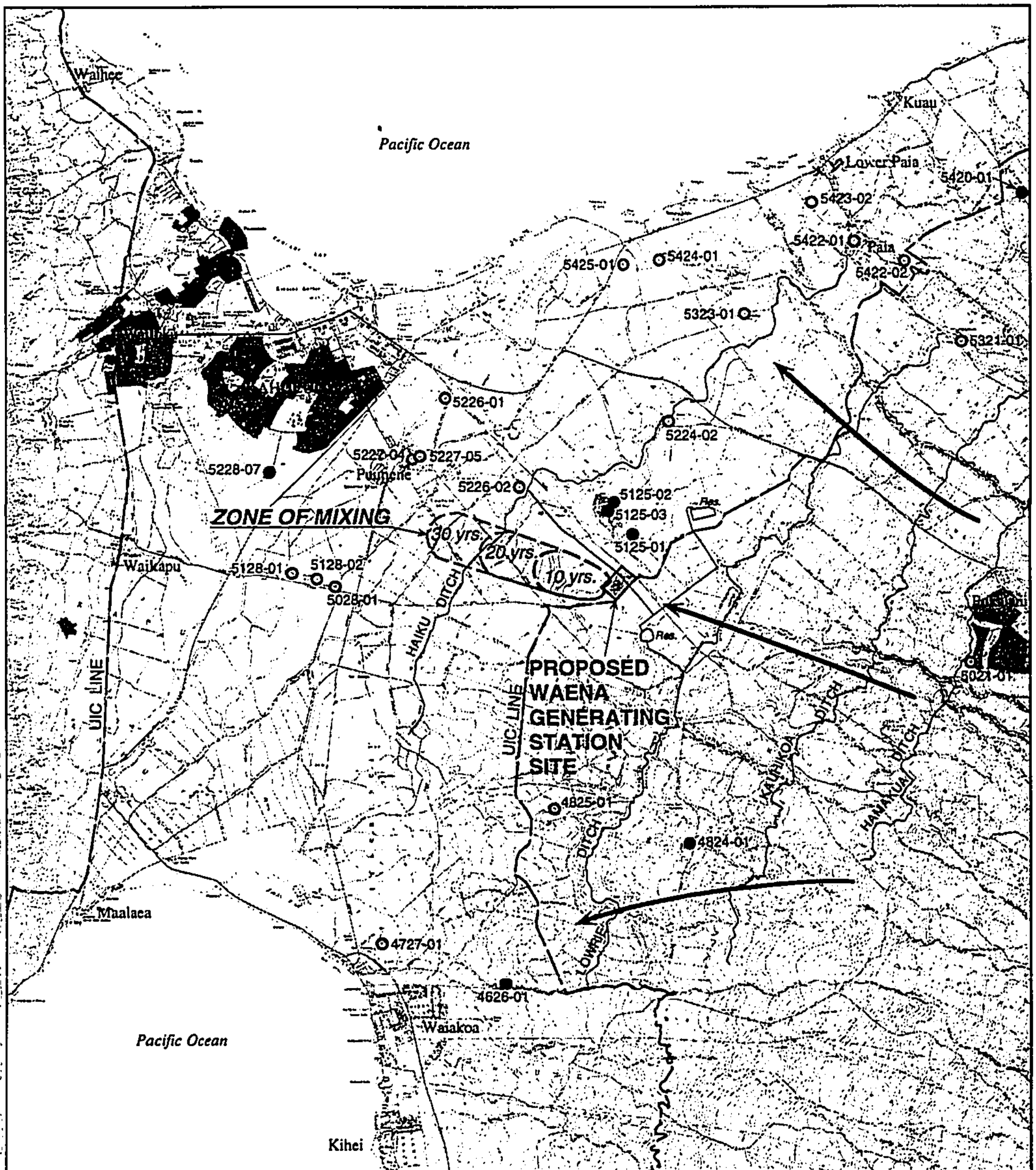
The Paia Aquifer is an area that experiences considerable irrigation recharge. The area contains an elaborate system of irrigation ditches and aqueducts, most notably the Haiku, Lowrie, Kauhikoa, and Hamakua Ditches (see Figure 4-3). These ditches convey an estimated average of 164 mgd of surface waters from streams located in windward valleys in East Maui. The entire area surrounding the project site is irrigated by the ditch system operated by Hawaiian Commercial and Sugar Company (HC&S). Overall, the ditch system extends 4 miles inland, 1 mile seaward, and more than 2 miles on either side of the project site. Consequently, a significant amount of artificial recharge occurs in the project area, which has resulted in lower groundwater salinity in some places.

Groundwater Movement. The basal aquifer which dominates the Central Sector is unconfined, thin, mostly brackish, and has a water table gradient of about one foot per mile. With some 26 miles of coastline and little to no impermeable coastal caprock formation to impede groundwater flow, the estimated average natural groundwater discharge to the ocean is only 2.3 mgd/coastal mile.

The general direction of groundwater flow in the vicinity of the project site is estimated to be in a northwesterly direction with ultimate movement broadly divergent westward towards the isthmus and northwesterly towards Kahului. General groundwater movement elsewhere in the Central Sector is towards the coast.

Water Quality. The variation in groundwater quality downgradient of the site is not precisely known, but groundwater quality generally becomes more brackish in a northwesterly direction toward the coast. Based upon data from three monitor wells located in the nearby Central Maui Landfill, the basal aquifer underlying the project site has a head of about 4.8 feet and chloride content that is barely potable in terms of chloride (192 to 216 mg/l). However, because the aquifer depends upon artificial recharge from excess irrigation water, the aquifer still is considered nonpotable and is not a potential source of drinking water. Table 4-10 contains the water quality of the underlying aquifer as measured by the monitoring wells located in the Central Maui Landfill.

Existing Wells. Groundwater in the project area is developed from a dozen or more wells and shafts and consists entirely of nonpotable water. The bulk of the water is used for sugarcane irrigation. Minor amounts of ground water are used for landscape irrigation and for industrial purposes at sugar mill and pineapple canning operations. A large component of the ground water pumped by HC&S for sugarcane irrigation comes from the recycling of excess irrigation water by deep percolation to the basal aquifer. Without such irrigation recharge, the basal aquifer developed by the HC&S and other wells in the area would produce groundwater with a much higher chloride content, rendering many of the wells useless.



LEGEND

- ○ Privately Operated Well (State Identification Number)
- ● State or County Well (State Identification Number)
- — — — Underground Injection Control (UIC) Line
- ——> Estimated Direction of Groundwater Flow
- ~~ Irrigation Ditch

Note: See appendix for individual well data. Source: Water Resource Associates, 1997

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FIGURE 4-3

WATER RESOURCES NEAR THE PROJECT SITE

NORTH 0 1 2 3 4 MILES

CH2M HILL

Table 4-10
Existing Groundwater Quality and Estimated Effluent Quality
Waena Generating Station

Parameter	Detected in Monitoring Wells[1] (mg/l)	Estimated Effluent Quality[2] (mg/l)
Ammonia	0.09-0.66	0.76
Bicarbonate	239-395	634
Biochemical Oxygen Demand	na	1.62
Carbon Dioxide	na	90
Chloride	132-216	400
Conductivity, umhos	na	1500
Fluoride	na	0.31
Hardness	172-202	374
Nitrate	3.3-5.1	8.4
Nitrite	na	1.93
Nitrogen	na	0.34
Oil & Grease	na	<5
pH	na	6.91
Phosphorus	na	0.33
Silica	na	56
Sulfate	29-71	100
Total Organic Carbon	0-17	17
Total Suspended Solids	na	<1
Total Alkalinity	239-395	634
Total Dissolved Solids	662-4910	5572
Turbidity	na	0.65
Calcium	17-25	42
Chromium	0-0.01	0.02
Magnesium	21-35	56
Potassium	9.5-24	34
Sodium	162-219	381

Notes:
[1] Data from monitoring wells located at Central Maui Landfill
[2] Estimates based upon Maalaea effluent quality for DTCC as applied to monitoring well data
na - Parameter not measured at Central Maui Landfill monitoring wells. Effluent quality reflects Maalaea conditions

Source: Water Resource Associates, 1997

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Source: Water Resource Associates, 1997

The nearest irrigation well to the project site is owned by HC&S and identified as Well #5226-02 on Figure 4-3. The well is located approximately 1.5 miles downgradient from the project and has a chloride content reported at between 335-490 mg/l.

The only existing municipal well source in the Central Sector is located in Kahului, approximately 4.5 miles northwest of the project site. Additional municipal well sources are currently contemplated in the Hamakuapoko area, located approximately 6.5 miles northeast of the project site. Well sites in the project area are identified on Figure 4-3.

4.6.1.2 Potential Impacts

Water Supply. Four brackish groundwater supply wells will be developed within the project site to meet water requirements for operation of the CTs and related facilities. Brackish groundwater will be demineralized and used primarily for NO_x control and boiler makeup water. Lesser amounts will be needed for fire protection, maintenance, and sanitary needs of personnel. Potable water for drinking purposes may be delivered by truck or supplied by other means.

The estimated water use for one DTCC unit is approximately 220,000 gallons per day (gpd). The projected average daily water requirements for all four DTCC units planned for the facility would be 880,000 gpd.

A fire flow requirement of 2,000 gallons per minute (gpm) for 2 hours must be provided to meet Maui County Water Systems Standards. Two separate 240,000-gallon storage tanks will be constructed to store water for use in fire protection.

Wells drilled at the project site will provide approximately 880,000 gpd of brackish water. At least four wells with pump capacities of 225 gpm are planned. Well water will be desalinated or treated as required and stored onsite.

Wastewater. The 232-MW project will generate an average of 440,000-480,000 gallons of wastewater per day. The wastewater stream will reflect typical treatment processes associated with the operation of CTs. The principal source of wastewater will be from reverse osmosis, which is a water treatment designed to produce relatively pure water from brackish groundwater. A by-product of reverse osmosis will be a concentrated solution of salts and minerals. The treated water will be used for NO_x control and for steam generation.

Further water refinement will be provided by demineralization. During demineralization, the process water is passed through cation and anion resin beds to remove minerals. The resin beds are periodically regenerated by backwashing, followed by acid and caustic injection, and additional rinsing of the beds. The wastewater from backwashing will contain minerals removed from the water, acid and caustic solutions used for neutralization, and traces of the resin chemicals.

Wastewater will also be produced from the heat-recovery steam generator (HRSG) cycle. This wastewater will contain a number of chemicals such as phosphate, sulfites, ammonia, and acids and caustics that have been added to minimize corrosion within the steam cycle. Other sources of wastewater include water from the dual media filters and stormwater, which has gone through an oil/water separator. Wastewater generated from the use of brackish supply water will contain more minerals and salts than wastewater generated from the use of potable water.

Wastewater treatment. Any wastewater potentially containing oil or grease will be routed to an oil/water separator for removal of the oil. Corrugated plate separators will contain a coalescing medium that improves separation by coalescing small oil droplets into larger ones, which then are separated by gravity. The effluent from the oil/water separators will have a total petroleum hydrocarbon concentration of 5 ppm or less.

Wastewater will be collected in wastewater storage tanks and will be at ambient air temperature when it is pumped to the injection wells. The average daily injection rate will be approximately 110 gpm per well. The estimated wastewater quality for the wastewater is shown in Table 4-10. After the wastewater storage tanks are filled to a prescribed capacity, the wastewater will be periodically pumped through a filter medium and a reinjection cartridge filter.

The wastewater will consist primarily of process water from the reverse osmosis system, backwash from the system, and regeneration waste from demineralization. The wastewater reinjection filter system will remove 95 to 98 percent of the suspended solids and 90 to 95 percent of the insoluble hydrocarbons. The wastewater will flow through polishing cartridge filters to reduce the level of suspended solids further before reinjection.

The reinjection filter is designed to automatically backwash the medium whenever it becomes dirty. This backwash will be based on a high differential pressure across the filter bed, or a preset time interval, whichever occurs first. The automatic backwash is expected to take place every 18 to 24 hours. A scrubbing cycle reconditions the filter bed during each backwash cycle by removing dirt and oil from the medium. Cleaning the medium in this way ensures a continually clean filter.

If SCR is required as BACT as a condition of the PSD permit, the wastewater produced would pass through additional steps to remove excess metals, adjust the pH of the water, and to air strip out the ammonia used in the SCR process. After final treatment, the wastewater would be stored in a treated wastewater storage tank prior to disposal in an injection well.

Sanitary Wastes. Sanitary wastewater generated by the project is expected to average less than 1,000 gpd as determined using estimates provided by the County of Maui Water Reclamation Division. MECO plans to construct a septic tank and leach field to treat effluent from sanitary facilities. Detailed plans for the domestic wastewater treatment system will be submitted to the DOH for review and approval as part of a treatment works approval application. The treatment system will conform to applicable provisions of DOH

Administrative Rules Chapter 11-62, including but not limited to Section 11-62-32, which specifies spacing for individual wastewater systems, and Section 11-62-33.1(a) which contains requirements for septic tanks.

The system will also conform to applicable sections of the Ten States Standards, and Chapters 10, 20, 40, and 50 of the DOH Administrative Rules. As specified in Chapter 10, information concerning soil and site conditions will be evaluated to determine an appropriate design for the proposed septic system. Factors to be evaluated will include depth of permeable soil, bedrock, or other limiting layer; soil factors; land slope; flooding hazard; and amount of suitable area available of the development of a leach field.

Injection Wells. Four deep injection wells will be used to dispose the process wastewater. The wells will be located downgradient from the supply wells and will be constructed and operated in accordance with DOH underground injection control (UIC) regulations.

The State of Hawaii has established a UIC line to protect groundwater sources of drinking water from contamination by injection well activity. The location of the UIC line is designed to protect groundwater resources mauka of the line. The location of the UIC line relative to the project site is shown in Figure 4-3. The project site is located makai of the UIC line where injection wells may be permitted. A UIC permit application will be submitted to the DOH for review.

The groundwater quality at the injection depth is currently unknown, however, the underlying aquifer is classified as nonpotable with chloride counts generally above 250 mg/l. Near the project site irrigation recharge has caused localized variations in chloride counts below 250 mg/l. However, the irrigation recharge is a variable phenomenon and the entire aquifer must still be considered nonpotable. The groundwater at the target injection zone is expected to be saline.

Impacts on Groundwater. Two potential impacts on groundwater have been evaluated:

- Potential impacts on groundwater levels and water quality in the site area due to pumping from the brackish aquifer
- Potential groundwater quality impacts downgradient of the site due to wastewater injection

Each potential impact is discussed in the text that follows.

Potential Impacts on Groundwater Levels and Water Quality Due to Pumping. As a result of removing irrigation recharge and additional pumping from the aquifer, the proposed Waena Generation Station project is anticipated to result in an approximatley 0.6 mgd net loss to the underlying aquifer. Based upon pumping test data of other wells in the Paia Aquifer, drawdown of groundwater levels associated with pumping the brackish water wells at the Waena Generating Station site is expected to be approximately 0.6 feet. A 0.07-foot drawdown of groundwater levels is anticipated at a distance of 1 mile following 365 days of pumping. The impact of pumping on local groundwater levels and quality is expected to be negligible. The nearest irrigation well is 1.5 miles downgradient from the project site and would not be affected. The proposed withdrawal volume is well within the estimated sustainable yield of the Paia aquifer. No adverse impacts on groundwater levels, groundwater quality, or irrigation wells due to water withdrawal are expected.

Potential Groundwater Quality Impacts Due to Wastewater Injection. The potential impacts from wastewater injection depend on the characteristics and composition of the effluent to be injected and the quality of the existing groundwater in the target injection zone. An average of 110 gpm of wastewater per well will be injected in the saline aquifer beneath the site. A worst-case scenario for modeling purposes was developed with the following assumptions:

- Rate of injection would be 110 gpm per well
- Total amount of 0.44 mgd injected from beginning of plant operation over 30 years
- Aquifer transmissivity of 192,700 square feet/day, aquifer thickness of 193 feet, aquifer porosity of 0.1
- A hydraulic gradient of 0.45 feet/mile based on monitoring well heads at the Central Maui Landfill
- No mixing of effluent with aquifer groundwater
- The groundwater at the target depth for wastewater reinjection is expected to be saline
- The wastewater composition as presented in Table 4-10

Using these assumptions, the modeled plume of wastewater, as shown in Figure 4-3, will extend downgradient of the project site, a distance of 0.8 miles after 10 years, 1.5 miles after 20 years, and 2.1 miles after 30 years of steady injection. No significant changes in groundwater levels are expected.

Although a worst-case scenario of no dispersion of the plume was assumed, in reality, as the wastewater plume migrates downgradient from the injection well, it will be affected by dispersion. Dispersion is the process by which a plume tends to spread by mechanical mixing and molecular (chemical) diffusion. The width of the plume will increase by dispersion, although the concentration within the plume will decrease until it eventually reaches that of the ambient groundwater.

Currently, no information on the dispersive properties of the aquifer at the project site is available. However, because the estimated wastewater chloride concentrations injected into the underlying aquifer are approximately the same as concentrations recorded from water withdrawn from the nearest irrigation well, the injected wastewater will certainly reach ambient groundwater concentrations before reaching the nearest existing irrigation well.

Therefore, the potential impact of the wastewater plume on general downgradient groundwater quality is not expected to be significant.

No significant changes to downgradient groundwater levels, groundwater quality, or irrigation wells are expected from the injection of treated wastewater.

4.6.1.3 Mitigation Measures

To prevent any possible groundwater contamination by seepage, the annular space around the casing of each supply well will be cement grouted from the surface to a depth just above the groundwater table. The wells will be constructed in accordance with all applicable regulatory requirements. Well construction permits and pump installation permits will be obtained from the State Commission on Water Resource Management.

Any potential impact from the use of injection wells will be mitigated by appropriate design and testing (pumping and injection) to determine aquifer characteristics, such as hydraulic conductivity, salinity, temperature, drawdown, and well capacity. The injection wells will be constructed and operated in compliance with DOH UIC regulations. Downgradient monitoring wells may be required as a condition of the DOH UIC permitting process. No additional mitigation measures are anticipated.

Drilling and pumping a test well is recommended as soon as practical to gather site-specific water quality data.

4.6.2 Surface Water

4.6.2.1 Existing Conditions

Surface water in the area is comprised of intermittent natural streams within Kalialinui and Pulehu gulches, reservoirs, and irrigation ditches. The reservoirs and ditches are owned and operated by HC&S specifically and solely for the impoundment and transport of irrigation water. Irrigation reservoirs and ditches are technically surface waters (Dames & Moore, 1995).

Drainage in the area is generally through a series of gulches extending radially from the upper slopes of Haleakala towards the central isthmus area. The area of the proposed project is drained by Kalialinui Gulch, located a quarter mile to the north, and by Pulehu Gulch, located a mile to the south of the project site. Both gulches are normally dry and the streambeds are heavily vegetated. The streams are designated as intermittent and flow only during storm runoff conditions.

The site of the proposed Waena Generating Station is located approximately 1,000 feet from Kalialinui Gulch and 5,000 feet from Pulehu Gulch. The flow from the site is directed to the northwest, away from both gulches. The nearest HC&S reservoir is located approximately

2,000 feet from the northeast boundary of the site. An irrigation ditch runs through the project site.

4.6.2.2 Potential Impacts

The development of the proposed Waena Generating Station will remove 65.7 acres from active sugarcane cultivation. Of that acreage, approximately 15 acres will remain in open space reserved for easements and approximately 50 acres will be developed. The developed area will consist of both impervious, asphalt areas and more pervious, gravel-covered areas. On the basis of the conceptual design currently available for the site, the proposed project would increase stormwater runoff from approximately 45.5 cubic feet per second (cfs) to approximately 215.4 cfs. Stormwater runoff over the developed 50 acres is anticipated to increase from approximately 34 cfs to 204 cfs.

To avoid project specific runoff from reaching adjoining sugarcane lands, the proposed project will include stormwater runoff and infiltration ponds to collect and contain stormwater on site. A 15-foot landscape buffer around the facility will also aid in stormwater percolation. Runoff ponds will have special sumps with oil/water separators to remove any oil before disposal of the storm runoff into an infiltration pond. An alternative disposal method of water from the runoff ponds could be through a shallow injection well (dry well). HC&S has requested that stormwater runoff be diverted away from their irrigation ditch.

Stormwater impacts and erosion to the on-site irrigation ditch are possible during the construction phase of the proposed generating station. However, use of best engineering practices to prevent runoff into the ditch can minimize these temporary impacts. No significant adverse impacts to the HC&S irrigation system is anticipated from construction-related activities.

4.6.2.3 Mitigation Measures

The proposed drainage improvements will be designed to produce no adverse impacts, due to stormwater runoff, on adjacent properties. All drainage improvements will conform to County of Maui standards. Drainage plans and erosion control plans will be designed and submitted to the County of Maui Department of Public Works for approval prior to construction. MECO will discuss the possibility of alternative disposal options with the Department of Health and HC&S during the preliminary engineering phase of the proposed generating station project.

4.7 Biological Resources

4.7.1 Existing Conditions

A biological survey was prepared for the proposed project by Botanical Consultants in March 1997. This section summarizes that report, which is provided in Appendix F.

4.7.1.1 Flora

The 65.7 acres for the proposed Waena Generating Station are presently under sugar cane cultivation. Surveys of the site and the corridors of the preferred and alternative transmission line corridors indicated two major vegetation types, Sugarcane Fields and Ruderal Vegetation.

Sugarcane vegetation type (*Saccharum officinarum*) consists of a densely growing, large grass with individual plants attaining heights of from 8 to 12 feet. This vegetation type grows so densely that other plants cannot penetrate the fields.

Ruderal, or weedy, vegetation is found around the edges of the proposed generating station site and along most of the transmission line corridors under consideration. The Ruderal fringe is generally mixed with grasses such as buffel grass (*Cenchrus ciliaris* L.), sour grass (*Digitaria isularis* (L.) Mez ex Ekman), star grass (*Chloris divaricata* R. Br.), and wiregrass (*Eleusine indica* (L.) Gaertn.) together with many species of seed bearing, thorny weeds. Most prominent among these are spiny amaranth (*Amaranthus spinosus* L.), *Bidens cynapiifolia* Kunth, sow thistle (*Sonchus oleraceus* L.), cheese weed (*Malva parviflora* L.) rattle box (*Crotalaria berteroana* DC), and apple of Peru (*Nicandra physalodes* (L.) Gaertn.).

Within the preferred and alternative transmission line corridors along Pulehu Road the common vegetation is mixed grasses, mainly buffel grass and Guinea grass (*Panicum maximum* Jacq.) with a great variety of weedy herbs mixed in. There are also some woody plants found along this part of the corridor. Scattered koa haole shrubs (*Leucaena leucocephala* (Lam.) deWit), and Java plum trees (*Syzygium cumini* (L.) Skeels) can be found, as well as some huge planted ear pod trees (*Enterolobium cyclocarpum* (Jacq.) Griseb.) and monkey pod trees (*Samanea saman* (Jacq.) Merr.) along the road where it crosses Haiku Ditch. From Haiku Ditch to the Puunene Sugar Mill the route of the corridor passes through an area of fallow fields, young sugar fields, or segments where the wayside vegetation has been removed.

Along North Firebreak Road eastward from Pulehu Road can be found mixed, weedy vegetation with small, scattered patches of Bermuda grass (*Cynodon dactylon* (L.) Pers.). Some woody koa haole and castor bean shrubs (*Ricinus communis* L.) are present along parts of Sunny Side Road, however, for the most part, vegetation within the corridor along Sunny Side Road has been removed and the ground layer sprayed.

The only native Hawaiian plants found during the survey were 'ilima (*Sida fallax* Walp) and pa'uohi'iaka (*Jacquemontia ovalifolia* Hallier). These species were located along Pulehu Road near the access road to the Central Maui Landfill. No rare or endangered species or species listed as candidate for such status were located either on the site of the proposed Waena Generating Station or within the preferred or alternative transmission line corridors.

4.7.1.2 Fauna

A field survey for fauna was conducted in March 1997. Three fixed station observation points of 20 minutes each were carried out along the generating station site boundaries. Additional observation points were carried out along the preferred and alternative transmission line corridors. Observations were made during early daylight hours in order to take advantage of the higher activity levels of both birds and mammals during cooler parts of the day. In addition, 45-minute observation periods were conducted from twilight to early darkness on two consecutive evenings to determine if the Hawaiian hoary bat or the Hawaiian owl are present in this area. Neither species was observed during either observation period. Hawaiian hoary bats are known to roost in higher elevations, however, they have been recorded at elevations as low as 400 feet and within gulches (Dames & Moore, 1995) and it is likely that they utilize the air space above the project site.

Only one species of mammal was found during the survey period. Individual mongooses (*Herpestes auropunctatus*) were seen along both Waiko Road and North Firebreak Road. The mongoose is a mammal which was introduced into Hawaii and is not considered to be endangered or threatened in any way. Because of the long standing use of the land in sugarcane, it is assumed that the house mouse (*Mus musculus*) and the black rat (*Rattus rattus*) also are present within the area, although they were not observed.

Because of the extensive modification and cultivation of the project site, it has almost no value as native bird habitat. Several non-native species were observed in areas around the site and along the proposed transmission line corridors where trees, large shrubs, and weedy vegetation were present. Some of the non-introduced species include the House Sparrow (*Passer domesticus*), Cattle Egret (*Bubulcus ibis*), House Finch (*Carpodacus mexicanus*), and Northern Cardinal (*Cardinalis cardinalis*). Doves, pigeons, and the Common Myna (*Acridotheres tristis*) were also observed. None of the species observed are listed as threatened or endangered, or as candidates for such status.

4.7.2 Potential Impacts

The proposed project will result in the removal of the existing sugarcane. No plants or animals listed as endangered or threatened, or which are candidates for such status were discovered within the site of the proposed generating station or along the proposed transmission line corridors. In addition, no special or unique bird or mammal habitat was discovered in these areas. No Hawaiian hoary bats or Hawaiian owls were observed in the area and these species are not likely to forage or roost at the project site. Although bats may use the air space above the project site, no habitat conducive to bat roosting or foraging exists on the project site. Construction of the proposed generating station would have no adverse impacts upon the Hawaiian Hoary Bat. No adverse impacts to flora or fauna resources are anticipated as a result of construction or operation of either the proposed generating station or the proposed transmission lines.

4.7.3 Mitigation Measures

Some sea birds, such as petrels and shearwaters are known to nest in high, craggy places such as the rim of Haleakala Crater. Although none were seen during the survey, they are known to leave their burrows at night and fly towards the ocean. Because these birds can become disoriented by bright lights, outside security lighting will be hooded to direct the light downward.

4.8 Archaeological and Cultural Resources

An archaeological inventory of the proposed generating station site and transmission line corridors was prepared by Scientific Consultant Services, Inc. (SCS). This section summarizes the SCS report. The complete report is provided in Appendix G.

4.8.1 Existing Conditions

The present project area is situated in Wailuku ahupua'a, Wailuku District, Maui. The ahupua'a area includes the coastal area of Kahului Bay from Kapukaula to Paukukalo and the northern half of the isthmus between Haleakala and the West Maui Mountains. Only one previous archaeological investigation has been conducted within the area covered by the proposed project, with no sites identified.

SCS conducted field investigations of the site and the proposed transmission line corridors in March 1997. The north and east sides of the generating station site were examined and the central portion was inspected from the cane haul road that bisects the site northwest-southeast. The proposed transmission line corridors were surveyed with walk-through sweeps. Pedestrian sweeps were not made into the middle of the proposed generating station site due to the dense sugarcane growth. However, because the entire site has been under sugarcane cultivation for over 100 years, the likelihood of encountering archaeological remains or sites would be highly improbable.

No archaeological resources were identified in any of the proposed transmission line corridors or at the site of the proposed generating station. Where the transmission line routes follow existing roads, dozed berms and/or cultivated cane fields adjoin the road rights-of-way. The generating station site lies within an existing cane field and, although the entire site was not surveyed on foot, it would seem unlikely that any sites would be present as cane field cultivation often creates plow zones up to four feet below the surface.

4.8.2 Potential Impacts

No archaeological resources were identified in any of the proposed transmission line corridors or at the site of the proposed generating station. As a result, the archaeological inventory survey of the project area concluded that the proposed Waena Generating Station and accompanying transmission lines are not expected to have an adverse impact on archaeological or cultural resources. In a letter dated August 29, 1997 and included within

Appendix G of this document, the State Historic Preservation Division concurred with the findings of the archaeological survey and determined that the proposed Waena Generating Station would have "no effect" upon known historic resources.

4.8.3 Mitigation Measures

On the basis of the archaeological survey findings, no mitigation measures are indicated. If any historic or prehistoric surface or subsurface archaeological features or deposits are uncovered during construction, MECO will stop work in the immediate vicinity and contact the State Historic Preservation Office for a determination of significance.

4.9 Visual Resources

4.9.1 Existing Conditions

4.9.1.1 Visual Environment

Visual resources in the vicinity have been evaluated in terms of the background, middleground, and foreground views from the project site. The site is situated within an area of gently sloping terrain which extends to the slopes of Haleakala. There are few significant topographic barriers to limit views. The area surrounding the project site is in active sugar cane production.

Foreground views, from the project site to 0.5 miles from it, include open fields of sugar cane and the Central Maui Landfill/Ameron Quarry. Adjacent views of the site from Pulehu Road are obstructed because the road grade is below that of the site.

Middleground views up to 2 miles from the project site include a continuation of the sugar cane fields. The terrain begins to rise more rapidly to the southeast, allowing the site to be more visible to traffic along Pulehu Road in those areas where the road grade is not below the surrounding topography. No residential or sensitive view points are located within this area.

Background views from 2 to 4 miles away include the HC&S Puunene Sugar Mill and Kahului to the northwest and the Kahului Airport to the north. Because of the difference in elevations between Kahului and the project site, views of the site from residential areas of Kahului are difficult. To the southeast, the terrain slopes upwards to Pukalani, over 4 miles away, which overlooks the central Maui isthmus. Haleakala Highway runs within the northeast view quadrant of the site with its closest point slightly over 2 miles away.

4.9.1.2 Viewer Groups

Viewer groups are characterized by their exposure and sensitivity to a landscape. Viewer exposure can be quantified in terms of viewer location, number of viewers, and duration of view. Viewer sensitivity is the receptivity of different viewers to their visual environment and is strongly affected by viewer activities, expectations, and preferences. The most sensitive viewer groups are those engaged in recreational activities, such as at a resort or scenic lookout, followed by those in residential areas.

Generally, recreationists and residents are more sensitive to their surrounding environment than are persons en route to a destination by either car or airplane. Upcountry residents and persons traveling on Haleakala Highway represent the principal viewers of the proposed generating station.

4.9.1.3 Key Views

Views have been selected for areas representing tourist or local resident view planes towards the project site. No public viewing points or scenic lookouts exist within 4 miles of the project site. The locations of these views are shown in Figure 4-4. The existing character of each view is described below.

View 1. This figure represents a site overview of the project site taken by helicopter. The current site is in sugarcane cultivation.

View 2. This view is taken from Haleakala Highway at a point mauka of the Lowrie Ditch, approximately 3 miles from the project site. The view is dominated by the sugarcane lands in the foreground and the West Maui Mountains in the background. The man-made reservoirs and the Lowrie Ditch are visible within the middleground.

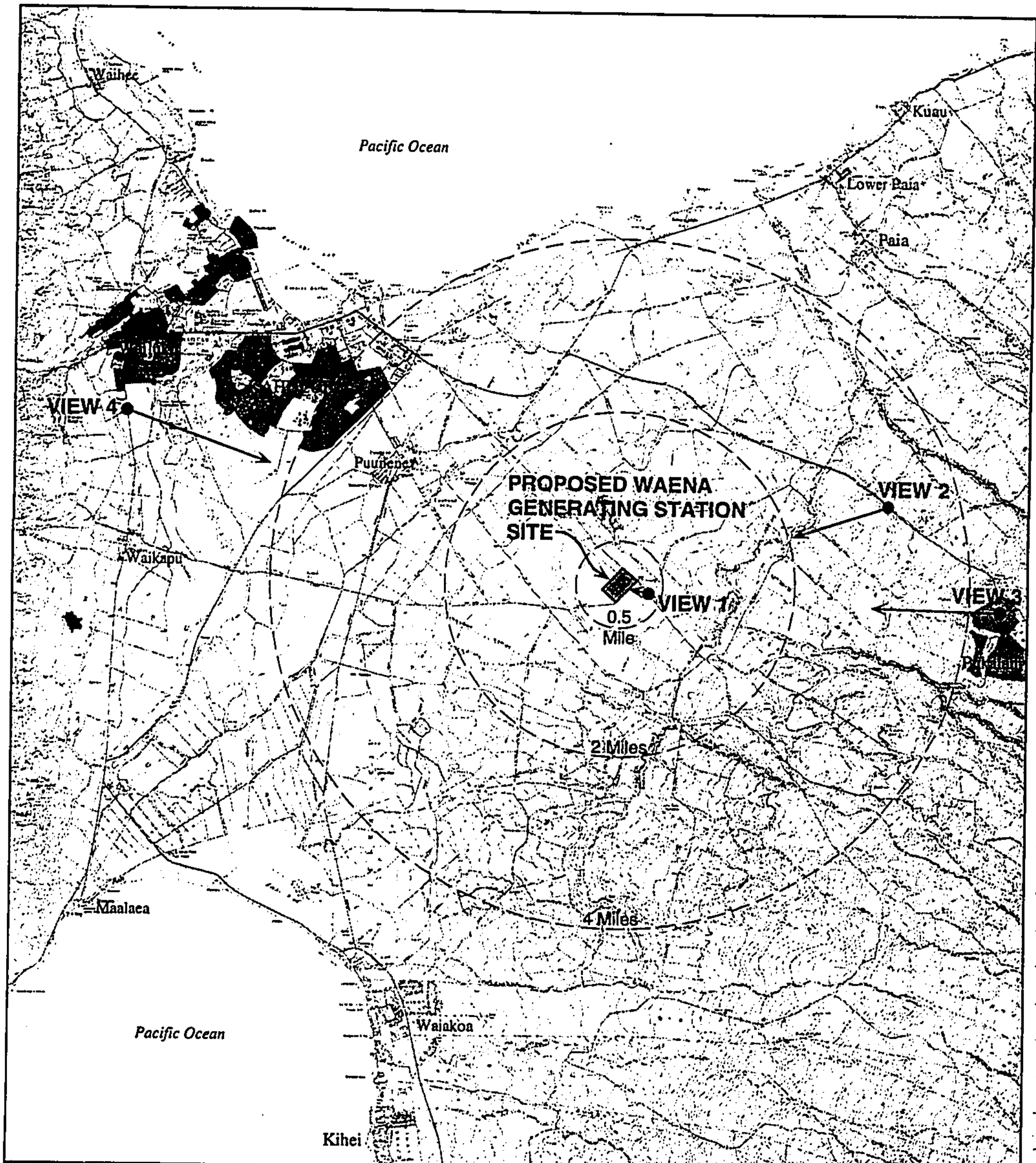
View 3. This view is taken from the Pukalani Community Park overlooking the Central Maui area. From this point, the project site is approximately 4 miles away. Views from the park are dominated by houses in the foreground and the West Maui Mountains in the background.

View 4. This view is taken from Honoapiilani Highway near Wailuku overlooking the Central Maui area. The project site is approximately 6 miles away. The view is dominated by residential development in the far foreground and the slopes of Haleakala in the background. The Puunene Sugar Mill is visible in thc middleground.

4.9.2 Potential Impacts

4.9.2.1 Daytime Visual Impacts

When fully developed, the proposed 232-MW Waena Generating Station will constitute a relatively large industrial complex. The structures housing the generating machinery, support equipment, and offices will be between 15 and 70 feet high and will cover approximately 25 acres. The four stacks will be 150 feet high and 24 feet in diameter. When these features are considered together with other elements of the project, such as storage tanks and roadways, the overall visual effect will be decidedly industrial.



LEGEND

- ● View Location and Number
- ⟶ Direction of View

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FIGURE 4-4

VIEW LOCATIONS

NORTH 0 1 2 3 4 MILES

CH2M HILL

The visual impacts of the proposed project were analyzed in terms of distance, screening such as vegetation, and backdrop, which consists of mountains. These features affect the degree of visual impact that an object in the landscape will have. From different viewer's locations, for example, the facility will be downslope, upslope, or across a broad plain. Given the open terrain, the site will be visible to some degree from a considerable distance. Figure 4-5 presents the effects of distance on the apparent size of an object being viewed.

Photographic simulations present the viewer with a computer-generated image of the proposed facility based on site plans and existing photographs of the project site. The following set of photo simulations presents the features of the proposed facility superimposed over the same views presented earlier. Impacts on visual resources are discussed in terms of the dominance of the facility in each view as follows:

- **Dominant.** The viewer's attention will be focused on the facility
- **Codominant.** The viewer's attention will be divided among other features in the landscape of equal interest to the viewer.
- **Subordinant.** The facility will constitute a minor component of the landscape. The viewer will not be aware of the presence of the facility unless specifically looking at it.

An evaluation of the proposed project in terms of visual resources is as follows:

Figure 4-6. This photosimulation is provided to show the elements of the proposed generating station and their relationship to one another. Landscaping surrounding the project perimeter, along with the lower grade separation of Pulehu Road will effectively mask the site from the view of passing motorists.

Figure 4-7. From this viewpoint, approximately 3 miles from the site, the proposed facility will be visible and will represent a codominant feature within the landscape. Although the stacks and will be noticeable due to the absence of other structures within the broad plain of the Central Maui isthmus, the apparent size of the facility will be small because of its distance from the viewer. In addition, views from highways are generally intermittent and brief due to foreground vegetation screening and the focus of the driver on multiple areas. The impact to the visual resources at this distance is considered insignificant.

Figure 4-8. From this viewpoint, about 4 miles from the project site, the proposed facility will represent a subordinate element within the landscape. The vertical forms of the stacks will be visible, however, the focus of the viewer from this distance will be drawn away by other, more noticeable, vertical elements within the landscape, such as intervening trees and utility poles and the much more dominant West Maui Mountains. The apparent size of the facility will be small due to its distance from the viewer. The impact to the visual resources at this distance is considered insignificant.

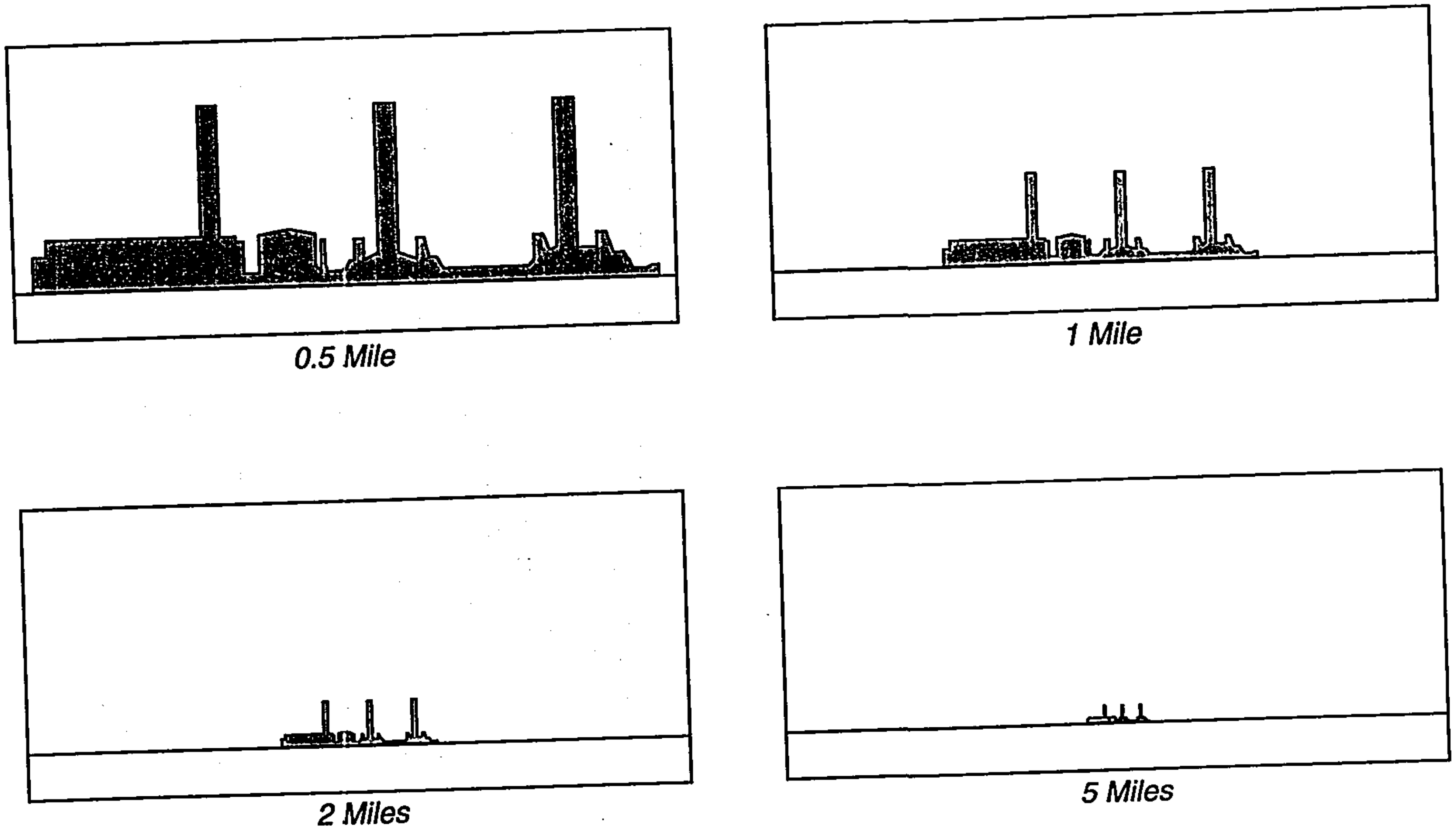

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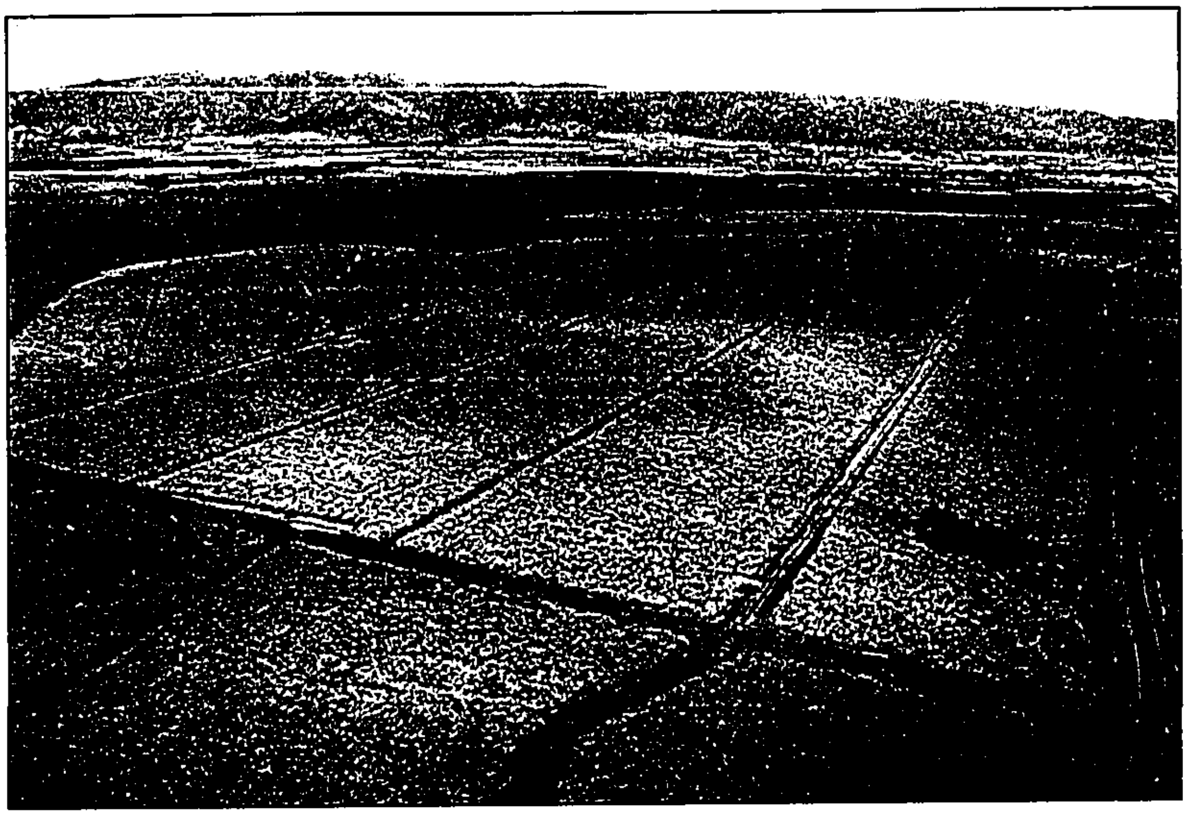
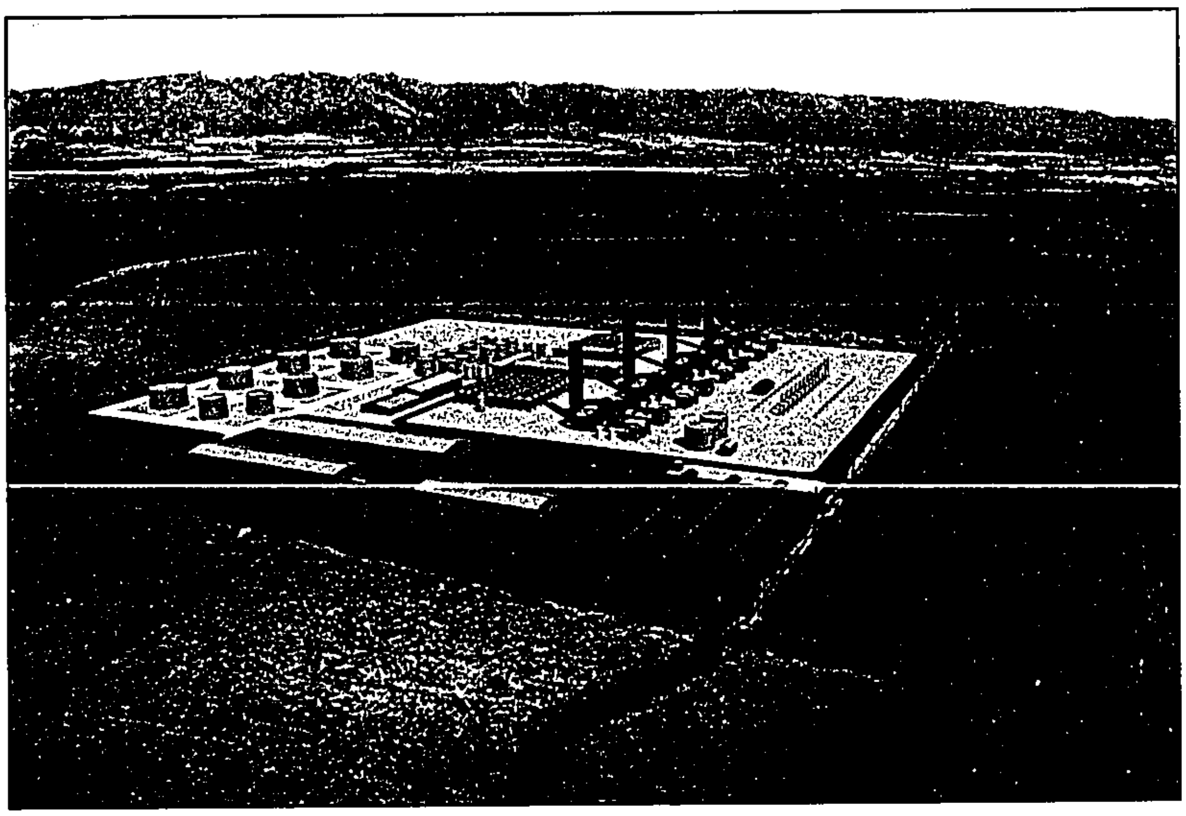
FIGURE 4-5

EFFECT OF DISTANCE ON APPARENT FACILITY SIZE

CH2M HILL

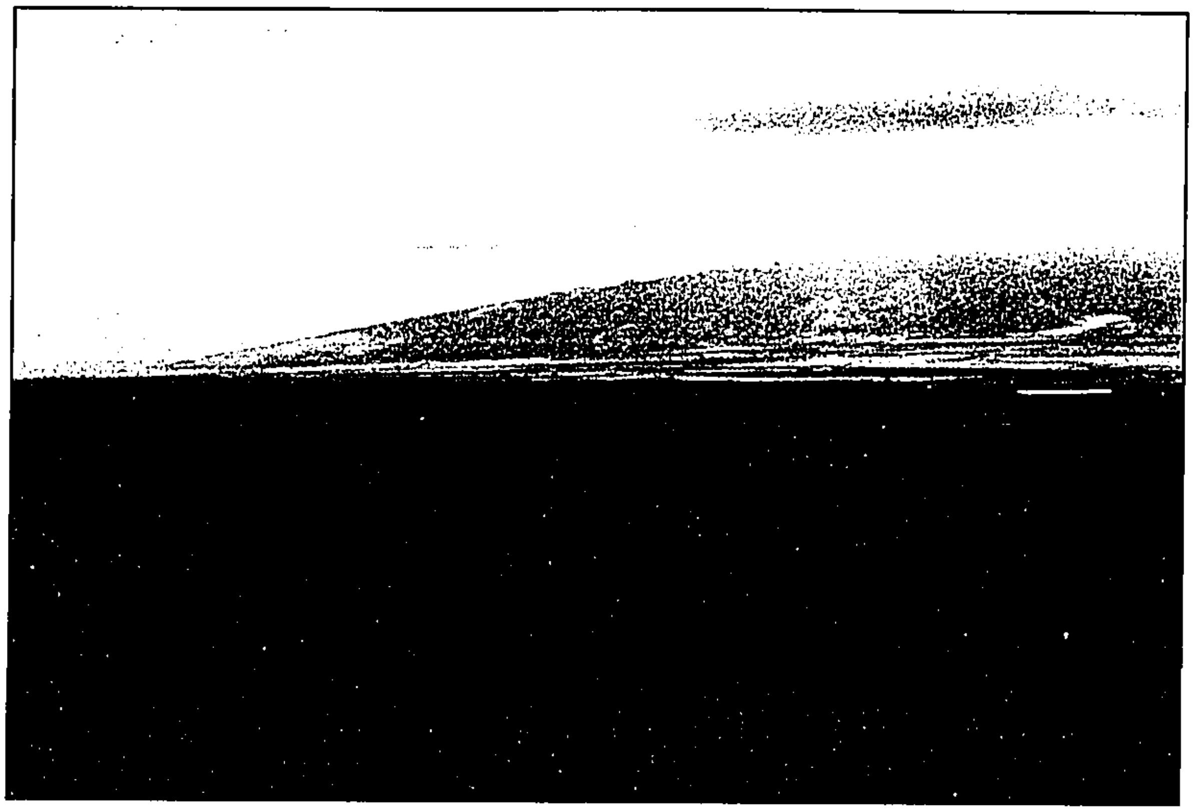


Elevated View of Project Site from Pulehu Road—Existing Condition

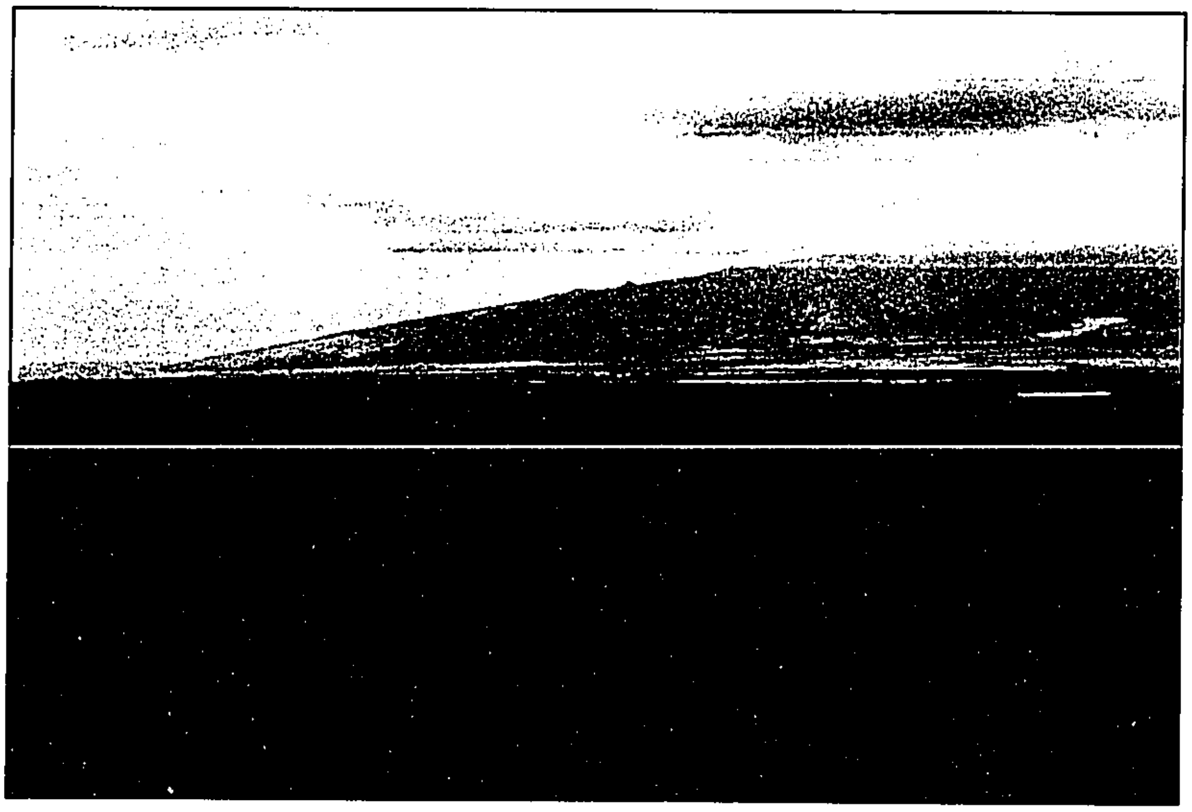


Elevated View of Project Site from Pulehu Road—Project Simulation

Figure 4-6
Key View 1

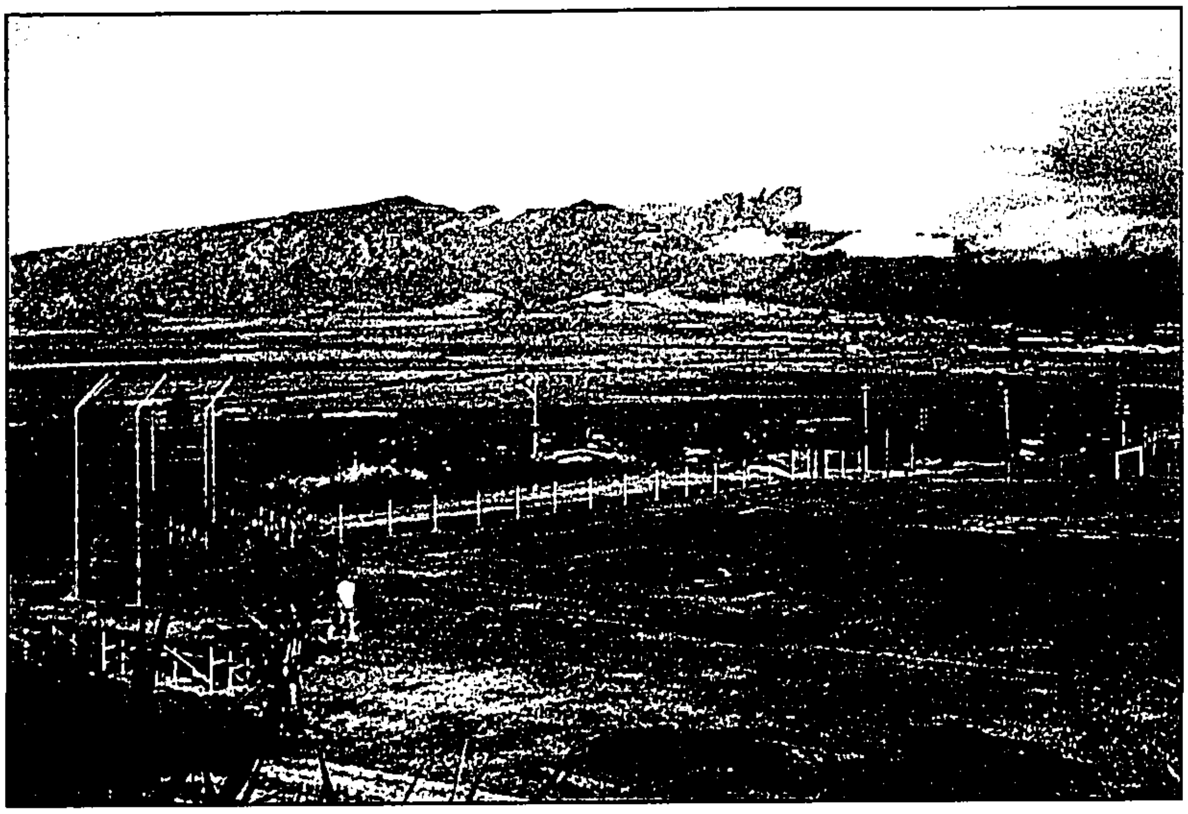


View of Project Site from Haleakala Highway— Existing Condition

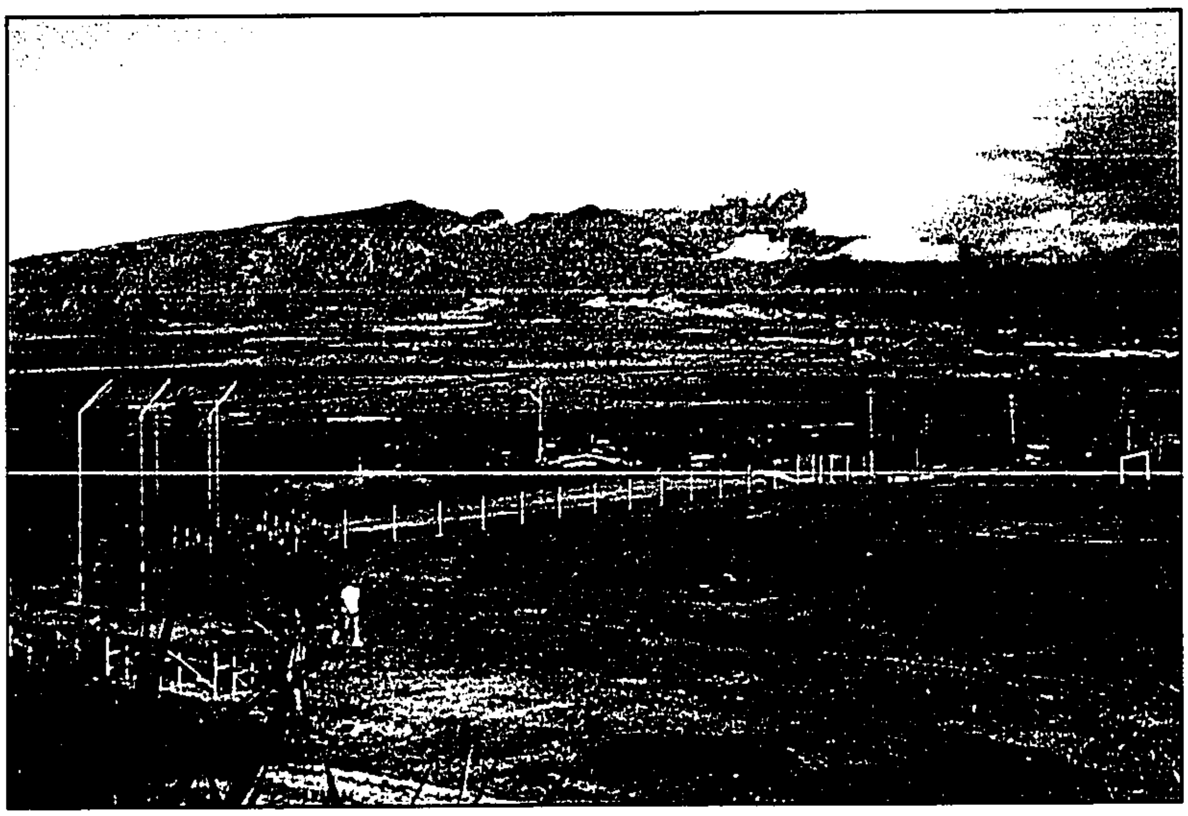


View of Project Site from Haleakala Highway— Project Simulation

Figure 4-7
Key View 2

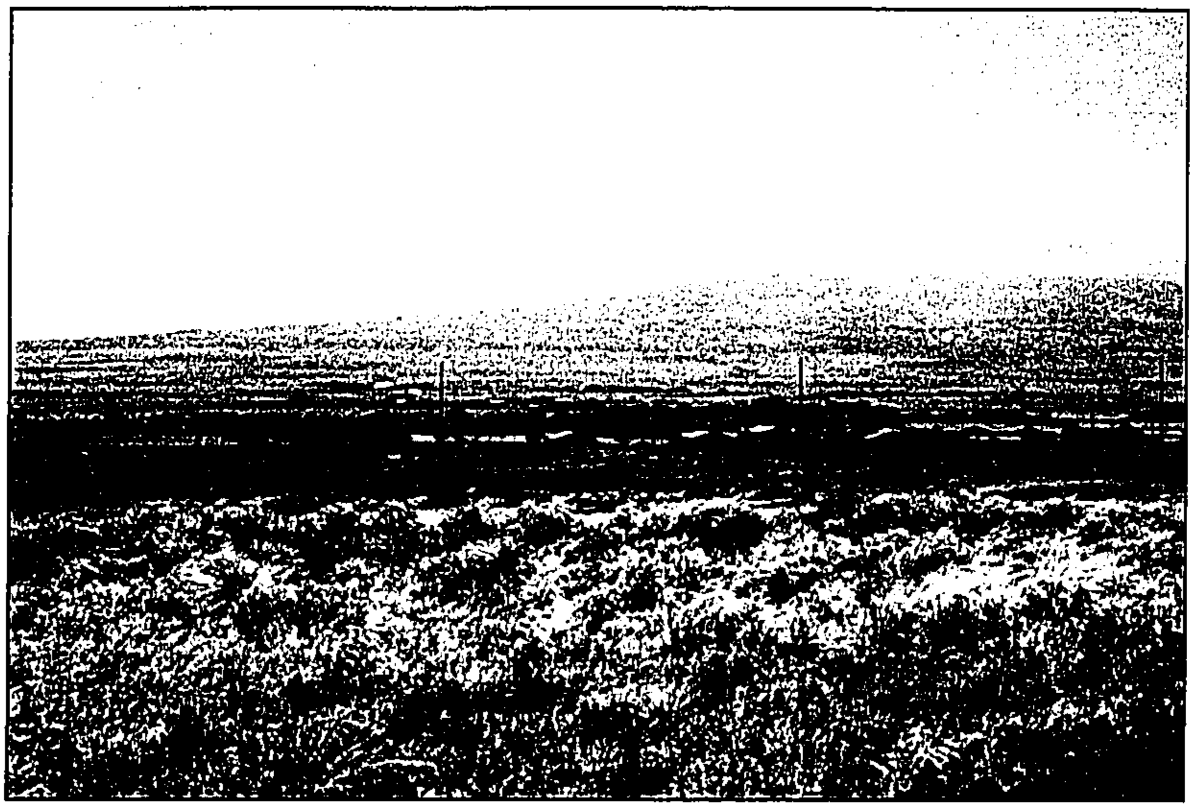


View of Project Site from Pukalani Community Center—Existing Condition

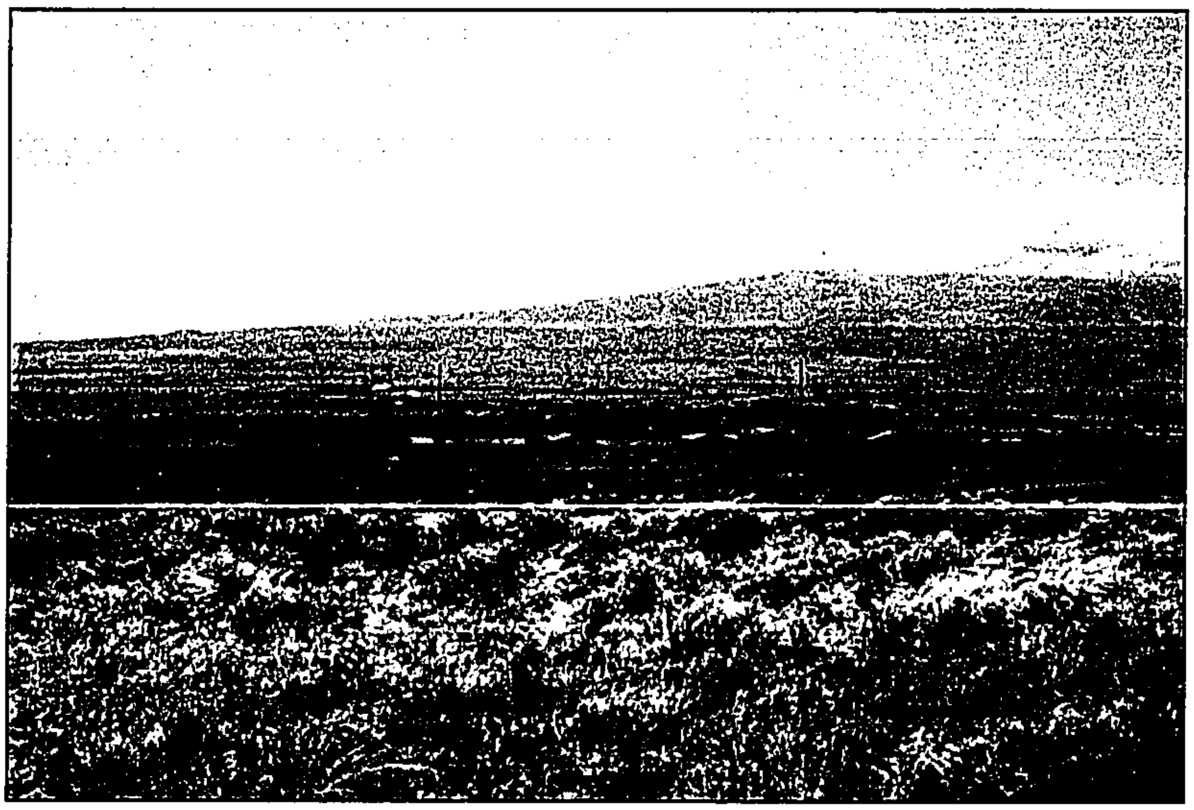


View of Project Site from Pukalani Community Center—Project Simulation

Figure 4-8
Key View 3



View of Project Site from Honoapiilani Highway near Wailuku—Existing Condition



View of Project Site from Honoapiilani Highway near Wailuku—Project Simulation

Figure 4-9
Key View 4

Figure 4-9. From this viewpoint, approximately 6 miles from the site, the proposed facility will be a subordinate element within the landscape. Although the vertical forms of the stacks will be somewhat visible, the viewers focus is on other vertical elements within the near middleground. In addition, the Puunene Sugar Mill represents a more noticeable element than the proposed facility within the view plane to focus attention. The apparent size of the facility is extremely small because of the distance from the viewer. The impact to the visual resources at this distance is considered insignificant.

The project site is over 2 miles from the closest viewing point along Haleakala Highway and over 4 miles away from the nearest Upcountry residential areas which could overlook the proposed facility. Because of this large distance from sensitive viewer locations, the generating station and exhaust stacks will represent only a codominant feature within the landscape up to 3 miles distance and only a subordinant feature within the landscape beyond 3 miles. The overall lack of other structures and facilities within the broad plain of the Central Maui Isthmus will allow the vertical structures of the stacks to be visible from some distance away, however, the large distances from viewing locations will make the apparent size of the facility small to the viewer and should not become a focus of attention. Because of this, the facility is not anticipated to have an adverse impact upon the area's visual resources.

4.9.2.2 Nighttime Visual Impacts

Because of the overall size of the proposed facility and the absence of other urban uses surrounding it, lighting used within the plant for nighttime security and operations will be visible to residents located upslope of the project site. Light impacts generally are present from three conditions:

1. The ability to directly view the light source
2. Light reflecting off of paved surfaces
3. The night glow associated with several sources at one location

Much like visual resource impacts, impacts from lights are mitigated by distance and intervening topography, structures, etc. which may mask direct visibility. The most noticeable impact from lighting is by directly viewing the light source. At close enough range, this leads to a "temporary blinding effect" and is often cited as the cause of disorientation in night birds, such as the Newell shearwater.

Reflective lighting is caused when light directed downward reflects off of paved, reflective surfaces, such as white concrete. What the viewer actually sees is the area being lit. This light is softer and more diffused than from viewing a direct source. As distance increases, this diffused light becomes less distinct and the sight becomes noticeable only as a "glowing" spot on the landscape. Vegetation around reflective ground surfaces can sometimes be used to mask them from viewers. Use of less-reflective pavement materials can also mitigate this lighting effect.

The third impact is from overall night glow. This is a typical effect from multiple light sources within urban areas and is usually associated with street lights, etc.

The proposed Waena Generating Station will have areas lighted at night for security reasons. These security lights will be hooded to direct the light downward. Because of this, no direct light sources should be visible to residents up slope of the facility. Some night glow impacts will be noticeable to Upcountry residents from reflective lighting and general multiple light sources at the facility. However, the reflective light and night glow effects produced by the station will lessen with distance and will diffuse into the ambient background within the 4 miles to the nearest Upcountry receptors. No adverse impacts from nighttime lighting are anticipated from the project.

4.9.3 Mitigation Measures

Blending the color of the facility and its exhaust stacks with the tones of the background landscape will be the most effective way to minimize its visual impact. A landscaping plan (see Figure 4-10 and Figure 4-11) is being developed to assist in the overall visual mitigation. Landscaping will be installed during Phase I to allow for full maturation of vegetation by the final phase installation. Planting will be irrigated to provide maximum growth.

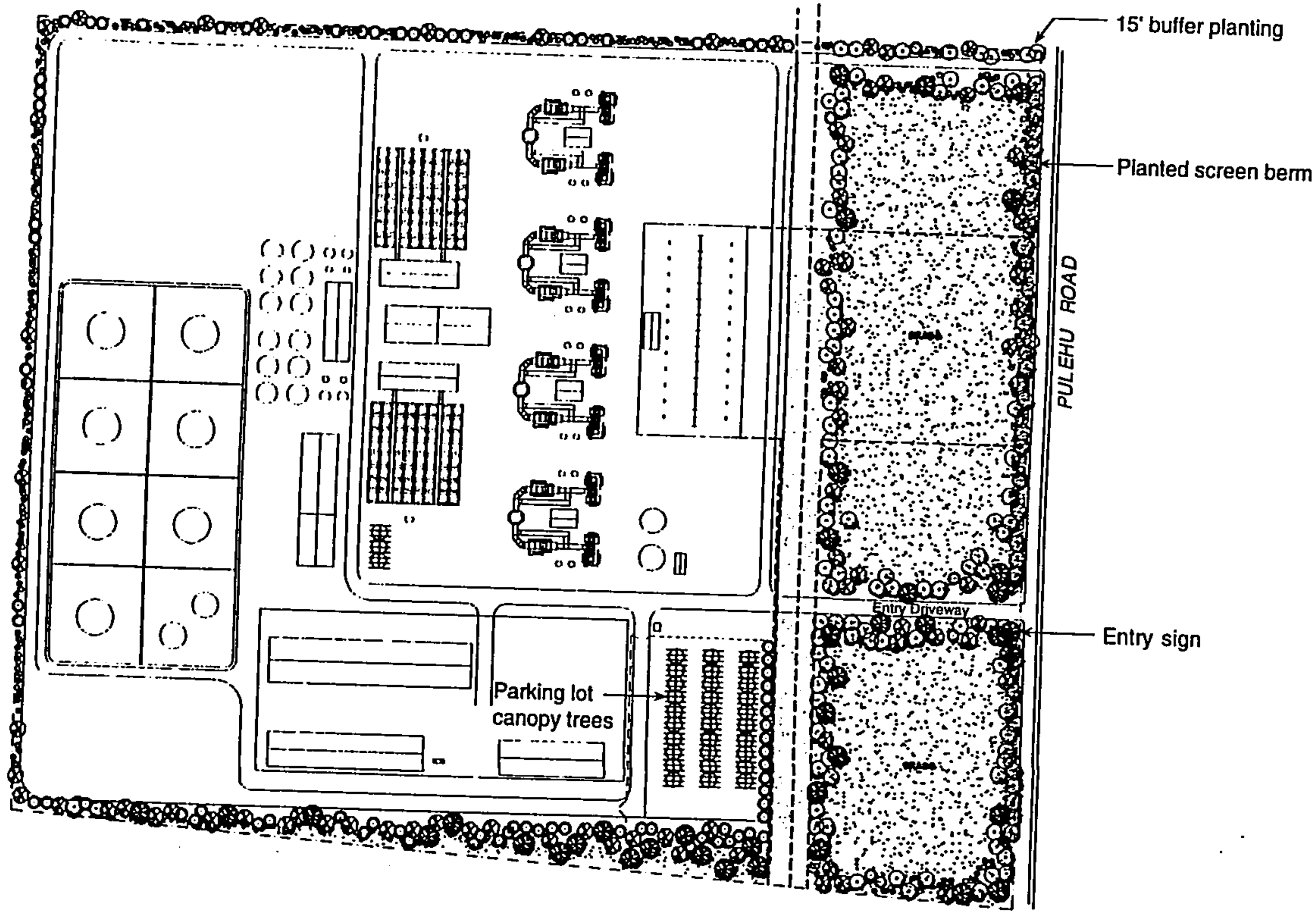
As a way to mitigate impacts from night lighting, all outside lighting will be properly shielded to direct light downward. In addition, use of halogen or intense white lights will be avoided and pavement will be made as non-reflective as possible.

4.10 Noise

An acoustic study of existing and anticipated noise conditions at and adjacent to the proposed Waena Generating Station was prepared by Y. Ebisu & Associates in May 1997. This section summarizes the report, which is provided in Appendix H.

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 as dBA.

Sound levels vary with time, and several methods are used to quantify sound over a given time period. A measure of the percentage of time that a sound level is equaled or exceeded is often used. For example, an L_{10} of 60 dBA means that the sound level equals or exceeds 60 dBA 10 percent of the time. Other ways to quantify sound over time include the



LARGE TREES
Kukui
False Kamani
Tamarind
Jacaranda

MEDIUM TREES
Alahe'e
Hawaiian Kou
Milo
Beach Heliotrope
Be-Still

SMALL TREES
Yew Pine
Geiger Tree
False Olive
Be-Still

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FIGURE 4-10

CONCEPTUAL LANDSCAPE PLAN

Not to scale

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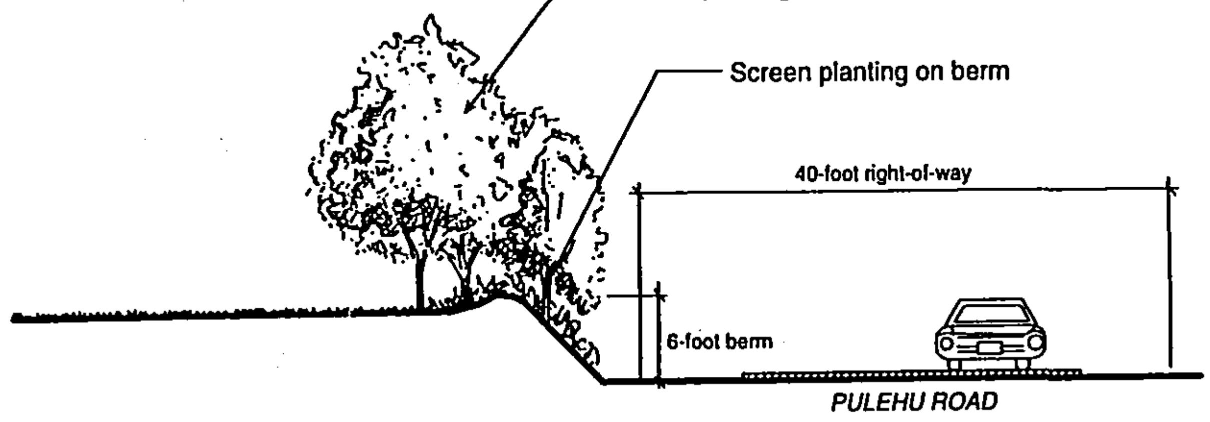
PULEHU ROAD SECTION



NATIVE AND POLYNESIAN-INTRODUCED PLANTING ALONG PULEHU ROAD:

- Milo
- Alahe'e
- Beach Heliotrope
- Kou

ENTRY DRIVEWAY SECTION – [B-B']

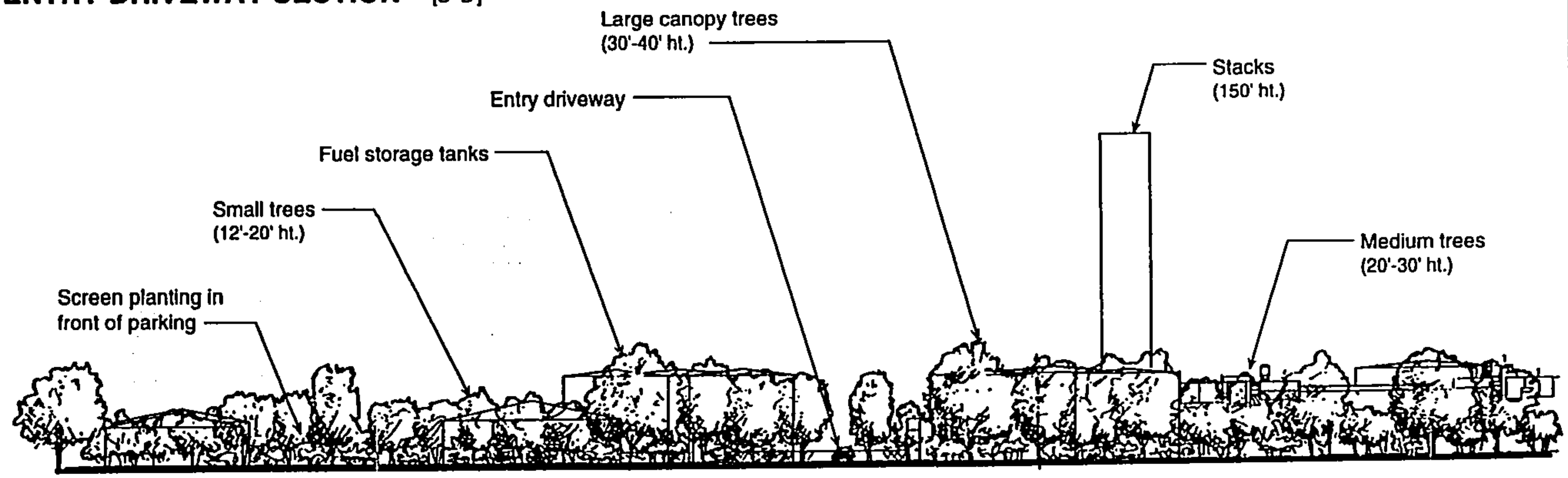


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FIGURE 4-11

CONCEPTUAL LANDSCAPE SECTIONS

Not to Scale

CH2M HILL

equivalent sound level (L_{eq}), which is the energy average of the sound pressure level for a stated period of time (usually one hour), and the day-night sound level (L_{dn}), which is a 24-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.

4.10.1 Evaluation Criteria

Two different noise level regulations are available for assessing noise impacts from the proposed Waena Generating Station. The two different regulations are:

1. Title 11, Chapter 46 *Community Noise Control*, adopted by the State Department of Health (DOH) in September 1996.
2. The U.S. Department of Housing and Urban Development (HUD)—This agency has established regulations that define the degree of acceptability of exterior noise levels for residential housing developments that have been constructed with financial assistance from the U.S. Government. This regulation does not apply to areas located adjacent to the proposed Waena Generating Station but can be used as a guideline.

The DOH, and HUD noise regulations are discussed below.

DOH Noise Regulations. New land uses in Hawaii are compared with applicable noise standards contained in Hawaii Administrative Rules Title 11, Chapter 46, *Community Noise Control*. On the Island of Maui, the DOH regulates noise from on-site activities. State DOH noise regulations are expressed in maximum allowable property line noise limits for areas zoned preservation/residential, apartment/commercial, and agricultural/industrial. The noise limits established for these zoning classes are shown in Table 4-11. These noise limits cannot be exceeded for more than 2 minutes in any 20-minute time period. Because the project site and surrounding areas are located on lands zoned for agricultural use, the DOH noise limits are 70 dBA for both the daytime and nighttime periods.

Construction noise also falls under permitted activities that can exceed the levels shown in Table 4-11 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 4-11 at or beyond the property line are allowed before 7 a.m. or after 6 p.m., Monday through Friday.

- No construction activities that produce noise levels in excess of the permissible sound levels shown in Table 4-11 at or beyond the property line are allowed for the hours before 9 a.m. and after 6 p.m. on Saturdays.

- No construction activities that exceed the noise levels specified in Table 4-11 are allowed on Sundays and on holidays.

Table 4-11
Maximum Permissible Sound Levels in Decibels (dBA)

Time	Zoning		
	Class A Residential and Preservation	**Class B Apartment, Hotel, and Business**	**Class C Agriculture, Industrial**
Daytime (7 a.m. to 10 p.m.)	55	60	70
Nighttime (10 p.m. to 7 a.m.)	45	50	70

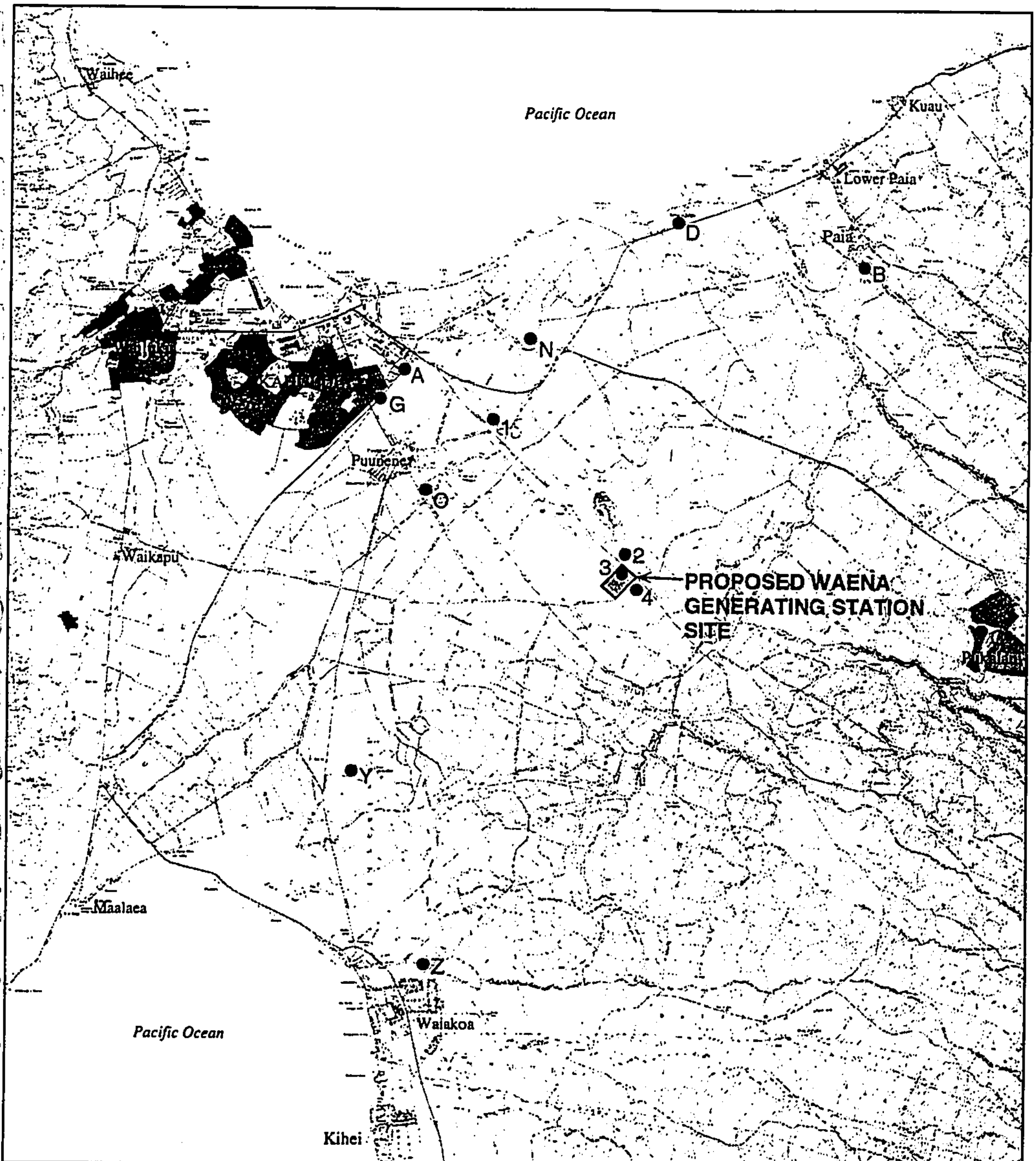
Notes:
a) Standards shall apply to the following excessive noise sources: stationary noise sources, and equipment related to construction, agriculture, and industrial activities.
b) Maximum permissible sound levels shall apply to any excessive noise source emanating within the specified zoning district, and at any point at or beyond the property line of the premises.
c) 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 or variance issued under HAR 11-46-7 and 11-46-8.
d) The allowable noise for impulsive sound shall be 10 dBA above the values in this table.

Hawaii Administrative Rules, Title 11, Chapter 46

HUD Regulations. HUD has established noise abatement and control regulations that affect the approval of new buildings and rehabilitated buildings constructed with financial assistance from the U.S. Government. According to the HUD regulations, an exterior day-night noise level of 65 L_{dn} or less is considered normally acceptable for residential housing developments. Because there are no housing developments located in the vicinity of the Waena Generating Station site that were constructed using federal funds, the HUD noise regulations do not apply. Therefore, the HUD regulations can be used only as a guideline.

4.10.2 Existing Conditions

The existing noise environment near the project site is quiet with occasional increases in noise levels from dump trucks, helicopters, local vehicular traffic along Pulehu Road, and the rustling of sugar cane leaves. Short-term daytime background ambient noise levels in the vicinity of the proposed generating station were measured in previous studies (Dames & Moore, 1995; Belt Collins, 1992) with average values ranging from 54 to 60 dBA. Locations of monitoring stations used to gather noise data for this EIS and for previous studies are shown in Figure 4-12.



LEGEND

●1 Noise Measurement Site and Identification Number

Source: Y. Ebisu & Associates, 1997

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FIGURE 4-12

NOISE MEASUREMENT SITES AROUND PROPOSED WAENA GENERATING STATION

NORTH 0 1 2 3 4 MILES

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Background ambient noise levels in the communities closest to the proposed generating station site were obtained by Y. Ebisu & Associates in April 1997. The communities surveyed included Kahului (Location A), Paia (Location B), Pukalani (Location C), Spreckelsville (Location D), and Puunene (Location O). The measurements were structured to document the lower background noise levels experienced during the quieter early morning period. The results ranged from 28.4 dBA in Paia to 58.7 dBA near Dairy Road in Kahului. In general, the noise levels were controlled by distant traffic and wind at all locations. In Puunene, the sugar mill controlled the measured background ambient noise levels (43-53 dBA).

4.10.3 Potential Impacts

The first 58-MW dual-train, combined cycle (DTCC) unit is planned to be operational by 2006. Final build out of the plant is not anticipated until after 2017. Noise levels associated with each of the four phases were computed and are contained within the noise analysis in Appendix F. Results of the analyses for the initial Phase I and the full-build out of the generating station (Phase IV) are reported below.

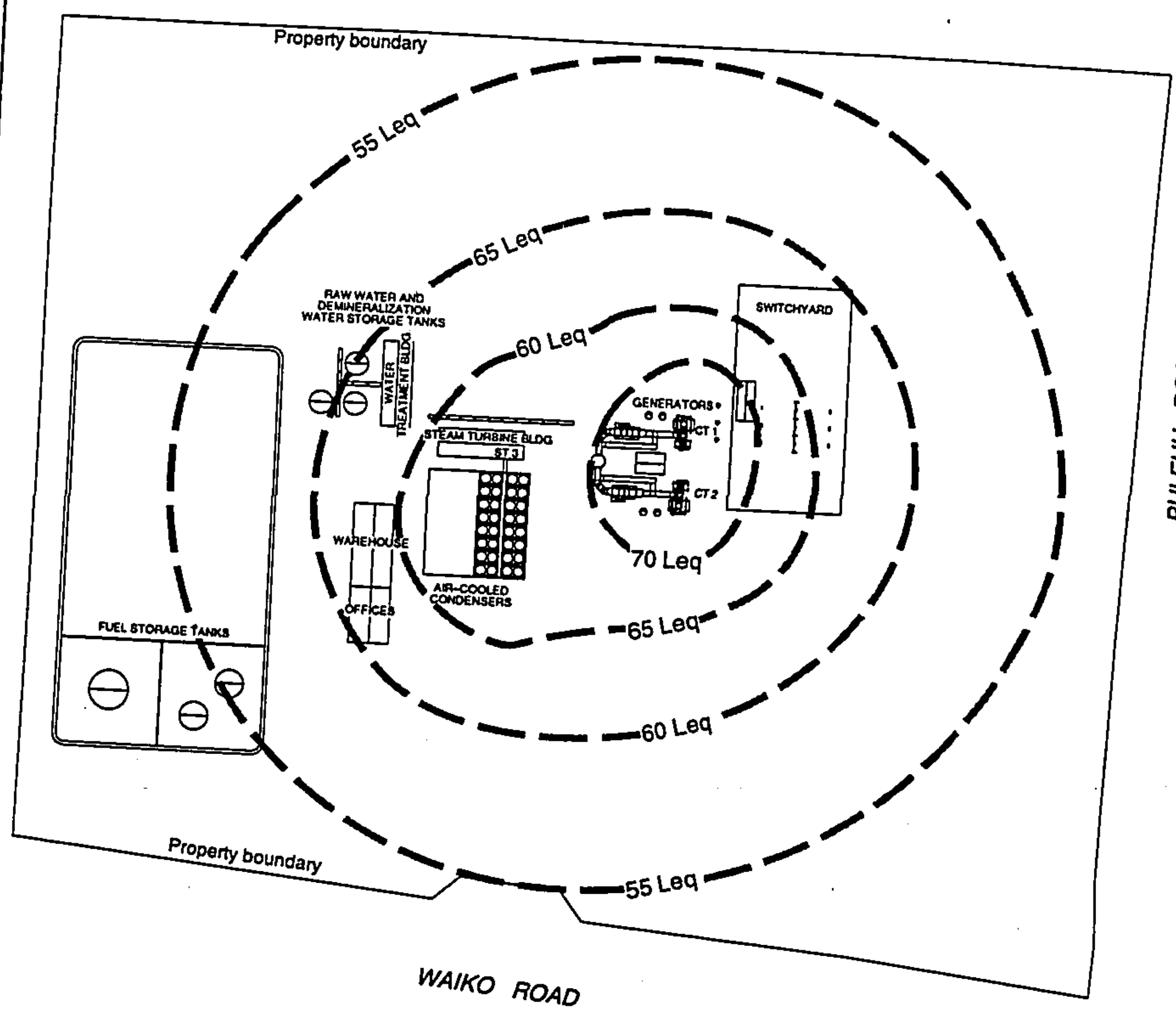
4.10.3.1 Phase I

Figure 4-13 depicts the hourly equivalent (L_{eq}) noise contours for the generating station with the first DTCC unit in operation during an afternoon/evening peak demand hour. The equivalent L_{dn} contours can be estimated by adding 6 units to the L_{eq} numbers. These station noise contours are expected to represent the worst-case noise levels during an afternoon/evening peak hour. As shown in the figure, the 70 L_{eq} is contained within the station boundaries and the State DOH 70 dBA limit for agricultural and industrial lots will not be exceeded.

The closest noise sensitive properties to the proposed Waena Generating Station are day care and social services facilities located in Puunene, beyond 2 miles from the site. Residences in the other closest communities of Kahului, Pukalani, Paia, and Waiakoa are located over 3 miles from the site. Due to the large separation distances between the generating station site and the nearest communities, the predicted noise levels from the proposed project range from 3.7 dBA in Waiakoa to 20.2 dBA in Puunene, well below the ambient noise levels measured at these sites. These calculations also included the effects of certain temperature and wind conditions experienced in central Maui which can amplify certain sounds by approximately 12 decibels.

4.10.3.2 Phase IV

Figure 4-14 depicts the hourly equivalent noise contours for the generating station following completion of the final DTCC unit and operating at full capacity. As shown in the figure, the 70 Leq noise contour should be contained within the station's property boundaries and would not exceed the State DOH 70 dBA limit for agricultural and industrial lots. Worst case noise



LEGEND

— — Hourly Equivalent Noise Contour (LEQ value)

Note: Ldn = Leq + 6

Source: Y. Ebisu & Associates, 1997

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FIGURE 4-13

HOURLY EQUIVALENT NOISE CONTOURS FOR THE PROPOSED WAENA GENERATING STATION PHASE 1

NORTH 0 200 400 FEET

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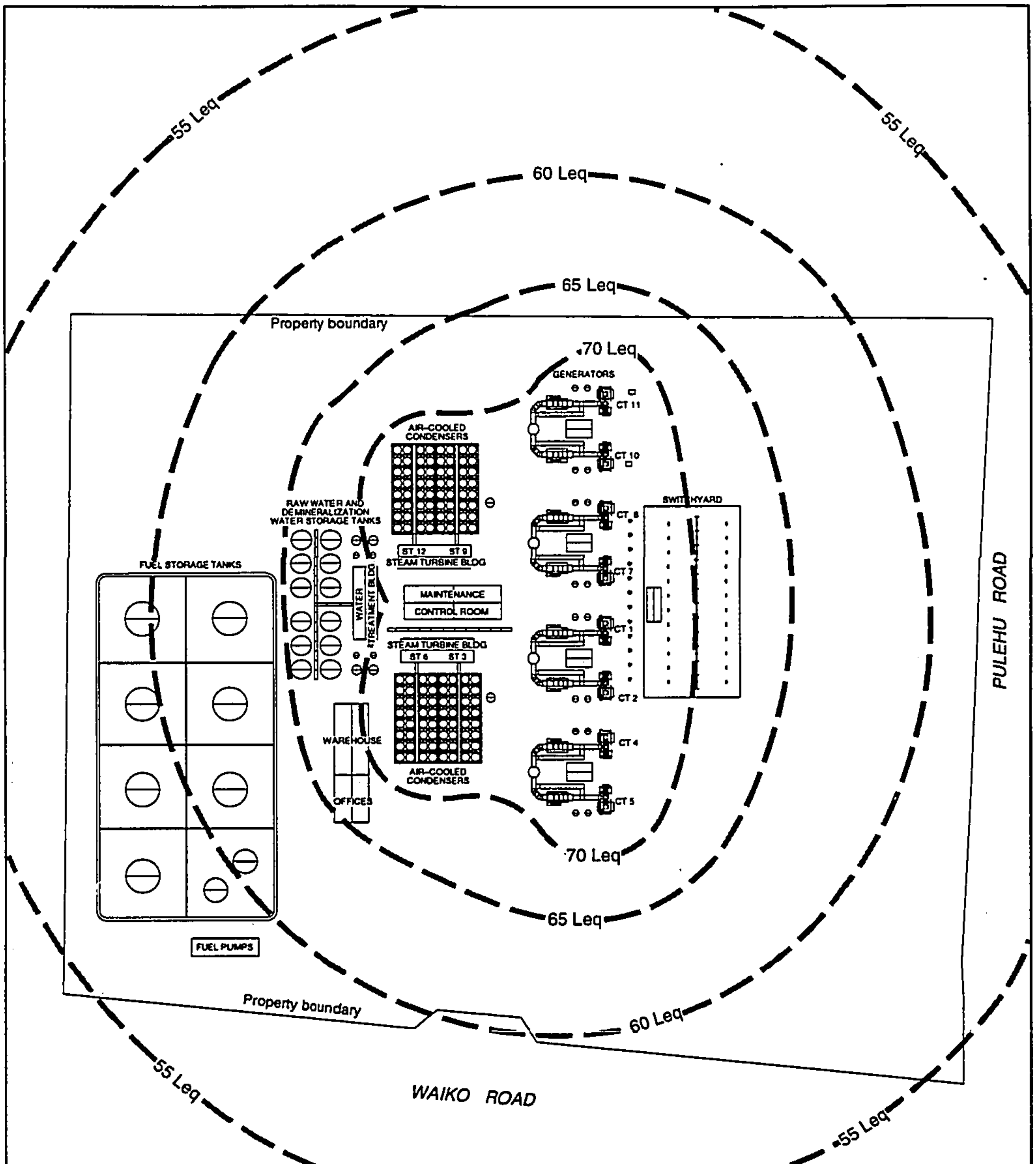

LEGEND

— — Hourly Equivalent Noise Contour (LEQ value)

Note: Ldn = Leq + 6

Source: Y. Ebisu & Associates, 1997

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FIGURE 4-14

HOURLY EQUIVALENT NOISE CONTOURS FOR THE PROPOSED WAENA GENERATING STATION, FULL BUILD

NORTH 0 200 400 FEET

CH2M HILL

levels produced by the generating station detectable at the nearest communities range from 9.7 dBA at Waiakoa to 26 dBA in Puunene, well below measured ambient noise levels.

4.10.3.3 Construction Noise

Construction noise will likely be unavoidable during construction of the generating station. Noise levels associated with operating diesel equipment typically range from about 57-67 dBA, measured 600 feet from the noise source. Because equipment will likely be moving from one location on the project site to another during construction, the duration and intensity of construction noise at a particular receptor location will vary.

At the noise sensitive properties in Puunene, which are at least 2 miles from the project site, predicted noise levels during construction and well drilling activities on the project site are not expected to exceed 24 dBA, below the existing ambient noise levels. Adverse impacts from construction noise are not expected due to the very low noise levels anticipated and due to the temporary nature of the work.

Compliance with the 70 dBA DOH noise limits for agricultural and industrial zoning is possible during rotary drilling operations which are located at least 200 feet from the property line. For cable drilling operations, the setback distance from the property line can be reduced to a range of 70 to 100 feet. However, because of the absence of any noise sensitive receptors within 2 miles of the project site, 24-hour well drilling operations should be possible without causing adverse noise impacts.

4.10.4 Mitigation Measures

No adverse noise impacts are expected as a result of the proposed Waena Generating Station. Compliance with the State DOH 70 dBA standard is expected at the property lines following completion and operation of all four DTCC units. Measured background ambient noise levels at the surrounding communities also indicate that the predicted sound levels from the proposed generating station probably will be inaudible during even the nighttime and early morning hours. No special noise mitigation measures will be required from MECO for operation of the proposed generating station.

A construction noise variance will be requested from the State DOH prior to undertaking construction and well-drilling activities. Mitigation of construction noise to levels less than 70 dBA along the station property lines will not be practical in all cases due to the intensity of the louder construction noise sources and due to the exterior nature of the work (rock breaking, grading, earth moving, trenching, concrete pouring, etc.). The use of properly muffled construction equipment will be required on the job site and DOH construction noise limits and curfew times will be followed.

Although there are currently no residential or noise sensitive receptors in the vicinity of the site, the noise levels generated by the proposed generating station following full build out would exceed the DOH 45 dBA nighttime Class A residential and preservation zone noise limits at locations up to 4,600 feet from the station boundaries. Therefore, future development of lands for residential/preservation uses within 4,600 feet and for commercial/multi-family uses within 2,500 feet should be discouraged unless it can be demonstrated that local shielding effects from buildings, tanks, etc. on the station site allow for shorter buffer distances.

4.11 Land Use

4.11.1 Existing Conditions

4.11.1.1 Existing Uses

The site of the proposed Waena Generating Station is owned in fee by the Maui Electric Company, Limited and is currently under sugarcane cultivation. Elements of HC&S's plantation operations on the site include an active irrigation ditch and maintenance easements. Figure 3-3 shows the location of the HC&S easements.

Lands adjacent to the site are owned by Alexander & Baldwin-Hawaii (A&B-Hawaii) and are also under sugarcane cultivation. The County of Maui owns and maintains Pulehu Road, which runs adjacent to the site. Across Pulehu Road from the project site is the Central Maui Landfill, owned and operated by the County of Maui, and a quarry operated by Ameron HC&D, Inc. The quarry activities are located on lands owned by A&B-Hawaii. Figure 3-2 shows land ownership of the site of the proposed generating station and surrounding areas. The nearest residential or commercial areas to the site are located over 2 miles away at Puunene.

4.11.1.2 Future Land Uses

Future changes to the existing land uses in the area include an expansion of the quarrying and landfill activities. The expansion of the landfill will encompass approximately 60 acres while the expansion of the quarry will encompass approximately 41 acres. Other potential projects within the central Maui isthmus include the expansion of Kahului Airport, and development of the Maui Economic Opportunity facility and the County of Maui bus maintenance facilities near the old Puunene Airport.

A request has also been made of the Maui County Council to redesignate approximately 50 acres near the intersection of Waiko Road and Mokulele Highway to light industrial use to recognize existing land uses and allow for expansion of the Mokulele Baseyard. In addition, the Department of Hawaiian Home Lands has indicated that they are acquiring land near the old Puunene Airport for future use. Locations of these potential changes in land use are shown in Figure 4-15.

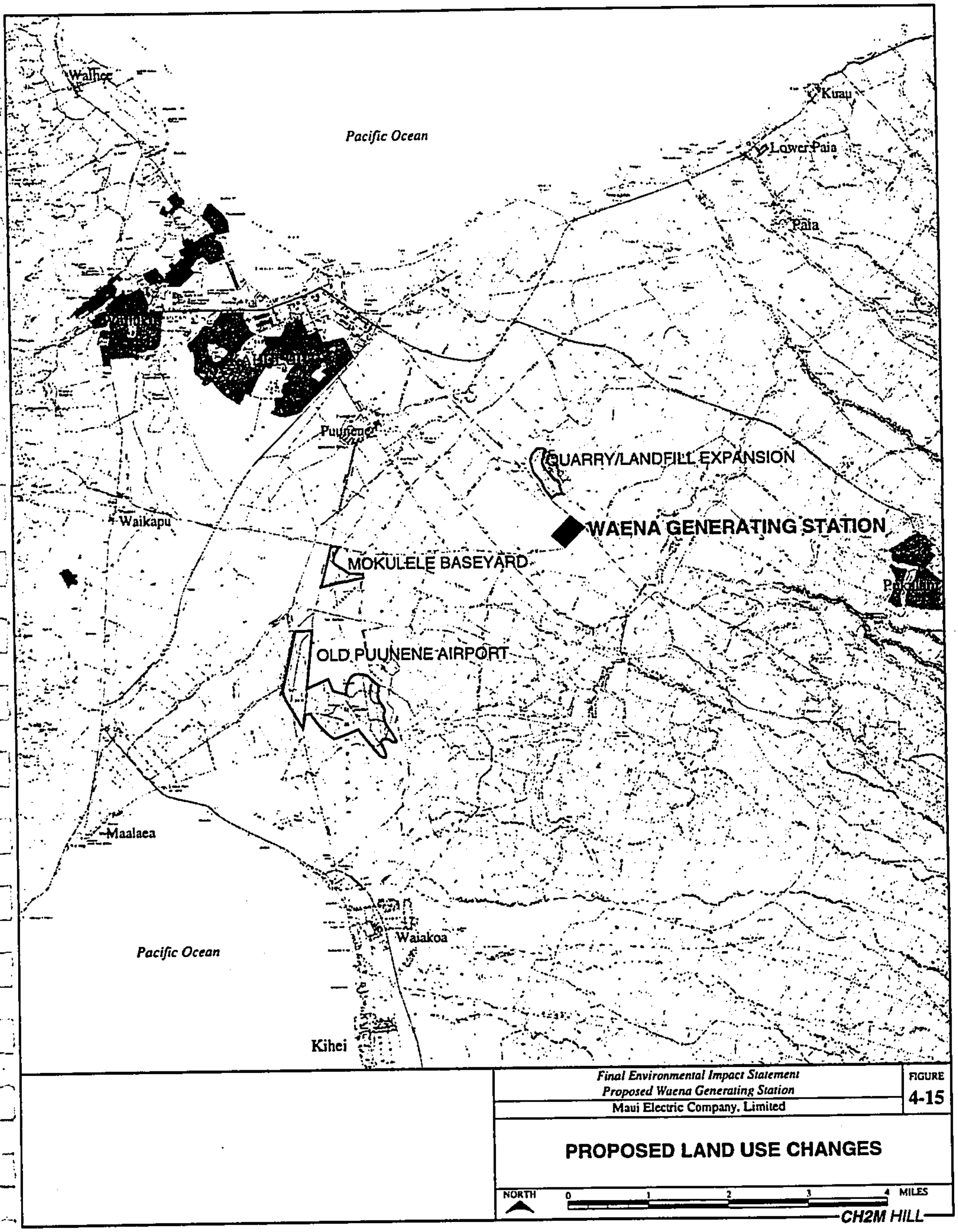

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FIGURE 4-15

PROPOSED LAND USE CHANGES

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4.11.1.3 State Land Use Designation

The State land use designation for the project site is Agricultural, as shown in Figure 4-16. Use of the site for the proposed generating station project will require a change in the current land use classification from "Agricultural" to "Urban."

4.11.1.4 Wailuku-Kahului Community Plan Designation

The project site is currently designated as "Agricultural" under Maui County's Wailuku-Kahului Community Plan, as shown in Figure 4-17. Use of the site for the proposed generating station project will require a change in the current Wailuku-Kahului Community Plan classification from "Agricultural" to "Heavy Industrial."

4.11.1.5 Maui County Zoning Designation

The project site is currently designated as "Interim" under Maui County's Zoning Code, as shown in Figure 4-18. Use of the site for the proposed generating station project will require a change in the current county zoning classification from "Interim" to "Heavy Industrial."

4.11.1.6 Agricultural Lands of Importance to the State of Hawaii

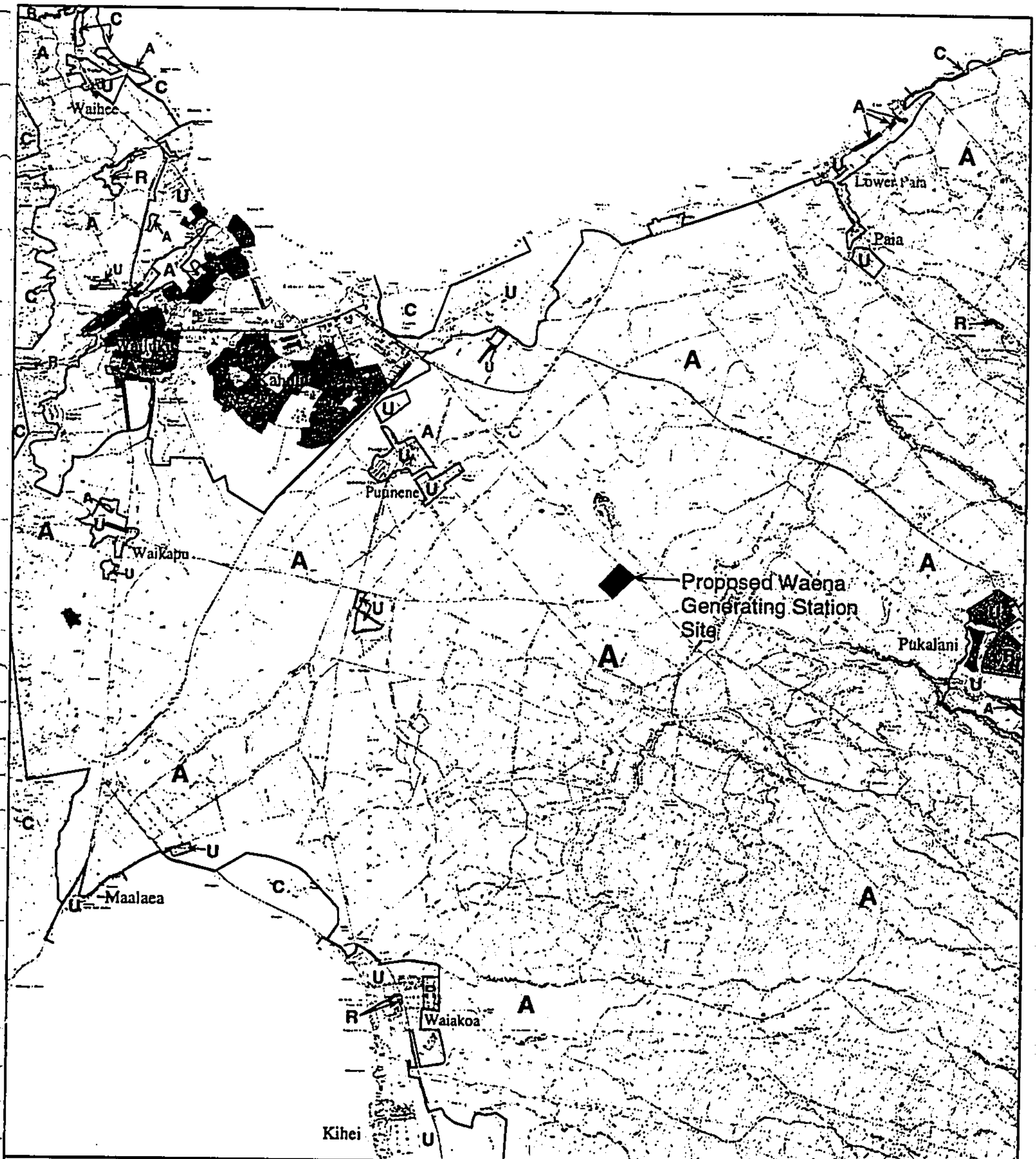
The site is listed as "Prime Agricultural Land" according to the Agricultural Lands of Importance to the State of Hawaii (ALISH) map. The University of Hawaii Land Study Bureau's Detailed Classification designates the land as "A." This classification system rates lands on a scale of "A" to "E," reflecting land productivity characteristics. Lands designated "A" are considered to be of highest productivity, with "E" rated lands ranked the lowest.

4.11.2 Potential Impacts

4.11.2.1 Impacts to Surrounding Land Uses

Proximity of the facility to the Central Maui Landfill and the Ameron HC&D, Inc. quarry operations will not hinder operations of either of the two existing industrial uses. The operation of the facility will also have no adverse impact on the continued sugarcane cultivation on adjacent properties.

Requests for changes in land use designations sometimes have the indirect effect of attracting similar land uses to the area. The higher zoning designation can be used as a justification for clustering of similar land uses. However; any further development in the area with similar land uses would require separate applications for state land use, community plan, and zoning redesignations, or for special use permits. Any request for a change in land use designation would entail a detailed submittal and analysis of specific impacts from the proposed project. Ultimately, state and county policy and decision makers would need to assess the compatibility of any future proposed land use changes with their applicable state and county land use plans, policies, and guidelines. At this time, MECO knows of no plans for future



STATE LAND USE DISTRICTS

- **U** Urban District
- **R** Rural District
- **A** Agricultural District
- **C** Conservation District

Source: Land Use Commission, State of Hawaii, 1997

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FIGURE **4-16**

STATE LAND USE DISTRICTS

NORTH 0 1 2 3 4 MILES

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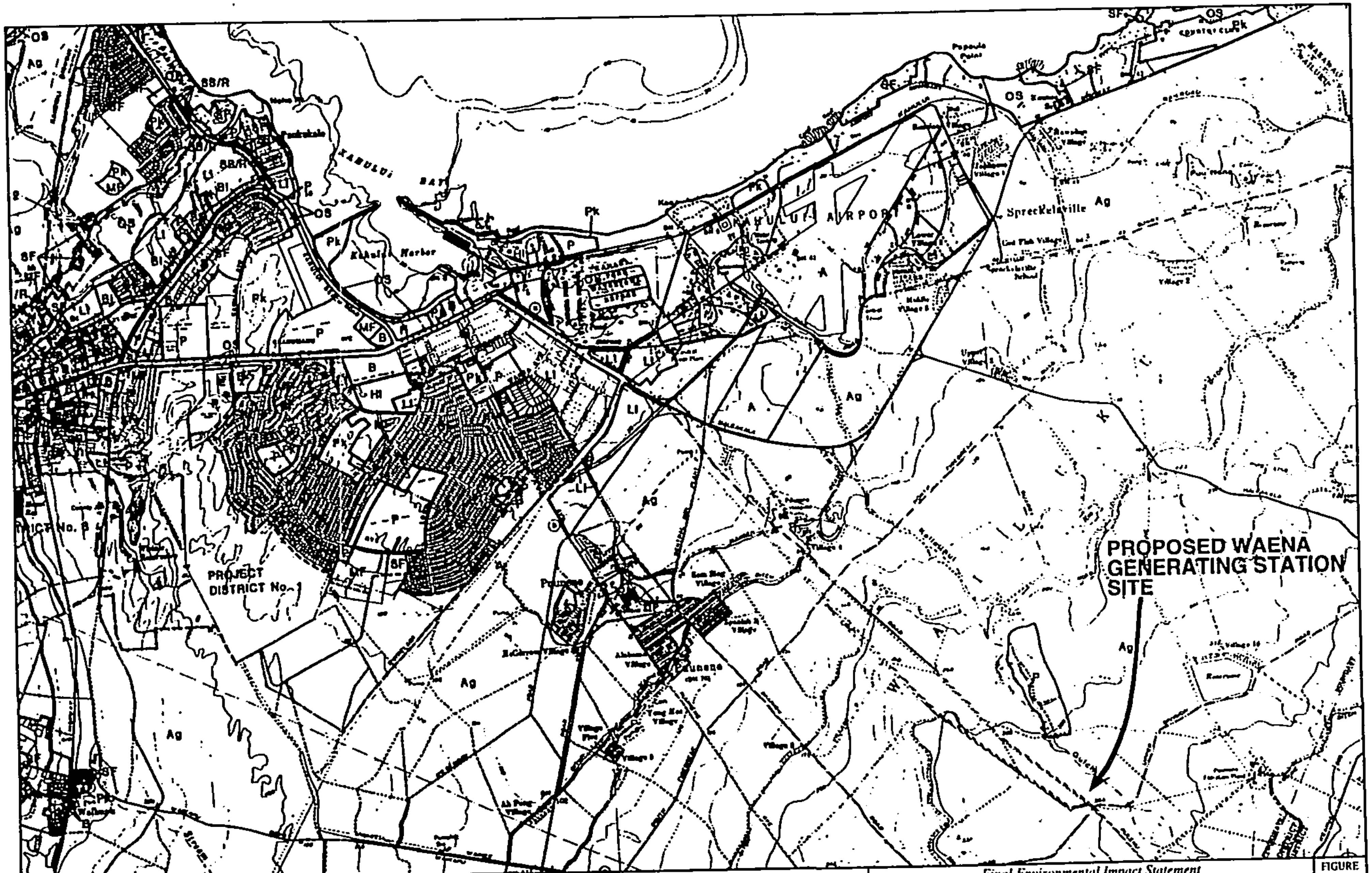

LEGEND

Ag	Agriculture	SB/R	Service Business Residential	OS	Open Space
R	Rural	LI	Light Industrial	PD	Project District
SF	Single-Family Residential	HI	Heavy Industrial	A	Airport
MF	Multi-Family Residential	H	Hotel	C	Conservation
B	Business/Commercial	P	Public/Quasi-Public		
BR	Business/Multi-Family	Pk	Park		
BI	Business Industrial	OS	Open Space		

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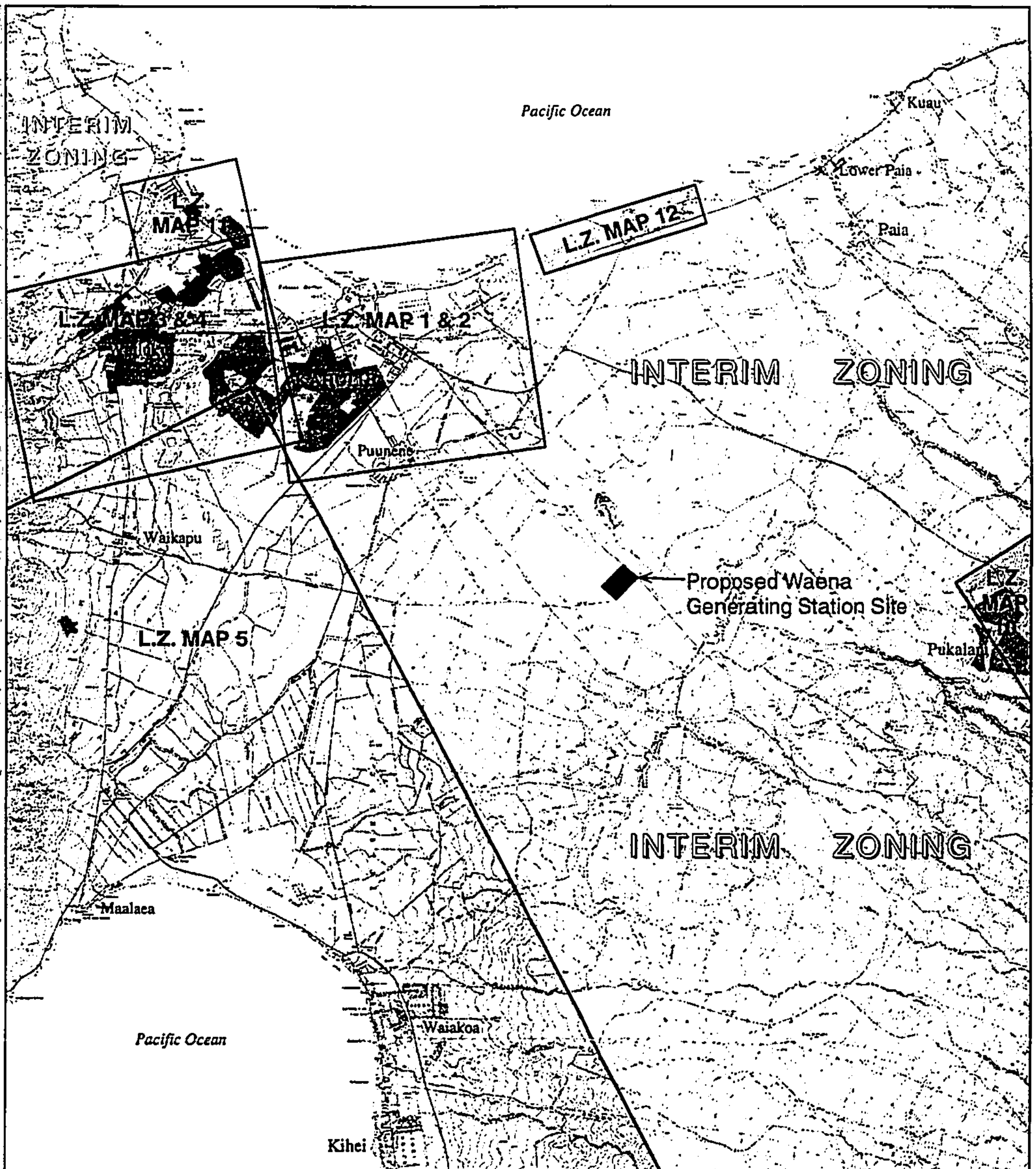
FIGURE 4-17

WAILUKU–KAHULUI COMMUNITY PLAN

CH2M HILL



LEGEND

- Area Coverage of County Zoning Maps
- Area Under Interim Zoning

Source: County of Maui, Planning Department

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FIGURE 4-18

COUNTY OF MAUI ZONING

NORTH 0 1 2 3 4 MILES

CH2M HILL

requests to change land use designations in the vicinity of the proposed Waena Generating Station.

4.11.2.2 Impacts to Agricultural Use

The change in land use from agricultural to urban/heavy industrial use will remove approximately 66 acres from active sugarcane cultivation. Impacts to agricultural lands from land use changes can take three forms:

- Impacts from the new land use on existing agricultural operations
- Impacts from agricultural operations on the new land use
- Indirect impact of the new land use on agricultural potential

Impacts on Existing Agricultural Operations. Construction and operation of the proposed Waena Generating Station will be a compatible land use to the existing and planned land uses in the vicinity of the project site. Existing easements with HC&S will be maintained throughout the development of the proposed project. Site access will occur from Pulehu Road and will not conflict with cane hauling operations along plantation roads. Activities associated with the proposed generating station will not negatively impact cultivation activities of surrounding properties.

Agricultural Impacts on Proposed Project. In some instances, the continued agricultural operations adjacent to a new land use will impact that new use. When this occurs, it is sometimes necessary for the agricultural uses to be modified. In the case of the proposed Waena Generating Station, MECO and HC&S have developed a cooperative relationship to ensure compatibility of agricultural and generating station operations.

As demonstrated at MECO's Maalaea facility, little impact occurs from adjoining cane cultivation. Prior to cane burning or harvesting activities, HC&S notifies MECO. MECO safety personnel keep an active watch during actual burning and facility employees are advised to have breathing aides and other protective devices immediately available in case of shifts in wind. HC&S operates under established field burning protocols to keep cane fires away from adjoining property boundaries. In addition, a 15-foot landscaped perimeter will be planted around the proposed generating station, further removing it from the adjoining cane fields. Because of the long-standing relationship between HC&S and MECO, as well as the established protocols, continued agricultural operations should not need to be modified to accommodate the proposed generating station.

Impacts on Agricultural Lands. According to the Maui County Data Book (County of Maui, 1996), approximately 360,000 acres of land in Maui County is classified as "farmland." Of this acreage, approximately 89,000 acres are considered cropland, 36,500 of which are cultivated by HC&S and 11,000 of which are cultivated by Maui Land & Pine Co., Ltd. (ML&P). The subject parcel represents approximately 0.02 percent of Maui County's total farmland, 0.07 percent of Maui County's total cropland, and only 0.18 percent of HC&S total acreage.

Currently, HC&S is in the process of expanding their current acreage under active cultivation by 280 acres near Kuihelani Highway as part of a strategy to reuse ML&P's cannery effluent. In addition, HC&S is working towards adding another 1,100 acres of land formerly cultivated by Wailuku Agribusiness.

The change in land use from agricultural to urban/heavy industrial will remove 65.7 acres of prime agricultural land from active cultivation. However, this represents an insignificant amount of HC&S's total acreage under cultivation and an even more insignificant amount of Maui County's total farmland. In addition, HC&S is undergoing expansion plans which will more than replace these 65.7 acres of cropland.

The removal of prime agricultural lands from production also must be weighed against the public use and public good derived from any proposed land use change. The proposed Waena Generating Station is planned to provide the necessary energy to both meet and allow the expanding energy needs of the Island of Maui's residents and economy. The additional energy will also allow for continued and expanded agricultural operations by ensuring reliable power for irrigation uses and processing operations.

Because the amount of prime agricultural land being removed is small, and HC&S will more than replace the loss, the proposed project is not considered to have a significant adverse impact on overall prime agricultural land production. Indirectly, the proposed project would have a beneficial impact by providing reliable power to support continued and expanded agricultural operations, as well as other land uses, on the Island of Maui.

4.11.3 Mitigation Measures

An application will be filed with the State Land Use Commission to request a change in the current land use classification from "Agricultural" to "Urban." Applications will also be filed with the County of Maui to request a change in the current Wailuku-Kahului Community Plan designation from "Agricultural" to "Heavy Industrial" and in the current Maui County Zoning Code from "Interim" to "Heavy Industrial."

No specific mitigation measures relating to adjoining land uses are necessary.

4.12 Socioeconomic Environment

4.12.1 Existing Conditions

The resident population on the Island of Maui has been increasing since 1970, as shown in Table 4-12, and growth is expected to continue into the next century. The resident population of the County of Maui, according to the 1990 census, was 91,361 persons. De facto population (residents and visitors) for 1990 was estimated at 129,781 persons.

Table 4-12 Resident Population Data for Island of Maui: 1960-1990		
Year	**Population**	**Percent Change**
1960	35,717	N/A
1970	38,691	8
1980	62,823	62
1990	91,361	45

Source: U.S. Census Bureau

Projections contained within the Maui County Community Plan Update Program Socioeconomic Forecast Report (Community Resources, Inc., 1992) indicate that the Island of Maui resident population will increase to 133,459 by the year 2010. These projections are shown in Table 4-13.

Growth on the Island of Maui in terms of employment, population, income, and economic activity has been closely tied to the visitor industry. In 1990, visitor expenditures were $2.2 billion. The primary visitor destination areas of the Island are the Kaanapali resort area of West Maui and the Kihei/Wailea area of South Maui. As a result, most of Maui's visitor industry jobs are located among these two areas. The Wailuku/Kahului region is the primary location of government jobs, professional services, and industrial support services. As of 1990, approximately 51,758 civilians were employed on the Island of Maui. This is expected to increase to 71,397 by the year 2010 (CRI, 1992).

Table 4-13 Island of Maui Population Projections by Region and Year			
Region	**2000**	**2005**	**2010**
Lahaina	18,737	20,574	22,924
Kihei-Makena	20,092	22,177	24,846
Wailuku-Kahului	40,452	43,821	48,132
Makawao-Pukalani-Kula	21,760	23,011	24,613
Paia	9,127	9,717	10,473
Hana	2,182	2,309	2,472
Total	**112,349**	**121,609**	**133,459**

Source: Community Resources, Inc., 1992

4.12.2 Potential Impacts

The proposed Waena Generating Station will enable MECO to better serve existing customers and will allow MECO to meet the ever increasing demands for electricity from the Island of Maui's growing population and economy. Directly, the facility will employ 46 new employees to run the generating operations and to provide support following completion of Phase IV. The project will also generate indirect jobs, such as truck drivers for fuel delivery and dock workers for fuel unloading. During construction, approximately 80 to 100 workers will be employed.

4.12.3 Mitigation Measures

No mitigation measures are proposed or required.

4.13 Infrastructure

4.13.1 Transportation

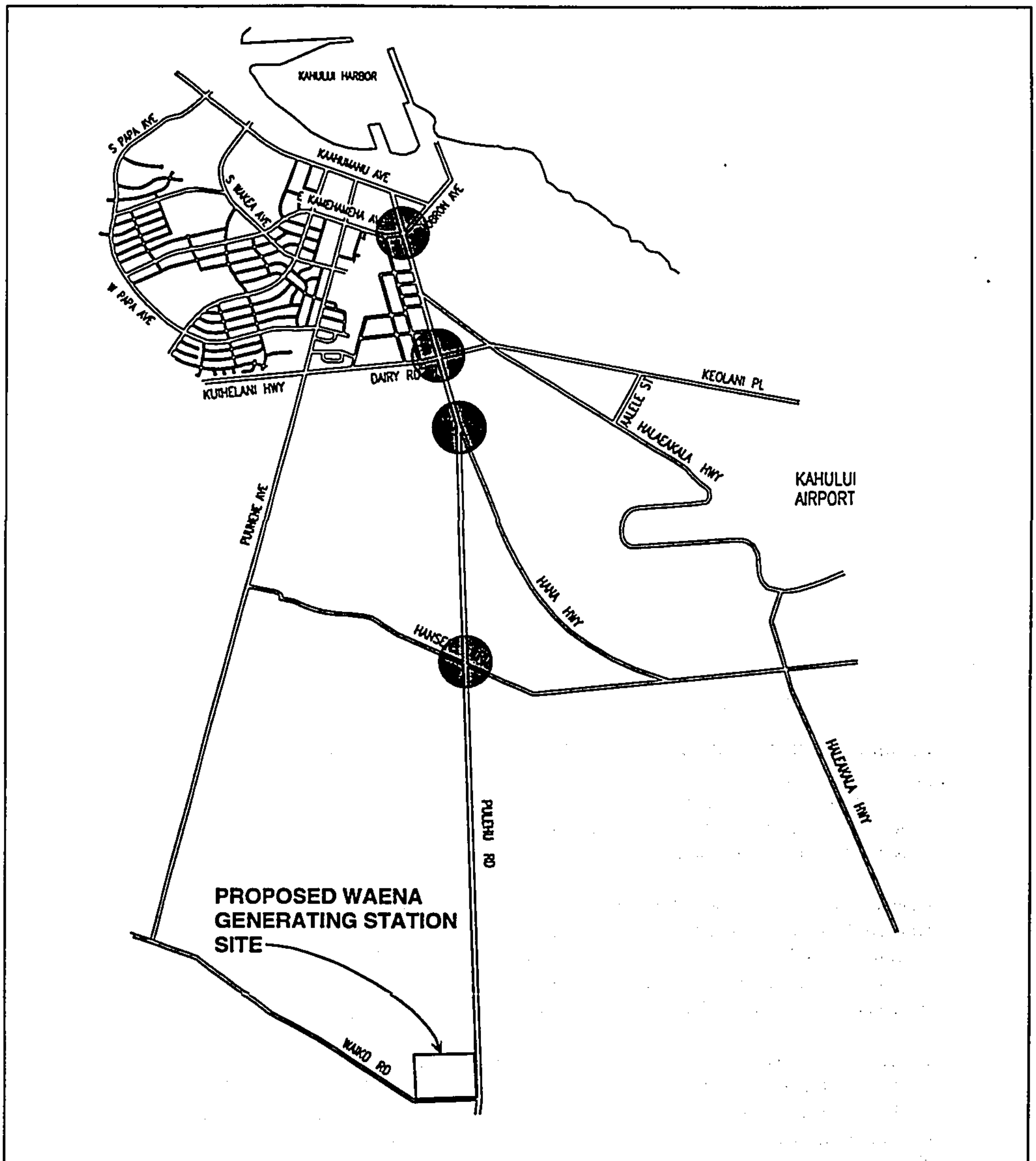
A traffic impact analysis was prepared for the proposed project by Austin Tsutsumi & Associates, Inc. in May 1997. The following section summarizes that report, which is included, without technical traffic count attachments, in Appendix I.

4.13.1.1 Existing Conditions

Existing Traffic Conditions. Figure 4-19 shows the major roadways in the vicinity of the project site. The site is accessed from Pulehu Road, a two-land County collector connecting the Upcountry area to Kahului. Pulehu Road is a rural, circuitous road used by Upcountry residents as an alternative route to Kahului. Waiko Road, an unimproved cane-haul road, runs parallel to the site's southwestern boundary and can also be used to access the site.

Pulehu Road intersects with both Hansen Road and Hana Highway near the project site. Hansen Road is a two-lane rural roadway that connects the Puunene area to the Airport area. Upcountry residents traveling towards the Kihei area often utilize this route. Hana Highway is a major State-owned four-lane divided highway linking Kahului and Hana. Major intersections along Hana Highway, such as at Dairy Road, are signalized.

Level-of-service (LOS) analyses were conducted at major intersections within the project vicinity for the morning, mid-day, and afternoon peak hour traffic periods. LOS is a qualitative measure used to describe the condition of traffic flow, ranging from free flow conditions at LOS A to congested conditions at LOS F. Results of the analyses are shown in Table 4-14.



LEGEND

● Study Intersection

Source: Austin, Tsutsumi & Associates, Inc. 1997

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FIGURE 4-19

EXISTING ROAD NETWORK AND STUDY INTERSECTIONS

NORTH 0 1 2 MILES

CH2M HILL

Table 4-14 Existing Year 1997 Traffic Conditions										
		AM Peak Hour			Mid-Day Peak Hour			Afternoon Peak Hour		
Intersection	Type	V/C Ratio	Delay (secs.)	LOS	V/C Ratio	Delay (secs.)	LOS	V/C Ratio	Delay (secs.)	LOS
Hana Hwy/Kamehameha Ave./Hobron Ave.	Unsig.									
Westbound Left Turn			9.7	B		24.9	D		28.1	D
Northbound Right Turn			7.7	B		12.4	C		23.6	D
Southbound Approach										
Left Turn			>45.0	F		>45.0	F		>45.0	F
Right Turn			6.5	B		4.6	A		4.4	A
Overall Intersection			>45.0	F		>45.0	F		>45.0	F
Hana Hwy/Dairy Rd.	Signal.									
Northbound Approach			59.3	F		38.8	D		79.0	F
Southbound Approach			65.2	F		39.3	D		54.6	E
Eastbound Approach			32.9	D		23.1	C		47.5	E
Westbound Approach			65.4	F		24.2	C		51.7	E
Overall Intersection		0.80	60.6	F	0.51	29.8	D	0.71	56.4	E
Hana Hwy/Pulehu Rd.	Unsig.									
Southbound Left Turn			4.5	A		7.3	B		19.4	C
Westbound Approach										
Left Turn			>45.0	F		>45.0	F		>45.0	F
Right Turn			5.3	A		8.5	B		21.2	D
Overall Intersection			>45.0	F		5.3	B		6.2	B
Hansen Rd./Pulehu Rd.	Unsig.									
Northbound Left Turn			2.6	A		2.4	A		2.4	A
Southbound Left Turn			2.6	A		2.5	A		2.8	A
Eastbound Approach			5.6	B		4.9	A		6.0	B
Westbound Approach			7.9	B		5.4	B		6.6	B
Overall Intersection			2.8	A		2.1	A		1.9	A

Source: Austin Tsutsumi & Associates, 1997

Generally, traffic flows smoothly past the project site to and from Hansen Road, with the intersection at Hansen Road operating smoothly (LOS A-B) overall, although individual left turning movements against the traffic flow are severely constrained during peak hour traffic (LOS F). The unsignalized intersection of Pulehu Road with Hana Highway operates under variable conditions throughout the day. Because of the heavier morning Kahului-bound traffic on both Hana Highway and Pulehu Road, left turns from Pulehu Road onto Hana Highway can be delayed over 45 seconds (LOS F). As Kahului-bound traffic along Pulehu Road and Hana Highway diminishes during the remainder of the day, overall intersection flow improves, although that particular left-turning movement remains at LOS F.

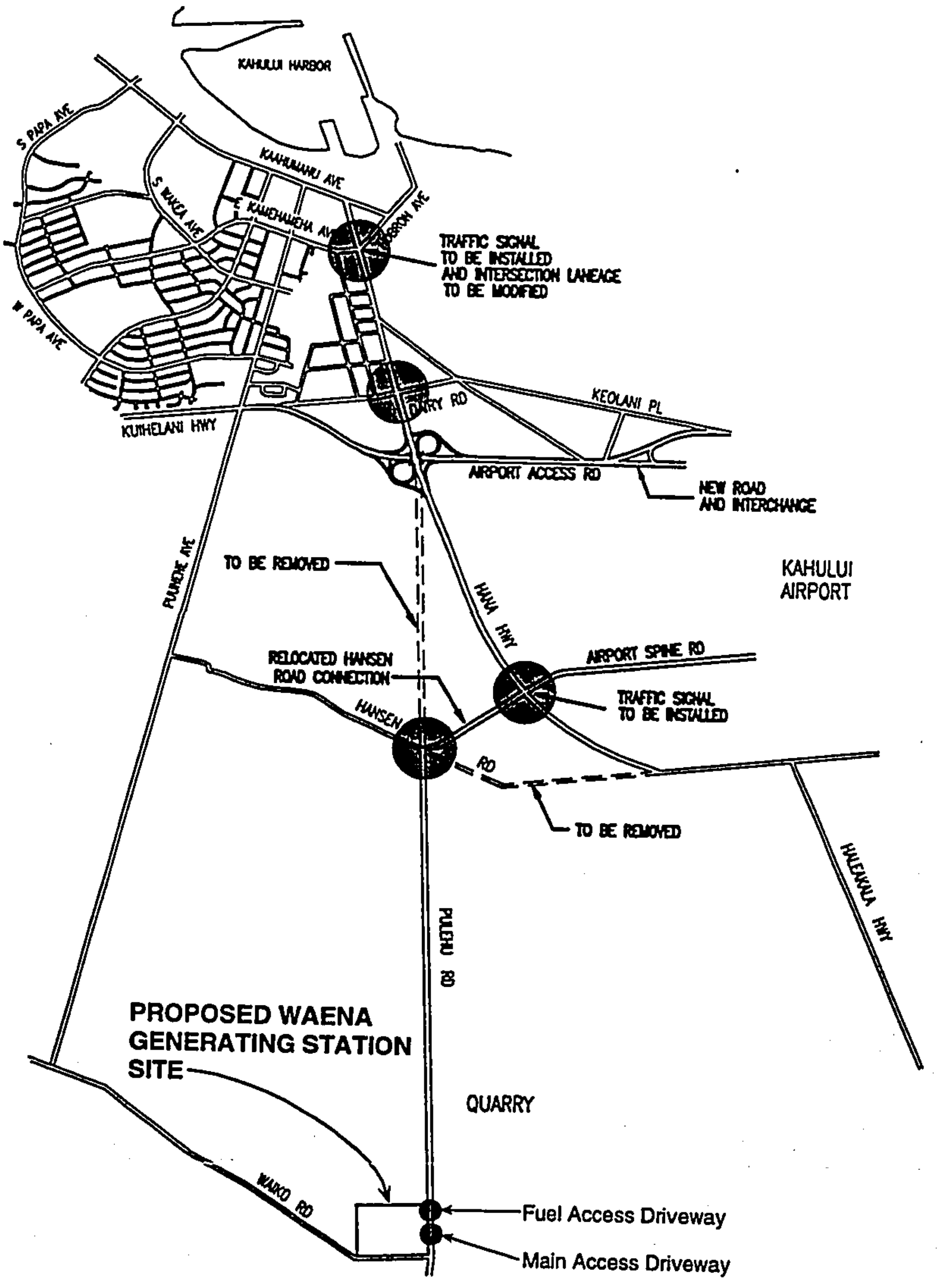
Future Highway Improvements. Prior to the planned operation of the proposed Waena Generating Station, several modifications in the existing roadway system are planned, including the construction of new roadways and traffic signals which will affect the existing study intersections. These roadway improvements are currently undergoing environmental processing or design.

The State Department of Transportation (DOT) is planning to implement traffic signals at the intersection of Hana Highway, Kamehameha Avenue, and Hobron Avenue. The lane configuration at this intersection would be revised to permit left turn and through movement on the Kamehameha Highway approach and through movements on the Hobron Avenue approach. In addition, the Hana Highway westbound right turn lane at this intersection would be extended.

As part of the Kahului Airport Master Plan, the DOT is proposing modifications to the present road network in the vicinity of the proposed project. The proposed modifications and new study intersections are shown in Figure 4-20. As part of the Airport Master Plan, the DOT will construct a new four-lane Airport Access Road. This new road will cross Hana Highway with a partial clover leaf interchange and require the closure of the section of Pulehu Road between Hana Highway and Hansen Road. In addition, Hansen Road will be closed between Pulehu Road and Hana Highway and realigned to meet Hana Highway in a signalized cross-intersection with a new Airport Spine Road. With these changes, regional and airport traffic is expected to divert from Dairy Road to the Airport Access Road and Dairy Road would serve local traffic. Construction of these improvements is expected to be completed by 1999.

Future Traffic Conditions. Future background traffic volumes for the year 2016 were determined for the study area based on projections within previous transportation studies and historical traffic count data. The target year was based on the time anticipated for the plant to reach full employment, anticipated to be following completion of Phase III. LOS analyses of the new study intersections are shown in Table 4-15.

The analyses indicate that the study intersections will be able to accommodate the future volumes, however, the traffic on the approaches are expected to experience very long delays which would be similar to the existing operations of the signalized at Hana Highway and Dairy Road. Additional improvements, such as widening Hana Highway to 6 lanes or



LEGEND

● Study Intersection

Source: Austin, Tsutsumi & Associates, Inc. 1997

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FIGURE 4-20

FUTURE ROAD NETWORK AND STUDY INTERSECTIONS

NORTH 0 1 2 MILES

CH2M HILL

Table 4-15 Future Year 2016 Traffic Conditions Without the Project										
		AM Peak Hour			Mid-Day Peak Hour			Afternoon Peak Hour		
Intersection	Type	V/C Ratio	Delay (secs.)	LOS	V/C Ratio	Delay (secs.)	LOS	V/C Ratio	Delay (secs.)	LOS
Hana Hwy/Kamehameha Ave./Hobron Ave.	Signal									
Northbound Approach			10.1	B		15.6	C		55.3	E
Southbound Approach			17.7	C		20.2	C		50.1	E
Eastbound Approach			10.1	B		16.4	C		54.4	E
Westbound Approach			4.2	A		6.6	B		13.0	B
Overall Intersection		0.63	6.9	B	0.70	12.4	B	0.78	39.3	D
Hana Hwy/Dairy Rd.	Signal									
Northbound Approach			15.6	C		14.9	B		53.8	E
Southbound Approach			18.5	C		15.4	C		52.5	E
Eastbound Approach			5.3	B		11.2	B		50.5	E
Westbound Approach			7.5	B		12.7	B		19.3	C
Overall Intersection		0.67	8.0	B	0.58	12.9	B	0.76	44.4	E
Hana Hwy/Hansen Rd./Airport Spine Rd.	Signal									
Northbound Approach			41.2	E		13.4	B		59.3	E
Southbound Approach			44.5	E		12.1	B		45.1	E
Eastbound Approach			14.2	B		7.3	B		42.9	E
Westbound Approach			35.0	D		7.3	B		10.8	B
Overall Intersection		1.00	30.6	D	0.63	7.9	B	0.89	34.3	D
Hansen Rd./Pulehu Rd.	Unsig.									
Southbound Left Turn			2.9	A		2.9	A		3.2	A
Westbound Approach										
Left Turn			10.5	C		8.5	B		9.3	B
Right Turn			4.0	A		3.7	A		3.9	A
Overall Intersection			2.2	A		1.6	A		1.4	A

Source: Austin Tsutsumi & Associates, 1997

constructing a new Kula-to-Kihei roadway are being considered to further alleviate regional traffic in the study area.

At the unsignalized intersection of the realigned Hansen Road with Pulehu Road, the stop-controlled Pulehu Road left-turn movement would be at LOS C or better.

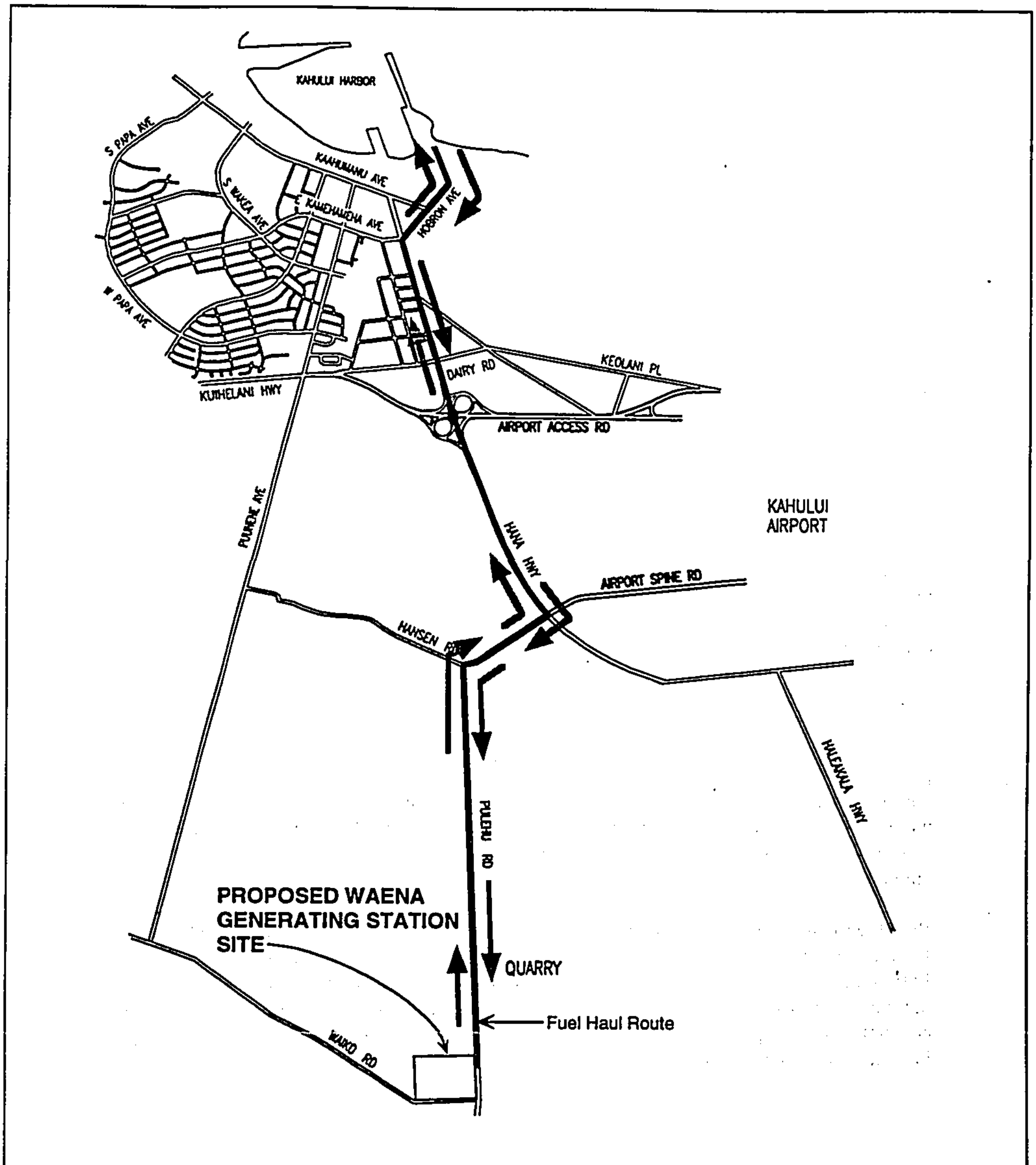
4.13.1.2 Potential Impacts

Trip Generation. The number of trips generated by the proposed project were developed for the year 2016 following the installation of Phase III. At that time, that plant is expected to reach its full complement of employees. The trip generation estimations include the number of employees per shift that would be working at the facility, the number of service and delivery trips to the site, and the number of fuel haul trucks delivering fuel to the sight on a daily basis. The estimates assumed the relocation or the transmission and distribution facilities to the new site, and maximum fuel delivery of 44 trucks per day. Fuel will be trucked to the site from Kahului Harbor over Hobron Avenue and Hana Highway to the new Airport Spine Road to reach Pulehu Road. This fuel haul route is shown in Figure 4-21.

The number of estimated trips generated by the proposed project is shown in Table 4-16. The project will generate approximately 210 vehicle trips during the morning peak hour, 145 entering the site and 65 exiting the site. Approximately 192 vehicle trips were estimated during the afternoon peak hour, 56 entering the site and 136 exiting the site.

Future Conditions with the Project. Project traffic was added to the estimated future traffic volumes to determine impacts to LOS. No further improvements to the area's roadways were assumed. The results of the analyses for the study intersections as well as the project access points are shown in Table 4-17. The analyses show that a small number of individual approaches and turning movements will experience drops in LOS. However, no intersection will experience an approach or turning movement greater than LOS E and the vehicle to capacity (v/c) ratio for the signalized intersections will not increase by any significant amount.

Both the main access and fuel delivery access driveways onto the project site from Pulehu Road are not anticipated to cause interference with regional traffic using Pulehu Road. The LOS of both access intersections is estimated to be LOS A. However, because of the change in topography between the project site and Pulehu Road, site distance analyses will need to be conducted prior to project design to determine the best placement of these access driveways in relationship to the overall facility design.



LEGEND

Route of Fuel Trucks

Direction of Fuel Trucks

Source: Austin, Tsutsumi & Associates, Inc. 1997

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FIGURE 4-21

FUEL HAUL ROUTE

NORTH 0 1 2 MILES

CH2M HILL

Table 4-16
Proposed Waena Generating Station Trip Generation

Trip Type	Quantity	Daily Trips	AM Peak Hour		Mid-Day Peak Hour		PM Peak Hour	
			Enter	Exit	Enter	Exit	Enter	Exit
Generation Production Operations[a]	20 Employees	40	0	0	0	0	0	0
Generation Non-Operations Production[b]	26 Employees	52	26	0	2	2	0	26
Transmission & Distribution[c]	110 Employees	220	104	0	10	10	0	104
Transmission & Distribution[c]	85 Field Crews/Trucks	170	0	50	0	0	50	0
Service & Delivery	40 Visitors/Supplies	80	9	9	0	0	0	0
Fuel Haul	11 Trucks	88	6	6	4	4	6	6
Total		650	145	65	16	16	56	136

Notes:
[a] These employees work in three shifts (6am-2pm, 2pm-10pm, 10pm-6am) and do not commute during the peak hours.
[b] The administrative and technical staff work one daytime shift (7am-3:30pm).
[c] Potential employee relocation from the Kahului Baseyard these employees normally work one shift (7am-3:30pm)., except for six dispatchers who work in three shifts. Individual employee commute trips to/from the project site are shown separately from the field crews traveling in MECO vehicles between the project site and repair/maintenance locations, which vary daily.

Source: Austin Tsutsumi & Associates, 1997

Summary. The Waena Generating Station will generate 210 morning peak hour trips, 32 mid-day peak hour trips, and 192 afternoon peak hour trips. When added to the estimated future traffic volumes, no significant adverse impacts in the level-of-service for the area roadways were detected and no intersection movements were anticipated to experience less than LOS E. MECO will coordinate site access issues along Pulehu Road with the County of Maui.

Hazardous Materials Transport. Delivery of fuel, acids, and caustic materials used in production operations will be conducted through an independent contractor, who is responsible for all handling from the tanker into the bulk storage areas at the project site. The contractor must comply with all training requirements imposed by the State DOT. All fuel drivers must complete a Hazardous Material Safety Course and attend short training seminars provided by the diesel fuel supplier. All hazardous materials transport contractors are required to file Spill Prevention Control and Containment (SPCC) plans with the State outlining the procedures to be carried out should there be a spill.

Table 4-17
Future Year 2016 Traffic Conditions With the Project

		AM Peak Hour			Mid-Day Peak Hour			Afternoon Peak Hour		
Intersection	**Type**	**V/C Ratio**	**Delay (secs.)**	**LOS**	**V/C Ratio**	**Delay (secs.)**	**LOS**	**V/C Ratio**	**Delay (secs.)**	**LOS**
Hana Hwy/Kamehameha Ave./Hobron Ave.	Signal									
Northbound Approach			10.3	B		10.6	B		55.9	E
Southbound Approach			18.1	C		16.8	C		50.9	E
Eastbound Approach			10.1	B		45.5	***E***		55.6	E
Westbound Approach			4.2	A		5.3	B		13.1	B
Overall Intersection		0.64	7.0	B	0.74	22.4	B	0.79	39.9	D
Hana Hwy/Dairy Rd.	Signal									
Northbound Approach			15.2	C		14.9	B		54.0	E
Southbound Approach			18.5	C		15.4	C		52.6	E
Eastbound Approach			5.5	B		11.2	B		50.9	E
Westbound Approach			8.0	B		12.7	B		20.1	C
Overall Intersection		0.68	8.4	B	0.58	12.9	B	0.77	44.5	E
Hana Hwy/Hansen Rd./Airport Spine Rd.	Signal									
Northbound Approach			41.4	E		13.9	B		58.9	E
Southbound Approach			41.6	E		21.1	B		42.4	E
Eastbound Approach			16.4	***C***		7.3	B		42.8	E
Westbound Approach			36.9	D		7.3	B		13.4	B
Overall Intersection		1.01	32.2	D	0.63	8.0	B	0.89	35.4	D
Hansen Rd./Pulehu Rd.	Unsig.									
Southbound Left Turn			3.2	A		3.0	A		3.4	A
Westbound Approach										
Left Turn			15.4	C		8.9	B		11.2	***C***
Right Turn			4.3	A		3.8	A		4.4	A
Overall Intersection			3.1	A		1.7	A		2.2	A
Pulehu Rd/Fuel Access	Unsig.									
Westbound Left turn			2.6	A		2.4	A		2.7	A
Driveway Approach			6.0	B		4.3	A		5.6	B
Overall Intersection			0.1	A		0.1	A		0.1	A
Pulehu Rd/Main Access	Unsig.									
Westbound Left turn			2.3	A		2.4	A		2.5	A
Driveway Approach			5.1	B		4.2	A		5.2	B
Overall Intersection			0.8	A		0.4	A		1.9	A

Notes:
Bold LOS indicates an improvement in level-of-service for that movement
Bold-italic LOS indicates a drop in level-of-service for that movement

Source: Austin Tsutsumi & Associates, 1997

If SCR is designated as BACT by DOH/EPA, aqueous or anhydrous ammonia will need to be transported to the facility. Transport of anhydrous ammonia requires pressurized tanks and the transport of either ammonia is regulated by the DOT. All transporters of hazardous materials are required to file appropriate SPCC plans for approval.

Air Transportation. The U.S. Federal Aviation Administration (FAA) has determined that the proposed project and accompanying 150-foot stacks do not represent a hazard to navigation. In addition, the FAA has determined that the stacks will not be obstructions and will not require hazard lighting or marking.

4.13.1.3 Mitigation Measures

The proposed project is not anticipated to have a significant adverse impact on the levels-of-service of the area's roadways. Thus, no specific mitigation measures are required. Specific site access points along the project site with Pulehu Road will be determined during the preliminary engineering phase and incorporated into the overall facility design. MECO will coordinate site access with the County of Maui Department of Public Works.

4.13.2 Utilities

4.13.2.1 Existing Conditions

Electrical Service. MECO currently has two 69-kV transmission lines running adjacent to the project site. The Maalaea-Kealahou 69-kV transmission line runs along Waiko Road to the intersection of Pulehu Road, then turns south and extends along Pulehu Road towards Kealahou. The Kanaha-Pukalani 69-kV transmission line runs from Kanaha Substation along Pulehu Road past the project site to the intersection of Waiko Road, where the line crosses Pulehu Road diagonally and continues across cane lands towards Pukalani. In addition to the MECO transmission system, HC&S has some smaller distribution lines which run through cane lands to service irrigation and water pumps.

Potable Water Service. No existing potable water service from the County of Maui exists near the project site.

Domestic Sewage Service. No existing domestic sewage service from the County of Maui exists near the project site.

Communications Service. Currently, the site is undeveloped and has no telephone or communications service.

4.13.2.2 Potential Impacts

Electrical Service. The construction and operation of the proposed Waena Generating Station is planned to meet the demand for more electricity on the Island of Maui for the next 30 years and beyond. In addition, placement of the generating station within the central portion of MECO's transmission system allows for more reliable delivery of power through the MECO transmission grid.

Transmission Line EMF Impacts. As a part of the proposed project, the existing Maalaea-Kealahou and Kanaha-Pukalani 69-kV transmission lines will be reconfigured through the proposed Waena Switchyard. As demand for additional electricity warrants, MECO will construct two proposed 69-kV circuits to go from the site to the Paia and Puunene areas and two proposed 12-kV circuits to go from the site to the Puunene area.

Electric and magnetic field (EMF) levels were calculated by Enertech Consultants in May 1997 for the proposed Waena Generation Station and the proposed transmission lines. A report on their analyses is contained in Appendix J. Five different overhead powerline configurations were modeled in the evaluation:

- Existing Maalaea-Kealahou 69-kV single-circuit transmission line
- Existing Kanaha-Pukalani 69-kV single-circuit transmission line
- Proposed Pulehu Road-North Firebreak Road 69-kV double-circuit transmission line with 12-kV double-circuit distribution line
- Proposed North Firebreak Road-Paia 69-kV single-circuit transmission line
- Proposed North Firebreak Road-Puunene 69-kV double-circuit transmission line with 12-kV double-circuit distribution line

All lines were assumed, for modeling purposes, to be in operation by 2020. Table 4-18 shows the modeled magnetic field levels for the 5 transmission line configurations given in milliGauss (mG). Distances modeled ranged from -250 feet from centerline out to +250 feet from centerline (0 represents directly beneath the powerline). Because the loading will vary on the Kanaha-Pukalani and Maalaea-Kealahou lines as they enter and leave the generating station, both conditions were modeled. Estimated magnetic field levels at the centerline ranged from 3.43 mG to 17.99 mG under the Kanaha-Pukalani single-circuit 69-kV line. One reason for the disparity among calculated levels is that the proposed transmission lines will consist of both double 69-kV and double 12-kV lines on the same pole. This allows for magnetic field cancellation effects between the two 69-kV and two 12-kV circuits as well as additional cancellation between the 69-kV and 12-kV circuits.

Table 4-18
Calculated Future Transmission Line Magnetic Field Profiles
(milliGauss)

Distance from Centerline (ft.)	Kanaha-Pukalani (69 kV)		Maalaea-Kealahou (69 kV)		Pulehu Rd-North Firebreak (69/12 kV)	North Firebreak Rd-Puunene (69/12 kV)	North Firebreak Rd-Paia (69 kV)
	Enter	Exit	Enter	Exit			
-250	0.45	0.52	0.77	0.73	0.09	0.01	0.94
-200	0.67	0.77	1.01	0.95	0.15	0.03	1.24
-150	1.14	1.30	1.48	1.40	0.28	0.10	1.81
-100	2.37	2.71	2.59	2.45	0.62	0.34	3.18
-50	6.62	7.58	5.91	5.58	1.69	1.25	7.25
0	15.70	17.99	10.97	10.36	3.50	3.43	13.46
50	7.60	8.71	5.76	5.44	1.47	1.83	7.07
100	3.08	3.53	2.78	2.62	0.47	0.71	3.41
150	1.63	1.86	1.68	1.59	0.18	0.33	2.06
200	1.02	1.17	1.18	1.11	0.09	0.17	1.45
250	0.71	0.81	0.90	0.85	0.06	0.10	1.11

Source: Enertech Consultants, 1997

Generating Station EMF Impacts. EMF levels were calculated at the property boundaries along the proposed Waena Generating Station. These results are shown in Table 4-19. As shown, the perimeter field values range from about 0.1 mG along the western side of the station to about 20.3 mG underneath the overhead transmission lines entering and exiting the facility within the corridor leading to Pulehu Road.

Summary. The calculation results of the generating station computer modeling indicate that the generating station equipment, due to its location near the center of the station, will not contribute significantly to the magnetic field levels at the perimeter of the station. The switchyard equipment also will not contribute significantly to the magnetic field levels at the station boundaries. The major source of magnetic fields at the proposed station perimeter and beyond is due primarily to the 69-kV and 12-kV overhead transmission lines, which enter and leave the station along Pulehu and Waiko Roads.

Table 4-19 Summary of Proposed Generating Station Perimeter Calculations		
	Calculated Magnetic Field (mG)	
Station Side	Minimum	Maximum
Southeastern Side	1.1	10.0
Northeastern Side	7.5	20.4
Northwestern Side	0.1	9.6
Southwestern Side	0.2	1.4

Source: Enertech Consultants, 1997

The proposed transmission lines will pass along undeveloped property used for sugarcane cultivation. No residential areas or other sensitive receptors, such as schools, day care centers, etc., are located within 250 feet of any of the proposed transmission lines. In addition, no development exists in an area around the generating station. Although the proposed project will represent an increase in the magnetic field levels found along Pulehu Road and North Firebreak Road, studies to date have been inconclusive as to the health impacts from electric and magnetic fields. In addition, the lack of existing and planned development along these roadways indicates that no significant adverse impact will occur.

Potable Water Service. Because the need for potable water is small, MECO will use bottled water transported to the generating station. No extension of the county water delivery system is anticipated.

Domestic Sewage Service. Sanitary wastewater generated by the project is expected to average less than 1,000 gpd. MECO plans to construct a septic tank and leach field to treat effluent from sanitary facilities. No extension of the county wastewater system is anticipated.

Detailed plans for the domestic wastewater treatment system will be submitted to DOH for review and approval as part of a treatment works approval application. The treatment system will conform to applicable provisions of DOH Administrative Rules Chapter 11-62, including but not limited to Section 11-62-32, which specifies spacing for individual wastewater systems, and Section 11-62-33.1(a), which contains requirements for septic tanks.

The system will also conform to applicable sections of the Ten States Standards, and Chapters 10, 20, 40, and 50 of the DOH Administrative Rules. As specified in Chapter 10, information concerning soil and site conditions will be evaluated to determine an appropriate design for the proposed septic system. Factors to be evaluated will include depth of permeable soil, bedrock, or other limiting layer; soil factors; land slope; flooding hazard; and amount of suitable area available for the development of a leach field.

Communications Service. MECO will link the facility to its own existing microwave communication and radio system. The supervisory control and data acquisition (SCADA) system controls the transmission grid and monitors generation. Telephone service will need to be provided through GTE Hawaiian Telephone.

4.13.2.3 Mitigation Measures

MECO will submit all necessary septic system plans to the State DOH for approval. No adverse impacts requiring mitigation were identified for electrical service, from EMF, or for potable water delivery or communications service.

4.13.3 Solid Waste

4.13.3.1 Existing Conditions

Solid waste disposal systems on Maui consist of the Central Maui Landfill, located across Pulehu Road from the site, and the Hana Landfill. The Central Maui Landfill was designed as the primary landfill on Maui and accepts commercial, industrial, and residential waste. It does not accept hazardous materials or construction materials. Construction materials and debris are disposed at the Maui Demolition and Construction Landfill on North Kihei Road near Honoapiilani Highway. In its current configuration, the Central Maui Landfill is estimated to reach capacity by 1999. Planned expansions to the land fill will extend its capacity through the year 2016 (Fujioka, 1996).

4.13.3.2 Potential Impacts

Solid waste generated by the proposed Waena Generating Station will consist of the following:

- Construction waste
- Materials associated with plant operation, administration, housekeeping, and maintenance operations
- Parts, materials, and equipment replaced during maintenance

Construction materials and waste will be disposed of in the Maui Demolition and Construction Landfill by the construction contractor. During operation, a minimal amount of solid waste will be generated. To reduce the amount of solid waste disposed, the Waena Generating Station will recycle whenever possible.

To the fullest extent possible, parts, materials, and equipment will be salvaged or recycled. The remaining wastes will be disposed of at the Central Maui Landfill. Solids from the sanitary septic system will be disposed of periodically at a County wastewater treatment facility.

4.13.3.3 Mitigation Measures

Current regulations will be adhered to during disposal of construction debris, solid waste, and hazardous waste and materials. No specific mitigation measures are required.

4.13.4 Hazardous Waste and Materials

4.13.4.1 Existing Conditions

Hazardous wastes and materials are currently sent off island for disposal per U.S. EPA and State DOH requirements. Hazardous wastes and materials are sent to Oahu and eventually shipped to the mainland for disposal at an approved hazardous waste landfill.

4.13.4.2 Potential Impacts

The use, storage, and transportation of hazardous materials are subject to state and federal laws and regulations. No hazardous wastes will be disposed of either onsite or within the State of Hawaii. Any hazardous waste will be disposed of in compliance with all applicable state and federal regulations.

If SCR is designated as BACT by DOH/EPA, either aqueous or anhydrous ammonia will need to be stored on site. Aqueous ammonia is a solution of ammonia and water. Anhydrous ammonia is a concentrated ammonia vapor. The storage of either of these two elements will require storage tanks in addition to those shown on the conceptual site plan.

Failure of any of the components of the ammonia storage or transfer elements could result in the release of ammonia vapor into the atmosphere. In the event of an ammonia release, the potential dangers are primarily related to exposure effects to the skin, eyes, nose, throat, and respiratory tract. Skin contact with ammonia can cause sever irritation and burns. Contact with ammonia by the eyes or by inhalation is very irritating and can cause damage at concentrations above 130 to 200 ppm. Because of the distance between the proposed facility and the nearest urban areas, any vapor releases would be anticipated to dissipate to insignificant levels prior to reaching them.

4.13.4.3 Mitigation Measures

Current regulations will be adhered to during disposal of construction debris, solid waste, and hazardous waste and materials. If ammonia is used as a part of the selected BACT, design precautions and warning systems will be incorporated into the facility and an emergency plan will be developed to ensure employee safety under Occupational Health and Safety Administration (OSHA) standards.

4.14 Community Services

4.14.1 Existing Conditions

4.14.1.1 Health Care

Health care and hospital services on Maui are provided by Maui Memorial Hospital, the island's only full-service hospital for acute care. Maui Memorial Hospital has 145 acute care beds and operates within the state hospital system administered by the State DOH. Private clinics, such as Kaiser Clinic and the Maui Medical Group, as well as private physicians, also provide health care services to island residents and visitors.

4.14.1.2 Police Protection

The Maui County Police Department, headquartered at the Wailuku Civic Center, provides police protection for the Wailuku-Kahului, Kihei, and Upcountry areas. Approximately 240 police officers and 80 support personnel are based at this station.

4.14.1.3 Fire Protection

Fire prevention, suppression, and protection services for the Wailuku-Kahului region is provided by the County Department of Fire Control. The nearest fire station to the project site is the Kahului Station, located on Dairy Road approximately 4 miles away. The Kahului Station is staffed by approximately 40 full-time personnel. Other facilities in the Central Maui area include a fire station in Paia and one in Wailuku.

4.14.1.4 Recreational Facilities

The nearest outdoor recreational facilities to the project site in the Central Maui area are ocean related and occur along the coastline from Kahului Harbor to Spreckelsville Beach. Existing facilities include Kahului Harbor Park and Kahului Beach, Kanaha Beach Park, and Spreckelsville Beach. The project site is located over 4 miles from these facilities.

4.14.2 Potential Impacts

4.14.2.1 Health Care

Development of the Waena Generating Station will involve major construction activities. The plant will be constructed by a contractor whose responsibilities will include a program of safe construction practices.

Operation of the generating station will involve the storage and handling of flammable and hazardous materials, as well as the use of heavy equipment and machinery. All personnel will be trained in procedures for the safe operation of equipment. The site will be equipped with the appropriate first aid equipment. Safety training is a continuous program.

4.14.2.2 Police Protection

On site security procedures will be developed by MECO and site access will be restricted through the construction of a perimeter fence and driveway access checkpoints. Security lighting will be provided throughout the generating station. Security lighting will be directed downwards and shielded to prevent interference with nighttime migratory birds.

4.14.2.3 Fire Protection

Emergency plans detail the procedures to be followed when there is a fire or fuel spill. As applicable, plans will be coordinated with the district fire department and health care facilities. All federal and state regulations regarding the operation of a generating facility and worker safety will be followed.

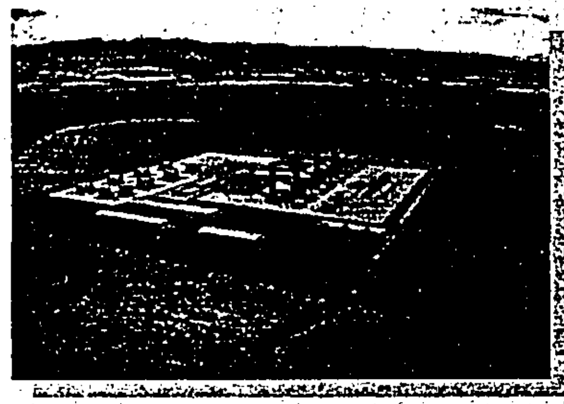
On-site water storage for fire suppression will be provided and will be designed to meet County of Maui standards for water flow and tank size. A carbon dioxide fire protection system will be used on the combustion turbines in the event of a fire. MECO currently has fire control plans for its generating facilities and a fire control plan will be designed specifically for the Waena Generating Station.

4.14.2.4 Recreational Facilities

Establishment of the proposed generating station will not have an adverse impact upon the areas recreational facilities because of its distance from these facilities. The electricity generated by the proposed project will provide the energy required for existing and planned recreational facilities throughout the entire Island of Maui.

4.14.3 Mitigation Measures

No special mitigation measures are required beyond those identified.



CHAPTER FIVE

RELATIONSHIP OF THE PROPOSED PROJECT TO LAND USE PLANS, POLICIES, AND CONTROLS

Chapter 5
Relationship of the Proposed Project to Land Use Plans, Policies, and Controls

5.1 Hawaii Revised Statutes, Chapter 343

Chapter 343 of the Hawaii Revised Statutes (HRS) establishes an environmental review process with the purpose of ensuring that environmental concerns are given appropriate consideration in decision making along with economic and technical considerations. Chapter 343 is implemented through Hawaii Administrative Rules (HAR) Title 11, Chapter 200. Under Section 5 of Chapter 343, an applicant must prepare an environmental review document should they "propose any amendments to existing county general plans where such amendment would result in designations other than agriculture, conservation, or preservation....." Because the proposed Waena Generating Station will require a change in the current Maui County Wailuku-Kahului Community Plan designation from "Agricultural" to "Heavy Industrial," this environmental impact statement is being prepared in accordance with HRS Chapter 343 as implemented by HAR Title 11, Chapter 200.

5.2 Hawaii Revised Statutes, Chapter 205

The site of the proposed Waena Generating Station is on land currently designated by the State Land Use Commission (LUC) as "Agricultural." Before construction of the proposed project, MECO will submit a petition for a State Land Use Commission boundary amendment to reclassify the site from the "Agricultural" to the "Urban" land use district pursuant to Chapter 205, HRS as implemented by HAR Title 15, Chapter 15, Land Use Commission Rules. The standards used by the LUC for determining Urban District boundaries, as listed in HAR 15-15-18, and the relationship of the proposed project to them are discussed below.

1. *It shall include lands characterized by "city-like" concentrations of people, structures, streets, urban level of services and other related land uses.*

2. *It shall take into consideration the following specific factors:*

   A. *Proximity to centers of trading and employment except where the development would generate new centers of trading and employment*

   B. *Substantiation of economic feasibility by the petitioner*

   C. *Proximity to basic services such as sewers, transportation systems, water, sanitation, schools, parks, and police and fire protection*

   D. *Sufficient reserve areas for urban growth in appropriate locations based on a ten-year projection*

3. *It shall include lands with satisfactory topography and drainage and reasonably free from the danger of floods, tsunami, unstable soil conditions, and other adverse environmental effects.*

4. *In determining urban growth for the next ten years, or in amending the boundary, land contiguous with existing urban areas shall be given more consideration than non-contiguous land, and particularly when indicated for future urban use on state or county general plans.*

5. *It shall include lands in appropriate locations for new urban concentrations and shall give consideration to areas of urban growth as shown on the state and county general plans.*

6. *It may include lands which do not conform to the standards in paragraphs 1 to 5:*

   A. *When surrounded by or adjacent to existing urban development*

   B. *Only when those lands represent a minor portion of this district*

7. *It shall not include lands, the urbanization of which will contribute toward scattered spot urban development, necessitating unreasonable investment in public infrastructure or support services.*

8. *It may include lands with a general slope of twenty percent or more which do not provide open space amenities or scenic values if the commission finds that those lands are desirable and suitable for urban purposes and that official design and construction controls are adequate to protect the public health, welfare and safety, and the public's interest in the aesthetic quality of the landscape.*

The proposed project will be a heavy industrial use and will be located in close proximity to two other heavy industrial uses, the Central Maui Landfill and the Ameron HC&D quarry. The site is also adjacent to other Agricultural District lands that will remain in sugar cultivation.

As a part of the site selection process, existing sugar mill sites on Maui and the industrial area near Kahului Harbor were analyzed and considered. Existing industrial areas within the Central Maui urban areas were eliminated from consideration due to constrained lands, air quality concerns, or incompatible adjacent land uses. The Waena site is less then 3 miles from Puunene (the nearest urban center), and, by contrast, the site is not adversely affected by constrained lands, air quality concerns, or incompatible adjacent land uses.

Factors considered in the site selection for the proposed Waena Generating Station included the compatibility of using the site for generation with the nearby quarry and landfill and the surrounding agricultural uses, the site's separation from more sensitive urban uses, and the site's centralized location within the MECO system. The centralized location will allow the station to provide reliable power and transmission of electricity to the Island of Maui and will allow for additional growth within the appropriate boundaries.

Slopes on the project site are minimal (approximately one degree). The site does not lie in any flood or tsunami zones. Soil conditions at the site consist of the Waiakoa series, a generally stony soil grading to hard bedrock within a depth of approximately 5 feet or so. Drainage will be contained on site. The location of the project site does not represent a significant adverse impact to scenic views or vistas, nor does it cause a significant adverse impact on the aesthetic quality of the landscape. Visual impacts can be mitigated through landscaping and choices of paint colors appropriate to the area. The construction and operation of the facility will adhere to existing regulations governing the public health, welfare, and safety. The proposed use of the site does not significantly diminish the available supply of land used for agricultural activities, nor will it have any adverse impact on the remaining adjacent agricultural uses.

The proposed project will not require extension of existing County or State infrastructure to the site and the project is not expected to have any direct impact that will require the expenditure of public funds for infrastructure. Potable water will be delivered by truck and sanitary wastewater facilities will be constructed on-site. Development of the site is expected to have a minimal impact on any requirement for police and fire protection. The project will have no significant adverse impact on regional traffic which will require mitigation. The project will not directly cause additional population growth on the Island of Maui, however, the project will indirectly support additional population and economic growth.

Maui Electric Company, Limited (MECO) is a subsidiary of Hawaiian Electric Company, Inc. (HECO), a company with publicly traded stock. MECO is regulated by the Public Utilities Commission (PUC). MECO has concluded that the proposed project meets internal economic feasibility criteria. As a subsidiary of a publicly traded company, MECO has access to the economic resources required to develop the project. MECO can request the authority from the PUC to make expenditures for construction of the proposed facility and to recapture costs through the electricity rates paid by MECO's customers. HECO is also able to issue bonds and stock to finance the project.

Development of the Waena site does not adversely impact the provision of sufficient service areas for other urban growth requirements. Approval of the "Urban" district designation would be consistent with the Land Use Commission's approval of Special Permits for the adjoining quarry and landfill. Urbanization of the site does not contribute to scattered spot urban development, as it is in close proximity to an existing landfill and quarry, both being uses permitted by the State Land Use Commission. The proposed MECO project will be compatible with these uses, as well as adjacent agricultural uses. While the area is not adjacent to existing Urban District lands, the establishment of the nearby landfill and quarry have created an area of "city-like" heavy industrial use near the proposed Waena Generating Station site which are located away from sensitive residential, commercial, and public areas. The quarry, landfill, and electrical generating station are all uses that are necessary to support these urban uses.

In addition to the standards for the Urban District set forth in HAR 15-15-18, the LUC considers specific criteria in making their decision as outlined in HAR 15-15-77. Those decision-making criteria for boundary amendments and the relationship of the proposed project to them are outlined below.

1. *The extent to which the proposed reclassification conforms to the goals, objectives, and policies of the Hawaii State Plan and relates to the applicable priority guidelines of the Hawaii State Plan and the adopted functional plans.*

2. *The extent to which the proposed reclassification conforms to the applicable district standards.*

3. *The impact of the proposed reclassification on the following areas of state concern:*

   A. *Preservation or maintenance of important natural systems or habitats*

   B. *Maintenance of valued cultural, historical, or natural resources*

   C. *Maintenance of other natural resources relevant to Hawaii's economy including, but not limited to agricultural resources*

   D. *Commitment of state funds and resources*

   E. *Provision for employment opportunities and economic development*

   F. *Provision for housing opportunities for all income groups, particularly the low, low-moderate, and gap groups*

4. *In establishing the boundaries of the districts in each county, the commission shall give consideration to the general plan of the county in which the land is located.*

The Hawaii State Plan is a guide for future long-range development. It identifies the goals, objectives, policies, and priorities for the State; allocates limited resources; improves coordination among federal, state, and county agencies; and establishes a system for integrating all major state and county activities. The extent to which the project conforms with the Hawaii State Plan and its related functional Plans is discussed in Section 5.4 and Section 5.5. The extent to which the project conforms with the provisions of the Maui County General Plan and the Wailuku-Kahului Community Plan is discussed in Section 5.7 and Section 5.8.

Site investigations and reconnaissance revealed no significant natural resources, habitats, cultural, or historic resources at the project site. Construction or operation of the proposed generating station will not have a significant adverse impact on any environmental resources.

The proposed project will require the removal of 65.7 acres of agricultural land from active production. However, this amount is insignificant when compared to the over 36,000 acres remaining in the HC&S plantation. In addition, plantations are actively creating additional cropland through expansion of their irrigation systems. The power generated by this facility will support further expansion and diversification of agricultural activities on Maui.

The operation of the proposed 232-MW facility will create approximately 46 new jobs directly. The project will require between 80 to 100 construction workers during the initial installation. Indirectly, the electricity provided by the proposed facility will support the continued economic expansion of the Island of Maui and provide the necessary energy to support affordable housing programs as they are developed.

The proposed Waena Generating Station project will be funded through the MECO customer base and will not require expenditures by either the State of Hawaii or the County of Maui.

Pursuant to HAR 15-15-24, the power generation on the site is a use permitted by the County of Maui on lands zoned "Heavy Industrial." MECO is pursuing the necessary County approvals to rezone the site to the "Heavy Industrial" zoning classification. The County's decision for a zoning reclassification cannot occur until after the State Land Use Commission has approved a redesignation of the site from the State's "Agricultural" to the "Urban" district.

5.3 Hawaii Revised Statutes, Chapter 205A

The purpose of the Hawaii Coastal Zone Management Program (HCZMP) is to establish guidelines for the use, protection, and development of resources in the coastal zone. Development activities in the coastal zone must conform to the HCZMP objectives and policies, as outlined in HRS Chapter 205A. As designated in HRS Chapter 205A, the coastal zone encompasses the entire State of Hawaii. The relationship of the proposed project to the goals and objectives of the HCZMP are outlined below.

1. Recreational Resources

Objectives: Provide coastal recreational resources accessible to the public.

Policies:

- *a. Improve coordination and funding of coastal recreation planning and management; and*
- *b. Provide adequate, accessible and diverse recreational opportunities in the coastal zone management area by:*
  1. *Protecting coastal resources uniquely suited for recreation activities that cannot be provided in other areas;*
  2. *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;*
  3. *Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
  4. *Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
  5. *Encouraging expanding public recreational use of county, state and federally owned or controlled shoreline lands and waters having recreational value;*
  6. *Adopting water quality standards and regulating point and non-point sources of pollution to protect and, where feasible, restore the recreational value of coastal waters; and*
  7. *Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits, and crediting such dedication against the requirements of Section 46-6 of the Hawaii Revised Statutes.*

2. Historical/Cultural Resources

Objectives: Protect, preserve and where desirable, restore those natural and man-made historic and prehistoric resources in the coastal zone management areas that are significant in Hawaiian and American history and culture.

Policies:

a. Identify and analyze significant archaeological resources;

b. Maximize information retention through preservation of remains and artifacts or salvage operation; and

c. Support state goals for protection, restoration, interpretation and display of historic resources.

3. Scenic and Open Space Resources

Objectives: Protect, preserve and, where desirable, restore or improve the quality of the coastal scenic and open space resources.

Policies:

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 the natural land forms 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.

4. Coastal Ecosystems

Objectives: Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

a. Improve the technical basis for mature resource management;

b. Preserve valuable coastal ecosystems of significant biological or economic importance;

c. Minimize disruption and 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 fresh water and marine ecosystems and prohibit land water uses which violate state water quality standards.*

5. Economic Uses

Objectives: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

a. Concentration 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 facilities, and energy-generating facilities are located, designed, and constructed to minimize adverse social, visual and environmental impacts in the coastal zone management areas; 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:

1. Utilization of presently designated locations is not feasible,

2. Adverse environmental effects are minimized, and

3. The development is important to the State's economy.

6. Coastal Hazards

Objectives: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion and subsidence.

Policies:

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 development comply with requirements of the Federal Flood Insurance Program; and *d. Prevent coastal flooding from inland projects.*

7. Managing Development

Objectives: Improve the development review process, communication, and public participation in the management of coastal resources and hazard.

Policies:

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 the application for development permits and resolve overlapping of 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.

8. Public Participation

Objective: Stimulate public awareness, education and participation in coastal management.

Policies:

a. Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;

b. Disseminate information on coastal management issues by means of educational materials, published reports, staff contact and public workshops for persons and organizations concerned with coastal related issues, development, and government activities; and

c. Organize workshops, policy dialogues, and site specific mediations to respond to coastal issues and conflict.

9. Beach Protection

Objectives: Protect beaches for public use and recreation.

Polices:

a. *Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;*

b. *Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and*

c. *Minimize the construction of public erosion-protection structures seaward of the shoreline.*

10. Marine Resources

Objective: Implement the State's ocean resource management plan.

Policies:

a. *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*

b. *Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*

c. *Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;*

d. *Assert and articulate the interest of the state as a partner with federal agencies in the sound management of the ocean resources within the United States exclusive economic zone;*

e. *Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon the ocean and coastal resources; and*

f. *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

The subject property is located approximately 4 miles inland. The proposed project will have no impact on the public's access and use of the shoreline area and there will be no adverse impact to nearshore waters from point and non-point sources of pollution. Because of its location and lack of coastal impacts, the project will conform with the objectives related to recreational resources, coastal ecosystems, beach protection, and marine resources.

There are no known traditional gathering activities and/or cultural practices affecting the subject property. The site and surrounding area have been utilized for sugarcane cultivation for nearly a century and no significant archaeological resources were discovered during surveys of the site. Therefore, it is anticipated that the subject property will not have an adverse impact upon any significant archaeological or historical resources.

The location of the project site does not represent a significant adverse impact to scenic views or vistas related to coastal areas. Visual impacts will be mitigated through landscaping and choices of paint colors appropriate to the area. Therefore, the project will have no negative impact on the visual character of its immediate environs within the Central Maui region.

The project complies with the economic uses objective by providing a necessary facility located away from coastal areas which will meet and support continued economic growth on the Island of Maui.

According to the Federal Emergency Management Agency's Flood Insurance Rate Map, the project site is located in Zone C, areas experiencing minimal flooding. According to the National Flood Insurance Program, Zone C areas are not considered to be flood plain areas. The site does not lie in a tsunami zone. The subject property has no involvement with construction of any structures within the shoreline area and will not have an impact upon any public beaches.

The project has produced an environmental impact statement which has gone through public review and comment. In addition, several public meetings were held during both the facility siting and environmental assessment phases of the project. The requirement of the project to follow the Maui County Community Plan amendment and County rezoning processes, as well as the state Land Use Boundary redesignation process, ensures that the development of the project will be managed with a high level of public input and participation.

The HCZMP is supplemented by the County's Special Management Area (SMA) that controls development along the shoreline. Activities in the SMA generally require a permit from the County. The project is not located within the County SMA and a Maui County SMA permit for the proposed project will not be required.

5.4 Hawaii State Plan

The Hawaii State Plan, Chapter 226, "Hawaii Revised Statutes," is a guide for future long-range development. It identifies the goals, objectives, policies, and priorities for the

State; allocates limited resources; improves coordination among federal, state, and county agencies; and establishes a system for integrating all major state and county activities.

Section 226-14 of the State Plan, Objectives and Policies for Facility Systems applies, in general, to the proposed project and states the following:

a. *Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.*

b. *To achieve the general facility system objective, it shall be the policy of this State to:*

   1. *Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans*

   2. *Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities*

   3. *Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user*

   4. *Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction, and maintenance of facility systems.*

The proposed Waena Generating Station is designed to meet the increasing demand for electricity on the Island of Maui and to improve system reliability. Due to the incremental nature of its construction, lasting over 20 years, the Waena Generating Station can accommodate changing public demands and allow for the flexibility of future designs and technologies. Currently, a 58-MW, dual-train combined-cycle unit is economical in terms of both initial and long-term costs.

Section 226-18 of the Hawaii State Plan, "Objectives and Policies for Facility Systems Energy/Telecommunications," applies specifically to the project and states the following:

a. *Planning for the State's facility systems with regard to energy shall be directed towards the achievement of the following objectives:*

   1. *Dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people*

2. Increased energy self-sufficiency where the ratio of indigenous to imported energy use is increased; and

3. Greater energy security in the face of threats to Hawaii's energy supplies and systems.

b. To achieve the energy 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.

c. To further achieve the energy objectives, it shall be the policy of this State to:

1. Support research and development as well as promote the use of renewable energy sources;

2. Ensure that the combination of energy supplies and energy-saving systems are sufficient to support the demands of growth;

3. Base decisions of least-cost supply-side and demand-side energy resource options on a comparison of their total costs and benefits when a least-cost is determined by a reasonably comprehensive, quantitative, and qualitative accounting of their long-term, direct and indirect economic, environmental, social, cultural, and public health costs and benefits;

4. Promote all cost-effective conservation of power and fuel supplies through measures including::

A. Development of cost-effective demand-side management programs;

B. Education; and

C. Adoption of energy-efficient practices and technologies;

5. Ensure to the extent that new supply-side resources are needed, the development or expansion of energy systems utilizes the least-cost energy supply option and maximizes efficient technologies;

6. Support research, development, and demonstration of energy efficiency, load management, and other demand-side management programs, practices, and technologies; and

7. Promote alternative fuels and energy efficiency by encouraging diversification of transportation modes and infrastructure.

The proposed project, in the context of MECO's integrated approach to energy production and conservation, conforms with these objectives and policies. The purpose of the proposed Waena Generating Station is to provide a system that meets the projected electrical demand, increases system reliability, and provides dependable electrical service to its customers.

Resource limitations and environmental, public health, and safety concerns were considered in selecting the site and appropriate technology for the generating facility. During the development of MECO's Integrated Resource Plan, a comparison of costs and benefits for both alternative fuels and alternative technologies was performed. At this time, alternative fuels and technologies do not represent the least-cost energy supply option or the maximum efficient technology. The use of diesel-fueled dual-train, combined-cycle units currently are justified while other renewable energy projects are being developed.

MECO is actively participating in education and research programs to further develop *alternative fuels and technologies in Hawaii, as is evident through their cooperation* with the Pacific International Center for High Technology Research, the County of Maui, and the State of Hawaii in examining biomass to electricity applications for Hawaii and through MECO's continued installation of small photovoltaic systems on public schools through their Sun Power for Schools project.

5.5 State Energy Functional Plan

The Hawaii State Plan requires the development of State Functional Plans (SFPs). While the Hawaii State Plan establishes long-term objectives for Hawaii, the SFPs delineate the specific strategies and prioritize actions that need to be addressed in the short term.

The objectives of the State Energy Functional Plan (1991) are to achieve dependable, efficient, and economical statewide energy systems capable of supporting the needs of the people and to increase energy self-sufficiency.

The major issues identified in the Plan that apply to the proposed project are discussed below. The proposed Waena Generating Station meets the first three objectives, however, it does not address the objective of furthering energy self-sufficiency.

5.5.1 Energy Conservation and Efficiency

Energy conservation and efficiency can reduce the dependence on imported fossil fuels and overall energy demand. To achieve this, an Integrated Resource Plan (IRP) was developed and approved by the PUC. Integrated Resource Planning is the process of developing, implementing, monitoring, and evaluating a utility resource plan that identifies an optimum mix of energy resources for meeting forecasted levels of consumer energy needs. Demand-Side Management (DSM) programs, which are a component of the IRP, were designed to influence customer consumption of electricity in a manner that will produce changes in the utility's demand. Potential programs include conservation, energy efficiency, load management, and fuel substitution.

The policy and action items pertaining to MECO are as follows:

Policy A(1): Promote and Stimulate Greater Energy Efficiency and Conservation in Non-Transportation Sectors

Action A(1)(a): Provide Technical Support and Assistance to the State Government, County Governments, the PUC, and The Energy Utilities in Developing the Integrated Resource Planning (IRP) Process and Carrying Out Demand-Side Management (DSM) Assessments.

Action A(1)(b): Advance the Use of Demand-Side Management (DSM) by Creating Pilot Programs and Promoting Education of Local Energy Producers and Users.

MECO is a participant in Integrated Resource Planning. Through the IRP process, MECO has developed a long-range energy plan for the Island of Maui by considering not only the traditional supply-side resources but also the customer (demand-side) resources that are available.

The following four tasks were included in the IRP process:

1. The forecasting task develops a 20-year forecast with high-, medium-, and low-growth scenarios.
2. The supply-side report lists and characterizes the available supply-side resource options.
3. The demand-side report develops programs whose benefits and costs can be weighed against supply-side options.
4. The integration phase then combines these three areas into a "least-cost" plan for the utility. The result is a 20-year, long-range plan combined with a 5-year action plan.

Integrated Resource Planning has brought about significant changes in the way utilities conduct their business, not only by including demand-side options as a resource but also by having the public participate in the planning process through advisory groups. MECO formed an advisory group representing business, government, environmental, cultural, and community groups. Those groups with a special interest in energy issues, as well as individuals who could lend special expertise to the process, were included.

The advisory group met several times during the plan development process. The meetings covered such areas as organizational issues, forecasting, demand-side resources, supply-side resources, and the IRP objectives and principles. Public meetings were also held on Maui, Lanai, and Molokai to present the forecasted sales and peak demand, identify DSM and supply-side resource options, and to obtain feedback so MECO could consider public input into the IRP process. These public meetings were also intended to introduce the IRP process to the general public so that they may have a better understanding of the participatory process.

As a result of the IRP process, MECO formed four DSM resource programs based upon the common end-uses and market segments that they address. These programs include the:

- Commercial and Industrial Energy Efficiency Program
- Commercial and Industrial Customized Rebate Program
- Commercial and Industrial New Construction Program
- Residential Efficient Water Heating Program

In addition to the four resource programs listed above, two service programs were included in the DSM action plan. The first is an educational program which includes public information, school education, and other activities to build awareness of energy efficiency and MECO's DSM program offerings. This program includes the continuation and expansion of the successful In Concert with the Environment (ICE) program currently operated by MECO. In addition, a low income program has been created to offer additional incentives and specialized marketing within the residential water heating program.

Altogether, these programs are projected to provide peak-demand saving of 1.5 MW in their first year of implementation and 14.6 MW of energy savings by the year 2004. However, because energy efficiency and peak capacity reductions have not been comprehensively pursued by any organization in Hawaii to date, there is considerable uncertainty about how to structure the DSM programs. Therefore, monitoring of the implementation process will be important. Programs will need to be adjusted as the implementation process moves forward. MECO expects to update its DSM program plans annually to optimize program implementation and energy savings.

5.5.2 Alternative and Renewable Energy

The State is encouraging development of alternative and renewable energy sources as Hawaii's primary energy source. These resources include geothermal, ocean thermal (OTEC), solar photovoltaic, biomass, wind, and hydropower. Although the State has made progress in alternative energy technologies, only geothermal currently provides a potential for firm, reliable electricity. It is the only commercially mature, indigenous resource available in large quantities that can be converted to baseload (24-hour-per-day) electricity. Other alternative energy resources, such as solar and wind technologies, do not provide firm, baseload power and are not economically feasible at this time.

MECO has contributed to and constructed facilities for alternative and renewable energy resources, such as wind and hydroelectric power. It also has power purchase contracts with independent power producers. These power purchase contracts are based on alternative and renewable technologies. Examples include sugar cane bagasse and biomass-fueled steam turbine generators. While extensive dependence on such contracts can increase supply risks, MECO has evaluated and continues to evaluate IPP alternatives and renewable energy power supply offers.

After examining the alternatives to this project (including coal, non-firm renewable energy sources such as wind or hydro power, increased DSM programs, and IPP proposals), MECO has determined that the proposed Waena Generating Station is the only reasonable way to meet its PUC obligations of providing high-quality, reliable service at the least cost to the customer within the necessary time frame.

MECO acknowledges that, in making the decision to expand with additional oil-fired units, it is contradicting the objective of energy self-sufficiency. As the project comes on-line, however, it will be possible to retire less fuel efficient units, and the overall ratio of fuel consumption to megawatts produced should improve. In addition, MECO continues to pursue long-term conservation measures and alternative fuel sources that will lessen the dependency on imported fossil fuels.

5.6 State Underground Injection Control Program

In 1984, the State Department of Health established the underground injection control (UIC) program, Administrative Rules, Title 11, Chapter 23, "Underground Injection Control." The purpose of the program is to protect the groundwater resources from pollution by subsurface wastewater disposal. Maps have been established that delineate a boundary line known as the "UIC line." Land that is makai of the UIC line is not restricted from disposal by underground injection. This project site is makai of the UIC line, as shown in Figure 4-2. Injection wells are permitted in this area by the Department of Health.

5.7 Maui County General Plan

The General Plan of the County of Maui was adopted in 1980 and updated in 1990. The General Plan is a statement of the long-range social, economic, environmental, and design objectives for the general welfare and prosperity of the people of Maui. The Maui General Plan contains over 20 different objectives, each with various policies for implementation. These objectives follow five major themes:

1. Protect Maui County's agricultural land and rural identity
2. Prepare a directed and managed growth plan

3. Protect Maui County's shoreline and limit visitor industry growth
4. Maintain a viable economy that offers diverse employment opportunities for residents
5. Provide for needed residential housing

The following objectives and polices pertain specifically to the proposed Waena Generating Station:

B. *Land Use*

Objective 1 *To preserve existing geographic, cultural and traditional community lifestyles by limiting and managing growth through environmentally sensitive and effective use of land.*

Policy b *Provide and maintain a range of land use districts sufficient to meet the social, physical, environmental and economic needs of the community.*

Objective 2 *To use the land within the County for the social and economic benefit of all the County's residents*

Objective 3 *To preserve lands that are well suited for agricultural pursuits*

Policy a. *Protect prime or productive agricultural lands from competing non-agricultural land uses.*

Policy d. *Discourage the conversion of productive or potentially productive agricultural lands to non-agricultural uses.*

The proposed Waena Generating Station will remove approximately 66 acres of prime agricultural land from active production. However, this amount represents only a small portion of the over 36,000 acres of land that HC&S has in production on the Island of Maui. In selecting the site for the proposed project, MECO examined several different areas which were not on prime agricultural lands. However, the results of the various environmental analyses and discussions with landowners determined that the current site was the most feasible for construction and operation of the generating station.

Conversion of the land from agricultural use to power generation will have no discernible impact upon the overall agricultural production on the Island of Maui. In addition, providing the appropriate land use for the proposed project will ensure the provision of sufficient electricity to meet the social and economic needs of the community.

E. Public Utilities and Facilities

Objective 1 To anticipate and provide public utilities which will meet community needs in a timely manner.

Policy a. Maintain all power and utility systems so as to meet public health and safety standards.

Policy b. Encourage new and expanded power generation facilities to be community planned based on sound land use and environmental planning principles.

Policy c. Assure the availability of power systems and sources that meet public health and safety standards.

Policy d. Locate energy producing plants in areas where they will not create health hazards.

The selection of the site for the proposed Waena Generating Station was made only after careful consideration of all environmental and community concerns. Due to its distance from major sensitive receptors, the construction and operation of the proposed facility is not anticipated to have significant environmental impacts nor will it create a health hazard. In addition, all aspects of the plants design, construction, and operation will follow applicable health and safety standards. The construction and operation of the proposed Waena Generating Station will meet the objective by allowing the timely provision of electrical power to meet community needs.

5.8 Wailuku-Kahului Community Plan

The Wailuku-Kahului Community Plan, one of nine Community Plans for Maui County, is mandated by the Charter of Maui County and the Maui County General Plan. The purpose of the Community Plan is to provide a relatively detailed scheme for implementing the objectives and policies of the County General Plan relative to the Wailuku-Kahului region. Contained in the plan are the desired sequence, patterns, and characteristics of future developments for the region as well as statements of standards and principles with respect to development and sequencing of future developments. The Community Plan is a guide to making decisions regarding the development in the region. Community Plans are updated every ten years. The current Wailuku-Kahului Community Plan was adopted in 1987. Revisions and updates to the existing Community Plan are currently being considered by the Maui County Council.

The recommendations contained within the Community Plan are supported by map exhibits which display recommended land use patterns, design guidelines, and transportation routes and public facilities. The current Community Plan designation for the site of the proposed Waena Generating Station is "Agricultural," which does not allow industrial uses.

Construction and operation of the generating station will require a change in the existing designation to "Heavy Industrial."

5.8.1 Existing Wailuku-Kahului Community Plan

The Community Plan recommendations adopted in 1987 were developed in response to major community concerns in the 1980s. Some of the basic issues addressed by the Community Plan include:

- Future growth
- Preservation of agricultural lands
- Preservation of agricultural communities
- Affordable housing
- Revitalization of Wailuku Town
- Compliance with other laws

Recommendations within the 1987 Community Plan emphasized actions centered around Wailuku and Kahului towns. Virtually no recommendations concerned the provision of infrastructure. Recommendations that could apply to the proposed Waena Generating Station include:

Environment

a. *Preserve agricultural lands as a major element of the open space setting which borders the various communities within the planning region.*

Energy

b. *Promote the use of alternative energy sources, such as biomass, wind, and solar.*

The proposed Waena Generating Station will take 65.7 acres out of agricultural production, which represents only a small percentage of the over 36,000 acres remaining under HC&S production. In addition, although the site of the proposed project is in an open space area, the area is not bordering any of the various communities within the planning region.

No vacant lands designated "Heavy Industrial" exist in any of the Community Plans affecting Central Maui, making it necessary to request a designation change to accommodate the project. Existing "Heavy Industrial" designated areas consist of HC&S's Paia and Puunene Sugar Mills, Kahului Harbor, and the Maui Land & Pineapple Cannery.

During the site selection and IRP processes, MECO considered the use of alternative energies, including biomass, wind, and solar power. However, these alternative energy sources are currently not economically feasible to provide baseload energy to the Island of Maui.

Because the purpose and need for the proposed Waena Generating Station is to provide for the increasing demand for energy forecast on the Island of Maui, the energy the facility provides will allow the County of Maui to implement many of the objectives and recommendations of the Community Plan, specifically those pertaining to supporting economic growth and the provision of health and safety services.

5.8.2 Proposed Wailuku-Kahului Community Plan Update

As a part of the 10-year Community Plan update process, changes to the 1987 Community Plan have been proposed to the Maui County Council for consideration. Some of the basic problems identified during the update process included:

- Airport and harbor facilities
- Public infrastructure
- Circulation and parking
- Beautification and litter control
- Elderly and youth services
- Recreational and community facilities
- Affordable housing

Although still under consideration by the Maui County Council, some of the specific recommendations contained within the Community Plan update which pertain to the proposed Waena Generating Station include:

Environment

1. *Preserve agricultural lands as a major element of the open space setting which borders the various communities within the planning region.*

7. *Minimize noise, water, and air pollution from industrial uses, electric power generating facilities, and wastewater treatment plants.*

Housing

6. *Coordinate the planning, design, and construction of public infrastructure improvements with major residential projects that have an affordable housing component.*

7. *Plan, design, and construct off-site public infrastructure improvements in anticipation of residential, commercial, and industrial developments defined in the Community Plan*

Government

5. *Insure that adequate infrastructure is or will be available to accommodate planned development.*

Land Use

1. *Insure that adequate lands are available to support the region's present and future agricultural activities.*

Infrastructure

Goal

Timely and environmentally sound planning, development, and maintenance of infrastructure systems which serve to protect and preserve the safety and health of the region's residents, commuters, and visitors...

Energy

1. *Promote the use of alternative energy sources, such as biomass, wind, and solar.*

The proposed Waena Generating Station is planned to meet the increasing need for electricity on the Island of Maui for the next 30 years. Planning and construction of the facility at this time is done to insure that adequate resources are available to industry, commerce, housing, and public services as they develop.

Although the generating station will displace 65.7 acres of agricultural use, the amount of land represents only a small percentage of the over 36,000 acres currently under production by HC&S. In addition, the site of the proposed generating station was selected because it minimized noise, water, and air quality impacts produced by the facility.

During the site selection and IRP processes, MECO considered the use of alternative energies, including biomass, wind, and solar power. However, these alternative energy sources currently are not economically feasible to provide baseload energy to the Island of Maui.

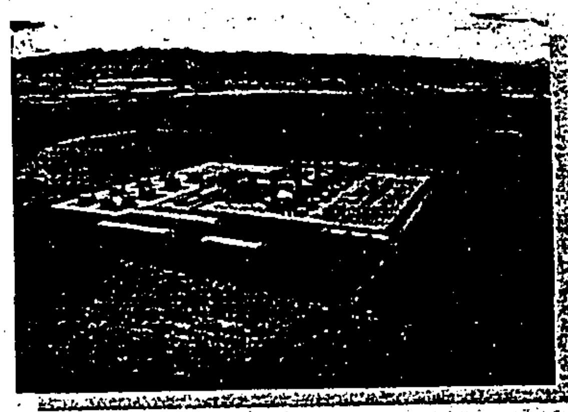
Because the purpose and need for the proposed Waena Generating Station is to provide for the increasing demand for energy forecast on the Island of Maui, the energy the facility provides will allow the County of Maui to implement many of the objectives and recommendations of the Community Plan, specifically those pertaining to supporting economic growth and the provision of health and safety services.

5.9 Maui County Zoning Code

The site of the proposed Waena Generating Station is currently governed under the Interim Zoning Provision as established under Chapter 19.02 of the Maui County Code. The purpose and intent of the interim zoning provision is to provide interim zoning regulations pending the formal adoption of a comprehensive zoning ordinance and map which are deemed as necessary in order to:

- Encourage the most appropriate use of the land
- Conserve and stabilize the value of property
- Prevent certain uses that will be detrimental to existing uses
- Protect the health, safety and welfare of the people of the County

MECO will submit a request to change the site's current zoning from "Interim" status to a "Heavy Industrial" classification under the Comprehensive Zoning Provisions contained in Chapter 19.04, Maui County Code. An "M-2 Heavy Industrial District" as defined under Chapter 19.26, Maui County Code, allows for uses which "may be obnoxious or offensive by reason of emission of odor, dust, smoke, gas, noise, vibration and the like and not allowed in any other district."



CHAPTER SIX

TOPICAL ISSUES

Chapter 6

Topical Issues

6.1 The Relationship Between Short-Term Uses and Long-Term Productivity

Short-term uses of the biophysical components of the environment include direct construction-related disturbances and direct impacts associated with an increase in activity that occurs in less than 5 years. Long-term uses of the environment include those impacts occurring over a period of more than 5 years, including permanent resource loss.

Short-term uses associated with the proposed Waena Generating Station and transmission lines include noise and minor traffic disruptions associated with construction of the facility and installation of the transmission lines. Long-term impacts will occur from the change in the visual environment by the addition of the facility to the Central Maui landscape. Air emissions produced by the facility will also decrease the criteria pollutant increments available to future new sources under the Prevention of Significant Deterioration (PSD) regulations.

Electrical energy is a resource that has become an indispensable part of life. Electric utility companies have the responsibility of providing reliable electric service at a reasonable cost to the consumer. Every effort should be made to conserve electricity, and new sources of energy production also need to be developed. As it becomes older, equipment runs less efficiently, uses more natural resources, and results in higher costs to the user. On the Island of Maui, population increases and the planned retirement of older equipment are creating the need for additional electrical generating capacity.

The population of the Island of Maui has grown dramatically over the last two decades. Overall population and economic growth on the Island of Maui is expected to increase. The proposed Waena Generating Station will best serve the long-term electric needs of the Island of Maui. The site is removed from population centers and sensitive receptors, poses no threat to endangered wildlife or archaeological resources, and is suitable from air quality and water supply/disposal standpoints.

6.2 Irreversible and Irretrievable Commitments of Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that use of these resources will have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (for example, energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (for example, extinction of a threatened or endangered species).

The development and construction of the proposed project will result in the irreversible and irretrievable commitment of certain natural and fiscal resources. Major resource commitments include the land on which the project is located and on which the facility will be constructed, as well as the money, construction materials, labor, and energy. The impacts of using these resources must be weighted against the expected positive socioeconomic benefits to be derived from the project versus the consequences of taking no action or of adopting another, less reliable alternative.

MECO's decision to continue the use of diesel fuel, rather than other fuel sources, is based on the economics of providing the required power within the necessary time frame. The proposed Waena Generating Station will allow the retirement of older, less fuel efficient units. In addition, the planned incremental addition of units over a period of several years will allow MECO to continue to evaluate the economics of alternative technologies and fuel sources. MECO is committed to the development of feasible, cost-effective alternative fuels and power sources and increased conservation measures to lessen dependency on imported fossil fuels.

6.3 Adverse Impacts that Cannot be Avoided

Because of the general nature of the topography of the Central Maui area, the proposed Waena Generating Station will be visible from areas located along the slopes of Haleakala. However, because of the distances of the proposed facility from the nearest viewing areas, the impact is not significant.

The loss of 65.7 acres of land currently under sugar cane cultivation also impacts the County's agricultural resources. However, the 65.7 acres represents a small portion of the over 36,000 acres under production by Hawaiian Commercial and Sugar Company (HC&S). HC&S also has the ability to replace these 65.7 acres by utilizing irrigation. Therefore, the impact to agricultural lands is insignificant.

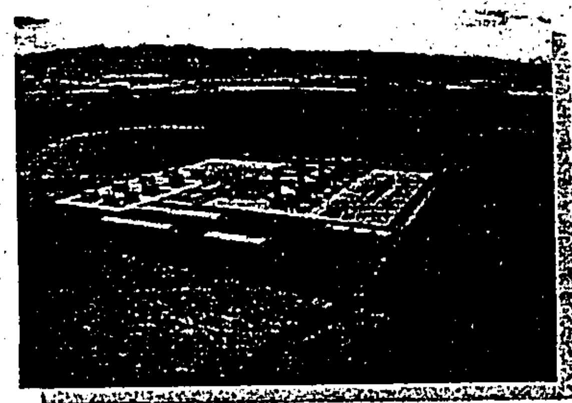
6.4 Unresolved Issues

Unresolved issues are those that cannot be answered at the present time or are unanswerable. Because the proposed Waena Generating Station has not been designed, several engineering-related issues remain unresolved, including the design of drainage improvements, locations of groundwater withdrawal and injection wells, and best available control technology for air emissions control. These issues will be fully resolved during the final engineering and design phases of the project and submitted to the appropriate federal, state and county agencies for approvals. The unresolved issue relating to the exact water quality of the underlying aquifer at the project site will be resolved by drilling a test well as soon as it is practical.

The exact nature of impacts to air quality and the mitigation measures that will be necessary are still unresolved at this time. Prior to construction of the proposed generating facility, MECO will perform extensive air modeling for review by the State of Hawaii Department of Health (DOH). During this modeling, if the results show that any air quality standards will be exceeded, appropriate mitigation measures will be identified. Final resolution of this issue will be determined during the PSD/Covered Source Air Permit review performed by the DOH. Possible measures to address this issue may include any of the following:

- Changing the type of fuel
- Raising the stack heights
- Scaling back the scope and size of the project
- Reducing the operating hours
- Determining type of air emission reduction equipment (BACT)

A final long-term unresolved issue associated with this proposed project concerns the commercial development of alternative energy sources. Although the development of technologies using renewable energy sources will eventually reduce our current reliance on fossil fuels for electricity generation, the timing of such a transition remains unclear. MECO acknowledges this issue with its phased, incremental development. The development and feasibility of alternative technologies will be continuously monitored for possible applications within the future Waena increments. MECO is currently engaged in a long-range energy planning effort referred to as integrated resource planning. This effort includes evaluation of existing energy resources, alternative energy resources, and conservation programs that ultimately may lead to reduced reliance on nonrenewable resources for energy production.



CHAPTER SEVEN

PUBLIC PARTICIPATION AND CONSULTATION

Chapter 7

Public Participation and Consultation

7.1 Introduction

Public participation during the Waena Generating Station project has consisted of a variety of meetings and briefings held between Maui Electric Company, Limited (MECO) and the public and interested agencies. The goal of these meetings was to solicit information and comments to use in both the selection of the preferred project site and in the preparation of the environmental impact statement.

7.2 Parties Consulted During Site Selection Process

During the final site selection process in 1995, several community and agency meetings and presentations were held within the Kihei, Kahului, Makawao, Kula, and Paia areas. These meetings were held to solicit comments on the three remaining alternative sites under consideration. Meetings which took place during this phase of the project included:

• Kihei Community Association General Meeting	May 16, 1995
• Kula Community Association Board Meeting	June 1, 1995
• Kihei Community Association General Meeting	June 20, 1995
• Pukalani Community Association General Meeting	June 29, 1995
• Presentation to Maui County Mayor	August 15, 1995
• Kula Farmers/Maui Farm Bureau Meeting	August 15, 1995
• Kula Community Association Meeting	August 17, 1995
• Makawao Main Street Association General Meeting	August 23, 1995
• Presentation to Maui County Planning Commission	October 10, 1995
• Presentation to Maui County Council	November 2, 1995
• Kahului Town Association Meeting	November 14, 1995

7.3 Parties Consulted During Preparation of the Draft EIS

7.3.1 EIS Preparation Notice

The Environmental Impact Statement Preparation Notice (EISPN) for the proposed 232-MW Waena Generating Station was published by the Office of Environmental Quality Control (OEQC) in the Environmental Bulletin on March 8, 1997. The deadline for receiving scoping comments for the Draft EIS was April 7, 1997. The EISPN and a copy of the Environmental Assessment prepared for the project were mailed to the OEQC distribution list as well as to Maui County elected officials, adjacent landowners, and others upon request. Responses indicating that the consulted party had either no comments or would defer comments until after reviewing the Draft EIS were received from the following:

- Department of Agriculture
- Geological Survey, Water Resources Division
- State of Hawaii Department of Accounting and General Services
- State of Hawaii Department of Education
- County of Maui Department of Parks and Recreation

Substantive comments were received from the following agencies and organizations:

- Department of the Army
- U.S. National Parks Service
- State of Hawaii Department of Business, Economic Development & Tourism
- State of Hawaii Department of Defense
- State of Hawaii Department of Hawaiian Home Lands
- State of Hawaii Department of Health
- State of Hawaii Historic Preservation Division
- State of Hawaii Housing Finance and Development Corporation
- State of Hawaii Office of Environmental Quality Control
- State of Hawaii Office of Hawaiian Affairs
- State of Hawaii Department of Transportation
- County of Maui, Board of Water Supply
- County of Maui Department of Public Works and Waste Management
- Sierra Club, Hawaii Chapter

Comment letters received and responses returned are included at the end of Section 7.3. Issues raised within the comment letters are listed in Table 7-1.

7.3.2 Public Scoping Meetings

Three public scoping meetings were held in the Central Maui and Upcountry Maui areas during the scoping period for the purpose of soliciting comments and public input on items to be covered in this EIS. Announcements for these meetings were published in the Maui News. The three meetings held were:

- Upcountry Swimming Complex, Pukalani March 18, 1997
- Kihei Elementary School March 19, 1997
- Maui Arts and Cultural Center, Kahului March 20, 1997

Combined attendance at the three meetings consisted of approximately 12 members of the general public. A summary of the meeting presentations and comments received are contained in Appendix K. Issues raised during the three public scoping meetings are included in Table 7-1.

7.3.3 Agency Meetings

In addition to the public meetings, MECO representatives met and consulted with the following agencies and organizations during the preparation of the Draft EIS:

- County of Maui Department of Planning
- County of Maui Department of Public Works
- County of Maui Department of Water Supply
- State of Hawaii Department of Transportation, Maui Representative
- State of Hawaii Department of Transportation, Airports Division
- State of Hawaii Department of Agriculture
- State of Hawaii State Land Use Commission
- Alexander & Baldwin - Hawaii
- Hawaiian Commercial & Sugar

Table 7-1
Issues Raised During EIS Public Scoping Period
MECO Waena Generating Station

Category of concern	Author/Agency/Group	Date	Comments
Air Quality	Gill, Gary Director, State Office of Environmental Quality Control	4/4/97	Include data on air quality
	Anderson, Bruce S. Deputy Director for Environmental Programs State Department of Health	4/10/97	Include air pollution and permitting requirements relating to the state and national ambient air quality standards, air quality increments, and Best Available Control Technology Include types of air pollution controls that will be installed Include existing ambient air quality levels, local meteorology and dispersion conditions in the area of the proposed project Include emissions and air quality impact of $PM_{2.5}$
	Price, Sr., Roy C. Vice Director of Civil Defense Dept. of Defense	3/31/97	Effect of exhaust on tourism
	Notar, John P. Meteorologist, National Parks Service Policy, Planning and Permit Review Branch	4/7/97	Discuss quantified impacts of SO_2, particulate, and NOx emissions to the park using a more refined complex terrain model than the EPA COMPLEX I model Describe impacts to the park using either the EPA Rough Terrain Dispersion Model (RTDM), the EPA Complex Terrain Dispersion Model (CTDM) or its screening version CTSCREEN. Perform a coherent plume visibility analysis with EPA VISCREEN model
	Okamura, Ken Maui County Farm Bureau	3/18/97	Impacts of air emissions on upcountry agricultural crops Types of emissions and concentration levels Rates of emissions Impacts of "Maui Vortex" Impacts on specific crops

Table 7-1
Issues Raised During EIS Public Scoping Period
MECO Waena Generating Station

Category of concern	Author/Agency/Group	Date	Comments
Air Quality, con't	Jencks, Charlie Director, Maui Co. DPW	1/27/97	How about air quality?
	Miyaguchi, Takeo Maui Farmers Exchange	3/18/97	Impacts on sensitive crops
	Eager, Harry The Maui News	3/18/97	Monitoring air quality after completion of project Frequency of air quality monitoring Worst-case scenario after completion of project (cumulative air quality impacts)
	Suyama, Colleen Maui Planning	1/27/97	Impact to air quality on residential areas
	Jim Williamson	3/19/97	Impacts of NOx and sulfur dioxide (EPA's standards and scrubbers) Accuracy of EPA's model for air circulation and the effect of "Maui Vortex"
	Moser, Steven	3/20/97	Impact on central and upcountry Maui, esp. if acceptable levels of NOx, sulfur dioxides, carbon monoxides, particulates, and ozone will be exceeded Impact of haze and possible negative economic cost on isle tourism Impact on isle crops; economic costs of crop losses Ability of State DOH to adequately monitor project for air quality maintenance
Alternative Fuels	Watson, Kali Chairman, Hawaiian Homes Commission Dept. of Hawaiian Home Lands	4/4/97	Are diesel oil-fired units best in terms of economic efficiency and pollution
	Notar, John P. Meteorologist, National Parks Service	4/7/97	Discuss alternative fuels including water emulsified fuels to reduce emissions
	Frankel, David Kimo Director, Sierra Club, Hawaii Chapter	3/21/97	Discuss alternative fuels

Table 7-1
Issues Raised During EIS Public Scoping Period
MECO Waena Generating Station

Category of concern	Author/Agency/Group	Date	Comments
Alternative Fuels, con't	Anderson, Bruce S. Deputy Director for Environmental Programs State Department of Health	4/10/97	Include feasibility of using cleaner burning fuels (naphtha and low sulfur diesel)
	Suyama, Colleen Maui Planning	1/27/97	Possible connection to the Central Maui Landfill for energy alternatives
	Jim Williamson	3/19/97	Alternative sources of fuel (Economies of Scale) Dependence upon fossil fuel
	Shepherd, Glenn	3/20/97	Ongoing research for alternative fuel sources Fuel flexibility; use of low-sulfur coal Type of fuel to be used for new station
	Sessums, Jerry	3/20/97	Fuel flexibility; utilizing methane as source of fuel from the nearby landfill
	Moser, Steven	3/20/97	Consideration of renewable resources as alternative
Alternative Sites	Watson, Kali Chairman, Hawaiian Homes Commission Dept. of Hawaiian Home Lands	4/4/97	Is site in optimum location relative to overall power system? What alternative sites considered?
	Suyama, Colleen Maui Planning	1/27/97	Alternative sites Alternative uses for the site
	Frankel, David Kimo Director, Sierra Club, Hawaii	3/21/97	Discuss alternative sites
	Oshiro, Roy S. Executive Director, Housing Finance and Development Corp.	4/2/97	Is HC&S capable of supplying more power in the future? How much power can Pioneer Mill supply on an intermittent basis? Discuss future power potential from Paia and Pioneer Mills
	Shepherd, Glenn	3/20/97	Potential to use quarry or a site near the quarry Site selection process Potential to expand Maalaea
	Gill, Gary Director, State Office of Environmental Quality Control	4/4/97	Discuss agreement not to expand Maalaea Plant

Table 7-1
Issues Raised During EIS Public Scoping Period
MECO Waena Generating Station

Category of concern	Author/Agency/Group	Date	Comments
Alternative Technologies	Frankel, David Kimo Director, Sierra Club, Hawaii Chapter	3/21/97	Discuss alternative technologies
	Egged, Rick Director, Office of Planning Department of Business, Economic Development and Tourism	4/7/97	Discuss long-term integrated resource management plan Discuss demand-side management programs and goals
	Notar, John P. Meteorologist, National Parks Policy, Planning and Permit Review Branch	4/7/97	Discuss the full range of control technology feasible for diesel-fired turbines such as Selective Catalytic Reduction
	Suyama, Colleen Maui Planning	1/27/97	Alternative technologies
	Shepherd, Glenn	3/20/97	Energy conservation programs
Archaeology	Hibbard, Don Administrator, State Historic Preservation Division	3/20/97	Probably "no effect" on significant historic sites
Construction	Suyama, Colleen Maui Planning	1/27/97	Construction impacts (including drainage)
Costs and Schedule	Watson, Kali Chairman, Hawaiian Homes Commission Dept. of Hawaiian Home Lands	4/4/97	Estimated incremental and total costs
	Moser, Steven	3/20/97	Overall cost to the ratepayer Effect of future increases in fuel costs
	Shepherd, Glenn	3/20/97	Time needed to complete project
Drainage	Lee, Lloyd Maui County Department of Public Works	4/7/97	Drainage improvements will be needed. Site is located in a large drainage basin
Education	Steel, Hana	3/19/97	Community education plan for the new power station
EMF	Ross, Martha Deputy Administrator State Office of Hawaiian Affairs	3/20/97	Potential hazards of electric and magnetic fields
Future of MECO's other power plant facilities	Williamson, Jim Steel, Hana	3/19/97	Future plans for MECO's existing power plants after completion of proposed Waena plant

Table 7-1
Issues Raised During EIS Public Scoping Period
MECO Waena Generating Station

Category of concern	Author/Agency/Group	Date	Comments
Future of MECO's other power plant facilities, con't	Shepherd, Glenn	3/20/97	Future plans for Kahului and Maalaea Power Plants after completion of proposed project
Growth Issues	Williamson, Jim	3/19/97	Growth rate of the island compared to the size of the power station
	Moser, Steven	3/20/97	Will there be an oversupply of power to the island? Increased available energy might stimulate additional growth Stimulation of industrial growth in adjacent properties
Infrastructure	Blane, David Maui Planning Director	1/21/97	Infrastructure needs must also be identified for the full project and a reasonable phasing plan developed
Land Use	Moser, Steven Shepherd, Glenn	3/20/97	Appropriateness of removing prime agricultural lands from production for project
	Watson, Kali Chairman, Hawaiian Homes Commission Dept. of Hawaiian Home Lands	4/4/97	Impacts of project on DHHL lands Operational impacts on surrounding community
	Shepherd, Glenn Steel, Hana	3/20/97	Future plans for the undeveloped portion of land fronting Pulehu Rd.
	Suyama, Colleen Maui Planning	1/27/97	Impacts on agricultural "A" lands
	Jencks, Charlie Director, Maui Co. DPW	1/27/97	Has MECO discussed with Alexander & Baldwin the use of the Hansen Road corridor? What will MECO do with the remnant parcel?
	Craddick, David Maui County Department of Water Supply	4/7/97	Does the site require a large lot subdivision?
Natural Hazards	Price, Sr., Roy C. Vice Director of Civil Defense Dept. of Defense	3/31/97	Install civil defense siren simulator Proximity of fuel storage to sugarcane
	Mizue, Paul Acting Chief, Planning and Operations Division, Corps of Engineers, Dept. of the Army	3/25/97	No impact on waters on the U.S. Site located in Flood Zone C

Table 7-1
Issues Raised During EIS Public Scoping Period
MECO Waena Generating Station

Category of concern	Author/Agency/Group	Date	Comments
Noise	Eager, Harry The Maui News	3/18/97	Impacts of noise Buffer zone around plant Comparable levels of noise
Public Safety	Craddick, David Maui Dept. of Water Supply	4/7/97	Site will need to develop its own approved fire suppression system
Soils	Shepherd, Glenn	3/20/97	Soil classifications for all of the alternative sites Soils productivity for the chosen for the project site
Solid and Hazardous Waste	Steel, Hana	3/19/97	Recycling program for the proposed plant
	Gill, Gary Director, State Office of Environmental Quality Control	4/4/97	Include data on hazardous waste generation and handling
	Jencks, Charles Director County of Maui Department of Public Works and Waste Management	4/16/97	Construction waste shall be disposed at the Maui Demolition and Construction Landfill on North Kihei Road
	Sairot, Bob Maui County State DOT	4/7/97	Types and quantities of hazardous materials transported
Traffic and Transportation	Hayashida, Kazu Director, State DOT	3/24/97	Traffic impacts on State facilities
	Moser, Steven	3/20/97	Hazards to air navigation for Kahului Airport
	Sessums, Jerry	3/20/97	Alternative ways to access the site Widening of Pulehu Road to accommodate large fuel trucks
	Jencks, Charlie Director, Maui Co. DPW	1/27/97	How many gallons of fuel will be stored in the tank farm? Will you truck it there? What about the Federal Aviation Administration?
	Sairot, Bob Maui County State DOT Representative	4/7/97	Incorporation of the Kahului Runway Expansion road realignments into the EIS Potential wear and tear to Pulehu Road from construction and fuel transport

Table 7-1 Issues Raised During EIS Public Scoping Period MECO Waena Generating Station			
Category of concern	**Author/Agency/Group**	**Date**	**Comments**
Traffic and Transportation, con't	Lee, Lloyd Maui County Department of Public Works	4/7/97	County has plan to upgrade Pulehu Road into a major collector Reclassification of site to urban would trigger road and frontage improvements Pulehu Road is a substandard road and some improvements to its subsurface may be necessary to handle the heavier trucks
	Suyama, Colleen Maui Planning	1/27/97	Traffic and Fuel Transport on Pulehu Road
Transmission Lines	Williamson, Jim	3/19/97	Reliability/redundancy of the proposed transmission lines
	Sairot, Bob Maui County State DOT Representative	4/7/97	Placement of new transmission lines
Visual Resources	Moser, Steven	3/20/97	Night visual pollution due to lights
	Jencks, Charlie Director, Maui Co. DPW	1/27/97	How about the viewshed?
	Frankel, David Kimo Director, Sierra Club, Hawaii Chapter	3/21/97	Discuss aesthetic impacts
Water/ Wastewater	Williamson, Jim	3/19/97	Water sources for the new project
	Suyama, Colleen Maui Planning	1/27/97	Water (Usage and impact to ground water.)
	Jencks, Charlie Director, Maui Co. DPW	1/27/97	What will MECO do for water?
	Anderson, Bruce S. Deputy Director for Environmental Programs State Department of Health	4/10/97	Address the impacts of injection Address well and injection well impacts, collectively Construction of injection wells will need a UIC permit Individual wastewater systems will have to be provided, and pre-construction approval will be required
	Oshiro, Roy S. Executive Director, Housing Finance and Development Corp.	4/2/97	Discuss possible reuse of treated effluent water for plant operations Discuss alternate ways of disposing waste water besides injection wells

Table 7-1
Issues Raised During EIS Public Scoping Period
MECO Waena Generating Station

Category of concern	Author/Agency/Group	Date	Comments
Water/ Wastewater, con't	Evanson, Mary	3/19/97	Drilling of wells for water Projected water demand after completion of project Re-use of water
	Sessums, Jerry	3/20/97	Proposed plans for stormwater and wastewater
	Craddick, David Maui County Department of Water Supply	4/7/97 4/25/97	A water treatment system may be required Impact on groundwater levels
	Moser, Steven	3/20/97	Increased aquifer salinity from increased pumping Viability of existing sustainable yield of aquifer given this and other area projects
Water Quality	Gill, Gary Director, State Office of Environmental Quality Control	4/4/97	Include data on ground and surface water quality in area
	Oshiro, Roy S. Executive Director, Housing Finance and Development Corp.	4/2/97	Is water quality a factor in plant maintenance
	Moser, Steven	3/20/97	Impacts of injection wells on aquifer water quality (e.g. types of pollutants and possible migration patterns)
	Evanson, Mary	4/20/97	Water quality tests at or near the site
No Comments at this Time	US Dept. of the Interior, US Geological Survey, Water Resources Division	3/13/97	
	US Dept. of Agriculture, Soil Conservation Service	3/31/97	
	State of Hawaii Dept. of Education	3/24/97	
	State of Hawaii Dept. of Accounting and General Services	4/4/97	
	County of Maui Dept. of Parks and Recreation	3/25/97	

7.3.4 Consulted Parties

The following is a list of agencies, organizations, and individuals who are currently consulted parties for the proposed 232-MW Waena Generating Station project. All parties on this list received copies of the EISPN and the environmental assessment prepared for this project and were invited to submit written scoping comments.

7.3.4.1 Federal Government

Commander
US Coast Guard
14th Coast Guard District
300 Ala Moana Blvd.
Honolulu, HI 96850

Commander
US Department of the Navy
Naval Base Pearl Harbor
Attn: Base Civil Engineer
Box 110
Pearl Harbor, HI 96860-5020

Head, Environmental Management Office
US Department of the Army
Directorate of Facilities Engineering
US Army Support Command Hawaii
Fort Shafter, HI 96858-5000

Mr. Paul Mizue
Acting Chief, Planning and Operations Division
US Department of the Army
Pacific Ocean Division, Corps of Engineers
Fort Shafter, HI 96858-5440

Regional Administrator
US Environmental Protection Agency
Region IX
75 Hawthorne St., 18th Floor
San Francisco, CA 94105

Director
US Department of Agriculture
Soil Conservation Service
P.O. Box 50004
Honolulu, HI 96850

Mr. William Meyer, District Chief
US Department of the Interior
Geological Survey, Water Res. Div.
677 Ala Moana Blvd., Rm. 415
Honolulu, HI 96813-5412

Director, US Dept. of the Interior
Fish and Wildlife Service
P.O. Box 50167
300 Ala Moana Boulevard
Honolulu, HI 96850

Director
US Dept. of the Interior
National Park Service
Haleakala National Park
P.O. Box 369
Makawao, HI 96768

Mr. John P. Notar, Meteorologist
US Dept. of the Interior
National Park Service
Policy, Planning and Permit Review Branch
Haleakala National Park
P.O. Box 369
Makawao, HI 96768

Director
US Dept. of Transportation
Federal Highways Administration
Division Administration
P.O. Box 50206
Honolulu, HI 96850

Mr. Kenneth M. Kaneshiro
State Conservationist
U.S. Department of Agriculture
PO Box 50004
Honolulu, HI 96850

7.3.4.2 State of Hawaii

Mr. Earl Yamamoto
State of Hawaii
Department of Agriculture
PO Box 22159
Honolulu, HI 96822

Mr. Michael Wilson
Director
State of Hawaii
Dept. of Land and Natural Resources
P.O. Box 621
Honolulu, HI 96809

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

Mr. Roy S. Oshiro, Executive Director
State of Hawaii
Dept. of Budget and Finance
Housing Finance & Development Corp.
677 Queen Street, Suite 300
Honolulu, HI 96813

Mr. Seiji Naya
Director
State of Hawaii
Department of Business, Economic
Development and Tourism
250 South Hotel St.
Honolulu, HI 96813

Mr. Bryan Kageyama
Maui District Representative
Department of Budget and Finance
Hawaii Public Utilities Commission
2264 Aupuni St.
Wailuku, HI 96793

Mr. Maurice Kaya
State of Hawaii
DBEDT
Energy Division
P.O. Box 2359
Honolulu, HI 96804-2359

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

Dr. Herman M. Aizawa
Director
State of Hawaii
Department of Education
P.O. Box 2360
Honolulu, HI 96804

Mr. Kali Watson
Chairman
State of Hawaii
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

Mr. Don Hibbard
Administrator
State of Hawaii
Dept. of Land & Natural Resources
Historic Preservation Division
33 South King Street, 6th Fl.
Honolulu, HI 96813

Mr. Lawrence Miike
Director
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801

Mr. Steve Takashima
State of Hawaii
Department of Transportation, Airports Division
869 Punchbowl St.
Honolulu, HI 96813

Ms. Esther Ueda, Executive Director
Land Use Commission
State of Hawaii Dept. of Business, Economic Development and Tourism
PO Box 2359
Honolulu, HI 96804

Rep. Michael White
State Capitol
Honolulu, HI 96813

Rep. Hermina Morita
State Capitol
Honolulu, HI 96813

Mr. Gary Gill, Director
State of Hawaii
Office of Environmental Quality Control
235 S. Beretania St., Suite 702
Honolulu, HI 96813

Mr. Rick Egged
Director
State of Hawaii
Office of State Planning
250 South Hotel Street
4th Floor
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Mr. Kazu Hayashida
Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

Mr. Bob Sairot
Maui County Representative
State of Hawaii
Department of Transportation
650 Palapala Dr.
Kahului, HI 96732

Ms. Martha Ross
Deputy Administrator
Office of Hawaiian Affairs
711 Kapiolani Blvd., Suite 500
Honolulu, HI 96813

Sen. Rosalyn Baker
State Capitol
Honolulu, HI 96813

Sen. Avery Chumbley
State Capitol
Honolulu, HI 96813

Mr. Doug Tom
Coastal Zone Management
State of Hawaii Dept. of Business, Economic Development and Tourism
PO Box 2359
Honolulu, HI 96804

7.3.4.3 County of Maui

Mr. Charles Jencks
Director
County of Maui
Department of Public Works
200 South High St.
Wailuku, HI 96793

Mr. Lloyd Lee
County of Maui
Department of Public Works
200 South High St.
Wailuku, HI 96793

Mr. Ken Okamura
Maui County Farm Bureau
P.O. Box 148
Kula, HI 96790

Mr. David Blane, Director
County of Maui
Planning Department
250 South High St.
Wailuku, HI 96793

Mr. Henry Oliva
Director
County of Maui
Department of Parks and Recreation
1580C Kaahumanu Ave.
Wailuku, HI 96793

Mr. Robert Carroll
Maui Planning Commission
County of Maui
250 S. High St.
Wailuku, HI 96793

Mr. Jerry Edlao
Maui Planning Commission
County of Maui
250 S. High St.
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Mr. David Craddick.
Director
County of Maui
Department of Water Supply
200 South High St.
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Ms. Colleen Suyama
County of Maui
Planning Department
250 South High St.
Wailuku, HI 96793

Dr. Hana Steel
County of Maui
200 South High St.
Wailuku, HI 96753

Ms. Moana Anderson
Maui Planning Commission
County of Maui
250 S. High St.
Wailuku, HI 96793

Ms. Barbara Long
Maui Planning Commission
County of Maui
250 S. High St.
Wailuku, HI 96793

Mr. William O. Nishibayashi
Maui Planning Commission
County of Maui
250 S. High St.
Wailuku, HI 96793

Ms. Louise Ross
Maui Planning Commission
County of Maui
250 S. High St.
Wailuku, HI 96793

Ms. Cindy Pojas-Smith
Maui Planning Commission
County of Maui
250 S. High St.
Wailuku, HI 96793

Mr. Joe Bertram
Maui Planning Commission
County of Maui
250 S. High St.
Wailuku, HI 96793

Councilmember Patrick Kawano
Maui County Council
200 S. High St.
Wailuku, HI 96793

Councilmember Kimo Apana
Maui County Council
200 S. High St.
Wailuku, HI 96793

Councilmember Alan Arakawa
Maui County Council
200 S. High St.
Wailuku, HI 96793

Councilmember Alice Lee
Maui County Council
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Wailuku, HI 96793

Councilmember Dennis Nakamura
Maui County Council
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Wailuku, HI 96793

Councilmember Sol Kaho'ohalahala
Maui County Council
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Wailuku, HI 96793

Councilmember Wayne Nishiki
Maui County Council
200 S. High St.
Wailuku, HI 96793

Councilmember J. Kalani English
Maui County Council
200 S. High St.
Wailuku, HI 96793

Maui County Cultural Resources
Commission
250 S. High St.
Wailuku, HI 96793

Councilmember Charmaine Tavares
Maui County Council
200 S. High St.
Wailuku, HI 96793

Mayor Linda Crockett-Lingle
200 S. High St.
Wailuku, HI 96793

Ms. Robbie Guard
Office of Economic Development
200 S. High St.
Wailuku, HI 96793

Mr. Kal Kobayashi, Energy Specialist
c/o Office of Economic Development
200 S. High St.
Wailuku, HI 96793

Mr. Travis Thompson, Director
Department of Finance
200 S. High St.
Wailuku, HI 96793

Fire Chief Ron Davis
c/o Kahului Fire Station
Kahului, HI 96732

Ms. Stephanie Aveiro, Director
Department of Housing and Human
Concerns
200 S. High St.
Wailuku, HI 96793

Chief Howard Tagomori
Maui Police Department
55 Mahalani St.
Wailuku, HI 96793

Mr. Kenzo Takumi
Maui Senior Citizens Planning and Coordinating Council
c/o Maui Economic Opportunity, Inc.
189 Kaahumanu Ave.
Kahului, HI 96793

7.3.4.4 University of Hawaii

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

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

7.3.4.5 Libraries

Head Librarian
State of Hawaii
Main Library
Hawaii Document Center
478 S. King Street
Honolulu, HI 96813

Head Librarian
University of Hawaii
Hamilton Library
Hawaiian Collection
2550 The Mall
Honolulu, HI 96822

Head Librarian
State of Hawaii Legislative Reference Bureau
State Capitol, Rm. 004
Honolulu, HI 96813

Head Librarian
Maui Community College Library
310 Kaahumanu Ave.
Kahului, HI 96732

State Archivist
State Archives
Iolani palace Grounds
Honolulu, HI 96813

Librarian
DBEDT Library
Capitol District 1, Fourth Floor
Honolulu, HI 96813

Head Librarian
Kahului Regional Library
90 School St.
Kahului, HI 96732

Head Librarian
Hana Public & School Library
P.O. Box 490
Hana, HI 96713

Head Librarian
Kihei Public Library
131 S. Kihei Rd.
Kihei, HI 96753

Head Librarian
Lahaina Public Library
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Lahaina, HI 96761

Head Librarian
Makawao Public Library
P.O. Box 647
Makawao, HI 96768

Head Librarian
Wailuku Public Library
251 High St.
Wailuku, HI 96793

Head Librarian
Molokai Public Library
P.O. Box 395
Kaunakakai, HI 96748

Head Librarian
Lanai Community School Library
P.O. Box 550
Lanai City, HI 96763

7.3.4.6 News Media

Editor
Honolulu Advertiser
605 Kapiolani Blvd.
Honolulu, HI 96813

City Editor
Honolulu Star Bulletin
P.O. Box 3080
Honolulu, HI 96813

Mr. Harry Eager
The Maui News
PO Box 550
Wailuku, HI 96793

Editor
Ka Molokai
P.O. Box 440
Kaunakakai, HI 96748

Editor
Haleakala Times
PO Box 1080
Makawao, HI 96768

Mr. Gary Kubota
Honolulu Star-Bulletin
PO Box 3080
Honolulu, HI 96813

7.3.4.7 Non-Governmental Organizations

Director of Environmental Health
American Lung Association
245 North Kukui Street
Honolulu, HI 96817

Hawaiian Electric Company
P.O. Box 2750
Honolulu, HI 96740

Director
Paia Main Street Association
PO Box 96779
Paia, HI 96779

Mr. James Lawrence
Kahului Town Association
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Kahului, HI 96732

Mr. Brian Miskae
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Director
Kula Community Association
PO Box 417
Kula, HI 96790

Jack Mueller
Director
Maalaea Community Association
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Ms. Debbie Nakama
Pukalani Community Association
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Pukalani, HI 96788

Mr. Henry Curtis
Executive Director
Life of the Land
1111 Bishop Street, Suite 503
Honolulu, HI 96813

Ms. Madelyn D'Enbeau
Makawao Main Street Association
3643 Makawao Avenue
Makawao, HI 96768

7.3.4.8 Other Interested Parties

Mr. Jim Williamson
672 Kumulani Dr.
Kihei, HI 96753

Mr. David Kimo Frankel
Director
Sierra Club, Hawaii Chapter
PO Box 2577
Honolulu, HI 96803

Dr. Steven Moser
Hawaii Medical Association
1883 Mill St.
Wailuku, HI 96793

Mr. Glenn Shepherd
477 S. Alu Rd.
Wailuku, HI 96793

GTE Hawaiian Tel
PO Box 2200
Honolulu, HI 96841

Jonathan Starr
S.R. 182
Hana, HI 96713

Mr. & Mrs. Jerry Sessums
210 Kaupea St.
Makawao, HI 96768

Ms. Mary Evanson
PO Box 694
Makawao, HI 96768

Mr. Takeo Miyaguchi
Maui Farmers Exchange
PO Box 295
Makawao, HI 96768

Jason Schwartz
Energy Exhange
PO Box 356, Suite 208
Paia, HI 96779

Scott Crawford
Maui Tomorrow
PO Box 429
Makawao, HI 96768

Chronicle Cablevision
350 Hoohana
Kahului, HI 96732

Jim Judge
662 Omaopio Rd.
Kula, HI 96790

Carl Freedman
4234 Hana Highway
Haiku, HI 96708

Ed Lindsey
Na Kupuna O Maui
1087 A Poobela Rd.
Makawao, HI 96768

Randall Moore
Hawaiian Commercial & Sugar
PO Box 266
Puunene, HI 96784

Mr. & Mrs. Gregory and Masako Westcott
PO Box 485
Haiku, HI 96708

Mr. Jeffery Parker
Tropical Orchid Farm
PO Box 170
Haiku, HI 96708

Mr. G. Stephan Holaday
Hawaiian Commercial & Sugar
PO Box 266
Puunene, HI 96784

USDA

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

P.O. Box 50004
Honolulu, HI
96850

Our People...Our Islands...In Harmony

March 31, 1997

RECEIVED
APR - 2 1997
CH2M HILL - HNL

Mr. Mark R. Willey, Project Manager
CH2M Hill, Inc.
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814-4530

Dear Mr. Willey:

Subject: Draft Environmental Assessment and Environmental Impact Statement Preparation Notice (EA/EISPN) - Maui Electric Company, Limited's 232-MW Waena Generating Station, Wailuku, Hawaii

We have reviewed the above mentioned document and have no comments to offer at this time.

Thank you for the opportunity to review this document.

Sincerely,

KENNETH M. KANESHIRO
State Conservationist

The Natural Resources Conservation Service works hand-in-hand with the American people to conserve natural resources on private lands.

AN EQUAL OPPORTUNITY EMPLOYER

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808 943.1133
Fax 808 941.8225

April 28, 1997

Mr. Kenneth M. Kaneshiro
State Conservationist
State of Hawaii
Department of Agriculture
PO Box 50004
Honolulu, HI 96850

Dear Mr. Kaneshiro:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
677 Ala Moana Boulevard, Suite 415
Honolulu, Hawaii 96813

RECEIVED
MAR 14 1997
CH2MHILL - HNL

March 13, 1997

Mr. Mark R. Willey
Project Manager
CH2M Hill, Inc.
1585 Kapiolani Blvd., Suite 1420
Honolulu, Hawaii 96814-4530

Dear Mr. Willey:

Subject: Draft Environmental Assessment and Environmental Impact Statement Preparation Notice (EISPN), Proposed Waena Power Generating Station, Maui Electric Company, Limited

The staff of the U.S. Geological Survey, Water Resources Division, Hawaii District, has reviewed the Draft Environmental Assessment and Environmental Impact Statement Preparation Notice (EISPN), and we have no comments to offer at this time.

Thank you for allowing us to review the report. We are returning it for your future use.

Sincerely,

William Meyer
District Chief

Enc.

CH2MHILL
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CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Mr. William Meyer
District Chief
US Department of the Interior
Geological Survey, Water Resources Division
677 Ala Moana Blvd., Rm. 415
Honolulu, HI 96813-5412

Dear Mr. Meyer:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P. O. BOX 119 HONOLULU HAWAII 96810

SAM CALLEJO
COMPTROLLER

MARY PATRICIA WATERHOUSE
DEPUTY COMPTROLLER

LETTER NO. (P)1268.7

APR 4 1997

APR - 7

Mr. Mark R. Willey
Project Manager
CH2M Hill
1585 Kapiolani Blvd., Suite 1420
Honolulu, Hawaii 96814-4530

Dear Mr. Willey:

Subject: Maui Electric Company, Ltd.
Proposed Waena Power Generating Station
EIS Preparation Notice

Thank you for the opportunity to review the subject document. The proposed project will have no impact on our facilities. Therefore, we have no comments to offer.

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

Sincerely,

GORDON MATSUOKA
State Public Works Engineer

RY:jk

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

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

Dear Mr. Matsuoka:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

BENJAMIN J. CAYETANO
GOVERNOR

RECEIVED APR - 2 1997

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

HERMAN M. AIZAWA, Ph.D.
SUPERINTENDENT

OFFICE OF THE SUPERINTENDENT

March 24, 1997

Mr. Mark R. Willey
Project manager
CH2M HILL, Inc.
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814

Dear Mr. Willey:

Subject: Waena Power Generating Station
Draft EA/EISPN
TMK 3-8-3: por. 1

The Department of Education has reviewed the subject EA/EISPN and has no comment on the proposed 232-megawatt electrical generation facility.

Thank you for the opportunity to respond.

Sincerely,

Herman M. Aizawa, PhD.
Superintendent

HMA:hy

cc: A. Suga, OBS
R. Murakami, MDO
B. Bonnet, MECO

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CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Dr. Herman M. Aizawa
Director
State of Hawaii
Department of Education
P.O. Box 2360
Honolulu, HI 96804

Dear Dr. Aizawa:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

DEPARTMENT OF
PARKS AND RECREATION
COUNTY OF MAUI

1580-C Kaahumanu Avenue, Wailuku, Hawaii 96793

LINDA CROCKETT LINGLE
Mayor
HENRY OLIVA
Director
ALLEN SHISHIDO
Deputy Director

(808) 243-7230
FAX (808) 243-7934

March 25, 1997

APR - 3

Mr. Mark R. Willey
Project Manager
CH2M HILL, INC.
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814-4530

Subject: **Draft Environmental Assessment for Maui Electric Company, Ltd. Waena Generating Station Project**

Dear Mr. Willey:

We have reviewed the Draft Environmental Assessment for the above subject and we have no comments or objections.

Thank you for the opportunity to review this material. Please feel free to contact me or Patrick Matsui at 243-7931 should you have any questions.

Sincerely,

HENRY OLIVA
Director

HO:PTM:ecq

mrwilley wpd

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CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Mr. Henry Oliva
Director
County of Maui
Department of Parks and Recreation
200 South High St.
Wailuku, HI 96793

Dear Mr. Oliva:

Subject: Maui Electric Company, Ltd. (MECO) Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF

March 25, 1997

RECEIVED
MAR 26 1997

Planning and Operations Division

Mr. Mark R. Willey
Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814

Dear Mr. Willey:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment (DEA) and Environmental Impact Statement Preparation Notice (EISPN) for the Waena Generating Station Project, Wailuku, Maui (TMK 3-8-3: por. 1). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act.

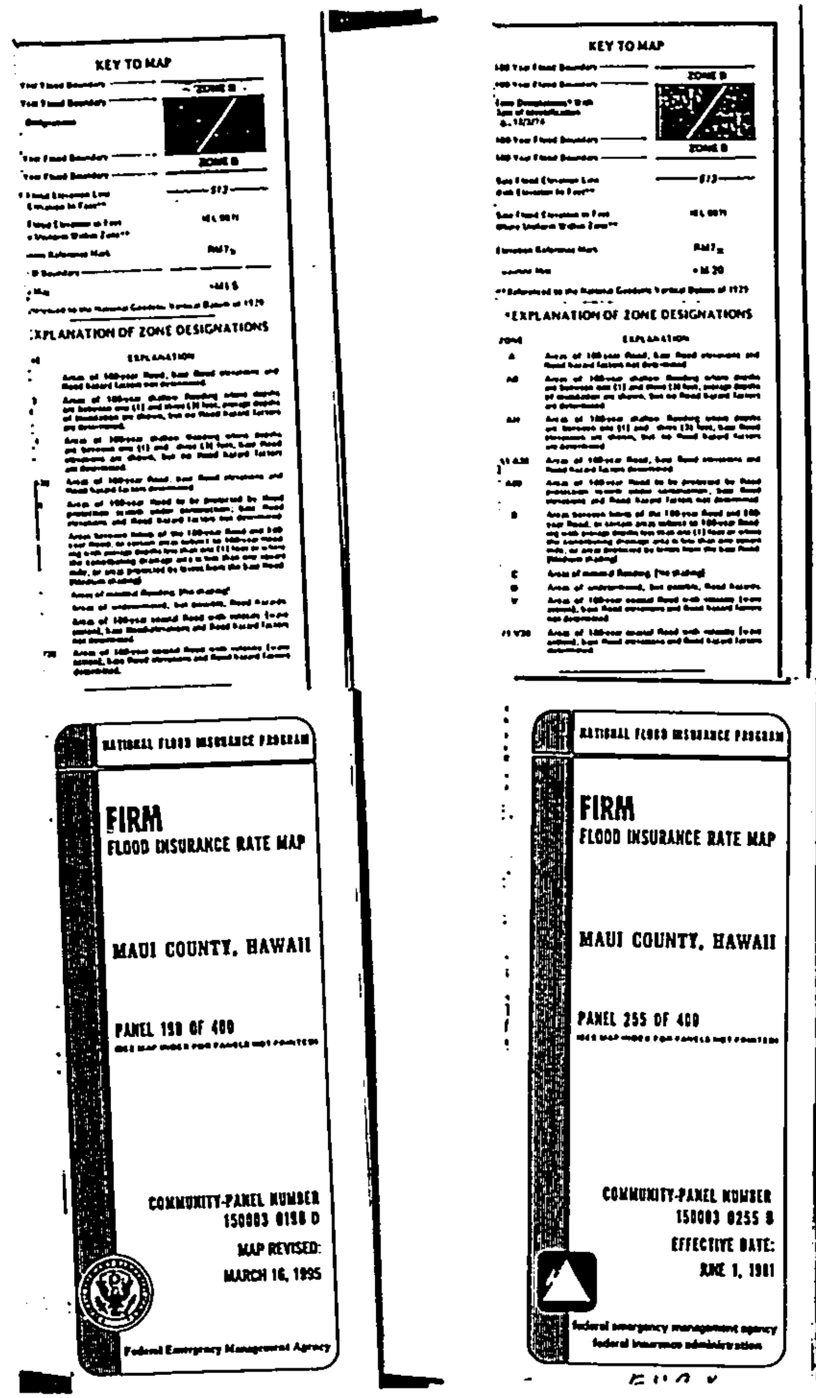
a. Based on the information provided, the project will not impact waters of the U.S.; therefore, a DA permit will not be required (file number PO970000133).

b. According to the enclosed Federal Emergency Management Agency's Flood Insurance Rate Map, panel numbers 150003 0255B (dated June 1, 1981) and 150003 0190D (dated March 16, 1995), the project site is located in Zone C (areas of minimal flooding).

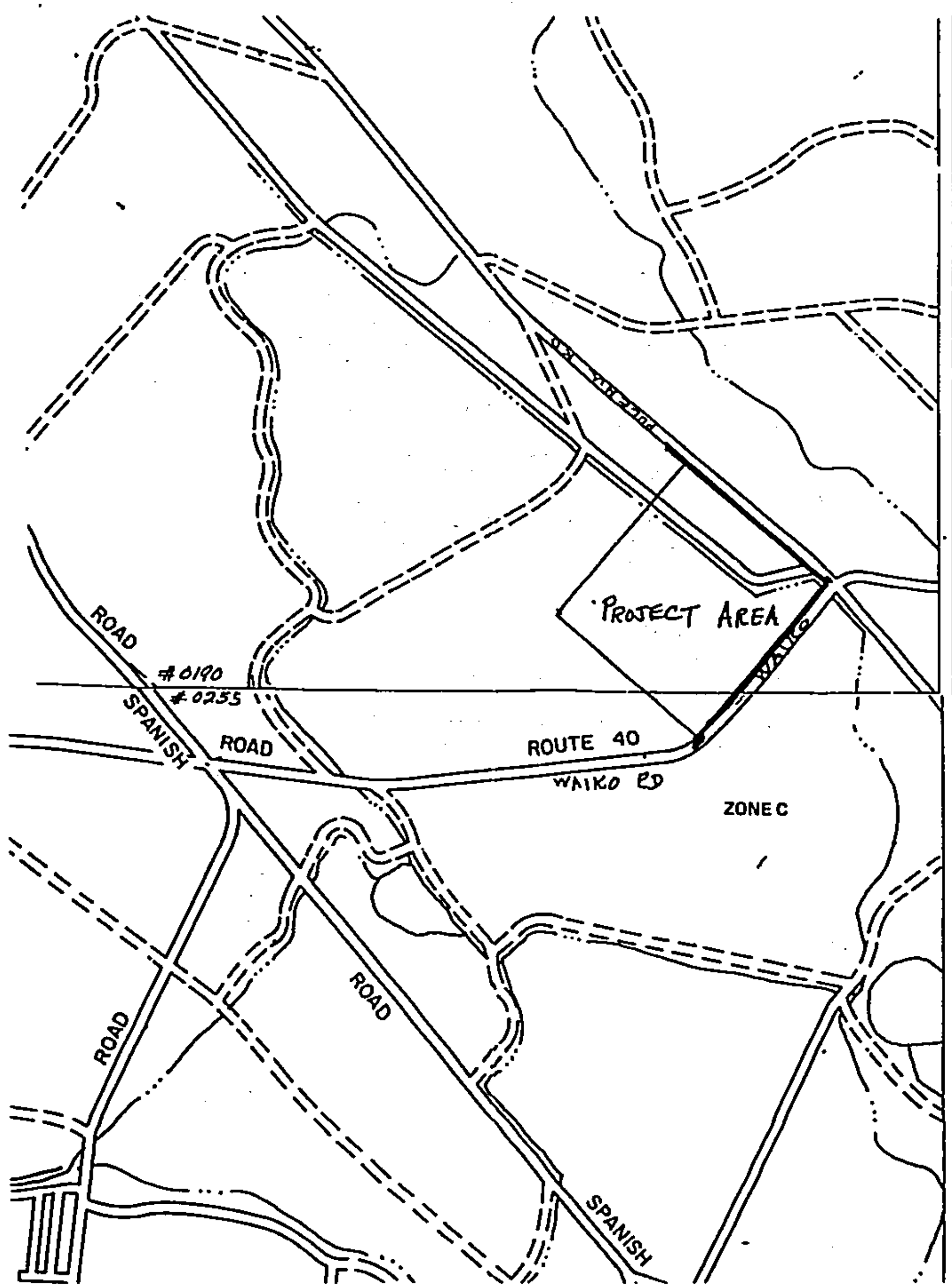
Sincerely,

Paul Mizue, P.E.
Acting Chief, Planning
and Operations Division

Enclosure



DOCUMENTS CAPTURED AS RECEIVED



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1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Mr. Paul Mizue
Acting Chief, Planning and Operations Division
US Department of the Army
Pacific Ocean Division, Corps of Engineers
Fort Shafter, HI 96858-5440

Dear Mr. Mizue:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

April 7, 1997

N3615 (2350)

Mr. David Blane
County of Maui
Planning Department
250 South High Street
P.O. Box 398
Kahului, Hawaii 96801

Dear Mr. Blane:

We are commenting on the Draft Environmental Assessment (EA) and the Environmental Impact Statement Preparation Notice (EISPN) for the proposed Maui Electric Company, Limited 232 megawatt Waena Generating Station. The proposed Waena station is located approximately 16 km northwest of Haleakala National Park (NP), a Class I air quality area administered by the National Park Service (NPS).

The NPS would like the final EA/Environmental Impact Statement (EIS) to address several particular aspects of interest to Haleakala NP. The EA/EIS should discuss the full range of control technology feasible for diesel fired turbines such as Selective Catalytic Reduction (SCR) and alternative fuels including water emulsified fuels to reduce emissions. An alternative fuel, such as A-21, can be used in any diesel or spark-ignited engine. Nevada has certified the fuel as a clean alternative, and the fuel meets California Air Resources Board standards for vehicles. The fuel is interchangeable with conventional fuels, so Maui Electric could consider using the fuel on a part-time or full-time basis. Use of the fuel may decrease emissions of sulfur dioxide (SO_2) nitrogen oxide (NO_x), volatile organic compounds, and carbon monoxide by up to 60%, resulting in reduced air quality impacts.

The NPS requests that the EIS contains the quantified impacts of SO_2, particulate, and NO_x emissions to the park using a more refined complex terrain model than the EPA COMPLEX I model. The NPS would prefer the EA/EIS to describe the impacts to the park using either the EPA Rough Terrain Dispersion Model (RTDM), the EPA Complex Terrain Dispersion Model (CTDM) or its screening version CTSCREEN. The NPS also requests that a coherent plume visibility analysis with the EPA VISCREEN model be performed, to address potential visible plume impacts inside the park. If you have any questions regarding this matter, please contact me at (303) 969-2079.

Sincerely,

John P. Notar

John P. Notar
Meteorologist
Policy, Planning and Permit Review Branch

cc:
HALE: Supt.
bcc:
PGSO: Judith Rocchio
ARD-DEN: Permit Review Group, Hauge, Reading and Project Files
ARD-DEN:JNotar:jn:4/7/97:x2079:WAENE.LTR

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1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Mr. John P. Notar, Meteorologist
US Dept. of the Interior
National Park Service
Policy, Planning and Permit Review Branch
P.O. Box 369
Makawao, HI 96768

Dear Mr. Notar:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific concerns, the Draft EIS will examine impacts to Haleakala National Park as determined through terrain models you recommended. The Draft EIS will also discuss SCR as a control technology and the feasibility of alternative fuels.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

SENT BY:COUNTY MAUI PLANNING ; 4-18-97 ; 7:03AM ; 8082437834→ 808 941 8225;# 4

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

BENJAMIN J. CAYETANO, GOVERNOR
SEIJI F. NAYA, DIRECTOR
BRADLEY J. MOSSMAN, DEPUTY DIRECTOR
RICK EGGED, DIRECTOR, OFFICE OF PLANNING

OFFICE OF PLANNING
235 South Beretania Street, 6th Flr., Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804
Tel.: (808) 587-2846
Fax: (808) 587-2824

'97 APR 16 P12:07
RECEIVED

Ref. No. P-6599

April 7, 1997

Mr. David W. Blane
Planning Director
County of Maui
250 S. High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Environmental Impact Statement Preparation Notice (EISPN) for Waena Generating Power Station, Maui

We have the following comment on the EISPN for the subject project.

The draft EIS should discuss how the proposed plant relates to Maui Electric Company's long-term integrated resource management plan and demand side management programs and goals that may have been developed.

Thank you for the opportunity to review this document. If there are any questions, please contact Charles Carole of our Coastal Zone Management Program at 587-2804.

Sincerely,

Rick Egged
Director
Office of Planning

CH2MHILL
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CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Mr. Rick Egged, Director
State of Hawaii
Department of Business, Economic Development and Tourism
Office of Planning
235 South Beretania St., 6th fl.
Honolulu, HI 96813

Dear Mr. Egged:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, the Draft EIS will include a discussion of MECO's integrated resource plan and the goals and programs of the demand side management plan.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

BENJAMIN J. CAYETANO
GOVERNOR

MAJOR GENERAL EDWARD V. RICHARDSON
DIRECTOR OF CIVIL DEFENSE

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

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

PHONE (808) 733-4300
FAX (808) 733-4287

March 31, 1997

APR - 3

TO: Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

ATTENTION: Mr. David Blane

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

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE; WAENA POWER GENERATING STATION

We appreciate the opportunity to comment on the Environmental Impact Statement Preparation Notice by CH2M Hill for Maui Electric Company, Inc., on the island of Maui, Wailuku district, Tax Map Key Number: 3-8-03:01 portion.

State Civil Defense (SCD) does not foresee any problems to our equipment by the addition of MECo's Waena power generating station. However, because there is no siren coverage in the proposed area, we recommend that a siren simulator be purchased and installed inside the facility.

Although not part of our expertise, the fuel storage does look dangerously close to the sugarcane fields and, because of the prevailing winds, would tourists be affected by the exhaust?

Our SCD planners and technicians are available to discuss this further if there is a requirement. Please have your staff call Mr. Norman Ogasawara of my staff at 733-4300.

bc: Mr. Mark R. Willey
CH2M Hill, Inc.
1585 Kapiolani Blvd., Suite 1420
Honolulu, Hawaii 96814

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CH2M HILL
1585 Kapiolani Blvd
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96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

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

Dear Mr. Price:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, MECO will work with your agency in the installation and operation of siren simulators. Also, MECO is re-examining the location of its fuel tanks *vis-a-vis* the existing sugar cane fields to determine if existing fire protection plans are adequate. Impacts to tourism from the project will also be addressed.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

BENJAMIN J. CAYETANO
GOVERNOR
STATE OF HAWAII

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

KALI WATSON
CHAIRMAN
HAWAIIAN HOMES COMMISSION

JOBIE M. K. M. YAMAGUCHI
DEPUTY TO THE CHAIRMAN

April 4, 1997

APR - 8

Mr. Mark R. Willey, Project Manager
CH2M Hill, Inc.
1585 Kapiolani Boulevard, Ste. 1420
Honolulu, Hawaii 96814-4530

Dear Mr. Willey:

SUBJECT: Waena Power Generating Station EISPN

We offer the following questions and comments after reviewing the environmental assessment report of February 1997 for the subject project:

1. DHHL is acquiring approximately 726 acres, identified as portions of parcels 1 and 8 of TMK No. 3-8-08. We request a detailed evaluation of the impacts of this project on these lands.

2. Is the proposed inland site in an optimum location relative to layout of the overall power system and service to the community? Were alternative sites considered?

3. Are the proposed diesel oil-fired power-generating units the best available in terms of economic efficiency and environmental pollution and other factors?

4. What are the estimated incremental and total costs and how will the project be funded?

5. Describe how operations may impact the surrounding community; e.g., frequency of fuel delivery, emissions from exhaust stacks, etc.

Should you have any questions, please call Darrell Yagodich, our Planning Office Administrator, at 586-3847.

Aloha,

Kali Watson

KALI WATSON, Chairman
Hawaiian Homes Commission

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Mr. Kali Watson
Chairman
State of Hawaii
Department of Hawaiian Home Lands
P.O. Box 1879
Honolulu, HI 96805

Dear Mr. Watson:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, MECO would like to thank you for identifying the parcels you are acquiring so that we can examine any potential impacts to them from the proposed plant. In addition, the Draft EIS will show the incremental costs of the plant construction and report impacts for fuel delivery and air emissions.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey

Mark R. Willey
Project Manager

enc.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

LAWRENCE MIIKE
DIRECTOR OF HEALTH

In reply, please refer to:

APR 17 1997

April 10, 1997 97-053/epo

Mr. Ed Reinhardt
Maui Electric Company
P.O. Box 398
Kahului, Maui, Hawaii 96732

Dear Mr. Reinhardt:

Subject: Draft Environmental Assessment (DEA)/Environmental Impact Statement Preparation Notice (EISPN)
Waena Generating Station Project
Waiko Road and Pulehu Road
Maui, Hawaii
TMK: 3-8-03:por. of 1

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

__Safe Drinking Water Branch, Underground Injection Control (UIC) Section__

The DEA states that in order to estimate the impacts of withdrawal on the groundwater, a hydrogeology study will be undertaken. This study should also address the impacts of injection activity. Supply well and injection well impacts should be addressed collectively. Also, the construction of injection wells will need a UIC permit from the Department of Health (DOH).

If there should be any questions on these comments, please contact Mr. Chauncey Hew of the UIC Section at 586-4258.

__Wastewater__

If there is no public sewer system to service the project, then treatment individual wastewater systems will have to be provided. Pre-construction approval will be required; plans and specifications for these systems must be submitted to the Maui District Health Office for review and approval.

If there are any questions regarding these comments, please call Mr. Herbert Matsubayashi, Chief Sanitarian, Maui District Health Office at 984-8230.

__Air Pollution__

The Draft Environmental Impact Statement should include an assessment or a discussion on the following topics:

1. The air pollution and permitting requirements relating to the state and national ambient air quality standards, air quality increments, and Best Available Control Technology.
2. The feasibility of using cleaner burning fuels in the power plant, such as naphtha and low sulfur diesel fuel oil.
3. The types of air pollution controls that will be installed on the combustion turbine generators.
4. The existing ambient air quality levels, local meteorology and dispersion conditions in the area of the proposed project.
5. The emissions and air quality impact of PM_{10}.

If you have any questions on these comments, please call Nolan Hirai of the Clean Air Branch at 586-4200.

Sincerely,

Bruce S. Anderson, Ph.D.
Deputy Director for Environmental Programs

c: Maui Planning Department
CH2M Hill✓
OEQC
SDWB
CAB
NR&IAQB
Maui District Health Office

CH2MHILL

Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Mr. Lawrence Miike, Director
c/o Mr. Bruce Anderson, Deputy Director
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801

Dear Mr. Miike:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, the Draft EIS will include discussion on impacts of injection activity and the procedures for disposal of wastewater through a hydrogeology study. A discussion of the air quality conditions, regulations, and potential impacts will also be included.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
GILBERT COLOMA-AGARAN

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

MAR 28

March 20, 1997

LOG NO: 16429 ✓
DOC NO: 9703SC19

Mark R. Willey, Project Manager
CH2M Hill
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814-4530

Dear Mr. Willey:

SUBJECT: Chapter 6E-42 Historic Preservation Review of an Environmental Assessment for the Proposed Waena Power Generating Station,
Wailuku, Wailuku District, Maui
TMK: 3-8-001: por. 01

Thank you for the opportunity to comment on the proposed 232-megawatt Waena Generating Station to be built in Central Maui along Pulehu and Waiko Roads near the existing Maui County Landfill. Our review is based on historic reports, maps, and aerial photographs maintained at the State Historic Preservation Division; no field inspection was made of the subject parcel.

Although these lands have not undergone an archaeological inventory survey, we have no record of historic sites on this parcel. Aerial photographs taken in 1972 clearly show that the entire area for the proposed station was formerly under sugar cane cultivation. Consequently, it is unlikely that significant historic sites are still present. Therefore, we believe that the proposed undertaking will have "no effect" on significant historic sites.

Should you have any questions, please feel free to call Sara Collins at 587-0013.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

SC:jen

cc: Ms. Elizabeth Anderson, Cultural Resources Commission, Maui Planning Department, 250 S. High Street, Wailuku, HI 96793

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Fax 808.941.8225

April 28, 1997

Mr. Don Hibbard, Administrator
State of Hawaii
Department of Land and Natural Resources
Historic Preservation Division
33 South King Street, Sixth Floor
Honolulu, HI 96813

Dear Mr. Hibbard:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, Scientific Consultant Services will be preparing an archaeological inventory survey for your review and will coordinate with your office.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET, SUITE 300
HONOLULU, HAWAII 96813
FAX (808) 587-0600

ROY S. OSHIRO
EXECUTIVE DIRECTOR

IN REPLY REFER TO
97:DEV/1054

April 2, 1997

Mr. Mark Willey, Project Manager
CH2M HILL, Inc.
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814-4530

Dear Mr. Willey:

SUBJECT: Draft Environment Assessment (EA) and Environmental Impact Statement Preparation Notice (EISPN) for Maui Electric Company's (MECO) 232-MW Waena Generating Station

Thank you for the opportunity to comment on the draft EA. We are pleased to provide the following comments and questions:

Water Resources

The proposed water source for power plant operations is the existing potable water supply underlying the brackish water aquifer. Please provide reasons for not tapping the brackish water aquifer and is water quality a factor in plant maintenance? Also, please discuss the possible reuse of treated effluent water for plant operations.

Disposal of Waste Water from Plant Operations

Please discuss alternate ways of disposing waste water from plant operations besides injection wells.

Existing Generation Resources

The current power agreement requires HC&S to supply 16 MW to MECO. Is HC&S capable of supplying more power in the future? How much power can Pioneer Mill supply on an intermittent basis? Please elaborate on the future power sources from these two mills especially the latter.

Thank you for the opportunity to comment on the draft EA.

Sincerely,

ROY S. OSHIRO
Executive Director

HFDC

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Honolulu, HI
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April 28, 1997

Mr. Roy S. Oshiro
Executive Director
State of Hawaii
Dept. of Budget and Finance
Housing Finance and Development Corporation
677 Queen Street, Suite 300
Honolulu, HI 96813

Dear Mr. Oshiro:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, the proposed project will tap the underlying brackish aquifer for its water use. Potable water will be brought in for domestic use. The Draft EIS will include discussion on water use and wastewater disposal as well as the ability of independent power producers on Maui to provide continuous service to MECO.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

GARY GILL
DIRECTOR

APR - 7 1997

April 4, 1997

Mr. Ed Reinhardt
Maui Electric Company, Ltd.
P.O. Box 398
Kahului, Hawai'i 96732

Dear Mr. Reinhardt:

We submit for your response the following comments on a February 1997, final environmental assessment/environmental impact statement preparation notice (FEA/EISPN) entitled "Proposed Waena Power Generating Station" submitted to our office by the County of Maui Planning Department. Notice of availability of this draft environmental assessment was initially published in the March 8, 1997, edition of the *Environmental Notice.*

1. Please discuss in the draft EIS the settlement agreement with the U. S. Fish and Wildlife Service not to expand the Ma'alaea Plant which may have affected Kealia Pond.

2. Page 2 notes that the elements of the power plant include pollution abatement/disposal technologies such as injection wells, fuel storage tanks, etc. We concur that the proposed action will include elements which constitute a source of pollution to the environment. Section 11-200-17(l), Hawai'i Administrative Rules states in pertinent part that "if the proposed action constitutes a source of pollution as determined by any government agency, necessary data shall be incorporated into the EIS." Please include in the EIS data on air quality, ground water quality, surface water quality and hazardous waste or hazardous material releases in the general vicinity.

Please include a copy of this letter and your response in the draft environmental impact statement for this project. If there are any questions, please call Mr. Leslie Segundo, Environmental Health Specialist at 586-4185. Thank you.

Sincerely,

GARY GILL
Director

c: Hon. David Blane, County of Maui, Planning Department
Mr. Mark Willey, CH2M Hill

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
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Honolulu, HI
96814-4530
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Fax 808.941.8225

April 28, 1997

Mr. Gary Gill
Director
State of Hawaii
Office of Environmental Quality Control
235 S. Beretania St., Suite 702
Honolulu, HI 96813

Dear Mr. Gill:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, MECO does not have a settlement agreement with the US Fish and Wildlife Service concerning Maalaea. Following completion of the dual-train combined-cycle unit currently being installed at Maalaea, MECO will have exhausted all available space at this plant for further expansion. In response to your second comment, the Draft EIS will contain the necessary data on existing and proposed conditions to make assessments as to the impacts on resources in the general vicinity.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPIOLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

APR - 2 '97

March 20, 1997

Mr. Mark R. Willey
Project Manager
CH2M HILL, Inc.
1585 Kapiolani Blvd., Suite 1420
Honolulu, HI 96814

Dear Mr. Willey:

Thank you for the opportunity to review the Environmental Assessment (EA) and the Environmental Impact Statement (EIS) Preparation Notice for the Maui Electric Company, Limited's 232-MW Waena Generating Station, Island of Maui. The project's objective is the development of an 232-MW new generating station to meet Maui's power needs for the next century.

The Office of Hawaiian Affairs (OHA) has no objections at this time to the EA and EIS Preparation Notice. But OHA intends to thoroughly review the EIS once the document is available for public review. OHA's major concern is potential hazards stemming from electric and magnetic fields generated by the station. OHA expects a major section of the EIS addressing mechanisms for public safety and health protection. Please contact Lynn Lee, Acting Officer of the Land and Natural Resources Division, or Luis Manrique, should you have any questions on this matter.

Sincerely yours,

Martha Ross
Martha Ross
Deputy Administrator

LM:lm

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Fax 808.941.8225

April 28, 1997

Ms. Martha Ross
Deputy Administrator
Office of Hawaiian Affairs
711 Kapiolani Boulevard
Suite 500
Honolulu, HI 96813

Dear Ms. Ross:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, MECO will include the results of EMF modeling showing anticipated EMF levels produced by the plant and the proposed transmission lines.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Mark R. Willey
Project Manager

enc.

SENT BY:COUNTY MAUI PLANNING ; 4- 3-97 ; 2:58PM ; 8082437634→ 808 941 8225;# 3

BENJAMIN J. CAYETANO
GOVERNOR

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
JERRY M. MATSUDA
GLENN M. OKIMOTO

'97 APR -1 P3:37

DEPT. OF PLANNING
COUNTY OF MAUI
RECEIVED

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
STP 8.7825

March 24, 1997

Mr. David W. Blane
Director
Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Waena Power Generating Station
Environmental Impact Statement
Preparation Notice (EISPN)
TMK: 3-8-03: por. 10

Thank you for your transmittal of March 6, 1997.

The EISPN acknowledges that the proposed development will impact traffic in the area. The traffic report should include an assessment of the traffic impacts to the State facilities.

We will defer further comment until we have had the opportunity to review the draft EIS.

Very truly yours,

KAZU HAYASHIDA
Director of Transportation

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April 28, 1997

Mr. Kazu Hayashida
Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813

Dear Mr. Hayashida:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109

APR 29

April 25, 1997

Mr. Mark Willey, Project Manager
CH2M Hill, Inc.
Honolulu Office
1585 Kapiolani Blvd., Suite 1420
Honolulu, Hawaii 96814-4530

Re: TMK: 3-8-03:001
Project Name: Proposed Waena Power Generating Station: Environmental Assessment

Dear Mr. Willey,

Thank you for the opportunity to review this Environmental Assessment. We offer the following recommendations.

1. Groundwater Levels - We look forward to reviewing the groundwater investigations and flow models that will be conducted as a part of the EIS. We recognize that you are considering reinjection of process water after it is used in the plant operations. This could mitigate the adverse impacts on water levels.

2. Groundwater Quality - We recognize that you are considering various options for treating the process water before it is reinjected to the aquifer. We look forward to reviewing the studies that may be conducted and the benefits/costs of each of these options.

Since pumping of substantial amounts of groundwater can lower groundwater levels and stream flows far down-gradient of the pumping, wetland areas may be effected by such pumping. Where possible, we recommend that you coordinate with the U.S. Fish and Wildlife Service and the State Department of land and natural resources, Division of Forestry and Wildlife to mitigate potential effects.

3. Best Management Practices - We ask that the you include best management practices (BMPs) for all operations, such as fuel storage and transfer operations, that may potentially contaminate surface or groundwaters. We have attached sample BMPs for fuel storage and loading/unloading, for your reference.

Sincerely,

FOR David Craddick
Director

wef

attachments:
Sample BMPs from "Water Quality Best Management Practices Manual for Commercial and Industrial Businesses", City of Seattle, 1989.

"By Water All Things Find Life"

WATER QUALITY

BEST MANAGEMENT PRACTICES

MANUAL

FOR COMMERCIAL AND INDUSTRIAL BUSINESSES
CITY OF SEATTLE

Prepared for the City of Seattle
Office for Long-range Planning
200 Municipal Building
Seattle, Washington 98104
(206) 684-8056

June 30, 1989

The preparation of this report was financially aided through a grant from the Washington State Department of Ecology with funds obtained from the National Oceanic and Atmospheric Administration, and appropriated for Section 306 of the Coastal Zone Management Act of 1972.

BMP 1.30 LOADING AND UNLOADING OF LIQUIDS

Loading or unloading of liquids occurs two ways: liquids contained in containers and direct liquid transfer.

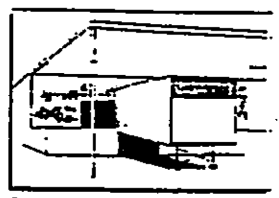
Consistent with Fire Code requirements (R.3 In Part V) and to the maximum extent possible, unloading or loading of liquids should occur within the manufacturing building so that any spills that are not completely retained, and residual materials resulting from the cleanup are discharged to the sanitary sewer.

BMPs are prescribed below for loading or unloading that must occur outside where loss to storm drains could occur.

CONTAINED LIQUIDS AT LOADING AND UNLOADING DOCKS

1. Loading/unloading docks shall have overhangs or door skirts that enclose the trailer end.

Dock with door skirt

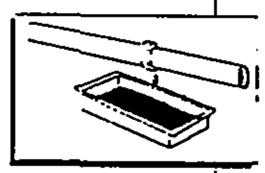


Dock with overhang

2. The loading/unloading area is to be appropriately designed to prevent runon of stormwater.
3. The business owner shall retain on site the appropriate materials for rapid cleanup of spills.

TANKER TRUCK TO ABOVE OR BELOW GROUND STORAGE TANKS

1. To minimize the risk of accidental spillage, the owner shall have a written "operations plan" that describes procedures for loading and/or unloading. Employees shall be trained in its execution.
2. As a part of the operations plan, or as separate document, the business owner shall have an Emergency Spill Cleanup Plan (BMP 1.50).
3. The area on which the transfer takes place, where the tanker truck is parked, shall be paved. If the liquid is reactive with asphalt (for example, gasoline) Portland cement concrete shall be used.
4. To avoid loss from spills during the transfer a deadend sump or a secondary containment system similar to that illustrated shall be used.



- Drip pan

5. Drip pans shall be placed at locations where spillage may occur such as hose connections, hose reels and filler nozzles. Drip pans shall always be used when making and breaking connections.
6. An employee trained in spill containment and cleanup shall be present during loading/unloading.

LOADING AND UNLOADING FROM OR TO MARINE VESSELS

Facilities and procedures for the loading or unloading of petroleum products must comply with Coast Guard requirements (R.6 in Part V).

TRANSFER OF SMALL QUANTITIES FROM TANKS AND CONTAINERS

See BMP 1.40 and BMP 1.50 regarding tanks and containers, respectively.

BMP 1.40

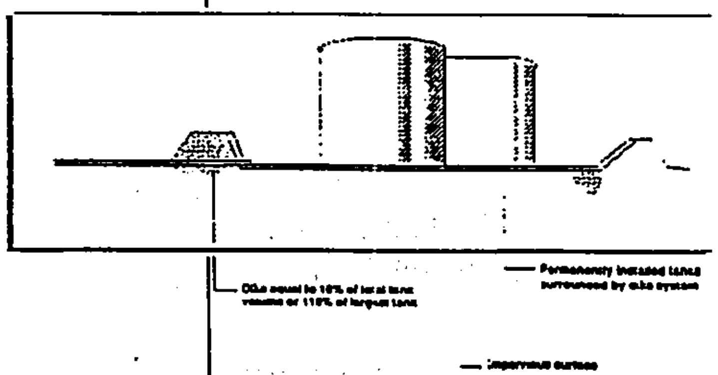
ABOVE GROUND TANK STORAGE

Storage of reactive, ignitable, or flammable liquids must comply with the Fire Code (R.3 in Part V). The following BMPs are to complement, not conflict, with current Fire Code requirements. Below ground tanks are to comply with WDOE requirements (R.7 in Part V).

PERMANENT TANK STORAGE

1. The tank shall include an overfill protection system to minimize the risk of spillage during loading.

2. Permanently installed tanks are to be surrounded by a dike system as illustrated below. The dike shall be of sufficient height to provide a volume within the diked area equal to 10% of the total tank storage or 110% volume of the largest tank whichever is greater.



3. The dikes and the surface within the dike area shall be sufficiently impervious to prevent loss of the stored material in the event of spillage.

4. Outlets from the tank area shall have positive control to prevent the uncontrolled discharge from the tank area of spilled chemicals or petroleum products.

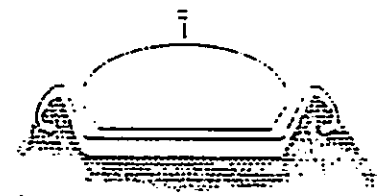
5. The outlet shall have a sump for the collection of small spills. It shall be cleaned weekly to minimize the contamination of stormwater.

6. During the wet season accumulated stormwater shall be released frequently.

7. For petroleum tank farms the stormwater shall pass through an oil/water separator (BMP 2.10 in Part IV).

TEMPORARY TANK STORAGE OF LIQUIDS

1. A secondary containment system similar to that shown shall be used whenever liquids are temporarily stored in in a portable tank



CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

May 31, 1997

139792

Mr. David Craddick, Director
County of Maui
Board of Water Supply
PO Box 1109
Wailuku, Maui, HI 96793-7109

Dear Mr. Craddick:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, MECO has retained the services of Water Resource Associates to perform models to indicate the extent of the potential zone of mixing associated with the proposed project. In addition, the impact of the estimated 0.88 mgd of non-potable water withdrawn from the underlying aquifer on surrounding wells and water levels will be discussed. Because the plant is not scheduled to begin construction until the year 2002, design consultants have not been determined at this time. As a result, the cost/benefits of specific water treatment alternatives will not be available within the timeframe of this EIS. However, because the water treatment and injection process will require permitting, more specific information will be available for your review during the preliminary engineering phase of this project.

Thank you also for your material on Best Management Practices for fuel storage and transfer operations. MECO is committed to using BMPs for all aspects of facility operation.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

LINDA CROCKETT LINGLE
Mayor
CHARLES JENCKS
Director
DAVID C. GOODE
Deputy Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
BRIAN HASHIRO, P.E.
Highways Division
Solid Waste Division

April 16, 1997

APR 19 1997

Mr. Mark R. Willey
CH2M Hill, Inc.
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814-4530

Dear Mr. Willey:

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT
MAUI ELECTRIC COMPANY-WAENA POWER GENERATION STATION
TMK (2) 3-8-003:001

We reviewed the subject application and have the following comment.

1. As the County's Central Maui Landfill no longer accepts construction debris, the waste shall be disposed at the Maui Demolition and Construction Landfill on North Kihei Road near its intersection with Honoapiilani Highway.

If you have any questions, please call David Goode at 243-7845.

Sincerely,

CHARLES JENCKS
Director of Public Works
and Waste Management

DG:co/mt
xc: Engineering Division
Solid Waste Division
Wastewater Reclamation Division
G:\LUCA\CZM\MELEC.WPO

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 28, 1997

Mr. Charles Jencks
Director
County of Maui
Department of Public Works
200 South High St.
Wailuku, HI 96793

Dear Mr. Jencks:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

Regarding your specific comments, MECO will identify the Maui Demolition and Construction Landfill in the EIS as the disposal area for construction debris.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

SIERRA CLUB, HAWAI'I CHAPTER

MALAMA I KA HONUA

P.O. Box 2577,
Honolulu, Hawai'i 96803
(808) 538-6616

RECEIVED MAR 24 1997

March 21, 1997

Ed Reinhardt
Maui Electric Company
P.O. Box 398
Kahului, HI 96732

Dear Mr. Reinhardt,

The Sierra Club requests that the Environmental Impact Statement for the power generation station in central Maui fully assess the following alternatives:

* alternatives sites;
* alternative technologies including photovoltaic systems;

and

* cleaner burning fuels such as natural gas.

The EIS should assess the environmental and economic benefits of these alternatives.

The EIS should fully disclose the aesthetic impacts of new above ground transmission lines.

Sincerely,

David Kimo Frankel
Director

cc Mark Willey
Gary Gill
David Blane

CH2MHILL

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CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8775

April 28, 1997

Mr. David Kimo Frankel
Director
Sierra Club, Hawaii Chapter
PO Box 2577
Honolulu, HI 96803

Dear Mr. Frankel:

Subject: Maui Electric Company, Ltd. (MECO)
Waena Generating Station EISPN

Thank you for responding to the Environmental Impact Statement Preparation Notice (EISPN) for MECO's proposed Waena Generating Station. As a part of the scoping process for this EIS, MECO solicited written comments through the EISPN, conducted three public comment meetings, and held individual briefings with several State and County of Maui agencies. The combined comments received by MECO through this process are summarized in the enclosed table.

Many important concerns were raised during the scoping period, including the impacts of the project on air quality, water quality, and local traffic, as well as requests to include discussion on possible alternative technologies, sites, and fuels. Please be assured that the subject EIS will address these issues and a copy of the Draft EIS will be provided to you for your review.

If you have any questions regarding the preparation of the EIS, please contact me at 941-1133 on Oahu or Mr. Neal Shinyama of MECO at 871-2341 on Maui.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

7.4 Comments Received on the Draft EIS

The Draft EIS was distributed on August 23, 1997. During the 45-day review and comment period, which ended on September 22, 1997, MECO held two public meetings to solicit comments on the Draft EIS. These meetings were held August 26, 1997 at the Maui Arts and Cultural Center in Kahului and on August 28, 1997 at the Upcountry Swimming Complex in Pukalani. These two meetings were attended by approximately 12 members of the public and comments were received from 5 people. A summary of the Draft EIS public comment meetings and the comments received, as well as a copy of the material provided at the meetings, can be found in Appendix K.

Comment letters on the Draft EIS were received from 28 individuals, public agencies, and organizations. Of these letters, 7 contained no comments. No-Comment letters were received from the following:

- Department of the Interior, U.S Geological Survey, Water Resources Division
- Department of the Navy
- State of Hawaii, Division of Public Works
- County of Maui, Department of Finance
- County of Maui, Department of Housing and Human Concerns
- County of Maui, Department of Parks and Recreation
- TCI Cable

The remaining 21 letters contained substantive comments from the following agencies, organizations, and individuals:

- Department of the Army, Army Corps of Engineers
- State of Hawaii, Department of Business, Economic Development, and Tourism - Energy, Resources and Technology Division
- State of Hawaii, Department of Health
- State of Hawaii, Department of Land and Natural Resources
- State of Hawaii, Department of Transportation
- State of Hawaii, Housing Finance and Development Corporation
- State of Hawaii, Office of Environmental Quality Control
- State of Hawaii, Office of Hawaiian Affairs

- State of Hawaii, Office of Planning
- University of Hawaii, Environmental Center
- County of Maui, Department of Public Works and Wastewater Management
- American Lung Association
- Hawaiian Commercial & Sugar Company
- Life of the Land
- Maalaea Community Association
- Maui Tomorrow
- Mr. Steven Moser, M.D.
- Mr. Jeffrey Parker
- Mr. & Mrs. Gregory and Masako Westcott
- Mr. James V. Williamson

The comment letters on the Draft EIS and responses are included in this Final EIS on the following pages.

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
677 Ala Moana Boulevard, Suite 415
Honolulu, Hawaii 96813

August 7, 1997

Mr. David Blane, Director
County of Maui Department of Planning
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Draft Environmental Impact Statement
Waena Generating Station
Wailuku and Makawao Districts - Island of Maui

The staff of the U.S. Geological Survey, Water Resources Division, Hawaii District, has reviewed the Draft Environmental Impact Statement (DEIS), and we have no comments to offer at this time.

Thank you for allowing us to review the DEIS. We are returning it for your future use.

Sincerely,

William Meyer
District Chief

cc: Mr. Ed Reinhardt, Maui Electric Company, Ltd.
Mr. Mark Willey, CH2M Hill, Inc.

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814 4530
Tel 808 943 1133
Fax 808 941 8275

November 3, 1997

139792.EI.04

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

Dear Mr. Meyer:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your August 7, 1997 letter concerning the Waena Generating Station Draft EIS. Although you had no comments, please feel free to contact me at any time regarding the proposed project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

DEPARTMENT OF THE NAVY

5090P.1
Ser N4(23)/ 4490
24 Sep 97

Mr. David Blane
Director
County of Maui Department of Planning
250 South High Street
Wailuku, HI 96793

Dear Mr. Blane:

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR WAENA GENERATING STATION, WAILUKU, MAUI OF JULY 1997

Thank you for the opportunity to review the DEIS for the Waena Generating Station, Wailuku, Maui of July 1997.

The Navy has no comment to offer at this time and appreciates the opportunity to participate in your review process.

If you have any questions, please feel free to contact me at 474-0439.

Sincerely,

STANFORD B. C. YUEN, P.E.
Facilities Engineer
By direction of
Commander, Naval Base, Pearl Harbor

Copy to:
Mr. Ed Reinhardt
Maui Electric Company, Limited
P.O. Box 398
Kahului, HI 96733-6898

Mr. Mark Willey
CH2M Hill, Inc.
1585 Kapiolani Boulevard, Suite 1420
Honolulu, HI 96814

CH2MHILL

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814 4530
Tel 808 943 1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Mr. Stanford B. C. Yuen, P.E.
Facilities Engineer
Department of the Navy
Naval Base Pearl Harbor
Box 110
Pearl Harbor, HI 96860-5020

Dear Mr. Yuen:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your September 24, 1997 letter concerning the Waena Generating Station Draft EIS. Although you had no comments, please feel free to contact me at any time regarding the proposed project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

(P)1533.7

AUG 13 1997

Mr. David Blane, Director
Department of Planning
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Waena Generating Station
Wailuku, Maui
Draft Environmental Impact Statement

Thank you for the opportunity to review the subject document. We have no comments to offer.

If there are any questions, please have your staff contact Mr. Ronald Ching of the Planning Branch at 586-0490.

GORDON MATSUOKA
State Public Works Engineer

RC:jy
c: Maui Electric Company, Limited
CH2M Hill, Inc.

CH2MHILL
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CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808 943 1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Mr. Gordon Matsuoka
State Public Works Engineer
State of Hawaii
Department of Accounting and General Services
PO Box 119
Honolulu, HI 96810

Dear Mr. Matsuoka:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your August 13, 1997 letter concerning the Waena Generating Station Draft EIS. Although you had no comments, please feel free to contact me at any time regarding the proposed project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

LINDA CROCKETT LINGLE
Mayor

COUNTY OF MAUI
DEPARTMENT OF FINANCE
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

TRAVIS O. THOMPSON
Director of Finance

WAYNE Y. FUJITA
Deputy Director of Finance

MEMO TO : David Blane

DATE : August 14, 1997

SUBJECT : DRAFT EIS - WAENA GENERATING STATION

Thank you for the opportunity to comment on the draft environmental impact statement for the Waena Generating Station.

The Department of Finance has no comments on the draft EIS.

Travis O. Thompson
Director of Finance

cc: Maui Electric Company, Limited
√CH2M HILL, INC.

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu HI
96814 4530
Tel 808 943 1133
Fax 808 941 8275

November 3, 1997

139792.EI.04

Mr. Travis O. Thompson
Director of Finance
County of Maui
Department of Finance
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Thompson:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your August 14, 1997 letter concerning the Waena Generating Station Draft EIS. Although you had no comments, please feel free to contact me at any time regarding the proposed project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

DEPARTMENT OF
HOUSING AND HUMAN CONCERNS
COUNTY OF MAUI

LINDA CROCKETT LINGLE, Mayor
STEPHANIE AVEIRO, Director
MARK PERCELL, Deputy Director

200 SOUTH HIGH STREET • WAILUKU, HAWAII 96793 • PHONE (808) 243-7805 • FAX (808) 243-7829

August 18, 1997

Mr. Mark Willey
CH2M Hill, Inc.
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814

Dear Mr. Willey:

Subject: Waena Generating Station
TMK 3-8-03:por. 01

We have reviewed the Draft Environmental Impact Statement (DEIS) for the subject project and wish to inform you that we have no comments to offer.

As requested, we are herewith returning the DEIS for your use.

Very truly yours,

Stephanie Aveiro
STEPHANIE AVEIRO
Director of Housing and
Human Concerns

ETO:hs

Enclosure

xc: Housing Administrator

TO SUPPORT AND ENHANCE THE SOCIAL WELL-BEING OF THE CITIZENS OF MAUI COUNTY.

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808 943 1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Ms. Stephanie Aveiro
Director
County of Maui
Housing and Human Concerns
200 South High Street
Wailuku, HI 96793

Dear Ms. Aveiro:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your August 18, 1997 letter concerning the Waena Generating Station Draft EIS. Although you had no comments, please feel free to contact me at any time regarding the proposed project.

Sincerely,

CH2M HILL

Mark R. Willey

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

DEPARTMENT OF
PARKS AND RECREATION
COUNTY OF MAUI
1580-C KAAHUMANU AVENUE WAILUKU, HAWAII 96793

Mayor
HENRY OLIVA
Director
ALLEN SHISHIDO
Deputy Director
(808) 243-7230
FAX (808) 243-7934

RECEIVED
SEP 30 1997
CH2MHILL - HNL

September 25, 1997

Mr. Mark Willey
CH2M HILL, INC.
1585 Kapiolani Boulevard
Suite 1420
Honolulu, HI 96814

Dear Mr. Willey:

SUBJECT: WAENA GENERATING STATION

We have reviewed the Draft Environmental Impact Assessment for the above referenced project and have no comments.

Thank you for the opportunity to review and comment on this project. Should you have any questions, please call Patrick Matsui, Chief of Planning and Development, at 243-7931.

Sincerely,

HENRY OLIVA
Director

HO:PTM:am

s:\planning\am\waename wpd

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814 4530
Tel 808 943 1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Mr. Henry Oliva
Director
County of Maui
Department of Parks and Recreation
1580-C Kaahumanu Avenue
Wailuku, HI 96793

Dear Mr. Oliva:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your September 25, 1997 letter concerning the Waena Generating Station Draft EIS. Although you had no comments, please feel free to contact me at any time regarding the proposed project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

CH2MHILL
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CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814 4530
Tel 808 943 1133
Fax 808 941 8225

TCI Cable
No Comment
Rec. 8-12-97

August 5, 1997

Dear Participant:

Attached for your review is a Draft Environmental Impact Statement (DEIS) which was prepared pursuant to the EIS law (Hawaii Revised Statutes, Chapter 343) and the EIS rules (Administrative Rules, Title 11, Chapter 200).

TITLE OF PROJECT	Waena Generating Station
LOCATION: ISLAND	Maui
DISTRICT	Wailuku
TAX MAP KEY NUMBERS:	Maui 3-8-03 portion of :01

AGENCY ACTION: ______ APPLICANT ACTION: X

YOUR COMMENTS MUST BE RECEIVED OR POSTMARKED BY (minimum 45 day comment period): September 22, 1997

PLEASE SEND ORIGINAL COMMENTS TO THE:

ACCEPTING AUTHORITY:	County of Maui Department of Planning
ADDRESS:	250 South High Street
	Wailuku, HI 96793
CONTACT:	Mr. David Blane, Director
PHONE:	243-7735

COPIES OF THE COMMENTS SHOULD BE SENT TO THE FOLLOWING:

PROPOSING AGENCY OR APPLICANT:	Maui Electric Company, Limited
ADDRESS:	P.O. Box 398
	Kahului, HI 96733-6898
CONTACT:	Mr. Ed Reinhardt
PHONE:	871-8461
CONSULTANT	CH2M HILL, INC.
ADDRESS:	1585 Kapiolani Boulevard
	Suite 1420
	Honolulu, HI 96814
CONTACT:	Mr. Mark Willey
PHONE:	943-1133

If you no longer need this EIS, please return it to CH2M HILL. Thank you for your participation in the EIS process!

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814 4530
Tel 808 943 1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Chronicle Cablevision
350 Hoohana
Kahului, HI 96732

Dear Mr. Sir:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your August 12, 1997 response concerning the Waena Generating Station Draft EIS. Although your company had no comments, please feel free to contact me at any time regarding the proposed project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

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

REPLY TO ATTENTION OF

August 19, 1997

Planning and Operations Division

Mr. David Blane, Director
County of Maui
Planning Department
250 South High Street
Wailuku, Maui 96793

Dear Mr. Blane:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement (DEIS) for the Waena Generating Station, Wailuku, Maui (TMK 3-8-3-: por. 1). The following comments are provided in accordance with Corps of Engineers authorities to provide flood hazard information and to issue Department of the Army (DA) permits.

a. Based on the information provided, a DA permit will not be required for the project. Please contact our Regulatory Section at 438-9258 for further information and refer to file number 970000133.

b. The flood hazard information provided on page 4-24 of the DEIS is correct.

Sincerely,

Paul Mizue, P.E.
Acting Chief, Planning
and Operations Division

Copy Furnished:

Mr. Mark Willey
CH2M Hill, Inc.
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu HI
96814 4530
Tel 808 943.1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Mr. Paul Mizue
Acting Chief
Planning and Operations Division
Department of the Army
U.S. Army Engineer District, Honolulu
Ft. Shafter, HI 96858-5440

Dear Mr. Mizue:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your August 19, 1997 letter confirming the information within the Waena Generating Station Draft EIS. Although you had no specific comments, please feel free to contact me at any time regarding the proposed project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

BENJAMIN J. CAYETANO, GOVERNOR
SEIJI F. NAYA, DIRECTOR
BRADLEY J. MOSSMAN, DEPUTY DIRECTOR

ENERGY, RESOURCES, AND TECHNOLOGY DIVISION
235 South Beretania St., 5th Flr., Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804
Tel.: (808) 587-3807
Fax: (808) 586-2536

'97 SEP -3 P1:16
RECEIVED

September 2, 1997

MEMORANDUM

TO: Mr. David Blane
Director
County of Maui Department of Planning

FROM: Maurice H. Kaya

SUBJECT: Draft Environmental Impact Statement: Waena Generating Station

We offer the following comments on the subject Draft Environmental Impact Statement.

We support Maui Electric's intent in seeking to provide facilities for expansion of its generation facilities. Successful permitting of the Waena Generating Station will help preclude situations in which the reserve margin, and potentially the reliability, of Maui's electric system is reduced due to permit delays.

However, Maui Electric's plans imply a continued dependence on fossil fuels to meet Maui's electricity needs. We urge Maui Electric to similarly identify and seek permits for appropriate facilities for renewable energy generation facilities. Actual deployment of fossil fuel generators at the Waena Generating Station should only be to meet needs which cannot be avoided through the use of cost-effective demand-side management programs or renewable resources.

Thank you for the opportunity to provide these comments.

CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814 4530
Tel 808 943 1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Mr. Maurice Kaya
Program Administrator
State of Hawaii
Department of Business, Economic Development, and Tourism
Energy, Resources, and Technology Division
PO Box 2359
Honolulu, HI 96804

Dear Mr. Kaya:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 2, 1997 letter concerning the Waena Draft Environmental Impact statement. MECO would also like to thank you for your support in their efforts to provide for expansion of their generation facilities. Our responses to your individual comments follow.

1. *We urge Maui Electric to identify and seek permits for appropriate facilities for renewable energy generation facilities. Fossil fuels generators should only be to meet needs which cannot be avoided through the use of cost-effective demand-side management programs or renewable resources.*

    MECO has extensively evaluated numerous supply-side resource alternatives in developing its Integrated Resource Plan (IRP). The selection of resource options for MECO's IRP is based on a screening process wherein a large number of potential supply-side options are considered. The screening process is a detailed process with significant input from MECO's public advisory group, which was convened to ensure maximum participation from all stakeholders in the overall IRP process.

MECO did evaluate the use of intermittent energy sources, such as solar, hydropower, and wind energy, as well as alternative fuels, such as methanol and ethanol, as a part of the IRP process. However, for capacity planning purposes, MECO is unable to include such intermittent or non-dispatchable sources of energy production as assured system generating capacity. MECO does use electricity from alternative energy sources when it is available. To the extent that electricity is available from these sources, MECO will avoid burning fossil fuels.

MECO also evaluated the use of firm, dispatchable energy from renewable sources, such as biomass technologies. However, the high fuel costs and low power plant efficiencies associated with biomass energy production do not make it a cost-effective option at this time.

Before MECO undertook its IRP process, the Public Utilities Commission (PUC) issued a framework for the planning process. One of the governing principles stated in the framework is the consideration of a plan's impact on the utility consumer, environment, culture, community lifestyles, State's economy, and society. The framework stated that, to the extent possible and feasible, the external costs and benefits should be quantified and expressed in dollar terms. When it is neither possible nor feasible to quantify any cost or benefit, such cost or benefit should be qualitatively measured.

MECO followed the PUC framework in preparing its IRP and considered externality costs as part of resource evaluation. Proxy monetized externalities were used to assess air emission impacts, and other externalities were assessed qualitatively. Even considering externality costs, the combustion turbine technology was the most cost-effective resource that could provide the needed amount of generation capacity within the required time frame.

In its IRP, MECO selected a resource plan within the context of short- and long-term resource strategies. For the short term, MECO is implementing aggressive demand-side management programs and conventional oil-based technologies because of the costs and uncertainties associated with renewable energies and alternative fuel sources. The Draft EIS includes a discussion of both alternative energy and alternative fuel sources and outlines the reasons they are not considered feasible for use within the short term. The short-term role for renewable/alternative energy resources; therefore, will continue to be in power purchased from independent power producers.

For its long-term strategy, MECO will continue to evaluate the technical and economic feasibility of using more alternative energy sources. As a part of the Waena project, the combustion turbines proposed can accommodate by-products of coal gasification rather than diesel. In addition, the overall project implementation over 20-30 years is designed to allow for the easy replacement of the proposed combustion-turbine technology with other energy generating alternatives when they become technically and economically feasible.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

LAWRENCE MIIKE
DIRECTOR OF HEALTH

In reply, please refer to:

September 18, 1997

97-053A/epo

Mr. David W. Blane, Planning Director
County of Maui
Planning Department
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
Project: Waena Generating Station
Location: Wailuku and Makawao Districts, Maui, Hawaii
TMK: (2) 3-8-03: Por. 1

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

Safe Drinking Water Branch

1. Section 4.6.1.2, *Potential Impacts*, Page 4-28: The first paragraph states, "Potable water for drinking purposes may be delivered by truck or supplied by other means." The water hauling company must be approved by the Safe Drinking Water Branch (SDWB) of the Department of Health to transport water between public water systems. Please verify which companies are currently approved for water hauling on Maui with Mr. Gordon Muraoka, Maui SDWB Sanitarian, at 984-8234. Also, please provide more details on the other sources for drinking water purposes.

2. The proposed development will use non-potable water for fire protection, maintenance, and sanitary needs of the personnel. The potable and non-potable water systems must be carefully designed and operated to prevent cross-connections and backflow conditions. The two systems must be clearly labeled and physically separated by air gaps or approved reduced-pressure principle backflow preventers to avoid contaminating the potable water supply. In addition, all non-potable spigots and irrigated areas should be clearly labeled with warning signs to prevent the inadvertent consumption of non-potable water.

If you should have any questions on this matter, please contact Ms. Queenie Komori of the Safe Drinking Water Branch at 586-4258.

Water Pollution

1. The applicant should contact the Army Corps of Engineers to identify whether a federal permit (including a Department of Army permit) is required for this project. If a federal permit is required, then a Section 401 Water Quality Certification is required from the State Department of Health, Clean Water Branch.

2. A National Pollutant Discharge Elimination System (NPDES) general permit is required for the following discharges to waters of the State:

   a. Storm water discharges relating to construction activities, such as clearing, grading, and excavation, for projects equal to or greater than five acres;

   b. Storm water discharges from industrial activities;

   c. Construction dewatering activities;

   d. Noncontact cooling water discharges less than one million gallons per day;

   e. Treated groundwater from underground storage tank remedial activities; and

   f. Hydrotesting water.

   Any person requesting to be covered by a NPDES general permit for any of the above activities should file a Notice of Intent with the Department's Clean Water Branch at least 30 days prior to commencement of any discharge to waters of the State.

3. After construction of the proposed facility is completed, an NPDES individual permit will be required if the operation of the facility involves any wastewater discharge into State waters.

Any questions regarding these comments should be directed to Mr. Denis Lau, Branch Chief, Clean Water Branch at 586-4309.

Polluted Runoff Control

Proper planning, design and use of erosion control measures and management practices will substantially reduce the total volume of runoff and limit the potential impact to the coastal waters from polluted runoff. Please refer to the *Hawaii's Coastal Nonpoint Source Control Plan*, pages III-117 to III-119 for guidance on these management measures and practices for specific project activities. To inquire about receiving a copy of this plan, please call the State Coastal Zone Management Program in the State Planning Office at 587-2880.

The following practices are suggested to minimize erosion during construction activities:

1. Conduct grubbing and grading activities during the low rainfall months (minimum erosion potential).
2. Clear only areas essential for construction.
3. Locate potential nonpoint pollutant sources away from steep slopes, water bodies, and critical areas.
4. Protect natural vegetation with fencing, tree armoring, and retaining walls or tree wells.
5. Cover or stabilize topsoil stockpiles.
6. Intercept runoff above disturbed slopes and convey it to a permanent channel or storm drain.
7. On long or steep slopes, construct benches, terraces, or ditches at regular intervals to intercept runoff.
8. Protect areas that provide important water quality benefits and/or are environmentally sensitive ecosystems.
9. Protect water bodies and natural drainage systems by establishing streamside buffers.
10. Minimize the amount of construction time spent in any stream bed.
11. Properly dispose of sediment and debris from construction activities.
12. Replant or cover bare areas as soon as grading or construction is completed. New plantings will require soil

amendments, fertilizers and temporary irrigation to become established. Use high planting and/or seeding rates to ensure rapid stand establishment. Use seeding and mulch/mats. Sodding is an alternative.

Any questions regarding these matters should be directed to the Polluted Runoff Control Program in the Clean Water Branch at 586-4309.

Wastewater

The subject document states that the process wastewater from the Waena Generating Station will be disposed into an injection well after being treated. Domestic wastewater from employees is to be treated and disposed of separately by means of a septic tank and soil absorption system.

We have no objections to the proposed project, provided that the wastewater generated at the site is properly treated and disposed of and that the Underground Injection Control Section of the Safe Drinking Water Branch issues a permit for the disposal of the wastewater into an injection well.

All wastewater plans must conform to the applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems." We reserve the right to review the detailed wastewater plans for conformance to applicable rules.

Should you have any questions on these comments, please contact Ms. Lori Kajiwara of the Wastewater Branch at 586-4294.

Sincerely,

BRUCE S. ANDERSON, Ph.D.
Deputy Director for Environmental Health

c: Maui Electric Company, Ltd.
CH2M HILL, INC.
SDWB
CWB
WWB

CH2MHILL

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Tel 808 943 1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Mr. Bruce Anderson, Ph.D.
Deputy Director
State of Hawaii
Department of Health
PO Box 3378
Honolulu, HI 96801

Dear Dr. Anderson:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 18, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *Please verify which companies are currently approved for water hauling on Maui with Mr. Gordon Muraoka, Maui SDWB Sanitarian, at 984-8234.*

    A telephone call to Mr. Muraoka has confirmed that there are three private companies within the geographic area of the proposed Waena Generating Station approved for water hauling. They are:

    1. **Tri Isle**
    2. **R&C Trucking**
    3. **Rojac**

    In addition, there are several bottled water companies serving the general geographic area of the proposed project. They are:

    1. **Waterman**
    2. **Star Ice**
    3. **Maui Soda**
    4. **Mauka Water**
    5. **Lahaina Pure Water Company**

2. *The applicant should contact the Army Corps of Engineers to identify whether a federal permit is required for this project.*

    A copy of the Draft EIS was provided to the U.S Army Corps of Engineers. In a letter dated August 19, 1997, the Corps responded that no Department of the Army permit will be required for the project. A copy of the USCOE letter is provided in the Final EIS.

3. *Comments regarding design of water systems, NPDES requirements, pollution runoff controls, and wastewater treatment and disposal.*

    In your letter, you mentioned several elements which must be followed during design and construction of the proposed Waena Generating Station. These design elements concerned the potable and non-potable water systems, need for an NPDES permit, pollution runoff controls, and UIC coordination. MECO will coordinate with the Department of Health and Maui County during the design and construction of the proposed project to insure that the facility meets design standards in these areas. This coordination will include applying for an NPDES permit prior to construction activities, receiving approval for grading and erosion control plans, and applying for appropriate UIC approvals.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

[signature]

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

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

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

SEP - 9 1997

Ref.:LD-PEM

File No. PM-97-059

Honorable David W. Blane
Planning Director
County of Maui
Planning Department
250 S. High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Blane:

SUBJECT: Request for Comments - Draft Environmental Impact Statement (DEIS), Waena Generating Station, Wailuku, Maui, Tax Map Key: 3-8-03:Por. 1

We have reviewed the Draft Environmental Impact Statement for the subject project, and would like to offer the following comments:

Land Division - Engineering Branch

We confirm that the proposed site is located in Zone C (no shading). This is an area of minimal flooding.

Commission on Water Resource Management (CWRM)

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas which are important for the maintenance of streams and the replenishment of aquifers.

We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

A Well Construction Permit and a Pump Installation Permit from the CWRM would be required before ground water is developed as a source of supply for the project.

Based on the information provided, it does not appear that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.

Thank you for the opportunity to review the subject Draft Environmental Impact Statement. Should you have any questions, please contact Patti Miyashiro of our Honolulu Land Division Office at (808) 587-0430.

HAWAII: Earth's Best!

Aloha,

MICHAEL D. WILSON

c: Maui Land Board Member
Maui District Land Office
Maui Electric Company, Ltd.
✓CH2M Hill, Inc.

bc: LD-Engineering
CWRM

CH2MHILL

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November 3, 1997

139792.EI.04

Mr. Michael D. Wilson
Director
State of Hawaii
Department of Land and Natural Resources
PO Box 621
Honolulu, HI 96809

Dear Mr. Wilson:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 9, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *We confirm that site is located in Zone C, an area of minimal flooding.*

   Thank you for your confirmation. We have also received confirmation of the Flood Zone C designation from the U.S. Army Corps of Engineers.

2. *We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.*

   Information on the project has been shared with the Maui County Department of Water Supply for their use. We will continue to coordinate with the Department of Water Supply as needed through the planning and construction of this project.

3. *We recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.*

   As a part of this project, water quality data will be gathered and submitted to the State Department of Health to support an Underground Injection Control Permit application. MECO will work together with the Department of Health and will not object to reasonable and fair conditions on permits as determined by the granting authorities.

4. *A Well Construction permit and a Pump Installation Permit from the CWRM would be required.*

   MECO will apply to the State Commission on Water Resource Management for both a Well Construction and Pump Installation Permit following more detailed engineering on the overall plant design.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
[redacted]
GLENN M. OKIMOTO
BRIAN K. MINAAI

IN REPLY REFER TO
STP 8.8145

September 12, 1997

Mr. David W. Blane
Director
Planning Department
County of Maui
250 South High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Waena Power Generating Station
Draft Environmental Impact Statement (DEIS)
TMK: 3-8-03: por. 01

Thank you for your transmittal of August 5, 1997.

Our State transportation facilities can adequately accommodate the subject project. We do not anticipate an adverse impact to our systems.

We appreciate the opportunity to provide comments.

Very truly yours,

KAZU HAYASHIDA
Director of Transportation

c: Mr. Ed Reinhardt, Maui Electric Company, Limited
Mr. Mark Willey, CH2M HILL, INC.

CH2MHILL
Celebrating 50 Years

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1585 Kapiolani Blvd
Suite 1420
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Tel 808.943.1133
Fax 808.941.8225

November 3, 1997

139792.EI.04

Mr. Kazu Hayashida
Director
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Dear Mr. Hayashida:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS

Thank you for your September 12, 1997 letter indicating that state facilities can adequately accommodate the proposed Waena Generating Station. Should you have additional comments on the proposed project, please feel free to contact me.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
677 QUEEN STREET SUITE 300
HONOLULU, HAWAII 96813
FAX (808) 587-0600

ROY S. OSHIRO
EXECUTIVE DIRECTOR

IN REPLY REFER TO
97:DEV/3473

August 29, 1997

The Honorable David Blane
Department of Planning
County of Maui
250 south High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

SUBJECT: Draft Environmental Impact Statement (DEIS) For Maui Electric Company's (MECO) 232-NW Waena Generating Station

Thank you for the opportunity to comment on the subject DEIS. We are pleased to provide the following comments and questions:

Page 4-29 Wastewater Treatment and Disposal

In lieu of disposing into injection wells, can the treated waste water from the operation of the plant be reused again either for plant generation or agricultural irrigation?

Page 4-32 Mitigation Measures

Depending upon the response to the above question, the paragraph under Mitigation Measures may need to be revised accordingly.

Page 3-29 Municipal Solid Waste

The recycling of solid waste as an alternate fuel source for this generation plant should be further studied. Plant design and layout should incorporate a waste-to-energy option as a long-term alternative to fossil fuel.

Thank you for the opportunity to comment on the DEIS.

Sincerely,

ROY S. OSHIRO
Executive Director

c: Ed Reinhardt, MECO
Mark Willey, CH2M Hill, Inc.

HFDC

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November 3, 1997

139792.EI.04

Mr. Roy S. Oshiro
Executive Director
State of Hawaii
Department of Budget and Finance
Housing Finance and Development Corporation
677 Queen Street, Suite 300
Honolulu, HI 96813

Dear Mr. Oshiro:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your August 29, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *Can the treated waste water from the operation of the plant be reused again either for plant generation or agricultural irrigation?*

   MECO will conduct water quality tests of the effluent generated by the Waena Generating Station. Should the water quality tests indicate the feasibility for such use, MECO will consider using it as irrigation water for its landscaping. Any use as agricultural irrigation would need to be approved by the adjacent landowners and appropriate regulatory agencies.

2. *The recycling of solid waste as an alternate fuel source for this generation plant should be further studied. Plant design and layout should incorporate a waste-to-energy option as a long-term alternative to fossil fuel.*

   From the County of Maui's EIS for the expansion of the Central Maui Landfill, it is anticipated that by the year 2016, Maui will produce approximately 670 tons per day of solid waste. Not all of this waste will be combustible. In addition, further reductions of the waste stream occur to accommodate composting and recycling activities. It is estimated that approximately 812 tons per day of combustible materials are required to produce 30-MW of electricity. Because insufficient solid waste is produced on Maui to fuel the amount of baseload generation required in the year 2016, it cannot be looked upon as an economically

> realistic alternative. This determination was also reached in 1995 during an examination of a waste-to-energy proposal by a mainland company for the County of Maui. Following analysis of the waste situation on Maui, both the company and the County decided to place their resources elsewhere.
>
> As a general rule, waste-to-energy plants are considered primarily a method of waste reduction, with electric energy as a by-product. Garbage-to-energy plants have become more problematic for the following reasons:
>
> - A relatively low volume of energy is available in garbage.
> - The amount of energy generated from burning garbage is decreasing because of increased recycling efforts.
> - The ash resulting from the burning of garbage may be classified as hazardous waste, requiring more costly disposal.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

BENJAMIN J. CAYETANO
GOVERNOR

ESTHER UEDA
EXECUTIVE OFFICER

STATE OF HAWAII
DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM
LAND USE COMMISSION
P O Box 2359
Honolulu, HI 96804-2359
Telephone 808-587-3822
Fax 808-587-3827

August 11, 1997

Mr. David W. Blane
Director of Planning
County of Maui
250 S. High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Draft Environmental Impact Statement (DEIS) for the Maui Electric Company, Limited's Waena Generating Station, Wailuku and Makawao Districts, Maui, TMK 3-8-03: por. 1

We have reviewed the DEIS for the subject project and have the following comments:

1) We confirm that the proposed Waena Generating Station Site, as represented in Figure 4-15 of the DEIS, is located within the State Land Use Agricultural District.

2) With respect to the quarry operated by Ameron HC&D, Inc., and the Central Maui Landfill, located across Pulehu Road from the project site, please be advised that the Commission approved an amendment to LUC Docket No. SP77-271/Ameron HC&D to delete approximately 59.686 acres of land from Ameron's quarry operations at Puunene, pursuant to Findings of Fact, Conclusions of Law, and Decision and Order dated June 27, 1997. In the same docket, the Commission also approved an amendment to add approximately 41.2 acres of land for expansion of Ameron's quarry operations, pursuant Findings of Fact, Conclusions of Law, and Decision and Order dated August 5, 1997.

Additionally, pursuant to Findings of Fact, Conclusions of Law, and Decision and Order dated July 21, 1997, the Commission approved the expansion of the Central Maui Landfill on approximately 29.340 acres of land at Puunene under LUC Docket No. SP97-390/Department of Public Works & Waste Management, Solid Waste Division, County of Maui.

3) The standards for determining the Urban District boundaries (§15-15-18, HAR) cited on page 5-1, section 5.2, of the DEIS were amended by the Commission pursuant to its Chapter 15-15, HAR, rule amendments. A copy of the amendments may be obtained from our office after they become effective on August 16, 1997.

4) Page 5-5, section 5.3, of the DEIS states that the project is not subject to Chapter 205A, HRS. Please be advised that pursuant to §205A-1, HRS, the coastal zone management area includes all lands of the State, including the project site. An assessment of the

conformity of the project to the CZM objectives and policies should therefore be provided.

5) The timeframe in which the necessary permits and approvals for the project are projected to be obtained should be provided.

6) According to page 3-15, Table 3-1, of the DEIS, the project will be comprised of four development phases. We suggest that the components (as listed on page 3-5) and acreage for each phase be identified in relation to the conceptual site layout (Figure 3-3). We note that the layout currently distinguishes only between Phase 1 and full buildout.

7) Clarification should be provided as to when Hawaiian Commercial & Sugar Company's lease to cultivate sugarcane on the project site terminates.

8) We understand that a district boundary amendment petition to reclassify the project site from the Agricultural District into the Urban District for this project will be filed with the Commission in the near future.

We have no further comments to offer at this time. We appreciate the opportunity to comment on the subject DEIS.

Should you have any questions, please feel free to call me or Bert Saruwatari of our office at 587-3822.

Sincerely,

for ESTHER UEDA
Executive Officer

EU:th

cc: Ed Reinhardt
Mark Willey
OEQC

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November 5, 1997

139792.EI.04

Ms. Esther Ueda
Executive Officer
State of Hawaii
Department of Business, Economic Development, and Tourism
Land Use Commission
PO Box 2359
Honolulu, HI 96804-2359

Dear Ms. Ueda:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your August 11, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *An assessment of the conformity of the project to the CZM objectives and policies should be provided.*

To address your comment, we have provided the following assessment on the conformity of the proposed Waena Generating Station project with the coastal zone management goals, objectives, and policies. This information has been added, *verbatim*, to Chapter 5 of the EIS.

Hawaii's Coastal Zone Management Program has established objectives and policies as identified in Chapter 205A, HRS. Those objectives and policies are primarily focused on development activities and the effects on the Coastal Zone resources and are outlined below.

1. Recreational Resources

Objective: *Provide coastal recreational resources accessible to the public.*

Policies:

a. Improve coordination and funding of coastal recreation planning and management; and

b. Provide adequate, accessible and diverse recreational opportunities in the coastal zone management area by:

1. Protecting coastal resources uniquely suited for recreation activities that cannot be provided in other areas;

2. 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;

3. Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

4. Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

5. Encouraging expanding public recreational use of county, state and federally owned or controlled shoreline lands and waters having recreational value;

6. Adopting water quality standards and regulating point and non-point sources of pollution to protect and, where feasible, restore the recreational value of coastal waters; and

7. Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits, and crediting such dedication against the requirements of Section 46-6 of the Hawaii Revised Statutes.

2. Historical/Cultural Resources

Objective: *Protect, preserve and where desirable, restore those natural and man-made historic and prehistoric resources in the coastal zone management areas that are significant in Hawaiian and American history and culture.*

Policies:

a. Identify and analyze significant archaeological resources;

b. Maximize information retention through preservation of remains and artifacts or salvage operation; and

c. Support state goals for protection, restoration, interpretation and display of historic resources.

3. Scenic and Open Space Resources

Objective: *Protect, preserve and, where desirable, restore or improve the quality of the coastal scenic and open space resources.*

Policies:

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 the natural land forms 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.

4. *Coastal Ecosystems*

Objective: *Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.*

Policies:

a. Improve the technical basis for mature resource management;

b. Preserve valuable coastal ecosystems of significant biological or economic importance;

c. Minimize disruption and 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 fresh water and marine ecosystems and prohibit land water uses which violate state water quality standards.

5. *Economic Uses*

Objective: *Provide public or private facilities and improvements important to the State's economy in suitable locations.*

Policies:

a. Concentration 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 facilities, and energy-generating facilities are located, designed, and constructed to minimize adverse social, visual and environmental impacts in the coastal zone management areas; 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:

1. Utilization of presently designated locations is not feasible,

2. Adverse environmental effects are minimized, and

3. The development is important to the State's economy.

6. *Coastal Hazards*

Objective: *Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion and subsidence.*

Policies:

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 development comply with requirements of the Federal Flood Insurance Program; and

d. Prevent coastal flooding from inland projects.

7. *Managing Development*

Objective: *Improve the development review process, communication, and public participation in the management of coastal resources and hazard.*

Policies:

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 the application for development permits and resolve overlapping of 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.

8. *Public Participation*

Objective: *Stimulate public awareness, education and participation in coastal management.*

Policies:

a. Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;

b. Disseminate information on coastal management issues by means of educational materials, published reports, staff contact and public workshops for persons and *organizations concerned with coastal related issues, development, and government activities; and*

c. *Organize workshops, policy dialogues, and site specific mediations to respond to coastal issues and conflict.*

9. *Beach Protection*

<u>*Objective:*</u> *Protect beaches for public use and recreation.*

<u>*Policies:*</u>

a. *Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;*

b. *Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and*

c. *Minimize the construction of public erosion-protection structures seaward of the shoreline.*

10. *Marine Resources*

<u>*Objective:*</u> *Implement the State's ocean resource management plan.*

<u>*Policies:*</u>

a. *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*

b. *Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*

c. *Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;*

d. *Assert and articulate the interest of the state as a partner with federal agencies in the sound management of the ocean resources within the United States exclusive economic zone;*

e. *Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon the ocean and coastal resources; and*

f. *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

The subject property is located approximately 4 miles inland. The proposed project will have no impact on the public's access and use of the shoreline area, and there will be no adverse impact to nearshore waters from point and non-point sources of pollution. Because of its location and lack of coastal impacts, the project will conform with the objectives related to recreational resources, coastal ecosystems, beach protection, and marine resources.

There are no known traditional gathering activities and/or cultural practices affecting the subject property. The site and surrounding area have been utilized for sugarcane cultivation for nearly a century, and no significant archaeological resources were discovered during surveys of the site. Therefore, it is anticipated that the subject property will not have an adverse impact upon any significant archaeological or historical resources.

The location of the project site does not represent a significant adverse impact to scenic views or vistas related to coastal areas. Visual impacts will be mitigated through landscaping and choices of paint colors appropriate to the area. Therefore, the project will have no negative impact on the visual character of its immediate environs within the Central Maui region.

The project complies with the economic uses objective by providing a necessary facility located away from coastal areas which will meet and support continued economic growth on the Island of Maui.

According to the Federal Emergency Management Agency's Flood Insurance Rate Map, the project site is located in Zone C, areas experiencing minimal flooding. According to the National Flood Insurance Program, Zone C areas are not considered to be flood plain areas. The site does not lie in a tsunami zone. The subject property has no involvement with construction of any structures within the shoreline area and will not have an impact upon any public beaches.

The project has produced an environmental impact statement which has gone through public review and comment. In addition, several public meetings were held during both the facility siting and environmental assessment phases of the project. The requirement of the project to follow the Maui County Community Plan amendment and County rezoning processes, as well as the state Land Use Boundary redesignation process, ensures that the development of the project will be managed with a high level of public input and participation.

2. *The timeframe in which the necessary permits and approvals for the project are projected to be obtained should be provided.*

Table ES-2 has been revised within the EIS as follows to provide the anticipated timing.

Table ES-2
List of Potential Permits and Approvals
for the Proposed Waena Generating Station and Transmission Lines

Permit/Approval	Agency	Timeframe Application	Timeframe Approval
County of Maui			
Environmental Impact Statement Acceptance	Planning Department/Mayor	3/97	12/97
Community Plan Amendment	Planning Commission/Council/Mayor	12/97	7/98
Change in Zoning	Planning Commission/Council/Mayor	12/97	12/98
Height Variance	Board of Variance & Appeals	3/02	7/02
Combustible and Flammable Liquid Tank Installation*	Public Works	3/02	7/02
Driveway Permit/Work in County Road ROW	Public Works	3/02	7/02
Flood Hazard Certification or Determination	Public Works	3/02	7/02
Building, Grading and Stormwater Management Permits	Public Works	3/02	7/02
State of Hawaii			
Land Use District Designation Reclassification	Land Use Commission	10/97	5/98
Noise Variance for Construction*	Department of Health	3/02	7/02
Prevention of Significant Deterioration/Covered Source Air Permit*	Department of Health	1/99	12/01
Test/Supply Well Well Construction Permit* Pump Installation Permit*	Commission on Water Resource Management/Department of Land & Natural Resources	 6/00 9/00	 12/00 1/01
Underground Injection Control Permit to Construct* Permit to Operate*	Department of Health	 3/02 6/03	 6/02 9/03
Approval for Domestic Wastewater Treatment*	Department of Health	6/03	9/03
NPDES Construction Dewatering* Facility Stormwater Discharge	Department of Health	 3/02 3/02	 7/02 7/02
Authority to Perform Work on State Highway ROW	Department of Transportation	3/02	7/02
Public Utilities Commission General Order 7 Approval*	Public Utilities Commission	1/99	12/99
Federal			
Determination of No Significant Hazard to Air Navigation	Federal Aviation Administration	6/97	6/97
Prevention of Significant Deterioration*	Environmental Protection Agency	1/99	12/01

* Time frame indicated is for installation of the first DTCC unit. Each subsequent DTCC unit may/will require additional permits.

3. *We suggest that the components (as listed on page 3-5) and acreage for each phase be identified in relation to the conceptual site layout (Figure 3-3).*

Table 3-1 in the EIS has been revised as follows to reflect the scheduling and land requirements for each addition of generation capacity. The entire 65.7-acre site will be developed for the installation of the first unit of generation. This will include full grading of the site and the installation of necessary infrastructure, such as drainage improvements, domestic wastewater systems, and roads, to support all four dual-train, combined-cycle (DTCC) generating units. As the need for additional generation capacity occurs, subsequent DTCC units will be placed upon the already improved site. Figure 3-5 of the EIS has been revised to indicate the placement and timing of these additional units and ancillary support structures. A copy of that figure is attached.

Table 3-1
Project Cost and Schedule
(1997 dollars)

Project Component	Acreage	Cost	Construction Start	Operation Date
Land Costs	65.7	$1,847,648	n/a	1997
DTCC 1/Site Development	65.7	$105,370,000	2002	2006
DTCC 2	0	$96,857,000	2005	2010
Transmission Lines	n/a	$10,419,000	2003	2004-2020
Transmission & Distribution Facility	0	$5,900,000	2014	2016
DTCC 3	0	$100,318,000	2009	2016
DTCC 4	0	$96,848,000	2013	2020
Total Project Cost		$417,559,648		

4. *Clarification should be provided as to when Hawaiian Commercial & Sugar Company's lease to cultivate sugarcane on the project site terminates.*

Hawaiian Commercial & Sugar Company (HC&S) holds a month-to-month lease for the project site until the area is required for development by MECO for utility purposes or December 31, 2004, whichever comes first, or if cultivation of crops on the premises is no longer permissible by law. HC&S must use the premises solely for the purpose of crop cultivation and ancillary agricultural activities.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

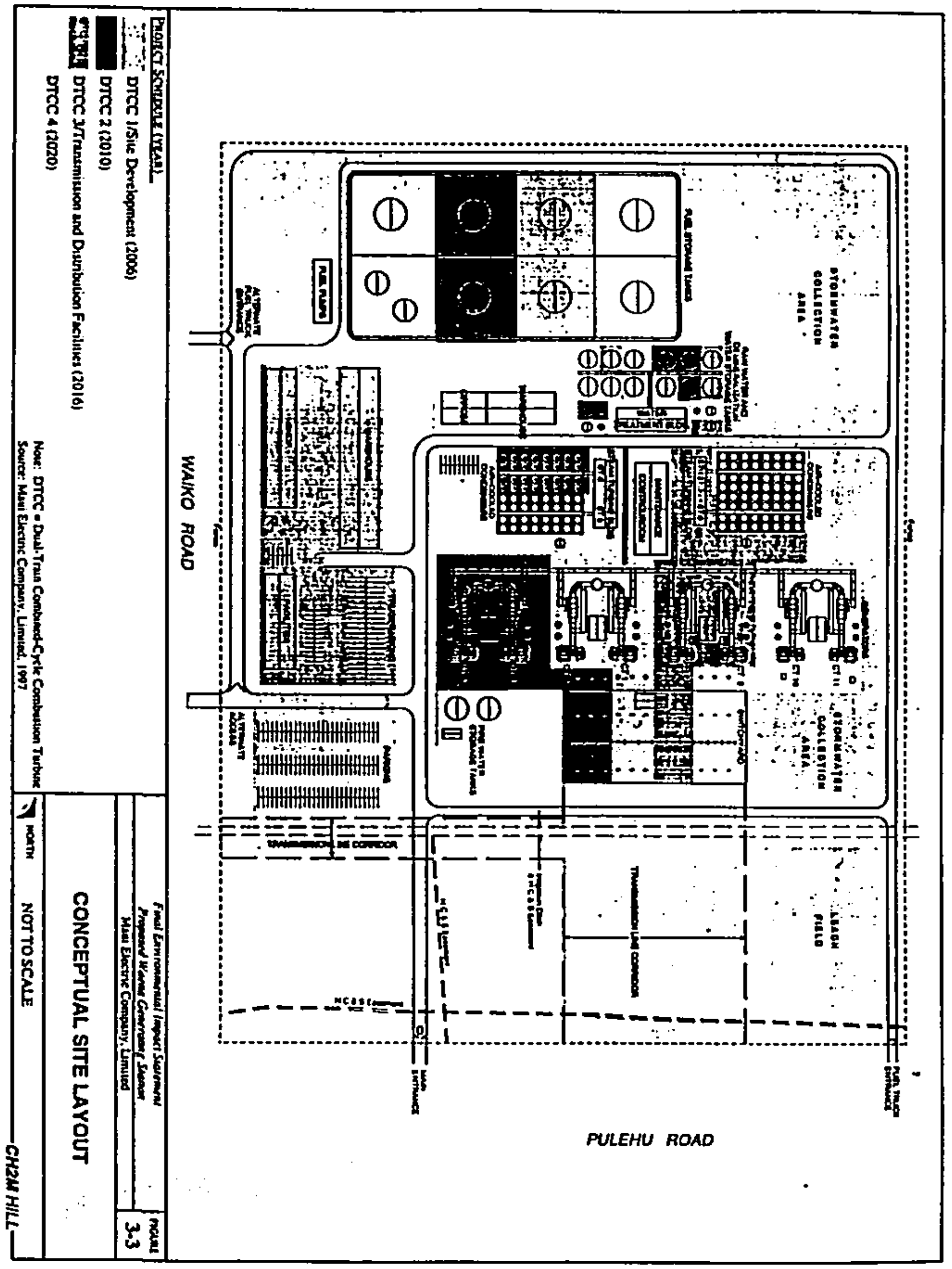
Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC



BENJAMIN J. CAYETANO
GOVERNOR

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235 SOUTH BERETANIA STREET
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GARY GILL
DIRECTOR

RECEIVED
1997 SEP 29 PM 1:28
MAUI ELECTRIC CO
ENGINEERING

September 22 1997

Mr. Ed Reinhardt
Maui Electric Company, Limited
P.O. Box 398
Kahului, Hawai'i 96733-6898

Dear Mr. Reinhardt:

By a July 29, 1997, letter from the County of Maui Planning Department, the Office of Environmental Quality Control has received copies of your draft environmental impact statement (DEIS) for the Waena Generating Station, TMK: Maui 3-8-03, portion of 01. We have published initial notice of availability of this DEIS in the August 8, 1997, edition of the *Environmental Notice*.

1. STATUS OF PERMITS AND APPROVALS

Please include the status (include application submission dates and expected dates of issuance) of the permits and approvals listed in Table ES-2.

2. ENVIRONMENTAL ACCIDENTS

Pursuant to Section 11-200-17(k), Hawai'i Administrative Rules, please discuss the possibility of environmental accidents from oil spills at the harbor or along the highways leading to the proposed project site along with mitigative measures.

3. CUMULATIVE IMPACTS

Please discuss cumulative impacts of the air emissions from the facility, the emissions of methane and other landfill gases from the Maui Central landfill, and the emissions from cane burning in the region.

If there are any questions, please call Mr. Leslie Segundo, Environmental Health Specialist, at 586-4185. Thank you for the opportunity to comment.

Sincerely,

GARY GILL
Director

CH2MHILL
Celebrating 50 Years

CH2M HILL
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Honolulu, HI
96814 4530
Tel 808 943 1133
Fax 808 941 8225

November 3, 1997

139792.EI.04

Mr. Gary Gill
Director
State of Hawaii
Office of Environmental Quality Control
235 South Beretania, Suite 702
Honolulu, HI 96813

Dear Mr. Gill:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 22, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *Please include the status (include application submission dates and expected dates of issuance) of the permits and approvals listed in Table ES-2.*

Table ES-2 has been revised within the EIS as follows to provide the anticipated timing of the potential permits and approvals.

Table ES-2
List of Potential Permits and Approvals
for the Proposed Waena Generating Station and Transmission Lines

Permit/Approval	Agency	Timeframe Application	Timeframe Approval
County of Maui			
Environmental Impact Statement Acceptance	Planning Department/Mayor	3/97	12/97
Community Plan Amendment	Planning Commission/Council/Mayor	12/97	7/98
Change in Zoning	Planning Commission/Council/Mayor	12/97	12/98
Height Variance	Board of Variance & Appeals	3/02	7/02
Combustible and Flammable Liquid Tank Installation*	Public Works	3/02	7/02
Driveway Permit/Work in County Road ROW	Public Works	3/02	7/02
Flood Hazard Certification or Determination	Public Works	3/02	7/02
Building, Grading and Stormwater Management Permits	Public Works	3/02	7/02
State of Hawaii			
Land Use District Designation Reclassification	Land Use Commission	10/97	5/98
Noise Variance for Construction*	Department of Health	3/02	7/02
Prevention of Significant Deterioration/Covered Source Air Permit*	Department of Health	1/99	12/01
Test/Supply Well	Commission on Water Resource Management/Department of Land & Natural Resources		
Well Construction Permit*		6/00	12/00
Pump Installation Permit*		9/00	1/01
Underground Injection Control	Department of Health		
Permit to Construct*		3/02	6/02
Permit to Operate*		6/03	9/03
Approval for Domestic Wastewater Treatment*	Department of Health	6/03	9/03
NPDES	Department of Health		
Construction Dewatering*		3/02	7/02
Facility Stormwater Discharge		3/02	7/02
Authority to Perform Work on State Highway ROW	Department of Transportation	3/02	7/02
Public Utilities Commission General Order 7 Approval*	Public Utilities Commission	1/99	12/99
Federal			
Determination of No Significant Hazard to Air Navigation	Federal Aviation Administration	6/97	6/97
Prevention of Significant Deterioration*	Environmental Protection Agency	1/99	12/01

* Time frame indicated is for installation of the first DTCC unit. Each subsequent DTCC unit may/will require additional permits.

2. *Please discuss the possibility of environmental accidents from oil spills at the harbor or along the highways leading to the proposed project site along with mitigation measures.*

MECO acknowledges that there will be an increase in fuel trucks using the area road network as a result of the proposed Waena Generating Station. However, the amount of traffic attributable to fuel trucks will be small on a per hour basis, beginning with one truck per hour in 2004 and increasing to 5 trucks per hour at full-build out in 2020. Several modifications in the existing roadway system are planned to occur within the next few years which will upgrade the roads used between Kahului Harbor and the proposed Waena Generating Station. As a result of these planned state and county modifications, traffic levels along the fuel haul route will not noticeably change, even following full-build out of the project in 2020. Because traffic congestion will not appreciably worsen as a result of the fuel trucks, we do not anticipate an increased potential for traffic accidents. Additionally, the State of Hawaii Department of Transportation (DOT) in a September 12, 1997 Draft EIS response letter, has indicated that the roadways will adequately accommodate the proposed project traffic.

The fuel barge traffic in and out of Kahului Harbor and on the coastline may not necessarily increase because of the Waena Generating Station. Reconfiguring the cargo carrying arrangement of existing barges or utilizing larger barges could accommodate the fuel requirements of the project. Thus an increase in the number voyages, or traffic, is not certain.

Fuel haul operators for both trucking and shipping must operate within licensing and regulatory standards established by the State Department of Transportation and United States Coast Guard (for marine facilities). These standards include accident and spill response plans. The contractor must also comply with all training requirements established by the State DOT and USCG, including Hazardous Materials Training Courses and fuel hauling and handling seminars provided by the diesel fuel supplier. Should an accidental spill occur while the fuel is in transit, it would be handled by the appropriate hazardous waste containment units of the county fire department, coast guard and the barge operator's spill response contractor. Because of the stringent regulatory requirements imposed on the facilities handling both fuel shipping and trucking operations, the occurrence and severity of accidents either along the area's roadways or within Kahului Harbor should be minimized. In addition, MECO is a member of the Clean Island Council, which has the resources in both equipment and expertise to handle oil spills. The Clean Island Councils is a party in the assessment, containment, and clean-up of any oil spill in the harbor area.

3. *Please discuss cumulative impacts of the air emissions from the facility, the emissions of methane and other landfill gases from the Maui Central Landfill, and emissions from cane burning in the region.*

The Waena Generating Station is not a source of methane. Particulate matter (i.e., $PM/PM_{10}/PM_{2.5}$) is the only pollutant emitted in significant quantities by both the landfill and Waena. Because Waena will have an insignificant impact on PM/PM_{10}, there will be little, if any, cumulative impact of the landfill with Waena.

The landfill may emit small amounts of other non-methane organic carbons. Some of these compounds, such as benzene, may also be emitted in very small quantities by the Waena

Generating Station. However, because of the very small emissions, the different nature of the landfill, and Waena stack emissions, the cumulative impact will be small. The landfill emissions are at ground-level and will have their greatest impact at the landfill boundary. The elevated Waena plumes result in very low concentrations at the property line.

As described in section 4.3.2.1, "Operational Air Emissions" in the DEIS, a 58-MW unit will only significantly impact 3-hour and 24-hour SO_2. Because SO_2 is not a major pollutant in cane burning, the cumulative impact of Waena and cane burning is expected to be small. Particulates comprise the major pollutant released by cane burning. The Waena Generating Station impact for particulates is expected to be insignificant.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPIOLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813-5249
PHONE (808) 594-1888
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'97 SEP 23 P1:01

September 17, 1997

Mr. David Blane
Director, Department of Planning
County of Maui
250 South High Street
Wailuku, Maui HI 96793

Subject: Draft Environmental Impact Statement (DEIS) for Waena Generating Station, Island of Maui.

Dear Mr. Blane:

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for Waena Generating Station, Island of Maui. The applicant proposes to design, construct, and operate a 232-MW electrical generating station on approximately 67 acres in Central Maui.

Table ES-1 of the DEIS shows a summary of potential impacts associated to the proposed generating station. Seventeen resources are included with their impacts clustered as follows: (i) eleven with no impact (64.7%), two with beneficial impact (11.8%), and four with adverse non-significant impact (23.5%). Given the size and complexity of the proposed development, it is somewhat naive for the applicant to claim that only a handful of nonsignificant adverse impacts will likely stem from a generating facility that will (i) cover 67 acres of prime agricultural land, (ii) have inordinate fuel transport, storage, and handling requirements, (iii) burn 312,000 gallons of fossil fuel per day, (iii) require 880,000 gpd of water, (iv) generate an average of 440,000 to 480,000 gpd of wastewater, and (v) be the source of high voltage transmission lines and concomitant electric and magnetic fields criss-crossing the Maui landscape.

The Office of Hawaiian Affairs (OHA) urges the applicant to review the Hawaii Administrative Rules, Title 11, Chapter 200 concerning criteria established to determine the significance of potential environmental impacts. OHA believes there are no provisions in Chapter 200 for nonsignificant adverse impacts.

The Office of Hawaiian Affairs (OHA) finds the DEIS inadequate in addressing fundamental questions concerning potential air contamination, loss of air quality, and overall public health stemming from the burning of about 312,000 gallons of diesel fuel per day. In order to obtain a tangible measure of the magnitude of contaminants likely to be released on a daily basis, OHA provides the following comparison.

The daily vehicle fuel consumption for the entire County of Maui for 1994 was 147,761 gallons (The State of Hawaii Data Book 1995, p. 450). If this fuel consumption rate is used as a reference, on a given day and at a single location, a fully operational Waena generating facility will be burning about two times as much fuel as the entire local automotive park.

The question that arises here is what will be the impacts of such massive fuel burning on Central Maui and nearby areas? The DEIS does not even raise this issue but is detailed and quite technical in describing (i) existing technology to generate electricity (Chapter 3), and (ii) non-significant impacts of contaminants based on empirical modeling of emissions, air quality, vortex effects, plum visibility, and so on (Chapter 4).

In addition, OHA is deeply concerned that prime agricultural lands will be irreversibly lost because of the proposed generating station. OHA is also concerned about high voltage transmission lines and associated electric and magnetic fields. Appendix 1 of the DEIS contains a detailed description of magnetic field modeling but does not address their adverse impacts on public health, safety, vegetation, wildlife, and so on.

Finally, OHA is concerned with proposed measures to handle wastewater. According to the DEIS, 440,000 gpd of wastewater will be pumped to four on-site injection wells. The applicant states that this wastewater will have no impact on underground water quality. OHA wonders, however, how the applicant has managed to equate the quality of wastewater with that of underground water in the area. To state that Waena's wastewater will be similar in quality to existing groundwater (page iv of Appendix E) would obviously eliminate any concerns about potential contamination of underground water. But it would ignore a basic fact that the wastewater produced by Waena will be loaded with chemicals from demineralization and heat-recovery steam generator processes. Once again, OHA urges the applicant to take a critical look to its plans to dispose wastewater in the absence of chemical data that substantiates the contention that Waena's wastewater will not contaminate underground water.

Please contact Lynn Lee, Acting Officer of the Land and Natural Resources Division, or Luis A. Manrique, should you have any questions on this matter.

Sincerely yours,

Randall Ogata
Administrator

Lynn Lee
Acting Officer,
Land and Natural
Resources Division

LM:lm
cc Trustee Clayton Hee, Board Chair
Trustee Abraham Aiona, Board Vice-Chair
Trustee Rowena Akana, Land & Sovereignty Chair
Trustee Haunani Apoliona
Trustee Billie Beamer
Trustee Frenchy DeSoto
Trustee Moses Keale
Trustee Colette Machado
Trustee Hannah Springer
CAC, Island of Maui

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November 3, 1997

139792.EI.04

Ms. Lynn Lee
Acting Officer
State of Hawaii
Office of Hawaiian Affairs
711 Kapiolani Boulevard, Suite 500
Honolulu, HI 96813-5249

Dear Ms. Lee:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 17, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *The Office of Hawaiian Affairs (OHA) urges the applicant to review the Hawaii Administrative Rules, Title 11, Chapter 200 concerning criteria established to determine the significance of potential environmental impacts. OHA believes there are no provisions in Chapter 200 for non-significant adverse impacts.*

   We disagree with your conclusions regarding lack of provisions for non-significant adverse impacts within HAR Title 11, Chapter 200. "Effects" or "impacts" under Title 11-200 may include ecological effects (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic effects, historic effects, cultural effects, economic effects, social effects, or health effects, whether primary, secondary, or cumulative. Effects may also include those effects resulting from actions which may have both beneficial and detrimental *(adverse)* effects, even if on balance the agency believes that the effect will be beneficial.

   Under Title 11-200-12, environmental effects, either beneficial or detrimental *(adverse)* must be evaluated as to whether they have a significant effect on the environment. Thirteen criteria have been established for consideration. Failure to meet any of these significance threshold does not eliminate an environmental effect (either beneficial or detrimental) from occurring. It merely establishes that it is a non-significant impact.

Specific reference to insignificant adverse impacts can be found in Title 11-200-17(m) which require that the Draft EIS describe any mitigation measures included in the action plan to reduce significant, unavoidable, adverse impacts to insignificant levels. This clearly indicates that HAR Title 11 Chapter 200 makes provisions for the identification of insignificant adverse impacts. Further guidance on the assessment of impacts and their significance can be found within 40 CFR 1508.27, which codifies the National Environmental Policy Act of 1969. The NEPA act of 1969 formed the foundation for HAR Title 11, Chapter 200.

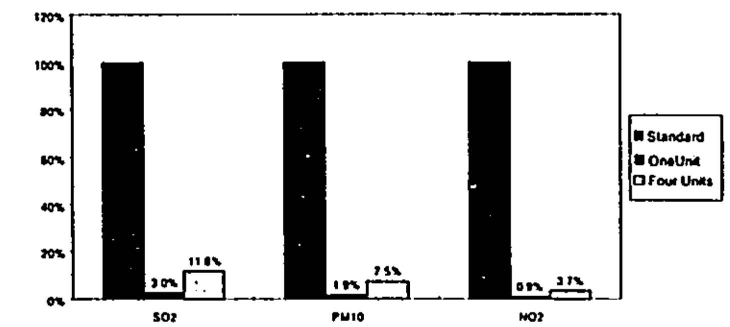
2. *The daily vehicle fuel consumption for the entire County of Maui in 1994 was 147,761 gallons... If this fuel consumption rate is used as reference, on a given day and at a single location, a fully operational Waena generating facility will be burning about two times as much fuel as the entire local automotive park. What will be the impacts of such massive fuel burning on Central Maui and nearby areas?*

Although the entire population of vehicles in Maui County can be considered a notable fuel consumption source, it is not meaningful to compare transportation fuel use with that of the Waena Generating Station as the fuels used, combustion types, and resulting emissions are very different. The Waena Generating Station will be the most fuel efficient type of electrical generation plant on the island of Maui. In addition to fuel combustion for power production, waste heat will be recovered to generate additional power via a heat recovery steam generator (HRSG) with no additional fuel use. Approximately 30 percent of the generation capacity from the four 58-MW units to be installed at Waena will be accomplished with HRSGs, thus increasing overall plant efficiency.

The information detailed in Section 4.3 of the Draft EIS is intended to address air quality impacts resulting from the Waena Generating Station. The air quality models are used to conservatively estimate generating station impacts to ambient air quality in the vicinity of the plant. As discussed in the Draft EIS, because only one 58-MW unit will be permitted at a time, the emissions from one unit were used in the preliminary modeling. Modeling results showed that all pollutant concentrations are below U.S. Environmental Protection Agency (EPA) levels of significant impact except for the 3-hour and 24-hour average sulfur dioxide concentrations. Thus, further Class II increment modeling was done for sulfur dioxide emissions which included the combined emissions from the four proposed Waena units and also the surrounding non-MECO sources. This additional modeling indicates compliance with EPA Class II increment limits which prevent significant air quality deterioration.

In addition to the information contained in the Draft EIS, the following graph compares emissions from the proposed Waena generating station to the ambient air quality standards established by EPA.

Comparison of Maximum Project Impacts with Ambient Standards



As indicated, the projected concentrations of SO_2, NO_x, and PM_{10} for the four 58 MW units combined are well within ambient air quality standards. Based on these numbers, full compliance with the ambient air quality standards is anticipated for the fully built-out generating station.

3. *OHA is deeply concerned that prime agricultural lands will be irreversibly lost because of the proposed generating station.*

Section 3.2.6 of the EIS document summarizes the extensive site screening process undertaken before MECO selected the Waena Generating Site. As indicated in Section 3.2.6, the selection of the Waena site was made after conducting several separate site screening studies between 1989 and 1996, representing an extensive site screening process. (The executive summaries of the last three site screening reports are contained in Appendices B-1, -2, and -3.) The agricultural designation of the site selected was given consideration during the screening. The site screening was conducted in conjunction with an extensive public consultation process that included consultation with representatives of community groups, public agencies, and several public meetings. Section 3.2.6 and Appendices B-1, -2, and -3 summarize why other sites were not chosen.

The site is listed as "Prime Agricultural Land" according to the Agricultural Lands of Importance to the State of Hawaii (ALISH) map. A lengthy discussion of the potential impacts to agricultural production were included in Section 4.11.2.2 of the Draft EIS. While there were other sites considered throughout the process which were not "prime agricultural lands," the Waena site was concluded to be the most appropriate site based on multiple criteria and on significant community input. As such, the loss of the prime agricultural land at the proposed Waena site must be balanced against the public good associated with adequate power generation and electrical reliability.

4. *OHA is concerned about high voltage transmission lines and associated electric and magnetic fields. Appendix I of the DEIS contains a detailed description of magnetic field modeling but does not address their adverse impacts on public health, safety, vegetation, wildlife, and so on.*

The issue of whether or not adverse public health impacts would be caused by the electric and magnetic fields from the transmission lines remains unresolved, as does the larger issue of health effects from electric and magnetic fields. However, the most recent studies examining the relationship between magnetic fields and public health effects have provided little support for the hypotheses that living in homes with high time-weighted average magnetic field levels or in homes close to transmission or distribution lines is related to the risk of childhood leukemia or other cancers (Verkasalo, October 1996 in the *British Medical Journal*; National Research Council Report, February 1997; Lancet, July 1993 in the *New England Journal of Medicine*).

Potential impacts due to electric and magnetic fields were discussed in Section 4.13.2.2 of the Draft EIS. The proposed transmission lines will pass along undeveloped property used for sugarcane cultivation. No residential areas or other sensitive receptors, such as schools, day care centers, etc., are located within 250 feet of any of the proposed transmission lines or the generating station. In addition, no critical or endangered habitat exist in the area around the generating station or along the proposed transmission line corridors. The lack of existing and planned development and the lack of endangered species and critical habitat indicate that no adverse impact will occur.

5. *OHA is concerned with proposed measures to handle wastewater....OHA wonders how the applicant has managed to equate the quality of wastewater with that of underground water in the area....OHA urges the applicant to take a critical look at its plans to dispose wastewater in the absence of chemical data that substantiates the contention that Waena's wastewater will not contaminate underground water.*

The variation in groundwater quality downgradient of the site is not precisely known, but groundwater quality generally becomes more brackish in a northwesterly direction toward the coast. Based upon data from three monitoring wells located in the nearby Central Maui Landfill, the basal aquifer underlying the project site has a head of about 4.8 feet and chloride content that is barely potable in terms of chloride (192 to 216 mg/l). However, because the aquifer depends upon artificial recharge from excess irrigation water, the aquifer still is considered non-potable and is not a potential source of drinking water. Table 4-10 in the Draft EIS contains the water quality of the underlying aquifer as measured by the monitoring wells located in the Central Maui Landfill.

As a part of the underground injection control (UIC) permit application, MECO must collect and present water quality data representative of local conditions for the State Department of Health (DOH) to review. Through this review, the DOH can make the final determination of the appropriateness of the injection well and wastewater disposal techniques. A final UIC permit will be issued by the DOH only after its critical review and acceptance of all pertinent well construction and water quality information. The UIC permit will include discharge limits and action levels for any constituents of concern. Furthermore, the UIC permit will require regular effluent monitoring in order for the DOH to continuously evaluate the quality of the effluent discharged.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

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Ref. No. P-6947

September 23, 1997

Mr. David W. Blane
Planning Director
Planning Department
County of Maui
250 S. High Street
Wailuku, Hawaii 96793

Dear Mr. Blane:

Subject: Draft Environmental Impact Statement (DEIS) for Waena Generating Station, TMK: 3-8-03:01 (portion), Maui

We support Maui Electric's goal to expand its generation facilities but we believe more information is needed. We have the following comments on the Waena DEIS.

The DEIS should address more clearly the net impact of the project to the area's groundwater resources (potable and brackish) needs. While it mentions the importance of agricultural irrigation to aquifer recharge, data are not provided to show the recharge contribution of the proposed site under cultivation. The DEIS should examine this in conjunction with the proposed extraction of brackish water for plant processes and the subsequent wastewater injection of wastewater from plant processes. Also, the DEIS should discuss whether there is net increase or decrease to recharge from the combination of these separate items.

Although the proposed project is below the underground injection control line as indicated in Figure 4-2 on p. 4-26, the direction of flow seems to show that polluted injection wastewater may head down-gradient towards existing private wells. Therefore, requiring down-gradient monitoring for effluent constituents in the groundwater should be considered as a mitigation measure.

The DEIS also stated that the use of the proposed site results in the loss of prime agricultural lands which will be replaced by the expansion of other agricultural lands. The quality of new planted acreage should be identified in the EIS.

Finally, the statement in Section 5.3 on p. 5-5 that "the project is not located within the County SMA and is not subject to HRS Chapter 205A," is incorrect. Chapter 205A defines the Coastal Zone Management (CZM) area as the entire State. Therefore, the project's compliance with the CZM objectives and policies is required, and the assessment should be incorporated into the EIS, in accordance with the Office of Environmental Quality Control's administrative rules.

If there are any questions, please contact Scott Derrickson of our Land Use Program at 587-2805 or Charles Carole of our CZM Program at 587-2804.

Sincerely,

Rick Egged
Director
Office of Planning

cc: Maui Electric Company, Limited
✓CH2M Hill, Inc.
OEQC

CH2MHILL

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November 3, 1997

139792.EI.04

Mr. Rick Egged
Director
State of Hawaii
Department of Business, Economic Development, and Tourism
Office of Planning
PO Box 2359
Honolulu, HI 96804-2359

Dear Mr. Egged:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 23, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *The DEIS should address more clearly the net impact of the project to the area's groundwater resources (potable and brackish) needs. The DEIS should examine recharge contribution in conjunction with the proposed extraction of brackish water for plant processes and the subsequent wastewater injection of wastewater from plant processes. Also, the DEIS should discuss whether there is net increase or decrease to recharge from the combination of these separate items.*

   The elimination of 65.7 acres of land from active sugarcane cultivation would result in a net loss of 0.15 mgd of irrigation recharge to the underlying basal aquifer. This estimate is based upon a drip irrigation application rate of 7,500 gal/day/acre and an estimated net recharge to groundwater of 30 percent. To the net loss of 0.15 mgd, we add the 0.88 mgd withdrawn through the supply well at full build-out and subtract the 0.44 mgd reinjected into the aquifer. As a result, the proposed project would represent a net loss of approximately 0.6 mgd from the underlying aquifer. However, in comparison to the nearest wells, which pump over 18 mgd, the withdrawal associated with the project is relatively insignificant and no adverse impact to overall aquifer groundwater levels is anticipated. As a part of the supply well permit process, a test well will be drilled to verify the amount of pumping possible at the site.

The anticipated net loss to the aquifer has been noted in the Final EIS as follows:

> "As a result of removing irrigation recharge and additional pumping from the aquifer, the proposed Waena Generation Station project is anticipated to result in an approximately 0.6 mgd net loss to the underlying aquifer."

2. *Although the proposed project is below the underground injection control line as indicated in Figure 4-2 on p. 4-26, the direction of flow seems to show that polluted injection wastewater may head down-gradient towards existing private wells. Therefore, requiring down-gradient monitoring for effluent constituents in the groundwater should be considered as a mitigation measure.*

   As a part of the well construction and operation permit and the underground injection control permit, MECO will conduct more detailed water quality analyses and submit the data to the Commission on Water Resource Management, the Department of Health, and other applicable agencies as required. MECO will work together with the permitting agencies and will not object to reasonable and fair conditions on permits as determined by the granting authorities.

3. *The DEIS also stated that the use of the proposed site results in the loss of prime agricultural lands which will be replaced by the expansion of other agricultural lands. The quality of new planted acreage should be identified in the EIS.*

   The 65.7-acre project site represents only 0.02 percent of Maui County's total farmland and only 0.07 percent of Maui County's total cropland. As indicated in the Draft EIS, Hawaiian Commercial & Sugar Company has embarked upon a program independent of the proposed Waena Generating Station to increase their agricultural acreage. This acreage includes 280 acres near Kuihelani Highway, designated as "Other Important Agricultural Lands" under the ALISH designations, and over 1,100 acres between Kuihelani and Honoapiilani Highway designated as "Prime Agricultural Lands" under ALISH.

   MECO realizes that the project will remove a small amount of prime agricultural lands from active sugarcane cultivation. However, the amount of land removed is insignificant in comparison to the overall acreage available on Maui. In addition, the loss must be judged against the greater public good represented by the project's increase in electrical reliability and electrical generation to meet further economic growth, including agricultural endeavors, on the Island of Maui.

4. *The project's compliance with the Coastal Zone Management objectives and policies is required, and the assessment should be incorporated in the EIS.*

   To address your comment, we have provided the following assessment on the conformity of the proposed Waena Generating Station project with the coastal zone management goals, objectives, and policies. This information has been added, verbatim, to Chapter 5 of the EIS.

Hawaii's Coastal Zone Management Program has established objectives and policies as identified in Chapter 205A, HRS. Those objectives and policies are primarily focused on development activities and the effects on the Coastal Zone resources and are outlined below.

1. Recreational Resources

<u>Objective:</u> *Provide coastal recreational resources accessible to the public.*

<u>Policies:</u>

a. Improve coordination and funding of coastal recreation planning and management; and

b. Provide adequate, accessible and diverse recreational opportunities in the coastal zone management area by:

1. Protecting coastal resources uniquely suited for recreation activities that cannot be provided in other areas;

2. 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;

3. Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

4. Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

5. Encouraging expanding public recreational use of county, state and federally owned or controlled shoreline lands and waters having recreational value;

6. Adopting water quality standards and regulating point and non-point sources of pollution to protect and, where feasible, restore the recreational value of coastal waters; and

7. Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits, and crediting such dedication against the requirements of Section 46-6 of the Hawaii Revised Statutes.

2. Historical/Cultural Resources

<u>Objective:</u> *Protect, preserve and where desirable, restore those natural and man-made historic and prehistoric resources in the coastal zone management areas that are significant in Hawaiian and American history and culture.*

<u>Policies:</u>

a. Identify and analyze significant archaeological resources;

b. Maximize information retention through preservation of remains and artifacts or salvage operation; and

c. Support state goals for protection, restoration, interpretation and display of historic resources.

3. Scenic and Open Space Resources

<u>Objective:</u> *Protect, preserve and, where desirable, restore or improve the quality of the coastal scenic and open space resources.*

<u>Policies:</u>

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 the natural land forms 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.

4. Coastal Ecosystems

<u>Objective:</u> *Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.*

<u>Policies:</u>

a. Improve the technical basis for mature resource management;

b. Preserve valuable coastal ecosystems of significant biological or economic importance;

c. Minimize disruption and 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 fresh water and marine ecosystems and prohibit land water uses which violate state water quality standards.

5. Economic Uses

<u>Objective:</u> *Provide public or private facilities and improvements important to the State's economy in suitable locations.*

<u>Policies:</u>

a. Concentration 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 facilities, and energy-generating facilities are located, designed, and constructed to minimize adverse social, visual and environmental impacts in the coastal zone management areas; 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:*

1. *Utilization of presently designated locations is not feasible,*

2. *Adverse environmental effects are minimized, and*

3. *The development is important to the State's economy.*

6. *Coastal Hazards*

Objective: *Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion and subsidence.*

Policies:

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 development comply with requirements of the Federal Flood Insurance Program; and*

d. *Prevent coastal flooding from inland projects.*

7. *Managing Development*

Objective: *Improve the development review process, communication, and public participation in the management of coastal resources and hazard.*

Policies:

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 the application for development permits and resolve overlapping of 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.*

8. *Public Participation*

Objective: *Stimulate public awareness, education and participation in coastal management.*

Policies:

a. *Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;*

b. *Disseminate information on coastal management issues by means of educational materials, published reports, staff contact and public workshops for persons and*

organizations concerned with coastal related issues, development, and government activities; and

c. *Organize workshops, policy dialogues, and site specific mediations to respond to coastal issues and conflict.*

9. *Beach Protection*

Objective: *Protect beaches for public use and recreation.*

Policies:

a. *Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;*

b. *Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and*

c. *Minimize the construction of public erosion-protection structures seaward of the shoreline.*

10. *Marine Resources*

Objective: *Implement the State's ocean resource management plan.*

Policies:

a. *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*

b. *Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*

c. *Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;*

d. *Assert and articulate the interest of the state as a partner with federal agencies in the sound management of the ocean resources within the United States exclusive economic zone;*

e. *Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon the ocean and coastal resources; and*

f. *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

The subject property is located approximately 4 miles inland. The proposed project will have no impact on the public's access and use of the shoreline area, and there will be no adverse impact to nearshore waters from point and non-point sources of pollution. Because of its location and lack of coastal impacts, the project will conform with the objectives related to recreational resources, coastal ecosystems, beach protection, and marine resources.

> There are no known traditional gathering activities and/or cultural practices affecting the subject property. The site and surrounding area have been utilized for sugarcane cultivation for nearly a century, and no significant archaeological resources were discovered during surveys of the site. Therefore, it is anticipated that the subject property will not have an adverse impact upon any significant archaeological or historical resources.
>
> The location of the project site does not represent a significant adverse impact to scenic views or vistas related to coastal areas. Visual impacts will be mitigated through landscaping and choices of paint colors appropriate to the area. Therefore, the project will have no negative impact on the visual character of its immediate environs within the Central Maui region.
>
> The project complies with the economic uses objective by providing a necessary facility located away from coastal areas which will meet and support continued economic growth on the Island of Maui.
>
> According to the Federal Emergency Management Agency's Flood Insurance Rate Map, the project site is located in Zone C, areas experiencing minimal flooding. According to the National Flood Insurance Program, Zone C areas are not considered to be floodplain areas. The site does not lie in a tsunami zone. The subject property has no involvement with construction of any structures within the shoreline area and will not have an impact upon any public beaches.
>
> The project has produced an environmental impact statement which has gone through public review and comment. In addition, several public meetings were held during both the facility siting and environmental assessment phases of the project. The requirement of the project to follow the Maui County Community Plan amendment and County rezoning processes, as well as the state Land Use Boundary redesignation process ensures that the development of the project will be managed with a high level of public input and participation.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

University of Hawai'i at Mānoa

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A Unit of Water Resources Research Center
2550 Campus Road • Crawford 317 • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

September 22, 1997
RE:0683

Mr. Ed Reinhardt
Maui Electric Company, Ltd.
P.O. Box 398
Kahului, Hawaii 96732

Dear Mr. Reinhardt:

Draft Environmental Impact Statement
Waena Power Generating Plant
Puunene, Hawaii

Maui Electric Company, Limited (MECO) proposes to incrementally construct and operate a 232-MW power generating plant on a 67-acre site near the intersection of Pulehu and Waiko Roads near Puunene, Maui. The project, which will be implemented in four phases, consists of four 58-MW dual-train combined cycle units. Currently sugarcane crops occupy the site; thus MECO must request a zoning change from agricultural to urban. The goal of the proposed project is to allow MECO to meet the island's future energy demands. Potential environmental impacts include air quality, water resources, aesthetics, socioeconomic conditions, and land use.

We reviewed this draft Environmental Impact Statement (EIS) with the assistance of Theresa Menard, Zoology; and Paul Berkowitz of the Environmental Center.

General Comments

In general, the document is well-organized, contains few deficiencies, and addresses most environmental concerns thoroughly. Unlike many projects with multiple phases, this EIS follows environmental regulations by assessing the impacts for all phases, not just the initial one. In terms of content, our greatest concern is the implicit acceptance of the State's continued reliance on fossil fuels. Although the document provides a detailed description of alternative energy sources, taken from the Integrated Resource Plan (IRP), it appears that little is being done to reduce the State's dependence on nonrenewable resources. At some point, Hawaii must do more than simply discuss the alternatives.

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Cumulative and Secondary Impacts

In terms of procedural issues, perhaps the most salient problem is the lack of attention to secondary and cumulative impacts. According to Section 11-200-12 of the Hawaii Administrative Rules (HAR), applicants "shall consider every phase of a proposed action, the expected consequences, both primary and secondary, and the cumulative as well as the short-term and long-term effects of the action." If an action either "involves substantial secondary impacts, such as population changes, or ... cumulatively has considerable effect upon the environment," then the action is considered significant.

The Waena Generating Plant draft EIS does not really consider the potentially significant secondary impacts of the project. While the document states that the proposed facility will provide enough electricity to meet projected economic and demographic growth, the document does not consider the possibility that the proposed power plant will stimulate or encourage population growth. This potential secondary effect should be addressed in the final EIS.

In terms of air quality, water resources, agricultural land, traffic, and aesthetics, the document effectively discusses the project's potential impacts. However, the document fails to consider how the proposed project might interact with other planned projects in the region. For instance, in addition to focusing on how much prime agricultural land will be lost as a direct result of the proposed project, the EIS should also assess how much prime agricultural land will be lost as a result of all anticipated projects in the region. This sort of cumulative assessment must be made for each category of impact in the final EIS.

Miscellaneous Notes

Our reviewers had two other miscellaneous comments regarding the proposed project. First, with regard to endangered species assessment, the consultant failed to use bat detectors during the bat survey. Also the survey was conducted for only brief periods on two consecutive evenings in March, the month with the fewest bat observations for all the Hawaiian islands. Thus both the methodology and duration of the bat survey were inadequate. Second, in terms of aesthetics, MECO should consider using taller landscaping since the currently planned trees will not effectively disguise the 150-foot smokestacks.

In conclusion, the document generally meets the legal requirements for environment assessment, except for the lack of consideration of secondary and cumulative effects. These deficiencies should be remedied at the final EIS stage.

Thank you for the opportunity to comment.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Planning Department, County of Maui
CH2M Hill ✓
Roger Fujioka
Mark Willey
Theresa Menard
Paul Berkowitz

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Celebrating 50 Years

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November 3, 1997

139792.EI.04

Mr. John T. Harrison
Environmental Coordinator
University of Hawaii at Manoa
Environmental Center
2550 Campus Road, Crawford Hall 317
Honolulu, HI 96822

Dear Mr. Harrison:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 22, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *The document does not consider the possibility that the proposed power plant will stimulate or encourage population growth. This potential secondary effect should be addressed in the final EIS.*

Population growth in an area is dependent on economic activity that exports goods and services from that area. Economists generally refer to economic activities that create exports and thus increase an area's employment and population as "primary" economic activities. New jobs created by primary economic activities generate new income that circulate through the economy. As the new income (less expediters that "leak" outside the area) circulates through an area's economy, new secondary employment and population are created. The secondary employment, in turn, creates income and expenditures that create tertiary employment.

Maui's primary economic activities are tourism, export agriculture, and other export goods and services. These primary economic activities are the "drivers" of employment and population growth on Maui. Electrical power production on Maui is a secondary economic activity. All of the electric power produced on Maui is consumed by users on the island. Demand for electrical power on Maui depends, directly and indirectly, on primary economic activities, with a second source of power demand derived from secondary and tertiary economic activities.

Construction employment and direct employment associated with the Waena Generating Station are discussed in Section 4.12.2 of the Draft EIS. As indicated, during construction it is expected that there would be approximately 80 to 100 workers directly employed by the project. The direct employment anticipated at the Waena Generation Station upon completion is 46 new employees.

Revised statewide employment multipliers were published in September 1997 by the state (*The 1992 Hawaii State Input-Output Study*, State of Hawaii, Department of Business, Economic Development, and Tourism, Research and Economic Analysis Division, September 1997). Multipliers for Maui Island or Maui County are not provided by the study or by the state, which requires us to use the statewide multipliers. Although use of these statewide multipliers overstates the multiplier effects for Maui Island, they are the most authoritative multiplier of employment impacts. The average employment multiplier for the state (total jobs per job) is 2.12. Based on the average multiplier of 2.12, the total employment attributable to the Waena project when fully operational would be 98 jobs, of which 46 would be the jobs at the Waena Generating Station and the other 52 would be elsewhere in the state. During the construction phase, the total employment attributable to the Waena project would range between 170 and 212 jobs, of which 80 to 100 jobs would be construction jobs at the site, and the remaining 90 to 112 jobs would be elsewhere in the state. Since construction employment is short-term, the continued employment in this area following completion of the facility would be attributed to other projects.

While the foregoing calculation of total employment impacts use statewide multipliers that overstate the Island of Maui and Maui County employment impacts, they do provide a basis for estimating population impacts. This may be done by using the most recent ratio of population relative to civilian jobs for Maui County [*State of Hawaii Data Book: 1996*, as yet unpublished]. For the Island of Maui, this ratio would likely understate the employment to resident ratio, as Molokai and Lanai have significantly higher unemployment rates then the Island of Maui. Based on data for Maui County, there exists 0.54 civilian jobs per resident. Using this ratio indicates that the net population associated with the 98 jobs attributable to the Waena project would be about 181 residents. The same ratio indicates that the net population associated with the 170 to 212 construction jobs would be in the order of 315 to 393 residents. Since construction employment is short-term, were the population associated with construction employment attributable to the Waena project to remain on the Island of Maui, it would be attributable to other projects.

The foregoing estimates of residents based on the job to resident ratio may be evaluated with state projections of resident population for Maui County for the years 2000 and 2020 [*Population and Economic Projections for the State of Hawaii to 2020: DBEDT 2020 Series*, State of Hawaii, Department of Business, Economic Development, and Tourism, Research and Economic Analysis Division, May 1997]. Maui County's resident population is projected to increase from 117,100 in 1996 to 155,400 in the year 2020. This represents an increase in the resident count of 38,300 between 1996 and 2020. In light of the projected population increases for Maui County between 1996 and 2020, the population that may be associated with the Waena Generating Station's employment, both operational and construction, is not considered to be significant.

Since the MECO project is not a primary economic activity, it is not expected to influence population growth on the Island of Maui. The generating station will meet the anticipated growth demands attributed to the island's primary economic activities and secondary and

tertiary growth induced by the primary economic activities. Should these demands not occur as anticipated, subsequent unit additions at the facility could be deferred.

2. *The document fails to consider how the proposed project might interact with other planned projects in the region, for instance, the EIS should also address how much prime agricultural land will be lost as a result of all anticipated projects in the region.*

   The project's interaction with other existing and planned projects on Maui Island will be principally related to providing electricity to residential and business customers of MECO. MECO will provide the electricity through its system of transmission and distribution lines. Monthly statements will be sent to customers. Other interaction will be very inconsequential and/or infrequent.

   The project's purpose is to respond to the anticipated increase in demand for electricity caused by other projects on the Island of Maui. The project itself is not expected to directly stimulate or increase the demand or support for other projects. Because of this, the project does not have a direct cause-and-effect relationship leading to the loss of any additional agricultural lands over and above those directly associated with the project site.

   Currently planned projects within the Central Maui basin were identified on Figure 4-14 of the DEIS. Maui County's proposal for the Mokulele Baseyard has the potential to utilize approximately 50 acres of land designated as prime agricultural. The Department of Hawaiian Home Lands also has expressed an interest in lands around the old Puunene Airport, much of which is also designated as prime agricultural. No other projects have been identified within the Central Maui basin at this time.

3. *Both the methodology and duration of the bat survey were inadequate.*

   Although bat detectors might have sensed the presence of bats within the area, the site itself is a flat area that experiences heavy cane cultivation. During harvesting, all vegetation is removed. No habitat exists on the site for bat roosting and surveys did not discover evidence of any roosting bats. No critical habitat exists on the site which would make it suitable for bat foraging. Although it is likely that bats utilize the air space above the project, the proposed generating station will not remove critical habitat necessary in any way for bat survival. Therefore, we do not anticipate the proposed project to have any adverse impact upon the endangered Hawaiian Hoary Bat.

4. *MECO should consider using taller landscaping since the currently planned trees will not effectively disguise the 150-foot smokestacks.*

   Use of certain types of landscaping around generating stations is determined mainly by the operational requirements of the facility. Certain landscaping, although desirable, often produces small leaves and debris which can damage equipment. In addition, taller landscaping can inhibit wind and air movement across the facility, which is required for much of the equipment cooled by air. Further consideration must be given to the height of landscaping under electric lines, which must remain short enough to maintain adequate clearances. MECO did consider using taller trees and landscaping; however, an equilibrium had to be reached between the height and type of tree with the above operational requirements. MECO realizes that the landscaping, as currently designed, will not disguise

the stacks, nor is it intended to. MECO will mitigate the visual impact of the stacks through the use of appropriate colors.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

LINDA CROCKETT LINGLE
Mayor
CHARLES JENCKS
Director
DAVID C. GOODE
Deputy Director
AARON SHINMOTO, P.E.
Chief Staff Engineer

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS AND WASTE MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration
EASSIE MILLER, P.E.
Wastewater Reclamation Division
LLOYD P.C.W. LEE, P.E.
Engineering Division
BRIAN HASHIRO, P.E.
Highways Division
Solid Waste Division

September 25, 1997

MEMO TO: DAVID W. BLANE, DIRECTOR OF PLANNING

F R O M: CHARLES JENCKS, DIRECTOR OF PUBLIC WORKS AND WASTE MANAGEMENT

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
MAUI ELECTRIC COMPANY - WAENA GENERATING STATION
TMK (2) 3-8-003:001

We reviewed the subject submittal and have the following comments.

1. A road widening lot may be required for the adjoining half of Pulehu Road to provide for future fifty (50) foot right-of-way and improved to County standards. Said lot shall be dedicated to the County upon completion of the improvements.

2. All structures, such as walls, trees, etc., shall be removed or relocated from the road widening strip. The rear boundaries of the road widening strip shall be clearly marked to determine if said structures have been properly removed and relocated.

3. A 30' radius shall be provided at the intersection of the proposed driveway and the adjoining Pulehu Road.

4. The EIS should address traffic impacts created by this development by showing future traffic conditions with and without the proposed development. The EIS should also discuss impacts if the proposed State Department of Transportation improvements are not completed. Finally, mitigative measures should be proposed to alleviate traffic congestion to L.O.S. "D" or better.

5. The draft EIS does not include a drainage report and, therefore, drainage impacts created by this development cannot be assessed.

6. The report states that the subject parcel is owned in fee simple by Maui Electric Company, Limited. However, County tax records show that the parcel is owned by Alexander & Baldwin, Inc. The applicant shall submit a copy of the deed confirming ownership by Maui Electric Company, or an authorization letter from Alexander & Baldwin, Inc., if Alexander & Baldwin is indeed still the owner of the parcel.

If you have any questions, please call David Goode at 243-7845.

DG:co/mt
xc: Engineering Division
Solid Waste Division
Wastewater Reclamation Division
S:\LUCA\CZM\WAENA

CH2MHILL

Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
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November 3, 1997

139792.EI.04

Mr. Charles Jencks
Director
County of Maui
Department of Public Works and Waste Management
200 South High Street
Wailuku, HI 96793

Dear Mr. Jencks:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 25, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *A road widening lot may be required for the adjoining half of Pulehu Road to provide for future 50-foot right-of-way and improved to County standards. All structures, such as walls, trees, etc., shall be removed or relocated from the road widening strip. The rear boundaries of the road widening strip shall be clearly marked to determine if said structures have been properly removed and relocated.*

   MECO will coordinate with the Maui County Department of Public Works during the design of the Waena Generating Station to insure compliance with your requests for road widening setbacks.

2. *A 30-foot radius shall be provided at the intersection of the proposed driveway and adjoining Pulehu Road.*

   MECO will coordinate with the Maui County Department of Public Works during the design of the Waena Generating Station to insure compliance with your design requirements concerning driveways and intersections.

3. *The EIS should address traffic impacts created by this development by showing future traffic conditions with and without the proposed development.*

   Section 4.13.1 of the Draft EIS discusses the potential impacts of the project on the area's transportation resources. Level-of-Service (LOS) analyses were performed for the existing 1997 conditions (Section 4.13.1.1), the results of which are summarized in Table 4-14. Future conditions without the project were also discussed in Section 4.13.1.1, and the results of these LOS analyses were summarized in Table 4-15. Future conditions with the project were discussed in Section 4.13.1.2, and the results of these LOS analyses were summarized in Table 4-17.

4. *The EIS should discuss impacts if the proposed State Department of Transportation improvements are not completed.*

   Should the State Department of Transportation improvements not be constructed, future traffic levels within the region will operate at level-of-service F at most major intersections, as indicated within traffic studies prepared for the Kahului Airport expansion. With the existing laneage configuration at the signalized intersection of Hana Highway and Dairy Road, the volume-to-capacity (v/c) ratio of the overall intersection would exceed 1.0 second and delays would be at LOS F during the morning, mid-day, and afternoon peak hours. At the existing unsignalized intersections of Hana Highway/Kamehameha Avenue/Hobron Avenue and Hana Highway/Pulehu Road, the minor street movements, especially the left turn movements onto Hana Highway, would be expected to experience very long delays (LOS F).

   Following the installation of the third generating unit and the transfer of the transmission and distribution functions from Kahului to the Waena site by 2016, project-related traffic would comprise approximately 0.4 to 3.5 percent of future peak hour traffic volumes entering the three Hana Highway intersections. For the unsignalized intersection of Hansen Road and Pulehu Road, the overall delay is estimated to be LOS C or better during the peak hours, with project traffic accounting for 4.1 to 20 percent of the total future peak hour traffic volumes at this intersection, depending on the specific traffic movement. The state highway improvements discussed in the Draft EIS would assist in the mitigation of future regional traffic conditions, which will occur with or without the proposed Waena project. These improvements are consistent with the February 1997 *Maui Long-Range Land Transportation Plan*, which describes future regional deficiencies, alternatives, and recommended transportation plans for the Island of Maui.

5. *Mitigation measures should be proposed to alleviate traffic congestion to LOS D or better.*

   The traffic report contained in Appendix I includes a discussion of possible mitigation measures to improve conditions at the one intersection operating at LOS E (Hana Highway and Dairy Road). This discussion can be found on pages 36-38 of the report which are reproduced and attached. It should be noted that the LOS problems identified at this intersection are regional in nature and are calculated to exist in the future even without the project, with the anticipated delay at the intersection being 44.4 seconds. The calculated delay at this intersection after full construction of the Waena Generating Station is 44.5 seconds, an insignificant 0.1 second increase.

6. *The Draft EIS does not include a drainage report and; therefore, drainage impacts created by this development cannot be assessed.*

CH2M HILL has prepared a preliminary drainage report using the conceptual designs contained within the Draft EIS. This report is attached to this letter. Briefly, the development of the proposed Waena Generating Station will remove 65.7 acres from active sugarcane cultivation. Of that acreage, approximately 15 acres will remain in open space reserved for easements and approximately 50 acres will be developed. The developed area will consist of both impervious, asphalt areas and more pervious, gravel-covered areas. On the basis of the conceptual design currently available for the 65.7-acre site, the proposed project would increase stormwater runoff from approximately 45.5 cubic feet per second (cfs) to approximately 215.4 cfs. Stormwater runoff over the developed 50 acres is estimated to increase from approximately 34 cfs to 204 cfs.

Drainage improvements will be designed to produce no adverse impacts, due to stormwater runoff, on adjacent properties. All drainage improvements will conform to County of Maui requirements and standards. A detailed drainage report, grading plans, and construction plans will be submitted to the County of Maui for approval following completion of the preliminary engineering and design phase of the project.

The information provided above on estimated drainage impacts based upon the conceptual design has been included in Section 4.6 of the Final EIS.

7. *The applicant shall submit a copy of the deed confirming ownership by Maui Electric Company.*

A copy of the Final Order of Condemnation transferring ownership of the subject property from Alexander & Baldwin-Hawaii to Maui Electric Company, Limited, is attached to this letter.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

Preliminary Drainage Report for the Maui Electric Company, Limited's Waena Generating Station

Prepared by CH2M HILL, Inc.

1.0 Introduction

The purpose of this report is to evaluate the existing drainage and project site conditions, and to develop a conceptual drainage plan for the proposed Waena Generating Station.

2.0 Proposed Project

2.1 Location

The proposed Waena Generating Station is located in central Maui, north of Waiko Road at its intersection with Pulehu Road, and is identified as parcels TMK 3-8-03:23 and 3-8-03:24. The site is currently leased to Hawaiian Commercial & Sugar Company (HC&S) for sugarcane cultivation. Lands immediately surrounding the site are owned by Alexander & Baldwin-Hawaii, and are used for sugarcane cultivation. Across Pulehu Road from the site are a sanitary landfill and a quarry .

2.2 Project Description

Maui Electric Company, Limited (MECO) proposes to design, construct, and operate a 232-megawatt (MW) electrical generating station on 65.7 acres of land located along Pulehu and Waiko Roads in central Maui. Related 69-kilovolt (kV) transmission lines from the site to substations at the Paia Sugar Mill and Puunene Sugar Mill are also proposed as a part of this project. Distribution lines (12kV) may also lead from the proposed generating station to Puunene. In addition, MECO may relocate its existing transmission and distribution base yard from its current location in Kahului to the new facility.

The Waena Generating Station will consist of four 58-MW dual-train combined-cycle (DTCC) generating units, with the first 20-MW combustion turbine scheduled for operation by the year 2004. Completion of the first 58-MW DTCC unit is planned for 2006. Usable portions of the site may be available for future plant expansion or be made available on an interim or long-term basis for energy-related activities. However, HC&S easements, transmission line corridors, leach fields, and other supporting urban uses will limit the amount of usable area available to non-MECO activities.

To accomplish this project, MECO intends to request changes in the Wailuku-Kahului Community Plan designation from "Agricultural" to "Heavy Industrial," in the State Land Use designation from "Agricultural" to "Urban," and in the Maui County Zoning Code from "Interim" to "Heavy Industrial."

3.0 Existing Conditions

3.1 Existing Land Uses

The site of the proposed Waena Generating Station is owned in fee by MECO, and is currently under sugarcane cultivation. Elements of HC&S's plantation operations on the site include an active irrigation ditch and maintenance easements.

Lands adjacent to the site are owned by Alexander & Baldwin-Hawaii (A&B-Hawaii), and are also under sugarcane cultivation. The County of Maui owns and maintains Pulehu Road, which runs adjacent to the site. Across Pulehu Road from the project site is the Central Maui Landfill, owned and operated by the County of Maui, and a quarry operated by Ameron HC&D, Inc. The quarry activities are located on lands owned by A&B-Hawaii. The nearest residential or commercial areas to the site are located over 2 miles away, at Puunene.

3.2 Topography

The proposed project site is relatively flat, with an average slope from the southeast to the northwest of approximately 1 degree. Elevations at the site range from approximately 335 feet above mean sea level (MSL) on the western side near Puunene, to 365 feet above MSL on the eastern side near the intersection of Waiko and Pulehu Roads.

3.3 Soils

The United States Department of Agriculture Soil Conservation Service (SCS) has classified the soils at the proposed generating station site as the Waiakoa Series, silty clay loam occurring on 3 to 7 percent slopes (WeB). This soil is generally stony, grading to hard bedrock within a depth of approximately 5 feet. Runoff potential of this soil is slow to medium, and the erosion hazard is slight to medium.

3.4 Climate

The climate of Maui is relatively uniform, characterized by moderate temperatures with rainy winters, and moderately high humidity throughout the year. The range of average temperatures between January, the coldest month, and August, the warmest month, is 71.5°F to 79.2°F. Rainfall is normally relatively light, and occurs mostly during the wet season from November through April. Annual rainfall in the project area is approximately 20 inches.

The Island of Maui is located in the tradewind belt, a region in the North Pacific dominated by a semi-permanent high pressure center north of Hawaii. Wind circulation around this high pressure area is clockwise and outward from the center, producing generally northeasterly wind flow over the Hawaiian Islands. Prevailing surface winds in the study area are from the

east/northeast. These northeasterly tradewinds occur over 70 percent of the time. However, during "Kona" conditions, the prevailing direction changes to a south/southwesterly direction. Wind patterns vary on a daily basis, with tradewinds generally being stronger in the afternoon. At night the wind direction becomes easterly as "drainage" winds blow down from Haleakala. The normal tradewinds, attenuated by the funneling effect of Haleakala and the West Maui Mountains, may attain speeds of up to 40 to 45 miles per hour through the Central Maui isthmus. Occasional strong Kona winds occur with the passage of storms during the winter months.

3.5 Drainage

Drainage in the area of the project site is generally via Kalialinui Gulch, located a quarter mile to the north of the project site, and Pulehu Gulch, located a mile to the south of the project site. Stormwater runoff from the proposed Waena Generating Station site generally sheet flows in a northwesterly direction, and enters the existing irrigation ditch running through the property.

3.6 Flood Zone

According to the Federal Emergency Management Agency's Flood Insurance Rate Map, the project site is located in Zone C, which are areas that experience minimal flooding. Furthermore, according to the National Flood Insurance Program, Zone C areas are not considered to be flood plain areas.

4.0 Conceptual Drainage Plan

4.1 Conceptual Drainage Plan

Development of the Waena Generating Station will increase stormwater runoff from the site, as compared to the existing condition. To prevent project-specific runoff from reaching adjoining sugarcane lands, the proposed project will include stormwater runoff and infiltration ponds to collect and contain stormwater on site. A 15-foot landscape buffer around the facility will also aid in stormwater percolation. Runoff ponds will have special sumps with oil/water separators to remove any oil before disposal of the stormwater runoff into an infiltration pond. Infiltration ponds and attendant sumps will be designed in accordance with the County of Maui's "Rules for the Design of Storm Drainage Facilities in the County of Maui" (Title MC-15, Chapter 4). A disposal alternative for stormwater runoff could include a shallow injection well (dry well). Any injection well would be constructed and operated in accordance with the State Department of Health's (DOH) underground injection control regulations. At this time, HC&S has requested that stormwater runoff from the Waena Generating Station be diverted away from the existing irrigation ditch. Site grading and development will occur to prevent stormwater runoff from impacting the existing irrigation ditch.

A detailed drainage report, grading plans, and construction plans will be submitted to the County of Maui for approval following completion of the preliminary engineering and design phase of the project.

4.2 Hydrology

The Rational Method, as described in the County of Maui's "Rules for the Design of Storm Drainage Facilities in the County of Maui," was used in calculating the anticipated stormwater runoff rate from the proposed Waena Generating Station. The calculations were based on a total developed area of 65.7 acres, and on a 50-year recurrence interval (1-hour storm). Of the 65.7 acres to be developed, approximately 15 acres will be restricted to open space due to existing and proposed easements. The remaining acreage will be developed with both impervious surfaces and more pervious gravel surfaces.

The stormwater runoff rate for the existing 65.7-acre site is approximately 45.5 cubic feet per second (cfs). The runoff rate for the developed Waena Generating Station is calculated to be approximately 215.4 cfs. Approximately 11 cfs is associated with the 15 acres restricted to open space. See the attached calculations.

5.0 Conclusion

The proposed drainage improvements will be designed to produce no adverse impacts, due to additional stormwater runoff, on adjacent properties. All drainage improvements will conform to County requirements and standards. A detailed drainage report, grading plans, and construction plans will be submitted to the County of Maui for approval following completion of the preliminary engineering and design phase of the project.

MAUI ELECTRIC COMPANY, LIMITED
WAENA GENERATING STATION

ATTACHMENT 1
RUNOFF CALCULATIONS

EXISTING

All references taken from *"Rules for the Design of Storm Drainage Facilities in the County of Maui," Title MC-15, Department of Public Works and Waste Management, County of Maui, Chapter 4.*

Calculate Q:

$Q = CIA$

1. 50.573 acre parcel = Q_1

- determine C_1:
  - -from Table 1: $C = 0.22$
  - -from Table 2: $C = 0.17 \Rightarrow 0.22 > 0.17$ therefore use $C = 0.22$

- determine I_1:
  - -from Plate 1: $T_c = 40$ min.
  - -from Table 4: assume 2.0 feet per second (fps)

$$\frac{2{,}000 \text{ ft}}{2.0 \text{ fps}} = 1{,}000 \text{ seconds} = 17 \text{ min.}$$

$17 \neq 40 \Rightarrow$ use $T_c = 40$ min.

-from Plate 7: 1-hour rainfall = 2.5 inches
-from Plate 2, for $T_c = 40$ min. and 2.5 inches rainfall $\Rightarrow I_1 = 3.1$ inches per hour

THEREFORE $Q_1 = C_1 I_1 A_1$
$= (0.22)(3.1)(50.573) = 34.5$ cubic feet per second (cfs)

$Q_1 = 34.5$ cfs

2. 15.127 acre parcel = Q_2

$C_2 = 0.22$

- determine I_2:
  - -from Plate 1: $T_c = 33$ min.
  - -from Table 4: assume 2.0 fps

$$\frac{1{,}500}{2.0} = 750 \text{ seconds} = 2.0 \text{ fps}$$

$12.5 \neq 33 \Rightarrow$ use $T_c = 33$ min.

-from Plate 7: 1-hour rainfall = 2.5 inches
-from Plate 2, for $T_c = 33$ min. and 2.5 inches rainfall $\Rightarrow I_2 = 3.3$ in/hr

THEREFORE: $Q_2 = C_2 I_2 A_2$
$= (0.22)(3.3)(15.127)$
$= 11.0$ cfs

$Q_2 = 11.0$ cfs

$Q_{TOTAL} = 45.5$ cfs

POST - CONSTRUCTION

Compute Composite "C":

- from Table 1:
  - -concrete/roof = 0.55 + 0.07 + 0.00 + 0.20 = 0.82
  - -pavement/road = 0.55 + 0.07 + 0.00 + 0.20 = 0.82
  - -gravel = 0.55 + 0.07 + 0.00 + 0.07 = 0.69

$$\Rightarrow \quad \text{"C"} = \frac{(0.82)(13.85) + (0.82)(15.95) + (0.69)(20.773)}{50.573}$$

C = 0.77

- from Table 2:
  - -concrete/roof = 0.95
  - -pavement/road = 0.95
  - -gravel = 0.40 (assume "Railroad - Yard areas")

$$\Rightarrow \quad \text{"C"} = \frac{(0.95)(13.85) + (0.95)(15.95) + (0.40)(20.773)}{50.573}$$

C = 0.72

$0.77 > 0.72 \Rightarrow$ use C = 0.77

- from Table 3:
  - -minimum runoff coefficients for built-up areas:

$\Rightarrow$ Industrial areas: C = 0.80 - 0.90 > 0.77

$$\frac{29.80}{50.573} = 0.59$$

THEREFORE: (0.59)(0.1) + 0.80 = 0.86

C = 0.86

POST - CONSTRUCTION

Calculate Q:

Q = CIA

- C = 0.86 (see calculations for composite "C")
- determine I:
  - -from Plate 1: T_c = 14 min.
  - -from Table 4: assume 5.0 feet per second (fps)

$$\frac{2{,}000 \text{ ft}}{5.0 \text{ fps}} = 400 \text{ seconds} = 6.7 \text{ min.}$$

$$6.7 \neq 14 \Rightarrow \text{use } T_c = 14 \text{ min.}$$

  - -from Plate 7: 1-hour rainfall = 2.5 inches
  - -from Plate 2, for T_c = 14 min. and 2.5 inches rainfall ⇒ I = 4.7 inches per hour

THERETORE Q_1 = $C_1I_1A_1$
= (0.86)(4.7)(50.573)
= 204.4

Q_1 = 204.4 cfs

Q_2 = $C_2I_2A_2$ (assume same as existing)
= (0.22)(3.3)(15.127)
= 11.0 cfs

Q_2 = 11.0 cfs

Q_{TOTAL} = 215.4 cfs

American Lung Association of Hawaii
245 N. Kukui Street
Suite 100
Honolulu, HI 96817-3951
Fax: (808) 537-5971
Phone: (808) 537-5966

AMERICAN LUNG ASSOCIATION. of Hawaii

RECEIVED AUG 26 AM 10 43 MAUI ELECTRIC CO. ENGINEERING DEPT

When You Can't Breathe, Nothing Else Matters®

Founded in 1904, the American Lung Association includes affiliated associations throughout the U.S., and a medical section, the American Thoracic Society.

18 August, 1997

Mr. Ed Reinhardt
Maui Electric Company, Limited
PO Box 398
Kahului, HI 96733-6898

RE: Draft Environmental Impact Statement (DEIS) for Waena Generating Station TMK Maui 3-8-03, portion of :01.

Dear Mr. Reinhardt:

We thank you for the opportunity to review the DEIS for the proposed Waena Generating Station on Maui. We have the following comments concerning the DEIS:

1. <u>Best Available Control Technologies (BACTs)</u>: Frequent references are made to the fact that the BACTs for air emissions are unresolved. We understand that the facility has yet to be designed, however the American Lung Association of, Hawaii (ALAH) has reservations regarding the discussion(s) of BACTs in the DEIS. It appears that the only BACTs discussed abate emissions generated via operation of the Combustion Turbines (CTs), even though the CTs are not the only source of emissions at the proposed facility. Specifically:

   A. No BACTs are discussed to control Volatile Organic (Hydrocarbon) Compounds (VOCs), such as those that may potentially come from the fuel farm operations; in fact this source is not even discussed (page 3-11). The fuel farm is projected to store approximately 10.5 million gallons of diesel #2, or potentially, naphtha, and approximately 400,000 gallons per day will be trucked into the facility at full build-out (page 3-6). While not required under CAA regulations, many facilities opt to install systems to minimize diesel vapor loss (e.g., tanks with floating pans and edge gaskets under stationary roofs).

   VOCs are given short shrift in the discussions of regulatory compliance as well. For instance, table 4-4 indicates that VOC emissions will be high enough to trigger Prevention of Significant Deterioration (PSD) regulations, however, VOCs are omitted from Tables 4-3 (Summary of Impact Levels, Monitoring Levels and PSD Increment), 4-5 (Comparison of Project Impacts with Significant Impact Levels) and 4-6 (Comparison of Maximum Predicted Sulfur Dioxide, Nitrogen Dioxide, and PM/PM-10 Concentrations with Class II PSD Increments). Nor is the impact of VOCs addressed in the text discussing these tables. Is this because the discussion deals only with emissions related to the CTs and does not addresss potential emissions from other sources within the facility, such as the tank farm and associated piping, collection systems and oily water separation units?

   B. Control of ammonia and related (decomposition or reaction) gases or vapors produced and released during a potential spill event at the Waena Generating Station facility or during transportation of ammonia to the facility is not discussed. How will these hazardous emissions be controlled if ammonia is required in the BACT for nitrogen oxide emissions?

   C. It is unclear from section four (4) just how the Environmental Protection Agency's (EPA) New Source Performance Standards will impact the project and if the BACTs proposed in section three (3) will be sufficient to maintain compliance – especially for the nitrogen oxides (NO_x).

   D. It is unclear from section four (4) if and how the EPA's new Ozone & Fine Particulate Matter (PM-2.5) Standards will impact the project. For instance, table 4-4 states that the expected PM emission rate for one 58-MW unit is 173 tons per year while the fifth footnote to this table states that the manufacturer expects an emission rate of 66.3 tons per year (per unit). Regardless of which figure is correct, both are related to the PM-10 standard and the fifth footnote also makes reference to the expected size of the particulate emission being less than 10 microns.

2. <u>Cumulative Air Impacts</u>: What will be the impact of the facility on air quality during cane burning or on VOG days? The impacts on the Kehei area appear to be most important with trade winds and on Kahului and Wailuku with Kona winds. It would have been helpful to have the project site indicated on the maps in the Maui Vortex study. It appears that the site is far enough down on the slope of Haleakala to have emissions swept in the same pattern as cane smoke. As cane smoke is a significant issue on Maui, the addition of a major stationary source is a concern.

3. <u>Fugitive Dust</u>: Fugitive dust controls are not described. While this project site is rurally located, fugitive dust control should none-the-less be a construction management issue. The State of Hawaii, Department of Health, typically provides recommendations on fugitive dust control through the Clean Air Branch at (808) 586-4200.

Should you have any questions about issues addressed herein, please feel free to contact me at ALAH, on Mondays or Wednesdays, at 808 537-5966, extension 307.

Respectfully,

[signature]

Allison M. Beale
Environmental Toxicologist,
Director of Environmental Health

cc: Katherine Hendricks, Clean Air Branch, Hawaii State Department of Health

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November 3, 1997

139792.EI.04

Ms. Allison M. Beale
Director of Environmental Health
American Lung Association
245 North Kukui Street
Honolulu HI 96817

Dear Ms. Beale:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your August 18, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *No BACTS are discussed to control Volatile Organic (Hydrocarbon) Compounds (VOCs), such as those that may potentially come from the fuel farm operations. While not required under CAA regulations, many facilities opt to install systems to minimize diesel vapor loss (e.g., tanks with floating pans and edge gaskets under stationary roofs).*

   Vapor loss resulting from the storage and use of diesel fuel is minimal as diesel has little if any vapor pressure. Because of this, diesel storage tanks are considered insignificant emissions sources by the Department of Health. As part of the PSD permitting process, if naphtha is determined as an economically viable fuel, all required control measures for this type of fuel will be adhered to, which includes the installation of primary and secondary seals on storage tanks and routine maintenance of piping components (i.e., valves and pumps, etc.) to minimize VOC leakage. A thorough review of best available control technologies (BACT) for volatile organic hydrocarbon emissions from combustion turbines and associated fuel storage facilities will be conducted as part of the PSD permitting process.

2. *VOCs are omitted from Tables 4-3 (Summary of Impact Levels, Monitoring Levels and PSD Increment), 4-5 (Comparison of Project Impacts with Significant Impact Levels), and 4-6 (Comparison of Maximum Predicted Sulfur Dioxide, Nitrogen Dioxide, and PM/PM-10 Concentrations with Class II PSD Increments). Nor is the impact of VOCs addressed in the text discussing these tables. Is this because the discussion deals only with emissions related to the CTs and does not address potential emissions from other*

sources within the facility, such as the tank farm and associated piping, collection systems and oily water separation units?

   VOCs are not presented in Table 4-3 because VOCs do not have ambient air quality standards associated with them. VOCs are regulated due to their ability to promote the formation of ozone. Although there are NAAQS and SAAQS for ozone, no significant ambient impact concentration has been established for ozone. Therefore, ozone was excluded from Tables 4-5 and 4-6. The potential impact of VOC emissions on ozone concentrations from the Waena Generating Station will be reviewed as part of the PSD permitting process.

3. *Control of ammonia and related (decomposition or reaction) gases or vapors produced and released during a potential spill event at the Waena Generating Site is not discussed. How will these hazardous emissions be controlled if ammonia is required in the BACT for nitrogen oxide emissions?*

   In the event that SCR is determined as BACT under the PSD air permitting process, the handling and storage of ammonia will be accomplished according to all applicable sections of Occupational Safety and Health Administration (OSHA) regulations for the storage and handling of anhydrous ammonia (29 CFR 1910.111). These requirements specify safe practices for the design, construction, location, installation, and operation of anhydrous ammonia systems. Examples of these practices include the use of construction materials that are suitable for ammonia service, connections with shutoff valves, procedures for ammonia transfer that require the continuous presence of an attendant, and location of the facilities away from fire hazards. Adherence to these practices will substantially minimize the potential for a release. In the event of a release, mitigation measures would include the use of water sprays or other methods to reduce ammonia vapor amounts. Emergency response procedures which include notification of the police and fire department in the event of a large release would also be implemented per EPA emergency planning and notification requirements (40 CFR 355).

4. *How will the Environmental Protection Agency's (EPA) New Source Performance Standards impact the project ? Will the BACTs proposed in section three (3) be sufficient to maintain compliance – especially for the nitrogen oxides (NO_x).*

   The New Source Performance Standard (NSPS) for combustion turbine nitrogen oxide emissions is 75 parts per million (ppm) in the exhaust gas at 15 percent oxygen. Current NO_x BACT for combustion turbines similar to those being planned for the Waena Generating Station is the use of water injection to achieve 42 ppm. This concentration is well below the NSPS requirement of 75 ppm. Both MECO's experience with the operation of combustion turbines and manufacturer's data indicate that compliance with this limit can be easily attained. The Waena Generating Station will be built and operated in full compliance with all applicable NSPS.

5. *How will the EPA's new Ozone & Fine Particulate Matter (PM-2.5) Standards impact the project?*

   EPA has developed a timeline for the implementation of the new standards with their first priority being the establishment of a comprehensive monitoring network to determine ambient fine particle concentrations across the country. The monitoring network will help EPA establish which areas meet or do not meet the new standards. The establishment of this monitoring system will take place over a three-year period with data collection beginning in some areas in the first year. Data will be collected for a period of three years. With an additional year estimated for analysis of the collected data, EPA should begin to classify some areas starting in 2002. States will then have three years from the date of being designated as attainment or non-attainment with the new standards to develop pollution control plans and submit them to EPA showing how they will meet the new standards. Until Hawaii is classified as either attainment or non-attainment, the new ambient standards will not be addressed by EPA or the Department of Health in the air permitting process. Once classification has been completed; however, all subsequent applications for new air permits and permit renewals must include the new standards. Thus, the exact impacts on the project cannot be determined at this time. MECO will comply with all applicable requirements at the time they seek air permits and permit renewals for each of the units.

In Table 4-4, the emissions estimated for a 58-MW unit are based on the operation of two General Electric LM2500 combustion turbines. The manufacturer information of 86.3 tons per year which is provided in the footnotes is based on a single LM2500 combustion turbine. Therefore, the value was doubled for a total of 173 tons per year in order to accurately represent particulate matter emissions. The maximum impact levels listed in comparison Table 4-5 for a 58 MW unit are based on this amount of annual particulate emissions. For the ambient impact analysis, the total 173-ton estimate was assumed to be less than 10 microns in size. As shown in Table 4-5, the maximum impacts for particulate emissions less than 10 microns in diameter are below the significant impact levels established by DOH and are therefore considered insignificant.

Although area classifications are not in place, it is reasonable to assume that the significant impact levels for $PM_{2.5}$ will be consistent with the existing levels of 5 micrograms per cubic meter for a 24 hour average concentration and 1 microgram per cubic meter for an annual average concentration. Based on this, and the assumption that all particulate emissions from the combustion turbines will be less than 2.5 microns in size, it can be said that $PM_{2.5}$ emissions from a 58 MW unit will be considered insignificant. As mentioned in the Draft EIS, compliance with the $PM_{2.5}$ standards will be assured in the air permitting process.

6. *What will be the impact of the facility on air quality during cane burning or on VOG days?*

Under most conditions, the Waena Generating Station will not significantly impact the existing air quality. As described in Section 4.3.2.1, "Operational Air Emissions" in the DEIS, a 58-MW unit will only significantly impact 3-hour and 24-hour SO_2. Because SO_2 is not a major pollutant in cane burning and VOG, the impact of the plant under those conditions is expected to be small. Particulates is the major pollutant released by cane burning. The Waena plant impact for particulates is expected to be insignificant.

VOG is primarily small particles of sulfates. According to EPA, the conversion of SO_2 into sulfates is slow, 0.4 percent per hour. (This conversion rate was obtained from an Environmental Protection Agency (EPA) publication entitled Air Quality Criteria for Particulate Matter and Sulfur Oxides, Volumes 1-3, 1982.) An evaluation of the impact of a similar unit at Keahole on the Big Island (i.e., CT4/5) demonstrated that this slow conversion did not allow for a significant impact on VOG. (See "Response to Comments from the

September 12, 1994, and April 10, 1995, Public Hearings on the Draft Permit for Hawaii Electric Light Company, Inc." dated September 26, 1995, page 30.) Because the VOG levels on Maui are generally lower than those in the Keahole area on the Big Island, it is reasonable to conclude that the Waena Generating Station will not significantly impact VOG.

7. *It would have been helpful to have the project site indicated on the maps in the Maui Vortex study, it appears that the site is far enough down on the slope of Haleakala to have emissions swept in the same pattern as cane smoke. As cane smoke is a significant issue on Maui, the addition of a major stationary source is a concern.*

The Maui Vortex study contained in Appendix C of the Draft EIS does include the location of the project site. The "Proposed Waena Site" shown in Figures 5.2 and 6.1 of the study is the location of the project site. As these figures indicate, the great majority of the project's plume will not be swept into the vortex. Because of the project's location, only the extreme eastern edge of the plume will be swept into the vortex.

8. *Fugitive dust controls are not described.*

During project construction MECO shall adhere to state and county requirements for the control of fugitive dust. State regulations require that no person shall cause or permit visible fugitive dust to become airborne without taking reasonable precautions. Examples of reasonable dust control measures include, but are not limited to, the application of water and/or covering open topped trucks and materials stockpiles.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

A&B HAWAII INC
HONOLULU, HI
G. STEPHEN HOLADAY
SR VICE PRESIDENT

HAWAIIAN COMMERCIAL & SUGAR CO
G. STEPHEN HOLADAY
PLANTATION GENERAL MANAGER
TELEPHONE: (808) 877-0081

HAWAIIAN COMMERCIAL & SUGAR COMPANY

PO BOX 266, PUUNENE, MAUI, HAWAII 96784

September 22, 1997

Maui Electric Company, Ltd.
Attn: Ed Reinhardt
P.O. Box 398
Kahului, Hawaii 96732

Dear Mr. Reinhardt:

SUBJECT: MECO Waena Power Generating Station Draft Environmental Impact Statement

Thank you for this opportunity to provide comments on the MECO Waena Power Generating Station Draft Environmental Impact Statement. Since the site is surrounded by our sugar cane fields and due to our involvement with the initial MECO site selection, HC&S is very interested in this project. We offer the following comments concerning the DEIS and look forward to working with MECO on them:

Section 2.2.3 Resource Planning -- As shown in the DEIS, the present power agreement between HC&S and MECO expires in 1999. Negotiations are expected to begin this month to extend the power agreement between HC&S and MECO.

Section 4.6.1 Water Resources -- Since HC&S has irrigation wells down slope of the power plant, we are concerned about the affect on existing ground water quality due to the wastewater injection wells and concerned about the potential impact the MECO well could have on the yields on HC&S' existing wells. The HC&S irrigation wells presently provide irrigation water and power plant cooling water for HC&S sugar operations. Our concern stems from the DEIS which states that the wastewater will contain "a concentrated solution of salts and minerals," "acid and caustic solutions used for neutralization, and traces of the resin chemicals" (from the reverse osmosis process). Although the DEIS contemplates no adverse affects to groundwater quality or levels, we believe that reasonable mitigating measures to reduce the chances of lowering the quality of the existing ground water resources should be taken.

HC&S Wells 8 and 19 (5227-04 and 5227-05) are located near the Puunene mill. These wells should be added to Figure 4-2.

Section 4.6.2 Surface Water -- The DEIS shows that "stormwater and infiltration ponds to collect and contain stormwater on site" will be constructed. HC&S would prefer to keep the runoff water out of the HC&S irrigation ditch that runs through the site. Any disposal of runoff water into the irrigation ditch would require a NPDES permit from the DOH.

Section 4.6.2.2 - The DEIS states that "storm water impacts and erosion of the on-site irrigation ditch are possible during the construction phase of the proposed generating station. However, use of best management practices to prevent runoff into the ditch can minimize these temporary impacts." In addition to implementation of BMP's to prevent runoff into the ditch, any storm water discharges during construction activities at the site will require coverage under and compliance with the State's General Permit for Discharges of Storm water Associated with Construction Activity, or an individual discharge permit.

Section 4.11.2.2 Impacts to Agricultural Use --

Agricultural Impacts on Proposed Project: At the present Maalaea power plant area, HC&S burns cane when the wind conditions are favorable and notifies MECO prior to burning cane. HC&S will continue to work closely with MECO concerning harvesting and cultivation operations to minimize impacts at the power plant.

Thank you for this opportunity to express our concerns.

Sincerely,

G. S. Holaday
Plantation General Manager

CC: County of Maui, Planning Department
Attn: David Blane
250 South High Street
Wailuku, Hawaii 96793

CH2M Hill

OEQC

meco\eis979d.doc

CH2MHILL

Celebrating 50 Years

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November 3, 1997

139792.EI.04

Mr. G. Stephen Holaday
Plantation General Manager
Hawaiian Commercial and Sugar Company
PO Box 266
Puunene, HI 96784

Dear Mr. Holaday:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 22, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *Although the DEIS contemplates no adverse affects to groundwater quality or levels, we believe that reasonable mitigating measures to reduce the chances of lowering the quality of the existing groundwater resources should be taken.*

    Section 4.6.1.3 summarizes the mitigation measures that will be undertaken to prevent adverse affects to groundwater quality or levels. To prevent any possible groundwater contamination by seepage, the annular space around the casing of each supply well will be cement-grouted from the surface to a depth just above the groundwater table. The wells will be constructed in accordance with all applicable federal, state, and county regulatory requirements. Well construction permits and pump installation permits will be obtained from the State Commission on Water Resource Management.

    Any potential impact from the use of injection wells will be mitigated by appropriate design and testing (pumping and injection) to determine aquifer characteristics, such as hydraulic conductivity, salinity, temperature, drawdown, and well capacity. The injection wells will be constructed and operated in compliance with the Department of Health (DOH) underground injection control (UIC) regulations and only after approval of a UIC permit by the DOH. MECO will work together with the permitting agencies and will not object to reasonable and fair conditions on permits as determined by the granting authorities.

2. *HC&S Well 8 and 19 (5227-04 and 5227-05) are located near the Puunene mill. These wells should be added to Figure 4-2.*

    These wells will be added to the figure in the Final EIS.

3. *HC&S would prefer to keep the runoff water out of the HC&S irrigation ditch that runs through the site. In addition to implementation of BMPs to prevent runoff into the ditch, any storm water discharges during construction activities at the site will require coverage under and compliance with the state's General Permit for Discharges of Stormwater Associated with Construction Activity.*

    MECO will take steps to coordinate the drainage design for the facility with HC&S and the County of Maui Department of Public Works to minimize stormwater runoff into the adjoining irrigation ditch during the construction phase of the operations. In addition, drainage plans designed for stormwater runoff following completion of the facility will direct flows away from the HC&S irrigation ditch. MECO will apply for the applicable NPDES permits and other regulatory approvals as required.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

LIFE OF THE LAND

HAWAI'I'S OWN COMMUNITY ACTION GROUP
PROTECTING HAWAI'I'S ENVIRONMENT THROUGH
RESEARCH, EDUCATION, ADVOCACY & LITIGATION

September 21, 1997

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250 South High Street
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Mark Willey
CH2M Hill
Honolulu, HI
fax: 941-8225

RE: Waena Power Station Draft Environmental Impact Statement (DEIS)

The Draft Environmental Impact Statement (DEIS) for the Waena Power Station states: "The site will result in the removal of approximately 67 acres of prime agricultural lands, from active production, however, this represents a very small percentage of the ..." Article XI, Section 3 of the Hawaii Constitution states that "The State shall conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands. ... Lands identified by the State as important agricultural lands needed to fulfill the purposes above shall not be reclassified by the State or rezoned by its political subdivisions without meeting the standards and criteria established by the legislature ..." Surely Maui Electric Company (MECO) could find suitable land which is not designated prime agricultural land. What non-prime sites were available? Why were those sites not chosen?

The Appendix on electromagnetic fields (EMFs) states that the modeling was done by Enertech Corporation for the Electric Power Research Institute (EPRI) using the SUBCALC and ENVIRO programs: "magnetic field modeling of the generators was based upon field measurements conducted at another generating station and were adjusted proportionally to attempt to reflect the difference in size and shape outputs." What is a list of the parameters used in each model (SUBCALC; ENVIRO)? What is a list of assumptions used in each model? Which station was used to calibrate the effectiveness of the models? Do the models measure magnetic fields only? Did they also measure electric fields? Do the models use time-weighted averages? How do they account for EMF spikes? Which configurations were analyzed? What EMF shielding models were considered? How much of the analysis is theoretical? How much of the analysis is based in reality? What would be the effect of using underground lines to and from the station in terms of EMF generation and shielding?

The Public Utilities Commission (PUC) has opened the electrical deregulation docket (96-493). What economic models were used to determine whether this plant would increase competition, lower electrical prices, and or promote alternative fuels in various scenarios under the proposed new competitive electrical production market? What would the stranded cost of this plant be in the event that it becomes unnecessary (redundant; obsolete) under deregulation?

Sincerely,

Henry Curtis

Henry Curtis
Executive Director

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Celebrating 50 Years

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November 3, 1997

139792.EI.04

Mr. Henry Curtis
Executive Director
Life of the Land
1111 Bishop Street, Suite 503
Honolulu, HI 96813

Dear Mr. Curtis:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 21, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *Surely MECO could find suitable land which is not designated prime agricultural land. What non-prime sites were available? Why were those sites not chosen?*

Section 3.2.6 of the EIS document summarizes the extensive site screening process undertaken before MECO selected the Waena Generating Site. As indicated in Section 3.2.6, the selection of the Waena site was made after conducting several separate site screening studies between 1989 and 1996, representing an extensive site screening process. (The executive summaries of the last three site screening reports are contained in Appendices B-1, -2, and -3.) The agricultural designation of the site selected was given consideration during the screening. The site screening was conducted in conjunction with an extensive public consultation process that included consultation with representatives of community groups, public agencies, and several public meetings. Section 3.2.6 and Appendices B-1, -2, and -3 summarize why other sites were not chosen.

The site is listed as "Prime Agricultural Land" according to the Agricultural Lands of Importance to the State of Hawaii (ALISH) map. While there were other sites considered throughout the process which were not "prime agricultural lands," the Waena site was concluded to be the most appropriate site based on multiple criteria and on significant community input.

2. *(a) What is the list of parameters used in each model? (b) What is a list of assumptions used in each model? (c) Which station was used to calibrate the effectiveness of the models? (d) Do the models measure magnetic fields only? (e) Did they also measure electric fields? (f) Do the models use time-weighted averages? (g) How do they account for EMF spikes? (h) Which configurations were analyzed? (i) What EMF shielding models were considered? (j) How much of the analysis is theoretical? (k) How much of the analysis is based in reality? (l) What would be the effect of using underground lines to and from the station in terms of EMF generation and shielding?*

(a) What is the list of parameters used in each model? **For modeling transmission and distribution lines, the computer program uses parameters as described on pages 1 and 2 of the technical report. Specifically, the following parameters are required to perform electric and magnetic field calculations for a power line:**

I. General Parameters:
- **A. Field calculation height**
- **B. Altitude**
- **C. Earth resistivity**

II. Bundle Parameters (required for each conductor):
- **A. Circuit number designation**
- **B. Phasing**
- **C. Voltage (L-L)**
- **D. Current**
- **E. Current angle**
- **F. Number of subconductors**
- **G. X and Y coordinates in space of bundle location**

III. Subconductor Parameters (required for each subconductor):
- **A. Name designation**
- **B. Spacing**
- **C. Overall diameter**
- **D. DC resistance**
- **E. 60 Hz resistance**
- **F. 60 Hz reactance**

IV. Calculation Parameters:
- **A. Starting location**
- **B. Ending location**
- **C. Interval spacing**

For modeling the generating station and associated powerlines, the computer program uses parameters as described on page 2 of the technical report. Specifically, the following parameters required to perform magnetic field calculations for this generating station model were:

I. World Parameters:
- **A. Minimum world coordinate values (X, Y and Z axes)**
- **B. Maximum world coordinate values (X, Y and Z axes)**
- **C. Calculation grid (X and Y coordinates and grid interval)**

II. Powerline Parameters (required for each type of powerline):
- A. Label designation
- B. Number of circuits
- C. Number of shield wires
- D. Line voltage

III. Tower Information (required for each powerline tower location):
- A. Tower location (X and Y coordinates in space)
- B. Angle of tower rotation
- C. Midspan clearance of the powerline
- D. Conductor phasing (for each circuit conductor)
- E. Phase spacing (for each circuit conductor)
- F. Conductor height (for each circuit conductor)
- G. Current (for each circuit conductor)
- H. Phase angle (for each circuit conductor)

IV. Buswork Parameters:
- A. Label designation
- B. Voltage

V. Node Information (required for each segment of buswork):
- A. Support location (X and Y coordinates in space)
- B. Angle of support rotation
- C. Conductor phasing (for each circuit conductor)
- D. Phase spacing (for each circuit conductor)
- E. Conductor height (for each circuit conductor)
- F. Current (for each circuit conductor)
- G. Phase angle (for each circuit conductor)

VI. Transformer Parameters:
- A. Label designation
- B. Location (X, Y, and Z coordinates in space)
- C. Angle of rotation
- D. Tank height
- E. Transformer type
- F. Bushings, high side spacing
- G. Bushings, low side spacing
- H. Bushings, high to low spacing
- I. Bushings, high side length
- J. Bushings, low side length
- K. High side voltages
- L. Low side voltages
- M. High side currents
- N. Low side currents
- O. High side phase angles
- P. Low side phase angles

VII. Custom Conductor Parameters :
- A. Node location (X, Y, and Z coordinates in space)
- B. Current
- C. Phase angle

VIII. Object Parameters :
- A. Polyline location (X and Y coordinates for each node)
- B. Text location (X and Y coordinates with text string)

(b) What is a list of assumptions used in each model? A description of the assumptions used to create and model the transmission line and substation areas are presented on pages 5, 6, and 7 of the technical report and summarized below:

Certain assumptions were made in performing these computer calculations. For the transmission lines, electric and magnetic fields were calculated for locations directly underneath the transmission lines at midspan and extending away from the transmission line center as lateral profiles. Field levels at other locations (such as at the tower/pole locations) would be lower than those calculated at midspan. For the generating station equipment and switchyard, magnetic fields were calculated for the entire generating station area and the immediate surrounding area where the associated transmission lines are located.

For the transmission line electric field calculations, a 5 percent overvoltage condition was assumed for each line type. The electric field shielding reduction that may exist at the project site due to the presence of buildings, light poles, trees, shrubs, and other objects was not included in these calculations. The effect of not including these objects, along with the worst case 5 percent overvoltage, is to produce electric field calculation results that are higher than those that would actually exist at the project site.

The phasing arrangement for the single 69 kV circuits was assumed to be A-B-C top to bottom. The phasing arrangement for the double circuit 69 kV and 12 kV circuits was assumed to be "unlike" phasing to maximize the magnetic field cancellation. For the double circuit configurations, the direction of current flow for each circuit was assumed to always be in the same direction. The loading values used for this modeling were provided by MECO and projected for the year 2020. The shield wires were assumed to be grounded at each tower/pole. The sag for the shield wires, as well as the 69 kV and 12 kV lines, was assumed to be 5 feet at midspan.

General diagrams were provided by MECO for locations of equipment. It was assumed that the output of the twelve generators within the station were equally providing the total power necessary to produce the loading on each 69 kV and 12 kV powerline associated with the station. Each individual generator was assumed to be producing a 69 kV bus load of about 250 Amps.

Magnetic field modeling of the generators was based upon field measurements conducted at another operating generating station and were adjusted proportionately to attempt to reflect the difference in size and output differences. The twelve main transformers which step up the voltage level from 13.8 kV to 69 kV, were included in the model. The twelve auxiliary transformers which step down the voltage level from 13.8 kV to 480V were also included in the model.

The 69 kV buswork was assumed to be routed from each transformer to the switchyard area. A simple ring-bus arrangement was assumed within the switchyard. Each 69 kV buswork segment was assumed to have 250 A of load per generator, with the loads combining at the buswork entering the switchyard. The buswork and other equipment associated with the 480V system which feeds the switchgear plant auxiliary loads were not included in the model. Also, the 69 kV disconnect switches, breakers, and other associated equipment were not included in the model.

(c) Which station was used to calibrate the effectiveness of the models? There was no specific existing station used to calibrate the proposed generating station model. The software does not require "calibration." The generating station proposed is a future design with projected loading and geometry assumptions. Hence, there are no existing sites which would be suitable for comparison to the proposed station overall.

The proposed generators to be used within the Waena station were the only equipment modeled using measurement data collected from another station. Similar turbine generators associated with the Keahole generating station, which is located on the Big Island of Hawaii, were used to model the proposed generators for the Waena station. These generators were measured for magnetic field levels as part of a separate project in 1993. The magnetic field measurement data collected was used to estimate the magnetic field contribution from the proposed generators at Waena.

(d) Do the models measure magnetic fields only? (e) Did they also measure electric fields? Computer models provide calculations, not measurements; since the proposed facility does not exist, measurements cannot be performed. Both magnetic and electric field calculations were performed.

(f) Do the models use time-weighted averages? The computer programs calculate field levels based upon the transmission line, distribution line, and substation parameters. Parameters which will affect calculated field levels include voltage, current, phasing arrangement, phase separation, conductor type, conductor height, distance between phases, and calculation location. With the exception of voltage and current, these parameters have fixed values (i.e., they will not vary, fluctuate, or change over time). The computer programs specifically model fields for a designated (fixed) voltage and current condition.

Calculations were performed for a projected year 2020 peak normal loading condition. The peak normal values would produce calculated magnetic field values which will be much higher than time-weighted average field values.

(g) How do they account for EMF spikes? Modeling was not performed for temporary or brief conditions. The software was used to model for normal and peak steady-state operating conditions.

(h) Which configurations were analyzed? For transmission lines, five transmission lines were modeled for future conditions using projected loading data for the year 2020 and assumed line geometry. On pages 3, 4, and 5 of the technical report (Tables 1 and 2 and Figure 1), descriptions are provided of the various transmission line configurations which were modeled. Both electric and magnetic field levels were calculated for each transmission line. For the proposed Kanaha - Pukalani 69 kV transmission line, calculations were performed using a single circuit delta configuration with a projected year 2020 load of 404 amps towards North Firebreak Road and 463 amps towards Waiko Road. For the proposed Maalaea - Kealahou 69 kV transmission line,

calculations were performed using a single circuit delta configuration with a projected year 2020 load of 375 amps towards Spanish Road and 354 amps toward Pulehu Road. For the proposed North Firebreak Road - Pala 69 kV transmission line, calculations were performed using a single circuit delta configuration with a projected year 2020 load of 460 amps towards Pala. For the proposed Pulehu - North Firebreak Road 69/12 kV transmission line, calculations were performed using a double circuit 69 kV configuration with a double circuit 12 kV underbuild, with a projected year 2020 load of 460 amps for both of the 69 kV circuits and 230 amps for both of the 12 kV circuits. For the proposed North Firebreak Road - Puunene 69/12 kV transmission line, calculations were performed using a double circuit 69 kV configuration with a double circuit 12 kV underbuild, with a projected year 2020 load of 460 amps on one of the 69 kV circuits, 404 amps on the other 69 kV circuit, and 230 amps for both of the 12 kV circuits. For the proposed Pulehu - North Firebreak Road 69/12 kV transmission line and the proposed North Firebreak Road - Puunene 69/12 kV transmission line, the phasing arrangement of the circuits was assumed to be "unlike" to optimize magnetic field cancellation. Line configurations were based upon existing line configurations and standard pole configuration drawings supplied by MECO.

For the proposed station, one model was created using the SUBCALC program. The model was created based upon the proposed station design and associated transmission line geometry with a projected year 2020 loading condition. The proposed station design used for the model is presented on pages 19 and 20 of the technical report and is based upon a preliminary site layout drawing and equipment list supplied by MECO. Drawings of the Maalaea Switching Station were referenced for descriptions and elevations of some of the station equipment (primarily buswork elevations and spacings and transformer parameters). The projected 2020 loading was supplied by MECO.

(i) What EMF shielding models were considered? No EMF shielding models were considered.

(j) How much of the analysis is theoretical? (k) How much of the analysis is based in reality? The calculation methods are based on Maxwell's equations that were developed in the last century and have been the solid basis for all modern computer modeling of electromagnetic fields.

The input data used to create the computer models were based upon proposed station designs, powerline configurations, and projected future loading conditions. The Waena Generating Station is a proposed station design. The exact locations of substation equipment, routing of the buswork, and other factors are designed and proposed. There is nothing unique or unusual about the proposed Waena Generating Station. Its general engineering design is similar to other stations and lines which have been built and are operating in the United States. Therefore, although the proposed Waena station, its associated powerlines, and the projected future loading conditions are conceptual in nature, the basis for their design and loading values is a well-established, historically-tested methodology which is compliant with both state and federal agencies with respect to sound electrical engineering principals.

(l) What would be the effect of using underground lines to and from the station in terms of EMF generation and shielding? Since an underground line configuration was not modeled, it is not possible give specific values for comparison with the proposed overhead configuration. However, generalized statements could be made about underground configurations.

For electric fields, the effect of undergrounding overhead powerlines would be to virtually eliminate electric fields due to the cables. The only remaining electric field sources for the proposed station would then be from the buswork and station equipment.

For magnetic fields, the effect of undergrounding overhead powerlines varies. The amount of field reduction is dependent upon conductor spacing, the material of the conduit or pipe used to contain the conductors (if not buried directly), and the depth at which the conductors are buried. In general terms, the effect of undergrounding a line will be to reduce the overall magnetic field influence in the general area near the line. Since the conductors are usually placed closer together in an underground arrangement, magnetic field cancellation between phases is significantly increased. The conduit or pipe which contain the conductors can also act as a magnetic field shield, depending upon the type of material used for the conduit or pipe. Increasing the depth of the conductors will also increase the magnetic field reduction, since the distance away from the conductors has increased. Magnetic field levels above an underground line will attain a maximum field value directly above the cable that could be higher than those from an overhead powerline, but the field will attenuate quickly with distance away from the cable.

3. *What economic models were used to determine whether this plant would increase competition, lower electrical prices, and or promote alternative fuels in various scenarios under the proposed new competitive electrical production market? What would the stranded cost of this plant be in the event that it becomes unnecessary under deregulation?*

The Public Utilities Commission is currently investigating the feasibility of electric competition in Hawaii under a docket opened in December 1996. Thus, the structure of competition within the electric utility market in Hawaii has not yet been defined nor have the economic models been developed. Competition issues, such as stranded costs, will need to be addressed within this docket. Because no economic models exist under this docket, none could be used in this project. In addition, as there has not yet been any decision through this docket concerning stranded cost analyses or their appropriateness, no stranded costs estimates can be made.

The current MECO IRP process, which was approved by the PUC, determined that the installation of dual train combined cycle (DTCC) units was the least cost plan of all resources considered (including alternative fuels). Several qualitative and quantitative methods were used in MECO's analyses of supply-side resources. The installation of DTCC units at the Waena Generating Station is consistent with MECO's IRP and least cost plan. The methodology and process followed by MECO for the formulation of their IRP program is outlined in their documentation to the PUC and can be reviewed at the commission offices upon request.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

MA'ALAEA COMMUNITY ASSOCIATION
250 Hauoli Street #301
Wailuku, HI 96793
August 25, 1997

Maui Electric Company, Limited
210 W. Kamehameha Avenue
Kahului, Hawaii 96732
Re: Waena Generating Station Project

Gentlemen:

MCA entered into a Settlement Agreement with MECO May 3, 1995. Items 1 through 8 of that agreement are part of the SMA permit for the Maalaea Power Plant.

Item 16. refers to the Maalaea Plant Site and says "By entering into and executing this settlement agreement, MCA does not admit that (a) this is a suitable site for the proposed expansion, (b) this site will be free from coastal hazards, (c) adverse impacts will not result from this project or (d) MECO could not locate these improvements elsewhere."

No one has ever provided MCA with the economic justification for installing the larger CT - Steam turbine units. No one has explained why the rate payers should be financing an estimated $60,000,000 extra as a result of their size and its affect on the reserve requirement criteria. We would like to have MECO provide that information to us.

Our association continues to believe that MECO "has too many eggs" in its Maalaea "egg Basket", we continue to believe that all of the new construction of generating facilities should be at a site or sites as far removed from the ocean as possible and at much higher elevations than the Maalaea site.

If MECO were to build the proposed Maalaea 19 CT unit at such a new site; to build the proposed Maalaea 18 steam turbine unit at the new site; and to then move the present, non-operating Maalaea unit 17 CT to the new site also, to complete the 58 MW installation, it would provide the beginning of a core generating unit. It would give the people of Maui the protection of generating units at a much more secure location than the Ma'alaea site, beginning in 1998. The present plan will not begin to provide this protection until 2004. Following this suggestion and continuing at the rate of the proposed expansion, would provide a core generating facility of 116 MW in 2006 at the new site. We are not endorsing the proposed rate of expansion, since it should be based on actual loads not estimates and the reserve requirements must be corrected, if necessary, as part of the final equation.

In that regard, we believe that MECO should prepare a plan to provide a standardized system of partial load dropping in the event of extraordinary loss of generating facilities. The consultant MCA hired during our previous intervention outlined procedures that mainland power companies used. They seem to routinely handle this type of problem and we think you should also apply this type of reasoning to basic reserve requirements.

No one can predict when a disaster, natural or man made will affect the Ma'alaea plant. The people of Maui need the insurance that a new facility would provide.

Items 4,5 & 7 of the Settlement Agreement deal with new power plants, and their locations.

The proposed Waena Generating Station Facility meets the various criteria above stated and therefor we support its location.

We appreciate the opportunity to make our comments and suggestions known to MECO and the community of Maui.

Submitted for the Ma'alaea Community Association,

[signature]

By, Jack F. Mueller, Chairman
Infrastructure Committee

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November 5, 1997

139792.EI.04

Mr. Jack Mueller
Maalaea Community Association
250 Hauoli Street #301
Wailuku, HI 96793

Dear Mr. Mueller:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your August 25, 1997 letter and testimony at our public comment meeting concerning the Waena Draft Environmental Impact statement. MECO would also like to thank you and your organization for supporting the location of the proposed Waena Generating Station. Our responses to your individual comments follow.

1. *"We believe that MECO should prepare a plan to provide a standardized system of partial load dropping in the event of extraordinary loss of generating facilities."*

MECO currently has two plans in place to provide a standardized system of partial load dropping (shedding) in the event of extraordinary loss of generating facilities. The first plan handles a situation when we know in advance that we will encounter a generation deficit. For this situation, MECO's Generation Capacity Deficit Plan provides a standardized system of customer load shedding through "rolling blackouts," where areas across the island are taken off the grid for short periods of time. In addition the plan provides a mechanism to alert large customers such as hotels, as well as to government and the general public, to the potential deficit and to ask them to curtail their electricity usage. Generally, this notification and request has sufficed to avoid rolling blackouts.

The second plan is designed with the sudden unexpected loss of generation capacity which results in the drop of the system frequency. Under this scenario, an automatic load shedding program begins, in which specific distribution circuits are automatically taken out of service in order to stabilize the system frequency.

2. *Move proposed Maalaea 19 CT, Maalaea 18 steam turbine, and present Maalaea Unit 17 CT to new Waena site.*

MECO filed an application with the PUC on June 23, 1993, for the purchase and installation of Maalaea's Dual-Train Combined-Cycle (DTCC) No. 2 to provide for the increase in electrical power demand and to improve the overall reliability of its generation system. Maalaea DTCC No. 2 consists of three phases: Phase I – a 20-MW combustion turbine, Phase II – a 20-MW combustion turbine, and Phase III – an 18-MW steam generator and two-heart recovery steam generators. The PUC approved MECO's application on January 12, 1995.

MECO sited DTCC No. 2 at the Maalaea power plant after concluding that it was lowest cost plan through economies of scale, shared infrastructure, and minimizing of personnel. In addition, because of the urgent existing need for additional capacity on Maui, the Maalaea site provides the only available option to install this needed capacity in a timely manner. The Maalaea site is available now; the Waena site could not be made operational until 2004. The Maalaea DTCC No. 2 project has been approved by the PUC, and MECO has obtained 49 permits, agreements, and approvals prior to installation. MECO is currently awaiting receipt of the air permit for the two 20-MW units (expected in early 1998) before commencing final installation. To abandon the installation of the next DTCC at Maalaea, the lowest cost plan, in favor of the new Waena site would subject the Maui ratepayers to both additional costs and capacity shortages. This action would not be considered reasonable or prudent.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

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September 22, 1997

Mr. Mark R. Willey
Project Manager
CH2M Hill
1585 Kapiolani Blvd., Suite 1420
Honolulu, Hawaii 96814

Dear Mr. Willey,

Subject: Maui Electric Company, Ltd. (MECO)
Proposed Waena Power Generating Station DEIS

Thank you for the opportunity to review the Draft Environmental Impact Statement for the proposed Waena Generating Station project.

Maui Tomorrow would like to offer the following comments:

1. The overall approach to planning Maui's energy future must be focused on self-sufficiency and efficiency, as stated in the County's General Plan. We are presently extremely over reliant on the importation of fossil fuels for our electrical and transportation needs, adding uncounted economic and environmental costs, and creating a situation of great insecurity. Maui's future energy system eventually must be based on a highly efficient renewable solar-hydrogen economy derived from our local resources. This is entirely possible, and it is in the context of envisioning this transition that we need to make our choices about our energy path today.

2. We concur with the comments of Mr. James V. Williamson (Aug. 28, 1997), and wish to emphasize the following points:

   a. Regarding the ISP process and DSM, despite the fact that MECO "considers its DSM program one of the most aggressive and dynamic in the United States" (Section 3.2.2) it seems that much more could be done in this area. In the EIS itself, the success and projections of various current DSM programs should be quantified to give some meaningful basis for comparison. The commitment must be to DSM as the single most important focus for MECO and our community as a whole to pursue for our energy future. There are gross inefficiencies existing on many levels in our energy use on Maui, and creativity is needed to plug these leaks and benefit from the negawatts generated. The recent experience of the Grand Wailea Resort with the Rocky Mountain Institute's eco-audit and retrofitting efforts (see attached article excerpts) provides a good model that should be pursued in all resorts, and which could apply to many other sectors of our economy. An even greater commitment must be established to facilitate this information and transition.

   b. The Peak Demand (Section 2.2.2) growth rate is assumed to be approximately 2.6 percent per year, but no supporting data is given as to how this number was derived. This assumption underlies the entire argument of the need for this generating capacity. Many factors could effect this and it could easily be too high.

   c. The .4% or .05% sulfur content of the fuel oil is critical. Along with the many points raised by Mr. Williamson which must be addressed, costs such as health are externalized and must be accounted for in the EIS.

   d. The fuel delivery via pipeline should be revisited, with more quantified details available to assess this option, and the reduced costs of combining the infrastructural development with a waste water delivery system for the cooling system.

2. DEIS mentions solar thermal under Solar Power (Section 3.2.4.6) only for use as solar water heaters and heat pump heaters. The fact that Hawaii has "the highest per capita installation" of these technologies in the US indicates their viability, but the DEIS does not address solar thermal as a large scale generation option. Sunlight rather than fuel oil can be used to boil water to turn turbines. According to a recent Home Power magazine solar thermal is the most cost efficient generation source available today. This technology must be considered, at least in a complementary manner to the present planned options.

3. The DEIS states that wind power would require 1600 acres and is not feasible for various reasons, but residents may be willing to make temporary sacrifices in areas such as visual intrusiveness, for air quality and self-sufficiency benefits associated, and there could be creative ways to find the necessary land in a transition to other technologies for our energy and to diversified uses and reforestation for the lands.

4. Will the injection of water of highly increased brackishness back into the groundwater have any detrimental impact? A closed loop cooling system should be considered, and the use of waste water, delivered via pipeline, the cost of which would be reduced if installed together with fuel delivery systems, as mentioned above.

In general, the flexibility apparently designed into the phased build-out of the station, as well as the possibility of converting the generators to alternative fuels, is positive. This underlines the reality that technology is advancing extremely rapidly, and we can expect 3 or 4 generations of improvement over the time period to pay off the investment into this plant. We almost certainly won't be burning oil 30 years from now. Next phases must be alternative sources, and HECO must invest in this direction - it is truly the future. A recent Science Magazine discusses very small (the size of a little finger nail) 50 watt generators running on pure hydrogen. This is just one example to encourage you to approach Maui's future energy needs from an open, imaginative and creative perspective, and to make Maui's energy self-sufficiency your first priority, through efficiency and clean renewable alternative technologies.

Thank you for your consideration of these concerns. If there are any questions, please contact me at 877-2462.

Sincerely,

Scott Crawford
Program Director

enc.

Excerpted from The Haleakala Times, April 16, 1997

By Dan Grantham

Ray Anderson's strategy of hope includes working with the Grand Wailea, the Dream Team, and the 1100 Interface associates who met here from all over the world to celebrate their interconnection while they engaged in a week long exercise to measure the differences sustainable practices can make in resource use at the hotel.

Amory Lovins, Research Director of the Rocky Mountain Institute and a world renowned leader in energy solutions, seemed to be enjoying himself: after mentioning that Hawaii imports almost all of its energy, including 200 million dollars a year just for power plants, said he finds "mineable inefficiencies" or negawatts here:

"I walk around looking at lights and motors, seeing them as little cash cows, plaintively mooing, wanting to milked, giving off flows of invisible dollars. A big motor (of which there are many at the resort) eats its own capital cost worth of electricity every few weeks...money that is flowing out of the island's economy."

Using the example of a leaking bathtub, Amory said you can either get a bigger water heater or plug the leaks. With electric rates here running about 15.7¢ a kilowatt-hour, equivalent to $253 for a barrel of oil, or 13 times the world oil price, those are expensive leaks.

Osage, Iowa, a town of 4000 people with a municipal utility, decided to reduce electricity waste by helping people with insulation, caulking, efficient showerheads, better lamps, etc. After several years the town saved so much they prepaid their bond debts, built up a $2.5 million surplus, cut rates 5 times in 5 years, for a total of about one third. The lower rates kept local businesses competitive and attracted two new factories.

Best of all, in Lovins' view, they kept over $1000 per household per year in town that had previously gone out of state to buy utility inputs - money that now stayed to support local jobs and create prosperity.

Lovins highly recommends solar water heating, saying they can save 70% of the energy use and the state actually makes money on the tax credit.

Lovins urged that one of the most useful things PUC's can do here is to reward utilities for cutting your bill; first by decoupling profits from the amount of power they sell, then allowing them to keep some of the savings from lower bills. In 1992 Pacific Gas and Electric invested $170 million in helping customers save power; of the 3 to 4 hundred million $ in savings, PG&E got to keep 15% - $40 million - their second biggest source of profit for the year.

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November 3, 1997

139792.EI.04

Mr. Scott Crawford
Maui Tomorrow
PO Box 429
Makawao, HI 96768

Dear Mr. Crawford:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 22, 1997 letter and your testimony at our public comment meeting concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

Pukalani Public Meeting

1. *Maui should develop a long-term plan to move away from the use of fossil fuels.*

MECO has extensively evaluated numerous supply-side resource alternatives in developing its Integrated Resource Plan (IRP). The selection of resource options for MECO's IRP is based on a screening process wherein a large number of potential supply-side options are considered. The screening process is a detailed process with significant input from MECO's public advisory group, which was convened to ensure maximum participation from all stakeholders in the overall IRP process.

MECO did evaluate the use of intermittent energy sources, such as solar, hydropower, and wind energy, as well as alternative fuels, such as methanol and ethanol, as a part of the IRP process. However, for capacity planning purposes, MECO is unable to include such intermittent or non-dispatchable sources of energy production as assured system generating capacity. MECO does use electricity from alternative energy sources when it is available. To the extent that electricity is available from these sources, MECO will avoid burning fossil fuels.

MECO also evaluated the use of firm, dispatchable energy from renewable sources, such as biomass technologies. However, the high fuel costs and low power plant efficiencies

associated with biomass energy production do not make it a cost-effective option at this time.

Before MECO undertook its IRP process, the Public Utilities Commission (PUC) issued a framework for the planning process. One of the governing principles stated in the framework is the consideration of a plan's impact on the utility consumer, environment, culture, community lifestyles, State's economy, and society. The framework stated that, to the extent possible and feasible, the external costs and benefits should be quantified and expressed in dollar terms. When it is neither possible nor feasible to quantify any cost or benefit, such cost or benefit should be qualitatively measured.

MECO followed the PUC framework in preparing its IRP and considered externality costs as part of resource evaluation. Proxy monetized externalities were used to assess air emission impacts, and other externalities were assessed qualitatively. Even considering externality costs, the combustion turbine technology was the most cost-effective resource that could provide the needed amount of generation capacity within the required time frame.

In its IRP, MECO selected a resource plan within the context of short- and long-term resource strategies. For the short term, MECO is implementing aggressive demand-side management programs and conventional oil-based technologies because of the costs and uncertainties associated with renewable energies and alternative fuel sources. The Draft EIS includes a discussion of both alternative energy and alternative fuel sources and outlines the reasons they are not considered feasible for use within the short term. The short-term role for renewable/alternative energy resources; therefore, will continue to be in power purchased from independent power producers.

For its long-term strategy, MECO will continue to evaluate the technical and economic feasibility of using more alternative energy sources. As a part of the Waena project, the combustion turbines proposed can accommodate by-products of coal gasification rather than diesel. In addition, the overall project implementation over 20-30 years is designed to allow for the easy replacement of the proposed combustion-turbine technology with other energy generating alternatives when they become technically and economically feasible.

2. *The ability to convert to another type of fuel is important. Could an oil generating crop that produces vegetable oil be used to power the machines. This would provide a replacement crop to sugar cane.*

While there have been tests on the use of vegetable-based fuels in internal combustion engines, such use within combustion turbines has not been shown to be practical at this time. Fuel production costs, thermal efficiencies, emission levels, and overall impacts on the generating units need to be examined in greater detail before such fuels can be realistically considered.

The combustion turbines proposed for the Waena project can accommodate by-products of coal gasification rather than diesel. In addition, the overall project implementation over 20-30 years is designed to allow for the easy replacement of the proposed combustion-turbine technology with other energy generating alternatives when they become technically and economically feasible. At this time; however, there has been no interest indicated from large landowners to replace their existing acreage from sugarcane cultivation to crops whose only use would be as a fuel supply for electrical generation.

3. *MECO should more aggressively pursue demand-side management and conservation programs. More information on these programs should be made available to the public.*

MECO does aggressively pursue demand-side management (DSM) programs. As of September 30, 1997, and since the beginning of its DSM programs one year ago, MECO, with the help of its customers, has succeeded in saving approximately 1.1 megawatts (MW) and approximately 6,467,800 kilowatt-hours (kWh) of electricity. This represents 64 percent and 68 percent of the first year's demand and energy goals, respectively, as presented in the PUC application for its DSM programs.

MECO started the implementation of its DSM programs in the later part of 1996, shortly after receiving approval from the PUC. These programs cover all customer segments throughout the entire County of Maui. These programs were the result of an extensive development process within the 1993 Integrated Resource planning process. The DSM programs were shown to be cost effective and feature a combination of end uses and market segments that have the highest potential for reducing load and saving energy. Such high savings have been accomplished by developing a comprehensive sales profile. The market sectors were based on the three major customer classes: residential, commercial and industrial. Energy devices (e.g., water heating, lighting, and cooling) were identified for each market segment to determine the most efficient DSM technologies and programs that could be applied to have the greatest impact on reducing demand and increasing energy savings.

Since the beginning of these programs, MECO also has conducted an aggressive advertising campaign to promote greater energy conservation. One-on-one contacts by MECO's Energy Services Representatives have been coupled with seminars, bill inserts, and newspaper, magazine, radio and television ads. MECO is making extensive use of testimonial advertising for both residential and commercial programs. In addition, MECO developed the "Efficient Times" newsletter, which is sent to all commercial customers. This newsletter provides retrofit examples, more testimonials, and simple calculation sheets. To reach the smaller commercial customers who do not normally participate, MECO has recently implemented a lighting promotion whereby it provides these customers, free of charge, half of the equipment needed to upgrade their lighting to more efficient standards. MECO feels that all of these elements, when considered together, make their DSM program one of the most aggressive in the country.

Comment Letter

1. *In the EIS itself, the success and projections of various current DSM programs should be quantified to give some meaningful basis for comparison.*

As of September 30, 1997, and since the beginning of its DSM programs one year ago, MECO, with the help of its customers, has succeeded in saving approximately 1.1 megawatts (MW) and approximately 6,467,800 kilowatt-hours (kWh) of electricity. This represents 64 percent and 68 percent of the first year's demand and energy goals, respectively, as presented in the PUC application for its demand-side management (DSM) programs.

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2. *The Peak Demand growth rate is assumed to be approximately 2.6 percent per year, but no supporting data is given as to how this number was derived...Many factors could affect this and it could easily be too high.*

The sales and peak forecast is made by utilizing a variety of forecasting tools, the expertise of the staffs of both MECO and HECO, and the input of our customers and respected organizations in the community. All data is analyzed and tested from various perspectives before a final forecast is adopted by the Forecast Planning Committee. The potential effects of energy efficiency and Demand Side Management (DSM) programs are also incorporated into the sales and peak forecast.

Historically, the adopted forecast has been reasonably close to recorded numbers. MECO believes that the small variances indicate the reasonableness of the forecasts.

MECO prepares near-term 5-year sales and peak forecasts annually using the latest available economic, historical sales and peak load data, as well as customer contact for existing projects and customer requests for future projects. Once every three years a long-term 20-year forecast is generated to examine the facilities needed to serve the power growth. The preparation of the sales and peak forecast is part of the comprehensive Integrated Resource Planning (IRP) process.

The primary advantage of the IRP forecasting process is to ensure that the forecast receives maximum exposure and evaluation through multiple levels of review. Overall, there are approximately 40 individuals on the MECO IRP Advisory Group (AG), the MECO Forecast Planning Subcommittee (FPSC), and the Forecast Planning Committee (FPC) who contribute their diverse expertise, knowledge and experience to the forecasting process. The use of the

MECO IRP AG provides a mechanism for members to provide feedback and input to the process.

The MECO IRP AG is comprised of members from the Department of Commerce and Consumer Affairs – Consumer Advocacy Division; Department of Business, Economic Development and Tourism – Energy Division; County of Maui Planning Department; County Office of Economic Development; Maui Chamber of Commerce; Maui Hotel Association; Maui Visitor's Bureau; Molokai Task Force; Lanai Resort Partners; island residents; and other businesses. The FPSC and FPC are made up of MECO staff in the Customer Service, Engineering, Production, Transmission and Distribution Departments and HECO staff in the Forecast, Generation Planning, and Integrated Resource Planning Divisions.

The general philosophy MECO follows in preparing its kilowatt-hour (kWh) sales and peak forecast is to place emphasis on consideration of estimated future sales and loads from as many different "viewpoints" or perspectives as possible.

The final forecasts selected by the FPC can be corroborated by more than one analytical method or source of information. Although mathematical trending of historical kWh sales data is one form of analysis used in our forecasting process, MECO does not depend solely on mathematical trending to forecast. Such an approach may fail to recognize and take into consideration important economic and demographic changes that are taking place in various districts of the three islands (divisions). The following is a description of the kWh sales and peak forecasting methodologies from which the final forecast is chosen.

The methods considered in the preparation of the kWh sales and peak forecast are the rate schedule analyses, market analyses, economic analyses, and customer service analyses. The methods are described as follows:

- The Rate Schedule Analyses methodology considers a spectrum of mathematical analyses of the patterns and trends in the number of customers, kWh sales, and average use per customer to the individual rate schedules using time series, econometric, and end-use methods.

  Generally, these mathematical modeling and trending techniques use mathematical relationships based on historical data and other related information to develop projections of future kWh sales and customers. These techniques vary in degree of sophistication and can be applied to a variety of load demand parameters for which historical and near-term future data are available.

- The Market Analyses are based on analyses of the market conditions influencing the different customer classes with special emphasis on customer-by-customer accounting of loads of our large power users. Also considered are influences on the residential class, including new construction outlook, resort development, private residential development, and government supported or sponsored housing.

  Market analyses is the primary forecasting method accepted for the large power users because the relatively small number customers allows for in-depth customer-by-customer analysis. Market analyses for this class consist of identification of known or expected changes in each customer's consumption attributable to factors

such as adjustments in a customer's demand load or operating characteristics, energy efficiency, added load and new construction.

- The Economic Analyses include judgmental analyses and considerations of the potential for future economic growth in the MECO service areas, based on broad economic indicators and opinions of economists and others prominent in the economic arena as presented in various periodicals, as well as contacts in the marketplace.

- The Customer Service Analyses are based on judgmental analyses and considerations of area growth based on day-to-day working knowledge of customers, customer billing data, and other customer-related factors that affect kWh sales and the customer count from month to month. The techniques employed in the Customer Service forecasting processes take into account changing conditions in the marketplace which may either explain the reasons for certain recorded values or which may influence kWh sales in the near future.

  Customer Service analyses consider load and customer growth for each of the customer class for each of the three service areas – Maui, Lanai, and Molokai. Although judgmental, this type of analyses addresses the factors that affect smaller segments of the service areas, thereby minimizing the margin of error in short-term forecasting.

Because of the detailed nature and the close customer contact included in these analyses, the results carry a high degree of validity for the short term. However, because of uncertainty on the part of customers' plans for significant changes in their energy usage patterns and the marketplace, Market and Customer Service analyses of the individual rate schedules are considered applicable for only about three years into the future. Mathematical analysis is used to project the forecast beyond that point.

In addition to the sales and peak forecasting methodology described above, MECO uses the Electric Power Research Institute's (EPRI) profile aggregation program, HELM (Hourly Electric Load Model) to forecast Maui Island's evening and day peaks and minimum loads. HELM takes reference customer class load profiles and adjusts them to levels of the approved sales forecast. The average monthly weekday and weekend reference customer class load profiles were developed in the 1995 MECO Class Load Study. The resulting sales load factor (ratio of the average hours of operation to the total annual hours available) and peak month are analyzed against recorded data to assure reasonableness. Maui Island's sales load factor and peak month have been stable over the past five years.

3. *The 0.4 percent or 0.05 percent sulfur content of the fuel oil is critical. Costs such as health are externalized and must be accounted for in the EIS.*

Under the Clean Air Act, the U.S. Environmental Protection Agency (EPA) is directed to identify pollutants which "may reasonably be anticipated to endanger public health and welfare" and to issue air quality criteria for them. These air quality criteria are intended to accurately reflect the latest scientific knowledge useful in indicating the kind and extent of all identifiable effects on public health or welfare which may be expected from the presence of a pollutant in the ambient air. The National Ambient Air Quality Standards (NAAQS) are established based on these criteria and are designed to protect human health with an adequate margin of safety. By selecting standards that provide an adequate margin of safety, the EPA is seeking not only to prevent pollution levels that have been demonstrated to be harmful but also to prevent lower pollutant levels that they find may pose an unacceptable risk of harm, even if the risk is not precisely identified as to nature or degree. Waena Generating Station emissions which would result from the use of diesel fuel containing 0.40 percent sulfur by weight will be in compliance with the NAAQS.

In addition, when following the Public Utilities Commission framework for developing the Integrated Resource Plan, MECO was required to consider externality costs as part of its resource evaluation. Monetized externalities were used to assess air emission impacts, and other externalities were assessed qualitatively. Even considering externality costs, the combustion turbine technology was the most cost-effective resource that could provide the needed amount of generation capacity within the required time frame.

Current data indicates that the use of diesel fuel containing 0.05 percent sulfur by weight would result in significantly increased fuel costs. In order to supply MECO, the local refineries would need to import 0.05 percent sulfur diesel from the West Coast, as they do not have the ability to manufacture this type of diesel fuel in amounts necessary for the Waena Generating Station. The product cost difference and importation costs alone would result in an estimated 20 percent increase in fuel costs. Additional increases would be realized with the need for MECO to build new storage and distribution facilities at Kahului Harbor in order to segregate the 0.05 percent sulfur diesel from diesel fuel that contains a higher amount of sulfur. A detailed review of control technologies for emissions associated with the Waena Generating Station will be conducted as part of the PSD permitting process and will be updated to include fuel cost considerations based on the Waena Generating Station operation date of 2004.

4. *The fuel delivery via pipeline should be revisited, with more quantified details available to assess this option, and the reduced costs of combining the infrastructural development with a wastewater delivery system for the cooling system.*

   We have attached the full fuel haul/pipeline analysis and relevant data prepared by Stone & Webster Engineering Corporation and will include the full report in the Final EIS. Preliminary economic analyses conducted for the fuel pipeline study indicated that costs for construction of a pipeline from the Kahului Harbor area (location of the Kahului Wastewater Treatment Plant) to the site of the proposed Waena Generating Station could run in excess of $16.5 million, assuming a 6-inch carbon steel single-containment pipe. Preliminary hydrogeologic analyses of the underlying brackish groundwater aquifer do not indicate that the withdrawal of water due to the proposed generating station will be costly or have any adverse impact upon aquifer levels or groundwater quality. Because of this, there is no justification for the large expenditures associated with pipeline construction to the site for the joint delivery of fuel and wastewater.

5. *The DEIS does not address solar thermal as a large scale generation option. Sunlight rather than fuel oil can be used to boil water to turn turbines.*

   Section 3.2.4.6 of the Draft EIS discussed solar power as an alternative to the Waena project, and includes a discussion of photovoltaic or solar thermal electric systems as well as other alternative generating technologies. MECO has operated and maintained the 20-kW Photovoltaic for Utility Scale Applications (PVUSA) since October 1989. During this period, MECO has gained valuable experience in this photovoltaic demonstration project. In addition, MECO recently installed a 1-kW photovoltaic system at Baldwin High School as part of its Sun Power for Schools pilot project. MECO intends to install additional photovoltaic systems by the end of 1998. High installation costs, large land requirements for central facilities, and other factors prevent widespread use of this technology at this time.

   MECO also reviewed a solar dish-engine renewable energy demonstration project in 1997. However, MECO decided to defer a commitment on this project because of Hawaii's low insolation, lack of interest for liquid fuel/hybrid demonstration, and project resource requirements. The results of a 1992 assessment of solar electric generating systems for Hawaii conducted by the Department of Business and Economic Development also revealed that Hawaii's direct insolation is lower than anticipated, thus making solar use less productive.

   MECO continues to track the development and progress of photovoltaic and other emerging technologies by participating in studies, communicating with Electric Power Research Institute, U.S. Department of Energy and its National Laboratories, attending conferences and workshops, visiting project and manufacturing sites and reviewing journal and reports. Although large-scale, solar-powered energy production has been shown to be technically feasible in some areas of the mainland southwest, the lack of sufficient and dependable insolation within the Central Maui region make development of a commercially-sized photovoltaic system unfeasible. However, residents who want to install small-scale individual solar units may pursue doing so.

6. *The DEIS states that wind power would require 1600 acres and is not feasible for various reasons, but residents may be willing to make temporary sacrifices in areas such as visual intrusiveness, for air quality and self-sufficiency benefits associated.*

   As a part of the IRP process, MECO fully evaluated the use of wind power within the Central Maui region. However, wind energy depends upon an intermittent resource, which at some times may not blow sufficiently to power the turbines. Because of this, wind cannot be depended upon to provide baseload generation, that is, energy available when it is demanded. While wind energy may be desirable from the community standpoint, it can be considered only supplemental to the overall generation system and is not feasible for large-scale baseload generation application. However, residents who want to install individual wind generator units may pursue doing so.

7. *Will the injection of water of highly increased brackishness back in to the groundwater have any detrimental impact?*

   Section 4.6.1.2 of the EIS document discusses the potential impact of wastewater reinjection. The potential impacts from wastewater injection depend on the characteristics and composition of the effluent to be injected and the quality of the existing groundwater in the target injection zone. A rate of 110 gpm of wastewater per well will be injected in the saline aquifer beneath the site. A worst-case scenario for modeling purposes was developed with the following assumptions:

- Total amount of 0.44 mgd injected from beginning of plant operation over 30 years
- Aquifer transmissivity of 192,700 square feet/day, aquifer thickness of 193 feet, aquifer porosity of 0.1
- A hydraulic gradient of 0.45 feet/mile based on monitoring well heads at the Central Maui Landfill
- No mixing of effluent with aquifer groundwater
- The groundwater at the target depth for wastewater reinjection is expected to be saline
- The wastewater composition as presented in Table 4-10

Using these assumptions, the modeled plume of wastewater, as shown in Figure 4-2, will extend downgradient of the project site, a distance of 0.8 miles after 10 years, 1.5 miles after 20 years, and 2.1 miles after 30 years of steady injection. No significant changes in groundwater levels are expected.

Although a worst-case scenario of no dispersion of the plume was assumed, in reality, as the wastewater plume migrates downgradient from the injection well, it will be affected by dispersion. Dispersion is the process by which a plume tends to spread by mechanical mixing and molecular (chemical) diffusion. The width of the plume will increase by dispersion, although the concentration within the plume will decrease until it eventually reaches that of the ambient groundwater.

Currently, no information on the dispersive properties of the aquifer at the project site is available. However, because the estimated wastewater chloride concentrations injected into the underlying aquifer are approximately the same as concentrations recorded from water withdrawn from the nearest irrigation well, the injected wastewater will certainly reach ambient groundwater concentrations before reaching the nearest existing irrigation well. Therefore, the potential impact of the wastewater plume on general downgradient groundwater quality is not expected to be significant.

No significant changes to downgradient groundwater levels, groundwater quality, or irrigation wells are expected from the injection of treated wastewater.

8. *A closed loop cooling system should be considered, and the use of waste water, delivered via pipeline, the cost of which would be reduced if installed together with fuel delivery systems.*

Cooling of the generating units will be accomplished through use of air-cooled condensers, not though an open (or closed) loop water cooling system. Water usage at the plant will be primarily for emissions control purposes. Preliminary hydrogeologic analyses of the underlying brackish groundwater aquifer do not indicate that the withdrawal of water due to the proposed generating station will be costly or have any adverse impact upon aquifer levels or groundwater quality. Because of this, there is no justification for the large expenditures associated with pipeline construction to the site for the delivery of wastewater.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR
WAENA GENERATING STATION

STEVEN MOSER M.D.

8/26/97

2.2.2. Peak Demand. The calculations for the future growth of power needs for Maui County may be overstated. A yearly growth of 2.6% may be too much if most of the growth takes place in residential building and use. Residences generally take up less energy than commercial usages, especially the visitor industry. Since much of the growth in the past has been in the hotels and condominium sectors, the increased power needs may have reflected this bias. Future residential growth may not increase power needs as much. Also solar power for water heating have a much greater usage per capita in residential settings than industrial or commercial settings.

2.2.3. Resource Planning. The schedule of Power Facility Additions and Retirements in Table 2-2 reveals the eventual plan for centralizing all power production on the Island in Maalaea and Waena by the year 2016, with only 58 MW (20%) of the total output coming from Maalaea. It shows the retirement of the Kahului plant and many of the Maalaea generators. It does not consider the independent power producers of HC&S and Pioneer Mill, because they are considered unreliable. This tendency to centralize all power production presents possible problems in event of natural or man-made disasters, such as hurricanes, fires, earthquakes, or sabotage. It also concentrates all of the environmental degradation into on main area, instead of distributing it. Finally it creates an infrastructural nidus for future industrial growth in the areas adjacent to the current large industrial project, further blighting the rural nature of the Central Valley of Maui.

3.1.4. Fuel Transport and Handling. Forty four tanker truck deliveries per day in the built power plant scenario represents a potential hazard for travel on our busy highways. Accidents involving tanker trucks have the potential for major disasters on one of our busiest highway, Hana Highway, with proximity to the airport, shopping centers, and other commercial areas. With increased growth of population and lagging infrastructural changes needed to handle increased traffic flow, and increase in accidents can be expected.

3.1.5. Best Available Control Technology. It is convenient for the proposers to decide the specific BACT "...has not yet been determined and will not be determined until such time as the State of Hawaii Department of Health and US Environmental Protection Agency review the design-specific elements and modeled air emissions through the air quality permit process."This allows the proposers to consider various control technologies, but to avoid committing to any of them, which makes it very difficult for the lay public, such as myself, or experts, to comment on them with any significance. It is also of great concern that BACT is really a misnomer, since the BACT may not be technically or economically feasible in any given technology. Since it is reasonable to assume that BACT usually involves a more expensive mode of pollutant abatement, most of these technologies will be rejected on a cost basis.

3.1.5.1. BACT for Sulfur Dioxide and Sulfuric Acid Mist. BACT for sulfur would logically include use of the lowest sulfur content fuel, i.e. .05%, but this is rejected for economic reasons in favor of .4% sulfur content, despite the 8-fold increase in sulfur emissions anticipated.

3.1.6. Project Schedule and Cost. The cost of the project is nearly half a billion dollars, which must be born by the ratepayers of Maui, over and above the current high cost of electricity on Maui. Could any of this massive expenditure for diesel burning plants be deferred to energy conservation measures and alternative energy development so that we could be less dependent on foreign petrochemicals, as we have stated in the Hawaii State Energy Plan.

3.2.2. Conservation and Energy Efficiency. This discussion of demand side energy conservation (DSM) outlines the many good ideas that are available for energy savings, but does not show any consideration for the effects of a concerted effort at widespread implementation in this county. The four resource programs referred to do not contain any true incentives, such as substantial tax breaks, construction regulations, and so. To quote, "However, because energy efficiency and peak capacity reductions have not been comprehensively pursued by any organization in Hawaii to date, there is considerable uncertainty about how to structure DSM programs. How much above the anticipated 10% reduction in peak electrical demand over 20 years could be realized with an aggressive, state supported DSM program.

4.3.1. Air Quality: Existing Conditions. There are no on-site air quality data for the proposed project site, the nearest being several miles away at Maalaea. It is difficult to see how the baseline readings at Maalaea could be substituted for the proposed site when there are so many pollution sources to the northwest and northeast of the proposed sight, in closer proximity than to Maalaea, including Puunene Sugar Mill, Kahului Airport, Kahului Power Plant and Paia Sugar Mill. The level of pollutants at the proposed site might be substantially different from the Maalaea site. Also, the details of the location of the Maalaea monitoring site is not given in relation to the Maalaea plant itself: is it upwind or downwind, and how far away? Also, the Maalaea plant is outside the Maui vortex.

4.3.2.1. Operational Air Emissions. The DEIS states, "Because only one 58 MW unit will be permitted at a time, the emissions from one unit werre used in the preliminary modelling. A full impact is not required for a particular pollutant when emissions for that pollutant would not increase the ambient concentration by more than the prescribed impact level (SIL)..." This is based on the <u>New Source Review Workshop Manual.</u> By being required legally to evaluate the project in this piecemeal fashion, one generator at a time, the DEIS evades the need to do a full impact analysis of the various pollutants. While this legality conveniently relieves the proposers of having to look at the cumulative impact of the built-out plant, it does not help us in determining what the real effect this project will have on the environment when the plant is finally completed. The DEIS is then able to go through each of the potential pollutants and disregard the impact of each.

4.3.2.2. Impacts on Haleakala National Park. The DEIS again quotes a federal workbook to say that since "regional haze 'is caused by multiple sources located throughout a region'", and since the "primary sources of regional haze on the island of Maui are cane burning, bagasse burning, automobiles, and volcanic emissions...", and finally since "the facility will emit insignificant amounts of constituents contributing to regional haze", it concludes that the "proposed Waena Generating Station is not expected to have any significant additive impact on regional haze." This is an entirely circular and fallacious argument, which relies on a lapse of logic to be believed.

Anyone who has come down the Pukalani Highway in the morning on a trade wind day can easily see the blue plume of the Kahului Power Plant superimposed on the dark backdrop of the West Maui Mountains. Are we really to believe that this readily visible degradation of air clarity generated from a 24 MW generator will be worse than the haze generated from a plant generating ten times as much power? Do we really want ten time the blue smoke dumped into the Central Valley, leading almost certainly to a great loss of natural color of the atmosphere, and a general dulling of the visual environment?

4.3.2.3. Impacts Due to the Maui Vortex. This discussion, while it agrees that there is such an entity as the Maui vortex, devises several arguments to discount the effects that the vortex might have on the disposition of air pollutants from the proposed plant. In reviewing the Appendix C3 which is the study supporting the conclusion that there is no impact, I found several questionable assumptions from a layman's point of view. The calculations are based on using the winds at 0200 (2AM), at which time the winds during regular tradewind conditions are very different as compared to daytime. Of course, there is no vortex generated at this time, so there is no entrainment of pollutants. It is never made clear to my satisfaction why this time of day was used in the calculations, as well as why they used the value of .35% as the percent of the plume that would be caught in the vortex at night time.

Not addressed in this confusing analysis are the daytime verticeal conditions and their effects, and more importantly for air quality, the true worst case scenario of prolonged inversions when the Kona winds are blowing for extended periods of time. These represent major flaws in the DEIS, and should be corrected for the final EIS. All of the subsequent calculations for various pollutants, as well as deposition values on crops for ethylene and sulfuric acid in the appendix C3 are potentially flawed from the premises and should be reevaluated.

4.6.1.1. Groundwater: Existing Conditions. It is of interest that the Landfill Monitor Wells 5105-01,02,03 near the project site all have chloride content below the potability limit of 250 mg/l (Table 1, Appendix E). Likewise, an examination of Figure 4-2 shows that the plant sits right on the Underground Injection Control line at its eastern edge. It is difficult to see how we can be so precise as to allow degradation on one side, while trying to maintain purity on the other side of this arbitrarily drawn line, especially when there are potable water resources on the downhill side as demonstrated in this case. Even if the reason for the decreased salinity is artificial recharge, the water may some day serve this island's growing thirst, as we run out of drinkable waters from other sources that are rapidly reaching their limit. What is economically unfeasible to reclaim today may become more feasible in the future as water is harder to find.

This project will gradually increase the salinity of the underlying aquifer as it reinjects nearly half a million gallons of water per day of wastewater over the 30 years of operations. Use of SCR as BACT will increase the water use and the degree of pollutants in the waste water to a greater degree. Also there is an assumption made in this section that the will ber no mixing of the effluent with aquifer groundwater.This is contradicted in Appendix E, the Groundwater Resource Assessment, page 12, which states, "...the resultant wastewater totals .44 mgdd, which will be returned to the basal aquifer by means of injection wells."

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November 3, 1997

139792.EI.04

Dr. Steven Moser
Hawaii Medical Association
1833 Mill Street
Wailuku, HI 96793

Dear Dr. Moser:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your August 26, 1997 letter and testimony at our public comment meeting concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *Peak Demand. The calculations for future growth of power needs for Maui County may be overstated.*

    The sales and peak forecast is made by utilizing a variety of forecasting tools, the expertise of the staffs of both MECO and HECO, and the input of our customers and respected organizations in the community. All data is analyzed and tested from various perspectives before a final forecast is adopted by the Forecast Planning Committee. The potential effects of energy efficiency and Demand Side Management (DSM) programs are also incorporated into the sales and peak forecast.

    Historically, the adopted forecast has been reasonably close to recorded numbers. MECO believes that the small variances indicate the reasonableness of the forecasts.

    MECO prepares near-term 5-year sales and peak forecasts annually using the latest available economic, historical sales and peak load data, as well as customer contact for existing projects and customer requests for future projects. Once every three years a long-term 20-year forecast is generated to examine the facilities needed to serve the power growth. The preparation of the sales and peak forecast is part of the comprehensive Integrated Resource Planning (IRP) process.

The primary advantage of the IRP forecasting process is to ensure that the forecast receives maximum exposure and evaluation through multiple levels of review. Overall, there are approximately 40 individuals on the MECO IRP Advisory Group (AG), the MECO Forecast Planning Subcommittee (FPSC), and the Forecast Planning Committee (FPC) who contribute their diverse expertise, knowledge and experience to the forecasting process. The use of the MECO IRP AG provides a mechanism for members to provide feedback and input to the process.

The MECO IRP AG is comprised of members from the Department of Commerce and Consumer Affairs – Consumer Advocacy Division; Department of Business, Economic Development and Tourism – Energy Division; County of Maui Planning Department; County Office of Economic Development; Maui Chamber of Commerce; Maui Hotel Association; Maui Visitor's Bureau; Molokai Task Force; Lanai Resort Partners; island residents; and other businesses. The FPSC and FPC are made up of MECO staff in the Customer Service, Engineering, Production, Transmission and Distribution Departments and HECO staff in the Forecast, Generation Planning, and Integrated Resource Planning Divisions.

The general philosophy MECO follows in preparing its kilowatt-hour (kWh) sales and peak forecast is to place emphasis on consideration of estimated future sales and loads from as many different "viewpoints" or perspectives as possible.

The final forecasts selected by the FPC can be corroborated by more than one analytical method or source of information. Although mathematical trending of historical kWh sales data is one form of analysis used in our forecasting process, MECO does not depend solely on mathematical trending to forecast. Such an approach may fail to recognize and take into consideration important economic and demographic changes that are taking place in various districts of the three islands (divisions). The following is a description of the kWh sales and peak forecasting methodologies from which the final forecast is chosen.

The methods considered in the preparation of the kWh sales and peak forecast are the rate schedule analyses, market analyses, economic analyses, and customer service analyses. The methods are described as follows:

- The Rate Schedule Analyses methodology considers a spectrum of mathematical analyses of the patterns and trends in the number of customers, kWh sales, and average use per customer to the individual rate schedules using time series, econometric, and end-use methods.

  Generally, these mathematical modeling and trending techniques use mathematical relationships based on historical data and other related information to develop projections of future kWh sales and customers. These techniques vary in degree of sophistication and can be applied to a variety of load demand parameters for which historical and near-term future data are available.

- The Market Analyses are based on analyses of the market conditions influencing the different customer classes with special emphasis on customer-by-customer accounting of loads of our large power users. Also considered are influences on the residential class, including new construction outlook, resort development, private residential development, and government supported or sponsored housing.

Market analyses is the primary forecasting method accepted for the large power users because the relatively small number customers allows for in-depth customer-by-customer analysis. Market analyses for this class consist of identification of known or expected changes in each customer's consumption attributable to factors such as adjustments in a customer's demand load or operating characteristics, energy efficiency, added load and new construction.

- The Economic Analyses include judgmental analyses and considerations of the potential for future economic growth in the MECO service areas, based on broad economic indicators and opinions of economists and others prominent in the economic arena as presented in various periodicals, as well as contacts in the marketplace.

- The Customer Service Analyses are based on judgmental analyses and considerations of area growth based on day-to-day working knowledge of customers, customer billing data, and other customer-related factors that affect kWh sales and the customer count from month to month. The techniques employed in the Customer Service forecasting processes take into account changing conditions in the marketplace which may either explain the reasons for certain recorded values or which may influence kWh sales in the near future.

  Customer Service analyses consider load and customer growth for each of the customer class for each of the three service areas – Maui, Lanai, and Molokai. Although judgmental, this type of analyses addresses the factors that affect smaller segments of the service areas, thereby minimizing the margin of error in short-term forecasting.

Because of the detailed nature and the close customer contact included in these analyses, the results carry a high degree of validity for the short term. However, because of uncertainty on the part of customers' plans for significant changes in their energy usage patterns and the marketplace, Market and Customer Service analyses of the individual rate schedules are considered applicable for only about three years into the future. Mathematical analysis is used to project the forecast beyond that point.

In addition to the sales and peak forecasting methodology described above, MECO uses the Electric Power Research Institute's (EPRI) profile aggregation program, HELM (Hourly Electric Load Model) to forecast Maui Island's evening and day peaks and minimum loads. HELM takes reference customer class load profiles and adjusts them to levels of the approved sales forecast. The average monthly weekday and weekend reference customer class load profiles were developed in the 1995 MECO Class Load Study. The resulting sales load factor (ratio of the average hours of operation to the total annual hours available) and peak month are analyzed against recorded data to assure reasonableness. Maui Island's sales load factor and peak month have been stable over the past five years.

2. *Resource Planning. This tendency to centralize all power production presents possible problems in the event of natural or man-made disasters, such as hurricanes, fires, earthquakes, or sabotage. It also concentrates all of the environmental degradation into one main area, instead of distributing it. Finally it creates an infrastructural nidus for*

future industrial growth in the areas adjacent to the current large industrial project, further blighting the rural nature of the Central Valley of Maui.

The most efficient (lowest cost) method of bulk electrical power generation remains via the centralized power plant concept. The centralized power plant provides economies of scale through both shared infrastructure and personnel. Additionally, a series of generating siting studies accomplished for MECO since 1989 have all highlighted the fact that only a small, limited number of potential generating sites exist on the Island of Maui, thereby restricting the distributed generation philosophy and further strengthening the centralized power plant concept. The Waena site was selected only after a careful, detailed, and thorough environmental analysis of such issues as: air quality, ground water, surface water, plants, wildlife, cultural resources, noise, hazardous materials/wastes, natural hazards, and traffic.

Future additional urban uses in the area must receive applicable land use, community plan, and zoning re-designations or special use permits. Because of this, policy and decision makers will be able to determine the extent and nature, if any, of future development around the proposed project site.

3. *Fuel Transport and Handling. Forty-four tanker truck deliveries per day in the built power plant scenario represents a potential hazard for travel on our busy highways.*

MECO acknowledges that there will be an increase in fuel trucks using the area road network as a result of the proposed Waena Generating Station. However, the amount of traffic attributable to fuel trucks will be small on a per hour basis, beginning with one truck per hour in 2004 and increasing to 5 trucks per hour at full-build out in 2020. Several modifications in the existing roadway system are planned to occur within the next few years which will upgrade the roads used between Kahului Harbor and the proposed Waena Generating Station. As a result of these planned state and county modifications, traffic levels along the fuel haul route will not noticeably change, even following full-build out of the project in 2020. Because traffic congestion will not appreciably worsen as a result of the fuel trucks, we do not anticipate an increased potential for traffic accidents. Additionally, the State of Hawaii Department of Transportation (DOT) in a September 12, 1997, Draft EIS response letter has indicated that the roadways will adequately accommodate the proposed project traffic.

Fuel haul operators are independent contractors who must operate within licensing and regulatory standards established by the State Department of Transportation. These standards include accident and spill response plans. The contractor must also comply with all training requirements established by the U.S. and State DOT, including Hazardous Materials Training Courses and fuel hauling and handling seminars provided by the diesel fuel supplier.

4. *Best Available Control Technology. Note: No commitment for BACT makes it difficult to comment on alternatives.*

The Draft EIS describes several types of air pollution control technologies which may be appropriate for use at the Waena Generating Station, based on current BACT determinations. However, because the first unit at the proposed generating station is not scheduled for operation until 2004, the existing feasible control technologies discussed as

BACT may be superseded by other emission control methods. Therefore, one cannot specify with absolute certainty at this time what the control technology for the project will be. The Draft EIS discloses the best information currently available.

5. *It is also of great concern that BACT is really a misnomer, since the BACT may not be technically or economically feasible in any given technology.*

As defined in the Clean Air Act (CAA), Best Available Control Technology (BACT) is "an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation emitted from or which results from any major emitting facility, which the permitting authority, on a case by case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment of innovative fuel combustion techniques for control of each such pollutant."

BACT for the Waena project will be evaluated by MECO in accordance with the CAA subject to approval by DOH and EPA. It is true that EPA allows for the consideration of technical and economic feasibility when determining best available control technology (BACT) for a given pollutant. However, it should be noted that EPA regulations also state that in no event can the application of BACT result in emissions of any pollutant that would exceed the level allowed by an applicable New Source Performance Standard (NSPS) regardless of economic consideration. New source performance standards require strict emissions limits for new sources based on proven control technologies. Emission sources located at the Waena Generating Station will at a minimum adhere to these requirements.

6. *BACT for Sulfur Dioxide and Sulfuric Acid Mist. BACT for sulfur would logically include use of the lowest sulfur content fuel, i.e., .05 percent, but this is rejected for economic reasons in favor of .4 percent sulfur content, despite the 8-fold increase in sulfur emissions anticipated.*

The U.S. Environmental Protection Agency (EPA) allows for the consideration of technical as well as economic feasibility considerations when determining best available control technology (BACT) for a given pollutant. The use of ultra low sulfur (0.05 percent sulfur) diesel fuel is currently not feasible due to the high costs associated with the purchase, transport, and distribution of this type of fuel. In order to accommodate the amount of fuel necessary for the Waena Generating Station, the local refineries would need to import 0.05 percent sulfur diesel from the West Coast, as they do not have the ability to manufacture ultra low sulfur diesel in the amounts necessary for the Waena Generating Station. The product cost difference and importation costs would result in an estimated 20 percent increase in the cost of fuel. Additional increases would potentially be realized with the need for MECO to build new storage and distribution facilities at Kahului Harbor in order to segregate the 0.05 percent sulfur diesel from diesel fuel that contains a higher amount of sulfur. A detailed review of control technologies for emissions associated with the Waena Generating Station will be conducted as part of the Prevention of Significant Deterioration (PSD) permitting process and will be updated to include fuel cost considerations based on the Waena Generating Station operation date of 2004.

7. *Project Schedule and Cost. Could any of this massive expenditure for diesel burning plants be deferred to energy conservation measures and alternative energy development so that we could be less dependent on foreign petrochemicals?*

MECO has extensively evaluated numerous supply-side resource alternatives in developing its Integrated Resource Plan (IRP). The selection of resource options for MECO's IRP is based on a screening process wherein a large number of potential supply-side options are considered. The screening process is a detailed process with significant input from MECO's public advisory group, which was convened to ensure maximum participation from all stakeholders in the overall IRP process.

MECO did evaluate the use of intermittent energy sources, such as solar, hydropower, and wind energy, as well as alternative fuels, such as methanol and ethanol, as a part of the IRP process. However, for capacity planning purposes, MECO is unable to include such intermittent or non-dispatchable sources of energy production as assured system generating capacity. MECO does use electricity from alternative energy sources when it is available. To the extent that electricity is available from these sources, MECO will avoid burning fossil fuels.

MECO also evaluated the use of firm, dispatchable energy from renewable sources, such as biomass technologies. However, the high fuel costs and low power plant efficiencies associated with biomass energy production do not make it a cost-effective option at this time.

Before MECO undertook its IRP process, the Public Utilities Commission (PUC) issued a framework for the planning process. One of the governing principles stated in the framework is the consideration of a plan's impact on the utility consumer, environment, culture, community lifestyles, State's economy, and society. The framework stated that, to the extent possible and feasible, the external costs and benefits should be quantified and expressed in dollar terms. When it is neither possible nor feasible to quantify any cost or benefit, such cost or benefit should be qualitatively measured.

MECO followed the PUC framework in preparing its IRP and considered externality costs as part of resource evaluation. Proxy monetized externalities were used to assess air emission impacts, and other externalities were assessed qualitatively. Even considering externality costs, the combustion turbine technology was the most cost-effective resource that could provide the needed amount of generation capacity within the required time frame.

In its IRP, MECO selected a resource plan within the context of short- and long-term resource strategies. For the short term, MECO is implementing aggressive demand-side management programs and conventional oil-based technologies because of the costs and uncertainties associated with renewable energies and alternative fuel sources. The Draft EIS includes a discussion of both alternative energy and alternative fuel sources and outlines the reasons they are not considered feasible for use within the short term. The short-term role for renewable/alternative energy resources; therefore, will continue to be in power purchased from independent power producers.

For its long-term strategy, MECO will continue to evaluate the technical and economic feasibility of using more alternative energy sources. As a part of the Waena project, the combustion turbines proposed can accommodate by-products of coal gasification rather than diesel. In addition, the overall project implementation over 20-30 years is designed to allow

for the easy replacement of the proposed combustion-turbine technology with other energy generating alternatives when they become technically and economically feasible.

8. *Conservation and Energy Efficiency. This discussion of demand side energy conservation (DSM) does not show any consideration for the effects of a concerted effort at widespread implementation in this country. ... How much above the anticipated 10 percent reduction in peak electrical demand over 20 years could be realized with an aggressive, state supported DSM program.*

MECO's demand-side management (DSM) programs is already very aggressive. As of September 30, 1997, and since the beginning of its DSM programs one year ago, MECO, with the help of its customers, has succeeded in saving approximately 1.1 megawatts (MW) and approximately 6,467,800 kilowatt-hours (kWh) of electricity. This represents 64 percent and 68 percent of the first year's demand and energy goals, respectively, as presented in the PUC application for its DSM programs.

MECO started the implementation of its DSM programs in the later part of 1996, shortly after receiving approval from the PUC. These programs cover all customer segments throughout the entire County of Maui. These programs were the result of an extensive development process within the 1993 Integrated Resource planning process. The DSM programs were shown to be cost effective and feature a combination of end uses and market segments that have the highest potential for reducing load and saving energy. Such high savings have been accomplished by developing a comprehensive sales profile. The market sectors were based on the three major customer classes: residential, commercial and industrial. Energy devices (e.g., water heating, lighting, and cooling) were identified for each market segment to determine the most efficient DSM technologies and programs that could be applied to have the greatest impact on reducing demand and increasing energy savings.

Since the beginning of these programs, MECO also has conducted an aggressive advertising campaign to promote greater energy conservation. One-on-one contacts by MECO's Energy Services Representatives have been coupled with seminars, bill inserts, and newspaper, magazine, radio and television ads. MECO is making extensive use of testimonial advertising for both residential and commercial programs. In addition, MECO developed the "Efficient Times" newsletter, which is sent to all commercial customers. This newsletter provides retrofit examples, more testimonials, and simple calculation sheets. To reach the smaller commercial customers who do not normally participate, MECO has recently implemented a lighting promotion whereby it provides these customers, free of charge, half of the equipment needed to upgrade their lighting to more efficient standards.

MECO's DSM program has been supported by the State of Hawaii, which also provides oversight and resource assessment. The state and federal governments also already provide several tax incentives for various energy conservation measures, including a 35 percent state tax credit for solar water heaters, a 20 percent state tax credit for heat pumps, and a 10 percent federal tax credit for heat pumps. Hotels also receive a 4 percent renovation tax credit for retrofitting and installing more energy efficient equipment. MECO feels that all of these elements, when considered together, make their DSM program one of the most aggressive in the country.

9. *Air Quality: Existing Conditions. There are no on-site air quality data for the proposed project site. It is difficult to see how the baseline readings at Maalaea could be substituted for the proposed site when there are so many pollution sources to the northwest and northeast of the proposed sight [sic], in closer proximity than to Maalaea, including Puunene Sugar Mill, Kahului Airport, Kahului Power Plant and Paia Sugar Mill. The details of the location of the Maalaea monitoring site is [sic] not given in relation to the Maalaea plant itself: is it upwind or downwind, and how far away? Also, the Maalaea plant is outside the Maui vortex.*

Monitoring Station 235, operated by MECO between August 1993 and July 1994, found that the existing air quality is well within the National and State Ambient Air Quality Standards (NAAQS/SAAQS). This station's location is west, southwest of the Maalaea plant, and to the west, northwest of the Maalaea Harbor.

MECO operated Monitoring Station 235 to satisfy the post-construction monitoring requirements for Maalaea combustion turbines units 14 and 16. The primary factor in locating this monitor was to capture the impact of Maalaea combustion turbine units 14 and 16.

The monitoring results for Station 235 are not a substitution for on-site results at the proposed Waena site. However, the data were gathered at a location generally downwind of the emission sources in central Maui, and can be considered representative of background air quality in the region for the purposes of the Draft EIS.

Waena-specific pre-construction monitoring results must be addressed in the air permit application. At that time, more detailed site-specific monitoring results must be presented. This may necessitate additional ambient air monitoring by MECO.

10. *Operational Air Emissions. The DEIS evades the need to do a full impact analysis of the various pollutants.*

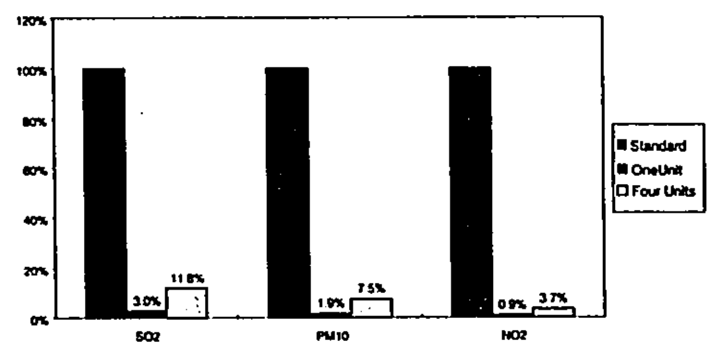
The Draft EIS is not intended nor is it required to fulfill the requirements of EPA's new source review program for prevention of significant air quality deterioration, nor can it reasonably do so at this point in the planning process as the actual plant operation is not scheduled to begin until 2004, and much of the information needed to perform this detailed analysis is not yet in existence.

It is likely that each of the four 58-MW generation units will be permitted separately due to the full build-out time frame (2004 through 2016). Each successive unit's permit application will account for those units and emissions already existing at the station. The PSD permitting process also requires a consideration of all existing emissions sources (both at the site and nearby) when determining ambient air quality impacts. The process, therefore, cannot considered piecemeal.

The Draft EIS did not list total project impacts (i.e., for four 58 MW units) for NO_x and PM_{10} since impacts for one unit would be below the EPA's significance level. From an air permitting standpoint, NO_x and PM_{10} impacts from four units would also be below the significance level assuming each unit was permitted separately. Notwithstanding this, the

figure below compares SO_2, NO_x, and PM_{10} impacts from four 58 MW units with the ambient air quality standards (AAQS).

Comparison of Maximum Project Impacts with Ambient Standards



As indicated, the projected concentrations of SO_2, NO_x, and PM_{10} for the four 58 MW units combined are well below ambient air quality standards. For sulfur dioxide, the predicted three hour average concentration for four units is 154 ug/m^3 or 11.8 percent of the AAQS (1300 ug/m^3). For nitrogen oxides, the predicted annual average concentration of 2.56 ug/m^3 for the four units is 3.7 percent of the AAQS (70 ug/m^3). And for particulate matter less than 10 microns in size, the predicted 24 hour average concentration for the four units is 11.32 ug/m^3, 7.5 percent of the AAQS (150 ug/m^3). Based on these numbers, full compliance with the ambient air quality standards is anticipated for the fully built-out generating station.

11. *Impacts on Haleakala National Park. Second paragraph: Are we really to believe that this readily visible degradation of air clarity generated from a 24 MW generator will be worse than the haze generated from a plant generating ten times as much power?*

The Kahului plant (the "24 MW generator") is an older boiler plant burning No. 6 fuel oil with 2.0 percent (maximum) weight sulfur content. The proposed Waena generating units are modern combustion turbines burning No. 2 fuel oil with 0.4 percent (maximum) sulfur content. The existing Maalaea units M-14 and M-16 are identical to the units proposed at Waena. MECO is not aware of any visibility problems, such as a "blue plume," caused by Maalaea units M-14 and M-16. Under normal operations, the emissions from the Waena stacks will be of relatively low opacity approximating the appearance of heat waves and will not be readily visible. The emissions from the Waena Generating Station combustion turbines will not resemble those produced by the steam units at the Puunene Sugar Mill or those produced by the combustion of No. 6 fuel oil at the Kahului Power Plant.

12. Impacts Due to the Maui Vortex. In reviewing the Appendix C3 which is the study supporting the conclusion that there is no impact, I found several questionable assumptions from a layman's point of view. The calculations are based on using the winds at 0200 (2AM), at which time the winds during regular tradewind conditions are very different as compared to daytime. ... It is never made clear to my satisfaction why this time of day was used in the calculations, as well as why they used the value of .35 percent as the percent of the plume that would be caught in the vortex at night time.

Daytime wind speeds tend to be higher than the nighttime values. Accordingly, the 0200 hour represents the most conservative scenario because of the light winds and poor dispersion. The vortex study's assumption of the 0200 pattern with a vortex duration of one month represents a worst-case scenario. This one month assumption requires that:

1. The trades blow continuously for a month,
2. No nocturnal vortex dissipation occurs in a month, and
3. Any emission entering the vortex does not leave the vortex, but recirculates within the vortex for a month.

Assuming that the vortex does persist at night is conservative. Under this assumption, the plume elements would not leave the vortex and would be trapped in the vortex for as long as a month.

The 0.35 percent is that fraction of the plume element that may be entrained into the vortex. As described in the Maui Vortex report, only those plume elements beyond 2.7 sigmas from the plume centerline will enter the vortex. Using standard statistical tables describing a normal distribution, 0.7 percent of the total distribution remains beyond 2.7 sigmas. Because only one side of the plume is exposed to the vortex, one-half that value, or 0.35 percent, is entrained into the vortex.

The vortex may not be present during the nighttime. As discussed in the report, there is ample evidence of significant nocturnal vortex shedding at night. To determine pollutant concentrations in the vortex with shedding, coupled with a potentially larger vortex during the daytime, we will make the following assumptions:

1. Vortex is shed every night. Thus, the vortex duration is 12 hours.
2. Because of stronger daytime tradewinds, the vortex may be larger and may entrain a larger portion of the plume. For purposes of this demonstration, we'll make the conservative assumption that 50 percent of the plume is entrained into the vortex.

Using these assumptions, the equation describes the vortex concentration at the end of 12 hours:

$$Cs(\mu g/m^3) = \frac{12(hours) \times Q(lb/h) \times P}{V(m^3)} \times \frac{45359(g)}{1(lb)} \times \frac{10^6(\mu g)}{1(g)}$$

Where:

t = Amount of time in hours
V = Vortex volume in cubic meters (3.65×10^{11} m^3)
Cs = Concentration level in micrograms per cubic meter
Q = Emission rate in pounds per hour
P = Fraction of plume to be entrained (0.5)

Based on this equation, the following table shows the worst-case concentrations:

Worst-Case SO_2, NO_2 and PM_{10} Concentrations with Nocturnal Vortex Shedding

Pollutant	Number of 58-MW DTCC[a] Units	Emission Rate (lb/hr) per Unit[b]	Fraction of Plume Entrained	Vortex Volume (m^3)	Vortex Duration (Hours)	Worst-Case Concentration (ug/m^3)
SO_2	1	220	0.5	3.65E+11	12	1.6
	2	220	0.5	3.65E+11	12	3.3
	3	220	0.5	3.65E+11	12	4.9
	4	220	0.5	3.65E+11	12	6.6
NO_2	1	84.6	0.5	3.65E+11	12	0.6
	2	84.6	0.5	3.65E+11	12	1.3
	3	84.6	0.5	3.65E+11	12	1.9
	4	84.6	0.5	3.65E+11	12	2.5
PM_{10}	1	39.4	0.5	3.65E+11	12	0.3
	2	39.4	0.5	3.65E+11	12	0.6
	3	39.4	0.5	3.65E+11	12	0.9
	4	39.4	0.5	3.65E+11	12	1.2

Notes:
[a] DTCC - Dual Train Combined Cycle
[b] Maximum emission rate from the "Air Quality Screening Analysis for the Central Maui Generating Project" (Jim Clary & Associates, September 1995)

Even under these worst-case conditions the concentrations are not significant. The maximum SO_2 concentrations does not exceed the 3-hour EPA significance level for SO_2 (25 µg/m^3) and the maximum NO_2 and PM/PM_{10} concentrations do not exceed the 24-hour PM/PM_{10} significance level (5 µg/m^3). (NO_2 does not have a short-term (i.e., 24-hour or less) ambient standard.)

13. Not addressed in this confusing analysis are the daytime vortical conditions and their effects, and more importantly the true worst case scenario of prolonged inversions when the Kona winds are blowing for extended periods of time.

The response to the proceeding question addressed daytime conditions in the Maui vortex. Tradewinds are responsible for the Maui Vortex. The vortex will not be present under Kona wind conditions. However, the air quality modeling (described in section 4.3.2.1, "Operational Air Emissions" in the DEIS) does include Kona conditions and any inversions. These modeling results show an insignificant impact for all but 3-hour and 24-hour SO_2. Additional modeling demonstrated that the worst-case concentrations with four 58-MW units is less than the PSD Class II increments, which are only 25-39 percent of the health-based ambient standards.

14. Groundwater: Existing Conditions. An examination of Figure 4-2 shows that the plant sits right on the Underground Injection Control line at its eastern edge. It is difficult to see how we can be so precise as to allow degradation on one side, while trying to maintain purity on the other side of this arbitrarily drawn line, especially when there are potable water resources on the downhill side as demonstrated in this case.

Pursuant to HAR Title 11, Chapter 23, Underground Injection Control, the underground injection control (UIC) line is the line on the Department of Health UIC maps which separates, in plan view, exempted aquifers and underground sources of drinking water (USDW). The aquifer designations are reviewed at least every three years and may be amended by the State DOH. Rather than the line being applied arbitrarily, there are certain criteria for exempting aquifers from underground sources of drinking water. Briefly, these criteria are as follows:

1. *The aquifer does not currently serve as a source of drinking water; and*
2. *The aquifer cannot now and will not in the future serve as a source of drinking water because of any of the following criteria:*
   - A. *It is situated at a depth or location which currently makes recovery of water for drinking water purposes economically or technologically impractical; or*
   - B. *It is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption; or*
   - C. *The total dissolved solids concentration or the groundwater is more than 5000 mg/l, and it is not reasonably expected to supply a public or private drinking water system.*

Even though an injection well may be allowed below the UIC line, no well may be constructed unless, prior to the start of any construction, an application is made for a UIC permit. As a part of the UIC permit application, MECO must collect and present water quality data representative of local conditions for the DOH to review. Through this review, the DOH can make the final determination of the appropriateness of the injection well regardless of its location mauka or makai of the UIC line.

In a September 18, 1997, letter from Bruce Anderson, the DOH provided water and wastewater-related comments on the Waena DEIS. It should be noted that the DOH Safe Drinking Water Branch did not raise or identify concerns about the proposed site being located next to its UIC line. In the same letter, the DOH Wastewater Branch expressed no objections to the project provided that wastewater is properly treated and disposed of, and that a UIC permit is obtained from the Safe Drinking Water Branch.

15. There is an assumption made in this section that there will be no mixing of the effluent with aquifer groundwater. This is contradicted in Appendix E, the Groundwater

Resource Assessment, page 12, which states, "...the resultant wastewater totals .44 mgd, which will be returned to the basal aquifer by means of injection wells."

The assumption that there would be no mixing of the effluent with the aquifer groundwater was made to show the hypothetically absolute *worst-case scenario*, as indicated on page 4-31 of the Draft EIS. Under this assumption, if the wastewater plume did not mix with the underlying aquifer, then the plume would carry similar concentrations as injected for a distance of 0.8 miles after 10 years, 1.5 miles after 20 years, and 2.1 miles after 30 years of steady injection.

However, as you (and the Draft EIS on page 4-31) point out, the reality of the situation is that as the wastewater plume migrates downgradient from the injection well, it will be affected by dispersion. Dispersion is the process by which a plume tends to spread by mechanical mixing and molecular (chemical) diffusion. While the width of the plume will increase by dispersion, the concentration within the plume will decrease until it eventually reaches that of the ambient groundwater. At this time, we anticipate the wastewater concentrations to be injected to be no greater than those already found downgradient of the project site. The wastewater plume should reach ambient aquifer concentrations well before it reaches the nearest existing irrigation well, some 1.5 miles downgradient.

Prior to construction and operation of the injection wells, site specific water quality data will be gathered and submitted to the State Department of Health for their review and determination of potential downgradient impacts as a part of the UIC permit process.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

[signature]

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

Tropical Orchid Farm

Huelo, Maui

9-22-97

To
Mr David Blane, Planning Director
Maui County Department of Planning
250 South High Street
Wailuku, Maui, Hawaii
96793

Mr. Mark R Willey, Project Manager
1585 Kapiolani Blvd , Suite 1420
Honolulu, Hawaii
96814

From
Jeffrey Parker, President
Tropical Orchid Farm, Inc.
P O Box 170
Haiku, Hawaii
96708

Dear Mr.'s Blane and Willey,

While I am a newcomer to the issue of the Waena Generating Station Environmental Impact Statement, after reading the document I feel compelled to offer my comments to the draft. Please add them to the final EIS.

While I sympathize with MECO's efforts to try and anticipate future energy demands and to develop a plan of action, issues that are important to me are not studied or the conclusions of the studies differ from my own. I think that we must remember that an EIS prepared for a developer always seeks to slant the conclusions towards the project being proposed. These documents, while being better than nothing, are far from being "unbiased" reviews of the proposed projects.

For example, a quick scan of the Summary of Potential Impacts reveals that while the preparers concluded that there will be adverse impacts from the project, their somewhat subjective opinion is that the impacts are "not significant'. Under "Visual Resources', the conclusion is "no significant impact'. I noticed that the computer-generated images of the views (Key Views 3 & 4) are shown <u>without</u> the smoke plumes rising up out of the smokestacks. Really, it does come down to the observers' opinion (i.e., am I the person being paid to prepare this justification document, or am I the citizen who will have to live with the many adverse impacts, and personally will gain nothing from this project?)

The following deficiencies of the EIS concern me:

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1. <u>Failure to analyze alternative energy sources in depth.</u>

The mantra of "not economically feasible at this time" is used to avoid serious consideration of alternative energy solutions which could have the positive effect of down-scaling this project. Specifically, there is no mention of Solar-Thermal technology which has been shown to be capable of generating large amounts of power in sunny areas of the country. One of the inventors of the Solar-Thermal demonstration project in Mojave, California actually came to Hawaii and gave a presentation to the State Legislature, in which he stated that Honolulu is one of the best sites in the country for this technology to work. Although this technology only supplies electricity during the daytime when the sun is out, it could supplement the generating plant, thereby reducing the size of the facility and the quantity of low-grade high-sulfur fuel used. MECO, in its EIS claims that solar technologies use too much acreage and therefore are "not economically feasible". I personally feel that MECO would be able to get as much acreage as it needs if it wanted to show leadership by seriously exploring solar energy.

Also, I have a problem with the idea that a higher grade, less-polluting fuel is not an alternative because it is "too expensive". Maui is a "special case" when it comes to preserving qualities like clean air, clean water, etc. Besides the negative effects to our citizens of burning low-grade fuel, our current leading industry, tourism, depends on being able to market clean air, clean water, and unobstructed vistas, to its consumers. Therefore, the EIS should discuss the cost/<u>benefits</u> of using the cleaner, less polluting low-sulfur fuels (i.e. better health and environment for our citizens, and preservation of our tourism image.)

I think the EIS should have discussed the concept of keeping our dollars here circulating in our own economy. In other words, when we buy fossil fuels from the mainland, 90% of the money leaves Hawaii. When we generate our power from renewable resources here in Hawaii, the money stays here, circulating in our local economy. This benefit can offset the "higher costs" of alternative energy.

MECO says that as a result of Integrated Resource Planning process, it formed four DSM resource programs including a Residential Efficient Water Heating Program. I would like to know why MECO now has decided to stop offering the $800 credit for solar hot water installations? I wonder if discontinuing that program is a way for MECO to turn consumers away from alternative energy at a time when they are trying to justify the their decision to continue reliance on fossil-fuel.

2. <u>Failure to study impacts of increased tanker traffic in and out of Kahului Harbor and on coastline. Also, fuel transport and handling.</u>

This is a serious omission of the EIS. Apparently the preparers didn't see the need to discuss how the fuel will get to Maui in the first place. Operating under baseload conditions, the generating plant could use 312,000 gallons of fuel per day. This is equivalent to an Exxon-Valdez tanker arriving at Kahului Harbor once a month! If one of these tankers runs aground along our sensitive coastline, will MECO share in the liability of such a disaster? The failure of the EIS to look at this aspect of energy development is clear grounds for the rejection of the document and a Supplemental EIS should be required.

Also, what are the environmental impacts of one of the 44 fuel tanker trucks per day crashing en-route to the plant? No mention of this in the EIS. Again, a supplemental EIS is required

3. Failure to study full and cumulative impacts as required by State law. (Using BACT as a convenient escape clause).

I have a problem with the Bact (Best Available Current Technology) concept when it is used to avoid examining the cumulative impacts of the project. The preparers state "It must be made clear that specific BACT for this project has not yet been determined and will not be determined until such time as the State of Hawaii Department of Health and U.S. Environmental Protection Agency review the design-specific elements and modeled air emissions through the air quality permit process. If the top control alternative is not applicable, or if it is not technically or economically feasible, it is rejected as BACT and the next most stringent alternative is then considered. This process continues until a control alternative is determined to be both technically and economically feasible for a particular air pollutant." In other words, we the citizens have no way of knowing what the final technologies will be. This is in direct opposition to one of the purposes of the EIS law, that a proposed project will be examined in its entirety before permitting and construction begins. This technique of using BACT as a way to avoid looking at the full impacts of the project, resembles another tactic used in EIS preparation called "segmenting". In segmenting, the project is proposed to be built in phases, thereby (supposedly) avoiding having to study the full, cumulative impacts. The issue of segmenting has been used successfully by environmental and citizens groups to have inadequate EIS's overturned in court. For the average citizen the "BACT cop-out" has the same implications as "segmenting". Another glaring example of this general type of tactic is found in the response to Water Director David Craddicks' letter. Mr. Willey states that "because the plant is not scheduled to begin construction until the year 2002, design consultants have not been determined at this time. As a result, the cost/benefits of specific water treatment alternatives will not be available within the time frame of the project."

If Mr. Blane accepts this EIS for the County of Maui, he basically is giving MECO permission to do anything they want!

4. Document concludes that project is in line with State and County land use policies and goals, when in fact it violates those stated directives.

The State Plan says "....it shall be the policy of this State to: Support research and development as well as promote the use of renewable energy sources." MECO acknowledges that, in making the decision to expand with additional oil-fired units, it is contradicting the objective of energy self-sufficiency (5.5.2).

The Maui County General Plan says "Objective 3 is to preserve lands that are well suited for agricultural pursuits. (Policy a) Protect prime or productive agricultural lands from competing non-agricultural land uses. (Policy d) Discourage the conversion of productive or potentially productive agricultural lands to non-agricultural uses." The MECO project clearly flies in the face of the Maui County General Plan.

The Wailuku-Kahului Community Plan contains the following: "Environment (a) Preserve agricultural lands as a major element of the open space setting which borders the various communities within the planning region. Energy (b) Promote the use of alternative energy sources, such as biomass, wind, and solar." The MECO project clearly is at odds with the wishes of the Citizens Advisory Commission.

The Maui County Zoning Code recommends "Preventing certain uses that will be detrimental to existing uses" and "Protecting the health, safety and welfare of the people of the County". Once again, although I understand the need of MECO to plan for the future, I think that the proposed project is in conflict with the State Plan, the County General Plan, the Wailuku- Kahului Community Plan, and the Maui County Zoning Code. Because MECO appears to be so out-of-step with the various experts and leaders who are responsible for these plans and policies, I believe a SEIS should be required.

5. Socioeconomic: Is infrastructure development a result of population and economic growth, or is it a cause of population and economic growth?

By creating a bigger power supply than is currently needed, will power-consumptive industries want to relocate here? The EIS admits that "..... the project will indirectly support additional population and growth." The EIS should address the benefits of having less population and growth if the "no action alternative" is selected.

6. EIS attempts to minimize importance of the conversion of prime ag lands into Urban and Heavy Industrial classifications.

As a farmer, it is my responsibility to question conversion of ag lands. While this particular project will convert "only" 67 acres of prime ag, it should be viewed in the context of all the other prime ag lands currently being threatened on Maui. Just one example; DOT is trying to have over 300 acres of prime ag reclassified to Urban for the Kahului Airport expansion. "The establishment of the nearby landfill and quarry have created an area of "city-like" heavy industrial uses near the proposed Waena Generating Station." Combined with a surplus of electricity, will we see the area near the proposed project turned into a giant industrial park like Cambell Industrial Park on Oahu?

7. Conclusions concerning impact of pumping ground water and of injection wells are inadequate.

Hydrology is a theoretical science. We simply do not know what the impact of these actions will be on the aquifer in that area. It is necessary to establish baseline studies before the project commences in order to be able to compare and assess the impacts when the project gets underway. In the EIS, Water Director David Craddick warns "since pumping of substantial amounts of ground water can lower ground water levels and stream flows far down-gradient of the pumping, wetland areas may be affected by such pumping."

Could the drawing-down of the brackish water in the aquifer lead to a drop in the level of the pure drinking water aquifer that is higher up?

8. Air quality.

Gary Gill of the Office of Environmental Quality Control states in the EIS "....the proposed action will include elements which constitute a source of pollution to the environment." Once again, by using the BACT loophole to avoid having to spell out what systems will eventually be chosen, we have no idea which scrubber technology will be deemed "economically feasible" by MECO.

Also, the attempt of the EIS to "explain away" the effects of the Maui Vortex on trapping particulate matter, is suspect. One thing, though, is certain: The project is within the area of the Vortex, as is clearly shown on the original Leopold's Vortex map and the NWS Vortex Model. Since the Vortex problem is real enough, why not burn the higher-grade low-sulfur fuel?

Not enough consideration was given to spending more money on low-sulfur fuel as an alternative to what is proposed. Because we Mauians place a high value on our clean air and natural beauty, we might prefer a higher generating cost with a cleaner environment as a result.

In conclusion, I hope that the EIS, in its present form will not be accepted by Mr. Blane and the County of Maui. Deficiencies in the EIS might be further addressed by a SEIS. Mr. Blane, I believe your responsibility to see that Maui's current residents are not adversely impacted by development projects, is greater than your charge to plan for future residents. I believe it is time for us to start looking at the issue of; what kind of economic growth can we have that does not involve population growth, instead of planning for massive population growth.

Thank you for the opportunity to comment.

Sincerely,

Jeffrey Parker

CH2MHILL

Celebrating 50 Years

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November 3, 1997

139792.EI.04

Mr. Jeffrey Parker
President
Tropical Orchid Farm
PO Box 170
Haiku, HI 96708

Dear Mr. Parker:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 22, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *There is no mention of Solar-Thermal technology which has been shown to be capable of generating large amounts of power in sunny areas of the country....I personally feel that MECO would be able to get as much acreage as it needs if it wanted to show leadership by seriously exploring solar energy.*

Section 3.2.4.6 of the Draft EIS discussed solar power as an alternative to the Waena project, and includes a discussion of photovoltaic or solar thermal electric systems as well as other alternative generating technologies. MECO has operated and maintained the 20-kW Photovoltaic for Utility Scale Applications (PVUSA) since October 1989. During this period, MECO has gained valuable experience in this photovoltaic demonstration project. In addition, MECO recently installed a 1-kW photovoltaic system at Baldwin High School as part of its Sun Power for Schools pilot project. MECO intends to install additional photovoltaic systems by the end of 1998. High installation costs, large land requirements for central facilities, and other factors prevent widespread use of this technology at this time.

MECO also reviewed a solar dish-engine renewable energy demonstration project in 1997. However, MECO decided to defer a commitment on this project because of Hawaii's low insolation, lack of interest for liquid fuel/hybrid demonstration, and project resource requirements. The results of a 1992 assessment of solar electric generating systems for Hawaii conducted by the Department of Business and Economic Development also revealed that Hawaii's direct insolation is lower than anticipated, thus making solar use less productive.

MECO continues to track the development and progress of photovoltaic and other emerging technologies by participating in studies, communicating with Electric Power Research Institute, U.S. Department of Energy and its National Laboratories, attending conferences and workshops, visiting project and manufacturing sites and reviewing journal and reports. Although large-scale, solar-powered energy production has been shown to be technically feasible in some areas of the mainland southwest, the lack of sufficient and dependable insolation within the Central Maui region make development of a commercially-sized photovoltaic system unfeasible. However, residents who want to install small-scale individual solar units may pursue doing so.

2. *The EIS should discuss the cost/benefits of using cleaner, less polluting low-sulfur fuels.*

The use of ultra low sulfur (0.05 percent sulfur) diesel fuel is currently not feasible due to increased costs associated with the purchase, transport, and distribution of this type of fuel. In order to accommodate the amount of fuel necessary for the Waena Generating Station, local refineries would need to import 0.05 percent sulfur diesel from the West Coast, as they do not have the ability to manufacture ultra low sulfur diesel in the amounts necessary for the Waena Generating Station. The product cost difference and importation costs would result in an estimated 20 percent increase in the cost of fuel. Additional increases would potentially be realized with the need for MECO to build new storage and distribution facilities at Kahului Harbor in order to segregate the 0.05 percent sulfur diesel from diesel fuel that contains a higher amount of sulfur. A detailed review of control technologies for emissions associated with the Waena Generating Station will be conducted as part of the PSD permitting process and will be updated to include fuel cost considerations based on the Waena Generating Station operation date of 2004.

3. *I think the EIS should have discussed the concept of keeping our dollars here circulating in our own economy.*

Expenditures associated with the Waena Generating Station will have a significant positive impact within the Maui economy. Local construction firms and local fuel handlers and distributors will be utilized as much as possible. Salaries paid to the permanent employees of the facility represent dollars circulating in the local economy. To the fullest extent practical, fuel is purchased from refineries located within the State of Hawaii. The provision of adequate amounts of reliable electricity to other commercial, industrial, and agricultural endeavors will also help benefit the local economy.

4. *Why has MECO now decided to stop offering the $800 credit for solar hot water installations?*

MECO has not decided to stop offering the $800 rebate. Based on the results of the Residential Efficient Water Heating program as currently conducted, MECO anticipates continuing the rebate for another 3 to 4 years as stated in the original PUC application.

5. *Failure to study impacts of increased tanker traffic in and out of Kahului Harbor and on coastline. Also, fuel transport and handling. If one of the tankers runs aground, will MECO share in the liability of such a disaster?*

The fuel barge traffic in and out of Kahului Harbor and on the coastline may not necessarily increase because of the Waena Generating Station. Reconfiguring the cargo carrying arrangement of existing barges or utilizing larger barges could accommodate the fuel requirements of the project. Thus an increase in the number voyages, or traffic, is not certain.

Fuel haul operators for both trucking and shipping must operate within licensing and regulatory standards established by the State Department of Transportation and United States Coast Guard (for marine facilities). These standards include accident and spill response plans. The contractor must also comply with all training requirements established by the State DOT and USCG, including Hazardous Materials Training Courses and fuel hauling and handling seminars provided by the diesel fuel supplier. Should an accidental spill occur while the fuel is in transit, it would be handled by the appropriate hazardous waste containment units of the county fire department, coast guard and the barge operator's spill response contractor. Because of the stringent regulatory requirements imposed on the facilities handling both fuel shipping and trucking operations, the occurrence and severity of accidents either along the area's roadways or within Kahului Harbor should be minimized. In addition, MECO is a member of the Clean Island Council, which has the resources in both equipment and expertise to handle oil spills. The Clean Island Councils is a party in the assessment, containment, and clean-up of any oil spill in the harbor area.

6. *What are the environmental impacts of one of the 44 fuel tanker trucks per day crashing en-route to the plant?*

MECO acknowledges that there will be an increase in fuel trucks using the area road network as a result of the proposed Waena Generating Station. However, the amount of traffic attributable to fuel trucks will be small on a per hour basis, beginning with one truck per hour in 2004 and increasing to 5 trucks per hour at full-build out in 2020. Several modifications in the existing roadway system are planned to occur within the next few years which will upgrade the roads used between Kahului Harbor and the proposed Waena Generating Station. As a result of these planned State and County modifications, traffic levels along the fuel haul route will not noticeably change, even following full-build out of the project in 2020. Because traffic congestion will not appreciably worsen as a result of the fuel trucks, we do not anticipate an increased potential for traffic accidents. Additionally, the State of Hawaii Department of Transportation (DOT) in a September 12, 1997, Draft EIS response letter has indicated that the roadways will adequately accommodate the proposed project traffic.

Fuel haul operators are independent contractors who must operate within licensing and regulatory standards established by the State Department of Transportation. These standards include accident and spill response plans. The contractor must also comply with all training requirements established by the US and State DOT, including Hazardous Materials Training Courses and fuel hauling and handling seminars provided by the diesel fuel supplier. Should an accidental spill occur, it would be handled by the appropriate hazardous waste containment units of the county fire department. Because of the measures put in place by the spill containment and accident response plans, no significant environmental impact would be anticipated from the spill of one truck.

7. *Failure to study full and cumulative impacts as required by state law (BACT)....We, the citizens, have no way of knowing what the final technologies will be. This is in direct opposition to one of the purposes of the EIS law, that a proposed project will be examined in its entirety before permitting and construction begins.*

The Draft EIS describes several types of air pollution control technologies which may be appropriate for use at the Waena Generating Station based on current BACT determinations. However, because the first unit at the proposed generating station is not scheduled for operation until 2004, the existing feasible control technologies discussed as BACT may be superseded by other emission control methods. Therefore, one cannot specify with absolute certainty at this time what the control technology for the project will be. The Draft EIS discloses the best information currently available.

8. *Compliance with State Land Use Policies and Goals. I think the proposed project is in conflict with the State Plan, the County General Plan, the Wailuku-Kahului Community Plan, and the Maui County Zoning Code.*

The Hawaii State Plan and other land use policies serve as guides for the future long-range development of the State and individual counties. They identify overall goals and objectives to help establish priorities and allocate resources. Because the documents deal broadly with topics, they contain objectives and policies that can be both complementary and/or contradictory. Chapter 5 of the Draft EIS outlines and evaluates the proposed project relative to state and county land use policies and goals. As part of our evaluation, we did take into consideration those goals and objectives which could be considered in conflict with the proposed project. We have determined that the proposed project will comply with the Hawaii State Plan, the State Land Use Commission regulations, the Maui County General Plan, the Wailuku-Kahului Community Plan, and the Maui County Zoning Code.

9. *Socioeconomic: Is infrastructure development a result of population and economic growth, or is it a cause of population and economic growth? By creating a bigger power supply than is currently needed, will power-consumptive industries want to relocate here?*

Population growth in an area is dependent on economic activity that exports goods and services from that area. Economists generally refer to economic activities that create exports and thus increase an area's employment and population as "primary" economic activities. New jobs created by primary economic activities generate new income that circulate through the economy. As the new income (less expediters that "leak" outside the area) circulates through an area's economy, new secondary employment and population is created. The secondary employment, in turn, creates income and expenditures that create tertiary employment.

Maui's primary economic activities are tourism, export agriculture, and other export goods and services. These primary economic activities are the "drivers" of employment and population growth on Maui. Electrical power production on Maui is a secondary economic

activity. All of the electric power produced on Maui is consumed by users on the island. Demand for electrical power on Maui depends, directly and indirectly, on primary economic activities, with a second source of power demand derived from secondary and tertiary economic activities.

Since the MECO project is not a primary economic activity, it is not expected to influence population growth on the Island of Maui. The generating station will meet the anticipated growth demands attributed to the island's primary economic activities and secondary and tertiary growth induced by the primary economic activities. Should these demands not occur as anticipated, subsequent unit additions at the facility could be deferred.

10. *EIS attempts to minimize importance of the conversion of prime agricultural lands into Urban and Heavy Industrial classifications. Project should be viewed in the context of all the other prime agricultural lands currently being threatened on Maui. Combined with a surplus of electricity, will we see the area near the proposed project turned into a giant industrial park like Campbell Industrial Park on Oahu.*

Section 3.2.6 of the EIS document summarizes the extensive site screening process undertaken before MECO selected the Waena Generating Site. As indicated in section 3.2.6, the selection of the Waena site was made after conducting several separate site screening studies between 1989 and 1996, representing an extensive site screening process. (The executive summaries of the last three site screening reports are contained in Appendices B-1, -2, and -3.) The agricultural designation of the site selected was given consideration during the screening. The site screening was conducted in conjunction with an extensive public consultation process that included consultation with representatives of community groups, public agencies, and several public meetings. Section 3.2.6 and Appendices B-1, -2, and -3 summarize why other sites were not chosen.

The site is listed as "Prime Agricultural Land" according to the Agricultural Lands of Importance to the State of Hawaii (ALISH) map. A lengthy discussion of the potential impacts to agricultural production were included in Section 4.11.2.2 of the Draft EIS. While there were other sites considered throughout the process which were not "prime agricultural lands," the Waena site was concluded to be the most appropriate site based on multiple criteria and on significant community input. As such, the loss of the prime agricultural land must be balanced against the public good associated with adequate power generation and electrical reliability.

11. *It is necessary to establish baseline studies before the project commences in order to be able to compare and assess the impacts when the project gets underwdy. Could the drawing-down of the brackish water in the aquifer lead to a drop in the level of the pure drinking water aquifer that is higher up?*

Drilling and pumping a test well has been recommended as soon as practical to gather site-specific water quality data for use in the design of the generating station. This water quality data will also include the amount of allowable drawdown.

Based upon pumping test data of other wells in the Paia Aquifer, drawdown of groundwater levels associated with pumping the brackish water wells at the Waena Generating Station site is expected to be approximately 0.6 feet. A 0.07-foot drawdown of groundwater levels is anticipated at a distance of 1 mile following 365 days of pumping. The impact of pumping on local groundwater levels and quality is expected to be negligible. The nearest irrigation well is 1.5 miles downgradient from the project site and would not be affected. The proposed withdrawal volume is well within the estimated sustainable yield of the Pala aquifer. No adverse impacts on groundwater levels, groundwater quality, or irrigation wells due to water withdrawal are expected.

12. *Air Quality. The project is within the area of the Maui Vortex. Since the Vortex problem is real enough, why not burn the higher-grade low-sulfur fuel?*

While plume elements may become entrained into the Maui Vortex, the worst-case study performed for the Draft EIS shows that, while burning No. 2 diesel with 0.4 percent sulfur (maximum), the pollutant concentrations inside the plume are not significant.

Emissions from the Waena Generating Station will be in compliance with ambient air quality standards with the use of 0.4 percent sulfur diesel fuel. Current data indicates that the use of a "higher grade low sulfur" fuel such as ultra low sulfur (0.05 percent sulfur by weight) diesel fuel would result in significant increased costs associated with the purchase, transport, and distribution of this type of fuel. Local refineries would need to import ultra low sulfur diesel from the West Coast, as they do not have the ability to manufacture this type of diesel fuel in amounts necessary for the Waena Generating Station. The product cost difference and importation costs alone would result in an estimated 20 percent increase in the costs for this type of fuel, thus rendering its use uneconomic.

13. *Not enough consideration was given to spending more money on low-sulfur fuel as an alternative to what is proposed.*

The use of ultra low sulfur (0.05 percent sulfur) diesel fuel is currently not feasible due to increased costs associated with the purchase, transport, and distribution of this type of fuel. In order to accommodate the amount of fuel necessary for the Waena Generating Station, local refineries would need to import 0.05 percent sulfur diesel from the West Coast, as they do not have the ability to manufacture ultra low sulfur diesel in the amounts necessary for the Waena Generating Station. The product cost difference and importation costs would result in an estimated 20 percent increase in the cost of fuel. Additional increases would potentially be realized with the need for MECO to build new storage and distribution facilities at Kahului Harbor in order to segregate the 0.05 percent sulfur diesel from diesel fuel that contains a higher amount of sulfur. A detailed review of control technologies for emissions associated with the Waena Generating Station will be conducted as part of the PSD permitting process and will be updated to include fuel cost considerations based on the Waena Generating Station operation date of 2004.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

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Comments on Draft Environmental Impact Statement
Waena Generating Station

Masako Westcott
Gregory Westcott

9. 15. 97

The headline of a front page article in today's Maui News (9.15.97) states:

"Greenhouse gas battle looms in South Pacific"

The article goes on to say:

"Our neighbors in the Pacific, the people of the Cook Islands, Tuvalu, Kiribati, Nauru, Niue, Tahiti, Nukuhiva, Tuamotu, the Australs and the Marshall Islands say their very survival depends on a reduction of greenhouse gases."

We in Hawaii have a particular responsibility to our Pacific neighbors to lead the way in the wise use of the world's limited resources.

The Waena Generating Station as presented in a Draft Environmental Impact Statement (DEIS), which at full capacity would burn 312,000 gals of deisel fuel a day, suggest that Maui is a child of America - the oil glutton - the world's number one producer of CO_2 greenhouse gases - rather than a leader in the Pacific Community.

Nowhere in this DEIS is there an examination of the real costs of fossil fuels. From Amazonia to the Arctic, from Nigeria to Burma, the search for and extraction of fossil fuels and the inevitable spills that come with the world wide transport of oil leave a trail of destruction. We cannot pretend that fossil fuels appear miraculously at Kahului Harbor as a gift from the gods. Nor can we deny that our pollution affects others.

In addition to this fundamental failure, this DEIS is inadequate because the proposed Waena Generating Station has not been designed. Therefore several engineering issues remain unresolved including drainage, the location of groundwater and injection wells, and the best available control technology (BACT) for air emission control.

This is a transparent attempt to avoid an examination of the environmental impacts.

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How was [illegible] a project design? determined without a project design?
Until the design is determined, the true costs both to the rate payer and to the environment are unknown.
Following this determination a Best Available Control Technology (BACT) is selected.
The DEIS states that: "The BACT alternatives are ranked according to stringency. If the top control alternative is not "applicable" or not technically or economically feasible it is rejected and the next most stringent alternative is considered. This process continues until a control alternative is determined to be both technically and economically feasible." Thus economics will determine environmental protection methods.
This is a contradiction of the LAER (lowest available emission rate) which is required without regard to economic impact. An examination of this proposal must include the real cost of all BACT (Best Available Control Technology — not the CACT — Cheapest Available Control Technology that suits MECO.
It is not enough for MECO to claim to support alternative energy and conservation. An EIS for this proposal must examine the obvious alternative of decentralized energy production (on-site) using currently available solar photovoltaic and solar thermal systems, and its effects on DSM - demand side management

If the true cost of MECO's proposal, including low sulphur fuels and the most stringent BACT for both air emissions and water purification before injection into the aquifer were known then decentralized solar energy production becomes economically attractive.
Together with a genuine effort from the State and County to implement alternatives including regulations on new construction and tax incentives we could dramatically decrease demand on MECO production.
More importantly Maui would avoid or at least diminish the serious problems that come with increasing use of fossil fuels. including:

- air pollution.
- an increasing demand for limited water.
- water pollution and the injection of this wastewater into the Paia aquifer. Considering our current water crisis this aquifer should be held in reserve for the future.
- an increasing likelihood of oil spills in Hawaii's waters, Kahului Harbor, or on our busy highways — none of which was examined in this DEIS.

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- noise and light pollution
- the vulnerability of a centralized system to natural disasters.
- the loss of prime agricultural land.
- the blight of a "decidedly industrial" complex in an open agricultural landscape.
- Encouraging further industrialization in Central Maui.

Furthermore, the photo simulations in this DEIS fail to show the smoke plumes rising from the four smoke stacks. The smoke rising from the Kahului plant is clearly visible from a great distance. That may be the strongest visual impact of this project and the failure to include it in the photo simulations is a serious deficiency.

Our home is powered completely by a solar photovoltaic system. We have no electric bills and are unaffected by power outages that plague others. It works.

The law requires an EIS to describe fully the project, its impacts and the alternatives. This DEIS fails to do this and should be rejected.

CH2MHILL
Celebrating 50 Years

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November 3, 1997

139792.EI.04

Mr. and Mrs. Gregory and Masako Westcott
PO Box 485
Haiku, HI 96708

Dear Mr. and Mrs. Westcott:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your September 15, 1997 letter concerning the Waena Draft Environmental Impact statement. Our responses to your individual comments follow.

1. *Nowhere in this EIS is there an examination of the real costs of fossil fuels (from production to delivery)*

   It is not reasonable to expect that the EIS include an examination "of the real costs of fossil fuels (from production to delivery)." The EIS concerns the proposed Waena Power Generating Plant, not the exploration, drilling and refinery alternatives for fossil fuels.

2. *The DEIS is inadequate because the plant has not been designed. Therefore several engineering issues remain unresolved.*

   The State of Hawaii administrative rules governing the preparation of environmental documents require that the documents be prepared at the earliest practicable time. Further, the rules state that the EIS involves the entire process of research, discussion, preparation of a statement, and review. An EIS is not expected to be based on final design for a project, particularly since issues that are resolved through the EIS preparation and the project permitting inevitably affect a project's design. It is not practicable to fully design the Waena Generating Station prior to completing the preparation of the EIS and the permitting of the project.

3. *An examination of this proposal must include the real cost of all BACT, not the CACT (cheapest available control technology)*

   As defined in the Clean Air Act (CAA), Best Available Control Technology (BACT) is "an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment of innovative fuel combustion techniques for control of each such pollutant."

BACT for the Waena project will be evaluated by MECO in accordance with the CAA subject to approval by Hawaii State Department of Health (DOH) and the U.S. Environmental Protection Agency (EPA). The EPA allows for the consideration of technical and economic feasibility when determining best available control technology (BACT) for a given pollutant. However, it should be noted that EPA regulations also state that in no event can the application of BACT result in emissions of any pollutant that would exceed the level allowed by an applicable New Source Performance Standard (NSPS) *regardless of economic consideration*. New source performance standards require strict emissions limits for new sources based on proven control technologies. Emission sources located at the Waena Generating Station will at a minimum adhere to these requirements.

4. *An EIS for this proposal must examine the obvious alternative of decentralized energy production (on-site) using currently available solar photovoltaic and solar thermal systems, and its effects on DSM.*

Section 3.2.4.6 of the Draft EIS discussed solar power as an alternative to the Waena project, and includes a discussion of photovoltaic or solar thermal electric systems as well as other alternative generating technologies. MECO has operated and maintained the 20-kW Photovoltaic for Utility Scale Applications (PVUSA) since October 1989. During this period, MECO has gained valuable experience in this photovoltaic demonstration project. In addition, MECO recently installed a 1-kW photovoltaic system at Baldwin High School as part of its Sun Power for Schools pilot project. MECO intends to install additional photovoltaic systems by the end of 1998. High installation costs, large land requirements for central facilities, and other factors prevent widespread use of this technology at this time.

MECO also reviewed a solar dish-engine renewable energy demonstration project in 1997. However, MECO decided to defer a commitment on this project because of Hawaii's low insolation, lack of interest for liquid fuel/hybrid demonstration, and project resource requirements. The results of a 1992 assessment of solar electric generating systems for Hawaii conducted by the Department of Business and Economic Development also revealed that Hawaii's direct insolation is lower than anticipated, thus making solar use less productive.

MECO continues to track the development and progress of photovoltaic and other emerging technologies by participating in studies, communicating with Electric Power Research Institute, U.S. Department of Energy and its National Laboratories, attending conferences and workshops, visiting project and manufacturing sites and reviewing journal and reports. Although large-scale, solar-powered energy production has been shown to be technically feasible in some areas of the mainland southwest, the lack of sufficient and dependable insolation within the Central Maui region make development of a commercially-sized photovoltaic system unfeasible. However, residents who want to install small-scale individual solar units may pursue doing so.

5. *The photosimulations in this DEIS fail to show the smoke plumes rising from the four smoke stacks. This may be the strongest visual impact of this project and the failure to include it in the photosimulations is a serious deficiency.*

The visual photosimulations are not deficient. Under normal operations, the emissions from the Waena stacks will be of extremely low opacity approximating the appearance of heat waves and will not be readily visible. The emissions from the Waena Generating Station combustion turbines will resemble those produced by the combustion turbines at the Maalaea Power Plant. They will not resemble emissions produced by the steam units at the Puunene Sugar Mill or those produced by the combustion of No. 6 fuel oil at the Kahului Power Plant.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC

JAMES V. WILLIAMSON
CONSULTING ENGINEER
672 KUMULANI DRIVE, KIHEI, HAWAII 96753
TELEPHONE (808) 874-6151 • FAX (808) 874-5305

August 30, 1997

Mr. David Blane, Director
County of Maui
Department of Planning
250 South High St.
Wailuku, HI 96793

Dear Mr. Blane:

Subject: Waena Generating Station - EIS Comments

Enclosed is a copy of the comments I made at the public meeting held by MECO in Pukulani on August 28, 1997. This meeting was convened to discuss the draft EIS for the proposed 232 MW Waena electric generating station.

Sincerely,

James V. Williamson, PE

cc: Ed Reinhardt, MECO, Kahului

Mark Willey, CH2M HILL, INC., Honolulu

Waena Generating Station Project
Maui Electric Company, Limited
Draft EIS Public Comment Meeting
Pukulani, August 28, 1997

Comments of James V. Williamson

First of all I would like to say I am very pleased that MECO is finally diversifying the location of the generation sources for this Island. I have no overall quarrel with the proposed project location and the type of generation proposed for our future. Having said that, I do have a number of comments on items which need to be addressed or revised before the EIS is finalized.

1. The IRP Process and DSM

Frankly I don't have too much faith in the Integrated Resource Planning (IRP) process. After several years and who knows how many meetings, there is not one alternative energy source in MECO's future plans: or is there any alternative fuel contemplated. And this process is all at the expense of the power consumers. There is an item in your power bill specifically to reimburse MECO and its consultants for IRP related costs.

As part of the IRP deliberations MECO is supposed to come up with a definite Demand Side Management (DSM) program to reduce the need for construction of generating plants. However, MECO apparently has difficulty putting such a plan into effect. There was supposed to be 1.5MW of DSM in place several years ago and now it is supposed to start this year. I would not hold my breath. The EIS states that there is "considerable uncertainty how to structure DSM, and the program will be revised annually". I don't agree. The power company has to commit to the concept of DSM and follow through on a definite program. Otherwise there is no way savings of 14 MW will be available in 2004 or 33MW in 2016.

I certainly do not believe the self serving statement that "MECO considers its DSM program one of the most aggressive and dynamic in the U.S.". For example, the EIS states that "the residential water heating market is one of the largest users of electrical energy and capacity". Why, therefore, dosn't MECO get involved in a real hands-on manner in encouraging solar water installations by providing no-interest loans, and even some grants. This would be a DSM program which could result in significant savings in the need to construct future generation. Such a program would give some substance to MECO's statement. Finally, the EIS should also specifically show the MW amounts for each item in the DSM program.

2. Load Growth

I suspect that the estimated 2.6% annual load growth in the future is too high. However, despite the importance of this assumption, there are no supporting data. In the past growth estimates have often been based on the State DBED&T projections which have proved to be too optimistic. Also I believe that MECO should make every effort to renew the generation agreement with HC&S when it expires in 1999. In my view the EIS incorrectly deletes the mill's 16MW from the future resources. After all it is one alternative technology, biomass conversion.

3. Plant Water

Instead of supplying water requirements from wells I strongly recommend (and suggest the County mandate) piping in reclaimed wastewater from the Kahului wastewater treatment plant. There is no mention of this alternative in the EIS.

4. Fuel Delivery

It is proposed to truck in all fuel for the plant from Kahului harbor. At build-out there would be 44 daily trips of 9,000 gallon tankers from the harbor to the plant. This is certainly not a desirable traffic situation. The EIS includes a summary table which shows the cost of a fuel line alternative would be $10 million more than the trucking alternative. However, even though I question this conclusion there is no detailed basis shown to verify this. There should be. Since the pipeline cost will include a large trenching component this cost could be shared with a wastewater supply line.

5. Visual Impacts

By far the greatest visual impact of the plant will be the four 150 foot high exhaust stacks. Also these stacks are a potential hazard for air traffic (not mentioned in the EIS). As discussed below under air quality, if proper NOX control is installed at the dual-train combined cycle units and low sulfur oil is used, this stack height could be reduced.

6. Air Quality Monitoring

Before I get into the details of my concerns with air quality I wish to address the monitoring of air emissions. The frequency and location of monitoring should be spelled out. Because of a shortage of staff the State Department of Health (DOH) tends to pass the responsibility for air quality monitoring to the generator of the emissions. This procedure is certainly undesirable. The EIS should state that DOH will perform the monitoring.

7. General Air Quality Analysis

I consider this site should be classified as a Class I area regardless of the DOH designation. Who knows what adjacent development will occur over the next 30 years. It is our health we are talking about.

I understand that the EPA "rules" which Prevention of Significant Deterioration (PSD) analysts love to hang their hat on, have to be followed. However, I believe the PSD air quality modeling is at best an inexact science. This analysis requires a lot of guess work about air movements and distribution of pollutants for a small area such as the Maui ismuth. Too much faith is placed in nice computer programs. Five years ago in reviewing Maalaea unit 16, I stated that the program being used took no account of circulating air currents in south Maui. I was almost ridiculed. Now the so called vortex effect is recognized. Hence I don't believe that anyone knows a particular stack height will "allow adequate dispersion preventing excessive concentration of air pollutants". We are so lucky to have trade winds.

In short, MECO should be making every effort now to reduce the emissions at the plant to a BACT (Best Available Control Technology) equivalent to LAER, the Lowest Achievable Emission Rate. If that is done, particularly for oxides of nitrogen (NOx) and fuel sulfur content, air emissions will not, and should not, generally be an unresolved issue as stated in the EIS, even though it is understood that an air quality permit will have to be obtained for each generating set. EPA has already promulgated stricter standards for particulate matter emissions and is even now making noises about tighter standards for SO2 emissions: NOx could be next. This EIS could be out of date before it becomes final.

Many of us believe that we in Paradise should not just be content to have air emission standards which are average throughout the country. I firmly believe that that the majority of Mauians would be willing to agree to a reasonable increase in power rates if it meant improving the air quality in this beautiful Island. Further, clean air is an essential ingredient in the continued success of our tourist industry.

8. Sulfur Dioxide Control

The control of sulfur dioxide and sulfur trioxide emissions is most efficiently and economically achieved by reducing the sulfur content of the fuel oil at the refinery . The No.2 distillate oil used by MECO has a sulfur content of 0.4%. By comparison it is commonplace on the mainland to produce fuel oils with a sulfur content of 0.05%, or one eighth of that used by electrical generators in Hawaii. For this reason SO2 emissions are almost an order of magnitude higher in Hawaii.

We are told by the power company that no such low sulfur oil is produced at the Hawaii refineries and that the only way to obtain 0.05% sulfur oil would be to import it from the mainland at a prohibitive cost. However, both BHP and Chevron produce diesel oil with this sulfur content for the trucking industry. If the refineries were willing, it would be necessary to expand the production facilities and the low sulfur fuel would no doubt be more expensive. The present EIS draft contains this vague statement: "Because the benefit of firing 0.05% fuel rather than 0.4% fuel is considered minimal in terms of reduced air emissions, the higher incremental cost effectiveness does not make it an attractive option as BACT for SO2 and H2SO4." How can reduction of sulfur content to 1/8 of that of the present fuel oil ever be considered minimal?

As for the additional cost, as stated above this has to be related to the community willingness to accept a commensurate reasonable increase in power rates to clean up the air. Lower sulfur fuel oil should also reduce costs by :

(1) allowing a reduction in the stack height, and
(2) significantly reducing problems and maintenance costs of the Selective Catalytic Reduction (SCR) unit to be installed to lower NOx emissions as discussed hereunder.

The estimated cost of obtaininy 0.05% fuel oil from the mainland, as compared to the cost of the present 0.4% fuel, should be shown in the EIS. The alternative of production at the Oahu refineries should also be discussed. The impact on power rates of using low sulfur fuel should be shown, including credit for reduction of stack height and lower SCR maintenance costs and higher plant efficiency.

Lower sulfur oil also provides an additional safeguard against possible farm crop and plant damage from the formation of sulfuric acid. Finally, I note that Dr. Bruce Anderson, DOH's Deputy Director for Environmental Programs, commented earlier that low sulfur diesel should be investigated which was never done. I my view low sulfur oil should be used beginning with the last installations at Maalaea.

9. Control of Oxides of Nitrogen (NOx)

Five years ago, I testified at a DOH hearing on the air quality permit for Maalaea units M14,15 and 16. I recommended that DOH mandate the use of low sulfur oil, and installation of full scale SCR equipment on the exhaust of these units (not just a demonstration model) to further reduce NOx emissions. This advice was not heeded and has again been ignored for the present installation at Maalaea units M17,18 and 19. Instead MECO continues to experiment with a small scale pilot model which has already cost $1.5 million which will no doubt be charged to the power consumers (the purchase price of one full scale SCR is even less than this amount).

A 123 MW combined cycle generator in Linkoping, Sweden has experience with an SCR unit. The results of that experience are considered to be relevant to the potential application of SCR to the MECO combined cycle heat recovery steam generators (HRSG). Ammonia-sulfide salts were deposited but were successfully removed with water washing of the HRSG tubes. Problems of increased salt deposits and HRSG pressure drop have occurred when fuel oil sulfur contents are greater than 0.1%, indicating the necessity to use low sulfur fuel oil (0.05% diesel).

NOx emissions from the Maalaea combined cycle generators are about ten time that achieved in Southern California. However, the EIS is quite negative on the concept of using an SCR for NOX control. It relates to significant corrosion of HRSG components at the Maalaea demonstration plant. This is to be expected considering the high level of sulfur in the current fuel oil. It points to the absolute need for MECO to change to low sulfur diesel fuel as soon as possible. It is unfortunate that MECO did not conduct SCR tests using the 0.05% diesel oil which is available on Oahu. I expect the results would have been entirely different.

I feel strongly that SCR equipment should be installed on future dual-train combine cycle units. SCR should be installed in the HRSG which means that one complete combined cycle unit (combustion turbine and unfired heat recovery unit), should be installed at one time. This is different from the plant installation schedules shown in the EIS. The above scheduling is also more credible since the system energy requirements are considered together with the need for peaking power, at the same time.

Thank you for the opportunity to present my comments on this EIS.

Sincerely,

James V. Williamson
672 Kumulani Drive
Kihei, Maui, HI 96753

CH2MHILL

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November 3, 1997

139792.EI.04

Mr. James V. Williamson
Consulting Engineer
672 Kumulani Drive
Kihei, HI 96753

Dear Mr. Williamson:

Subject: Maui Electric Company, Limited's Waena Generating Station Draft EIS Comments

Thank you for your August 30, 1997 letter and testimony at our public comment meeting concerning the Waena Draft Environmental Impact statement. MECO would also like to thank you for your support of the location for the proposed Waena Generating Station. Our responses to your individual comments follow.

1. *Why doesn't MECO get involved in a real hands-on manner in encouraging solar water installations by providing no-interest loans, and even some grants. This would be a DSM program which could result in significant savings in the need to construct future generation.*

MECO is already involved in actively encouraging solar water installations. More than 525 solar water heaters have been installed through MECO's Residential Efficient Water Heating program since the beginning of the program one year ago. All systems installed through the program are inspected by a MECO solar inspector to ensure quality workmanship and longevity. MECO is in constant contact with the more than 10 contractors approved to install the solar water heaters though the program.

MECO has been actively working with local credit unions on Maui to guarantee easy access to low interest financing to Maui's residents to participate in the solar water heating program. The credit unions are committing their resources to help the community. MECO also offers $800 rebates for those who purchase solar hot water heaters.

As of September 30, 1997, and since the beginning of its DSM programs one year ago, MECO, with the help of its customers, has succeeded in saving approximately 1.1 megawatts (MW) and approximately 6,467,800 kilowatt-hours (kWh) of electricity. This represents 64 percent and 68 percent of the first year's demand and energy goals, respectively, as presented in the

PUC application for its demand-side management (DSM) programs. MECO considers these savings very significant.

2. *I suspect that the estimated 2.6 percent annual load growth in the future is too high. However, despite the importance of this assumption, there are no supporting data.*

The sales and peak forecast is made by utilizing a variety of forecasting tools, the expertise of the staffs of both MECO and HECO, and the input of our customers and respected organizations in the community. All data is analyzed and tested from various perspectives before a final forecast is adopted by the Forecast Planning Committee. The potential effects of energy efficiency and Demand Side Management (DSM) programs are also incorporated into the sales and peak forecast.

Historically, the adopted forecast has been reasonably close to recorded numbers. MECO believes that the small variances indicate the reasonableness of the forecasts.

MECO prepares near-term 5-year sales and peak forecasts annually using the latest available economic, historical sales and peak load data, as well as customer contact for existing projects and customer requests for future projects. Once every three years a long-term 20-year forecast is generated to examine the facilities needed to serve the power growth. The preparation of the sales and peak forecast is part of the comprehensive Integrated Resource Planning (IRP) process.

The primary advantage of the IRP forecasting process is to ensure that the forecast receives maximum exposure and evaluation through multiple levels of review. Overall, there are approximately 40 individuals on the MECO IRP Advisory Group (AG), the MECO Forecast Planning Subcommittee (FPSC), and the Forecast Planning Committee (FPC) who contribute their diverse expertise, knowledge and experience to the forecasting process. The use of the MECO IRP AG provides a mechanism for members to provide feedback and input to the process.

The MECO IRP AG is comprised of members from the Department of Commerce and Consumer Affairs – Consumer Advocacy Division, Department of Business, Economic Development and Tourism – Energy Division, County of Maui Planning Department, County Office of Economic Development, Maui Chamber of Commerce, Maui Hotel Association, Maui Visitor's Bureau, Molokai Task Force, Lanai Resort Partners, island residents and other businesses. The FPSC and FPC are made up of MECO staff in the Customer Service, Engineering, Production, Transmission and Distribution Departments and HECO staff in the Forecast, Generation Planning, and Integrated Resource Planning Divisions.

The general philosophy MECO follows in preparing its kilowatt-hour (kWh) sales and peak forecast is to place emphasis on consideration of estimated future sales and loads from as many different "viewpoints" or perspectives as possible.

The final forecasts selected by the FPC can be corroborated by more than one analytical method or source of information. Although mathematical trending of historical kWh sales data is one form of analysis used in our forecasting process, MECO does not depend solely on mathematical trending to forecast. Such an approach may fail to recognize and take into consideration important economic and demographic changes that are taking place in various

districts of the three islands (divisions). The following is a description of the kWh sales and peak forecasting methodologies from which the final forecast is chosen.

The methods considered in the preparation of the kWh sales and peak forecast are the rate schedule analyses, market analyses, economic analyses, and customer service analyses. The methods are described as follows:

- The Rate Schedule Analyses methodology considers a spectrum of mathematical analyses of the patterns and trends in the number of customers, kWh sales, and average use per customer to the individual rate schedules using time series, econometric, and end-use methods.

  Generally, these mathematical modeling and trending techniques use mathematical relationships based on historical data and other related information to develop projections of future kWh sales and customers. These techniques vary in degree of sophistication and can be applied to a variety of load demand parameters for which historical and near-term future data are available.

- The Market Analyses are based on analyses of the market conditions influencing the different customer classes with special emphasis on customer-by-customer accounting of loads of our large power users. Also considered are influences on the residential class, including new construction outlook, resort development, private residential development, and government supported or sponsored housing.

  Market analyses is the primary forecasting method accepted for the large power users because the relatively small number customers allows for in-depth customer-by-customer analysis. Market analyses for this class consist of identification of known or expected changes in each customer's consumption attributable to factors such as adjustments in a customer's demand load or operating characteristics, energy efficiency, added load and new construction.

- The Economic Analyses include judgmental analyses and considerations of the potential for future economic growth in the MECO service areas, based on broad economic indicators and opinions of economists and others prominent in the economic arena as presented in various periodicals, as well as contacts in the marketplace.

- The Customer Service Analyses are based on judgmental analyses and considerations of area growth based on day-to-day working knowledge of customers, customer billing data, and other customer-related factors that affect kWh sales and the customer count from month to month. The techniques employed in the Customer Service forecasting processes take into account changing conditions in the marketplace which may either explain the reasons for certain recorded values or which may influence kWh sales in the near future.

  Customer Service analyses consider load and customer growth for each of the customer class for each of the three service areas– Maui, Lanai, and Molokai. Although judgmental, this type of analyses addresses the factors that affect smaller segments of the service areas, thereby minimizing the margin of error in short-term forecasting.

Because of the detailed nature and the close customer contact included in these analyses, the results carry a high degree of validity for the short term. However, because of uncertainty on the part of customers' plans for significant changes in their energy usage patterns and the marketplace, Market and Customer Service analyses of the individual rate schedules are considered applicable for only about three years into the future. Mathematical analysis is used to project the forecast beyond that point.

In addition to the sales and peak forecasting methodology described above, MECO uses the Electric Power Research Institute's (EPRI) profile aggregation program, HELM (Hourly Electric Load Model) to forecast Maui Island's evening and day peaks and minimum loads. HELM takes reference customer class load profiles and adjusts them to levels of the approved sales forecast. The average monthly weekday and weekend reference customer class load profiles were developed in the 1995 MECO Class Load Study. The resulting sales load factor (ratio of the average hours of operation to the total annual hours available) and peak month are analyzed against recorded data to assure reasonableness. Maui Island's sales load factor and peak month have been stable over the past five years.

3. *MECO should make every effort to renew the generation agreement with HC&S when it expires in 1999. In my view the EIS incorrectly deletes the mill's 16 MW from the future resources.*

The EIS did not incorrectly delete HC&S's 16 megawatts from consideration. MECO is currently negotiating the generation agreement with HC&S. However, because the eventual outcome of these negotiations cannot be guaranteed at this time, MECO must be prudent in its resource planning and anticipate the worst-case scenario that MECO could lose HC&S's 16 MW of generation. Only after any power purchase agreement is approved can MECO realistically consider the additional generation capacity.

4. *Instead of supply water requirements from wells I strongly recommend (and suggest the County mandate) piping in reclaimed wastewater from the Kahului wastewater treatment plant.*

Preliminary economic analyses conducted for the fuel pipeline study indicated that costs for construction of a pipeline from the Kahului Harbor area (location of the Kahului Wastewater Treatment Plant) to the site of the proposed Waena Generating Station could run in excess of $16.5 million, assuming a 6-inch carbon steel single-containment pipe. Preliminary hydrogeologic analyses of the underlying brackish groundwater aquifer do not indicate that the withdrawal of water due to the proposed generating station will have any adverse impact upon aquifer levels or groundwater quality. Because of this, there is no justification for the large expenditures associated with pipeline construction to the site for the delivery of wastewater.

5. *The EIS includes a summary table which shows that the cost of a fuel line alternative would be $10 million more than a trucking alternative. However, even though I question this conclusion there is no detailed basis shown to verify this.*

We have attached the full fuel haul/pipeline analysis and relevant data prepared by Stone & Webster Engineering Corporation. The full report is found in Appendix A in the Final EIS.

6. *The stacks are a potential hazard for air traffic (not mentioned in the EIS). If proper NO_x control is installed at the dual-train combined cycle units and low sulfur oil is used, this stack height could be reduced.*

An application for a Determination of No Significant Hazard to Air Navigation was made to the Federal Aviation Administration on June 4, 1997. On June 24, 1997, the FAA issued a determination that the proposal "*is not considered an obstruction under any standard of FAR, Part 77, Subpart C and would not be a hazard to air navigation. Obstruction marking and lighting are not necessary.*" This determination was reported in the Draft EIS on page 4-79.

EPA regulations allow for the use of good engineering practices when determining the height of generating station stacks. Stack heights must at a minimum be greater than a formula stack height, $H_{GEP} = H + 1.5L$, where H is the height of nearby structure(s) and L is the lesser dimension, height, or projected width, of nearby structures. The 150-foot stack height for the Waena Generating Station serves to reduce the impacts of all pollutants, not just NO_x. Even with increased controls for NO_x and sulfur dioxide, a reduction in stack height could potentially result in greater impacts from particulate matter (PM_{10}) and carbon monoxide emissions. The one-time cost savings from a reduction in stack height would not begin to offset the on-going costs to implement and maintain control methods such as SCR and the use of ultra low sulfur fuels.

7. *The frequency and location of monitoring stations for air emissions should be spelled out. The EIS should state that DOH will perform the monitoring.*

The frequency and location of monitoring stations will be determined by the DOH in the air permitting process. Typically, DOH has required a minimum of one year of post-construction ambient air quality monitoring to assure compliance with ambient air quality standards. It is the responsibility of the emissions generator to ensure that required air quality monitoring is done in accordance with EPA approved monitoring methods. The DOH provides oversight for the monitoring program and assures that EPA approved monitoring methods are complied with by reviewing the data, audit reports, etc. Therefore, it is not necessary for DOH to perform the actual monitoring, provided that the Department continues to provide adequate review of data collection and conformance with EPA methods.

8. *I consider this site should be classified as a Class I area regardless of the DOH designation. Who knows what adjacent development will occur over the next 30 years.*

EPA regulations for the prevention of significant deterioration allow for the establishment of land areas as Class I, II, or III in order to identify land use goals. Congress established certain areas, e.g., wilderness areas and national parks, as mandatory Class I areas. In Hawaii there are two Class I areas: Hawaii Volcanoes National Park on the Big Island and Haleakala National Park on Maui.

The land areas adjacent to Haleakala National Park are subject to additional emissions considerations due to the potential for Class I area affects from sources situated there. This extra consideration is required for any major source or modification within 100 kilometers of a Class I area. These additional requirements include performing a preliminary analysis to find whether the source may increase the ambient concentration of any pollutant by one microgram/ cubic meter (24-hour average). Class I increment analyses are performed when a significant ambient impact is predicted. Therefore, it can be said that the Waena Generating Station project, as well as other future major sources, are subject to requirements potentially more stringent than those for Class II areas which are situated apart from a Class I area.

9. *MECO should be making every effort now to reduce the emissions at the plant to a BACT (Best Available Control Technology) equivalent to LAER, the Lowest Achievable Emission Rate. If this is done, particularly for oxides of nitrogen (NO_x) and fuel sulfur content, air emissions will not, and should not, generally be an unresolved issue as stated in the EIS.*

The application of lowest achievable emission rates or, LAER, applies only to areas not in attainment with NAAQS. The State of Hawaii, including Maui County, is in attainment with the NAAQS and; therefore, is subject only to BACT. The air permitting process for the Waena Generation Station will require BACT for each of the units in accordance with all federal and state air quality regulations. The station will be built in increments spanning 20 years. Appropriate BACT for each unit will be determined at the time of permitting.

10. *How can reduction of sulfur content to 1/8 of that of the present fuel oil ever be considered minimal? As for the additional cost...this has to be related to the community willingness to accept a commensurate reasonable increase in power rates to clean up the air. The estimated cost of obtaining 0.05 percent fuel oil from the mainland, as compared to the cost of the present 0.4 percent fuel, should be shown in the EIS. The alternative of production at the Oahu refineries should also be discussed. The impact on power rates of using low sulfur fuel should be shown, including credit for reduction of stack height and lower SCR maintenance costs and higher plant efficiency.*

Currently, the use of ultra low sulfur (0.05 percent sulfur) diesel fuel would result in increased costs associated with the purchase, transport, and distribution of this type of fuel. In order to accommodate the amount of fuel necessary for the Waena Generating Station, the local refineries would need to import 0.05 percent diesel from the West Coast, as they do not have the ability to manufacture ultra low sulfur diesel in the amounts necessary for the Waena Generating Station. The product cost difference and importation costs would result in an estimated 20 percent increase in the cost of fuel (based on current information). Further increases would be potentially incurred as the result of the need for MECO to build new storage and distribution facilities at Kahului Harbor in order to segregate the 0.05 percent sulfur diesel from diesel fuel that contains a higher amount of sulfur.

However, because the first unit at the proposed Waena generating station is not scheduled for operation until 2004, the existing logistical considerations and cost estimates may well be superseded. Therefore, it is not meaningful to provide a detailed cost analysis for the use of ultra low sulfur fuel and the resulting increases in user rates at this time.

The current New Source Performance Standard (NSPS) for sulfur in fuels to be burned in combustion turbines is 0.8 percent by weight. Diesel fuel with 0.4 percent sulfur by weight exceeds this standard at one half of the sulfur content. As shown in the Draft EIS, compliance

with the ambient air quality standards for SO2 can be achieved using the 0.4 percent sulfur content diesel fuel. A detailed review of control technologies for emissions associated with the Waena Generating Station will be conducted as part of the PSD permitting process.

11. *I feel strongly that SCR equipment should be installed on future dual-train combine cycle units. SCR should be installed in the HRSG which means that one complete combined cycle unit (combustion turbine and unfired heat recover unit), should be installed at one time.*

At this time the use of SCR with combustion turbines has not been determined as a feasible method of NO_x control for simple cycle operation and has been demonstrated to cause operational problems with combined cycle operation when firing sulfur bearing fuels. A thorough review of all current and available NO_x emission control technology will be conducted as part of the PSD permitting process. This review will include SCR as applicable to the operational scenario presented in the permit application and will be based on the most recent technology information available.

Thank you for taking the time to review the Draft EIS. Please feel free to contact me if you have any further questions or comments regarding this project.

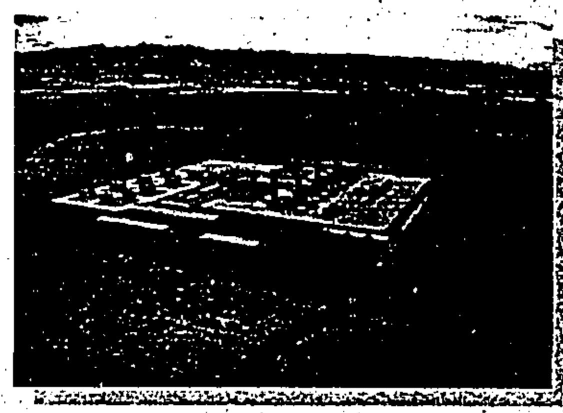
Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

enc.

c: Mr. Neal Shinyama, MECO
Mr. Mike Yuen, HECO
Ms. Colleen Suyama, Maui County Planning
Mr. Gary Gill, OEQC



CHAPTER EIGHT

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Chapter 8

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Y. Ebisu & Associates — Noise Impact Analysis
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Dr. Thomas Schroeder — Air Quality
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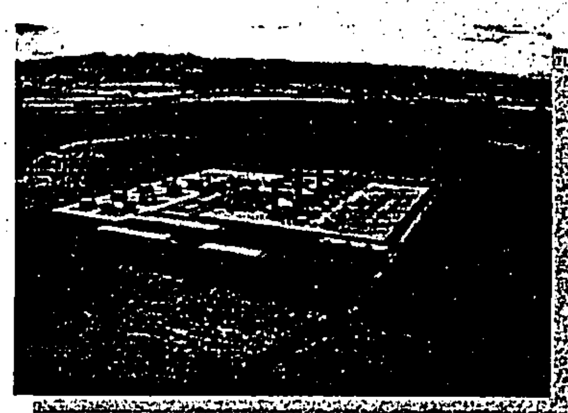

CHAPTER NINE

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Chapter 9

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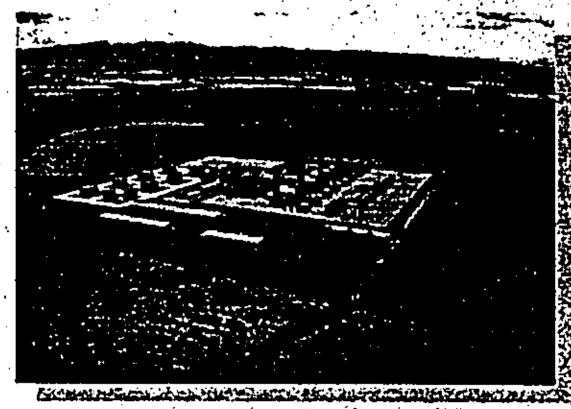
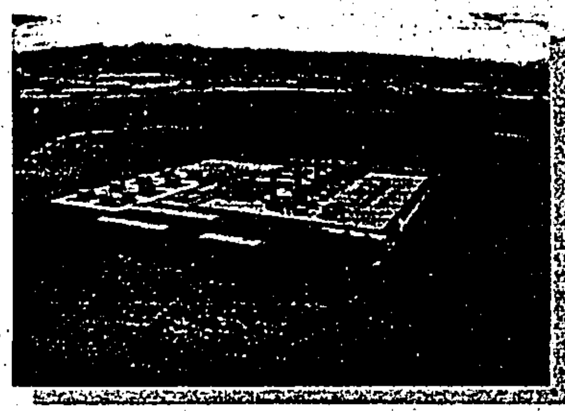


APPENDICES



APPENDIX A

FUEL TRANSPORT STUDY

MAUI ELECTRIC COMPANY, LIMITED'S

PROPOSED WAENA GENERATING STATION

FUEL TRANSPORT STUDY

Prepared by:

Stone & Webster Engineering Corporation

Prepared for:

CH2M HILL, Inc.

and

Maui Electric Company, Limited

May 1997

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EXECUTIVE SUMMARY

The addition of the eight combustion turbines at the proposed power plant will require approximately 44 daily truckloads of fuel. The fuel delivery will require 11 trucks for single-shift delivery operation or five trucks for double-shift delivery operation to meet the fuel requirements based on a five-day work schedule. This study compares the cost of trucking the fuel versus pumping the fuel by pipeline to Waena Generating Station.

The study is based on a 28-year period for capital cost recovery and evaluates pumping durations varying from 4 hours to 20 hours through a pipeline sized from 4 inches to 10 inches. Attachment 1 summarizes the Accumulated Present Worth Revenue Requirement (APWRR) for trucking and all pipeline cases. Attachment 4 describes the pipeline cases considered and costs associated with each.

The study indicates that a lower cost APWRR is realized for truck transport than any of the pipeline APWRR costs. There is a $10 million cost difference between the lowest cost pipeline alternative with a secondary containment and the trucking transport alternative.

Although a fuel pipeline without containment has been considered for the Waena Generating Station, future environmental regulations and laws will prohibit installation of a pipeline without secondary containment. Federal regulations currently require secondary containment and monitoring for underground storage tanks and piping associated with such tanks. The State of Hawaii or the County of Maui do not currently require secondary containment. However, based on previous permitting and site planning experience in Maui County, permits for a pipeline without secondary containment will be very difficult to obtain.

The economic assumptions in this study are based on a complete build-out of the power plant facility. Because the schedule for the site build-out is long (approximately 30 years), it is impossible to say when all units at the site will be in the dual-train, combined-cycle (DTCC) format, or if all future units will utilize fuel oil. Because of these reasons, in addition to its significantly lower costs, we believe trucking should be the method of fuel delivery to the Waena Generation Station.

INTRODUCTION

The purpose of this study is to determine if a fuel oil pipeline to the Waena Generating Station is economically feasible when compared to the cost of transporting fuel to the site by truck.

The study evaluates various pipeline options versus trucking of No. 2 diesel fuel to the site. A total of 11 different pipe combinations and secondary containment options were evaluated. These 11 different case are summarized in Attachment 4. Among these cases are 6-, 8- and 10-inch pipe sizes installed both with and without secondary containment. A 4-inch pipe was initially considered in the evaluation. However, due to the high pressure in the line, the 4-inch pipe was eliminated from consideration.

PIPELINE ASSUMPTIONS

The following assumptions and criteria were used for fuel pipeline economic analysis:

1. First operational year for the pipeline—2004
2. Base year for all Present Worth Accumulation—2004
3. Levelized After Tax Rate of Return—12.50 percent
4. Escalation rate for operation and maintenance (O&M) of pipeline, capital cost values, and power cost—2.6 percent/year
5. Revenue Requirement for O&M—1.09751
6. Electric power cost—$0.06235 per kW-Hr 2004 cost escalated 2.6 percent/year from $0.0521 per kW-Hr 1997 cost.
7. O & M Labor Rate—$43.27 per hour 2004 cost escalated 2.6 percent/year.
8. Fuel handling requirements are from HECO GEPPS.
9. Revenue Requirement Factor for capital—Per HECO IFPS model based on 28 year recovery.
10. Maintenance cost of pipeline 0.5 percent of initial capital cost and escalated 2.6 percent annually.
11. Pipeline distance from Kahului terminal area to Waena Generating Station—26,140 ft.
12. Daily pumping requirements based on 7-day week.
13. Full build-out of the pipeline in year 1.
14. Permit delay and costs at $1 million per year for 5 years per CH2M HILL experience

FUEL TRUCKING ASSUMPTIONS

1. First operational year for trucking—2004.
2. Base year for all Present Worth Accumulation—2004.
3. Levelized After Tax Rate of Return—12.50 percent
4. Escalation rate for fuel trucking cost—2.6 percent/year.
5. Fuel handling requirements are from HECO GEPPS run.
6. Truck loads are 214 bbls.
7. Trucking cost—$0.693 per barrel 2004 cost escalated 2.6 percent/year from $0.579 per barrel 1997 cost.
8. Revenue Requirement for trucking—1.09751.
9. Daily truckloads based on 5-day work week @ 11 truckloads per single-shift delivery operation.
10. Trucking distance from Kahului terminal area to Waena Generating Station—26,140 ft.

ECONOMIC EVALUATION

GENERAL

In order to economically evaluate the costs for trucking and pipelines on an equal basis, the total costs were converted to an Accumulated Present Worth Revenue Requirement (APWRR) to the year 2004. Attachment 1 summarizes the results of this study for all cases evaluated. The alternative with the lowest APWRR is considered the most economical option. The HECO IFPS information provided capital revenue requirement factors based on a 28-year period.

The study includes costs associated with obtaining rights-of-way for routing of pipeline and acquisition of pipeline easements. The study does not include costs associated with additional costs for road maintenance due to truck traffic. The study also does not include pipeline costs associated with any change in fuels piped.

FUEL TRUCKING

Transport distance to the site was measured from the Kahului terminal area. The fuel transport route is shown in Figure 1. The transport distance falls within the same fuel transport pricing zone as the Maalaea Power Plant. Therefore, the fuel transport cost for Maalaea was used to determine fuel transport costs to the new site. The 1997 Maalaea fuel transport price of $0.5790 per barrel was escalated 2.6 percent per year to obtain 2004 dollar values. Additionally, fuel trucking values were escalated 2.6 percent per year in the study.

The annual fuel consumption was provided by a HECO GEPPS run and was used to determine a daily fuel trucking requirement based on a 5-day work week for trucking. When all 8 combustion turbines are operational, the fuel delivery requirements will be 44 fuel deliveries a day using 11 trucks for single-shift operation or 5 trucks for double-shift operation.

The HECO GEPPS run provided fuel consumption requirements for a period of 20 years. For the remaining years of the study, the fuel consumption requirements of year 20 were used.

PIPELINE

Various pipeline sizes were evaluated to provide a range of pumping flow rates and pumping times. Based on a full-site installation of 8 combustion turbines, pumping times of 20, 16, 12, 8, and 4 hours were evaluated to determine pipe and pumping sizes. Attachments 2 and 3 show the criteria used to determine pipe velocities, pump head requirements and pump power requirements for carbon steel and fiberglass carrier pipe. In the attachments, 4-, 6-, 8- and

10-inch pipe sizes are considered. In Attachment 2 (carbon steel) the 4-inch carrier pipe was eliminated completely from consideration due to high pressures, and the higher pump rates in 6-inch and 8-inch pipe were eliminated because pressures were considered too high. In Attachment 3 (fiberglass carrier pipe) only the 8- and 10-inch pipe sizes were evaluated. Pressures in the 4- and 6-inch pipe were considered too high for fiberglass pipe systems.

The pipeline line cost (APWRR) is based on a capital cost for material, installation costs, and additional costs for engineering, permitting, annual maintenance costs, annual operator costs, and annual power consumption costs. The pipeline costs include costs associated with obtaining right-of-way for routing of the pipeline and acquisition of pipeline easements. Costs associated with obtaining permits, and the delays and costs resulting from administrative and judicial challenges to the permits, were based on the local experience of Maui Electric Company, Limited's land use consultant CH_2M HILL, on similar projects. In addition, although the pipeline can be designed to carry different types of liquid fuels, costs associated with altering between various fuels, including pipeline cleaning and storage preparation, the unknown nature of future alternative fuels and their overall availability did not make inclusion of such costs appropriate for this study.

For each pipeline size, a dollar-per-foot cost was determined based on vendor budgetary quotes. These prices were then escalated 2.6 percent per year to provide 2004 dollar values. Attachment 4 shows dollar-per-foot costs for 11 different cases of pipe systems considered. The cost for each case includes material costs, a 10 percent allowance for fittings, cathodic protection for carbon steel systems, leak detection for secondary containment systems, installation costs, and radiography for carbon steel pipe. A 10 percent contingency was also added to the total dollar-per-foot cost. These values, listed in Attachment 4, were then used to calculate the total capital cost of the pipeline installation with additional costs for a pumping station located at the terminal, along with engineering and permitting costs.

Annual maintenance costs for the pipeline are based on 0.5 percent of the initial capital cost, escalated 2.6 percent annually.

Power consumption costs are based on the power (kW) requirements calculated for pumps in Attachments 2 and 3 adjusted for pump operation time and based on a $0.06235 per kW-Hr 2004 rate.

Attachment 4 includes capital costs for a pump station to be located at the terminal and estimated engineering and permitting costs.

SUMMARY OF COSTS

The results of the study, indicating the lowest accumulated present worth costs for each of the different options, are tabulated below:

DESCRIPTION	CASE	PUMP RATE HOURS	ACCUMULATED PRESENT WORTH COST
Trucking Cost		N/A	$9,161,047
6 inch carbon steel, no containment	1	20	$16,525,830
8 inch carbon steel, no containment	2	20	$16,816,750
10 inch carbon steel, no containment	3	20	$17,121,077
6 inch carbon steel, steel containment	4	20	$20,769,804
8 inch carbon steel, steel containment	5	20	$21,431,650
10 inch carbon steel, steel containment	6	20	$22,106,904
6 inch carbon steel, fiberglass containment	7	20	$19,228,293
8 inch carbon steel, fiberglass containment	8	20	$20,420,033
10 inch carbon steel, fiberglass containment	9	20	$21,360,234
8 inch fiberglass pipe, fiberglass containment	10	20	$21,078,890
10 inch fiberglass pipe, fiberglass containment	11	20	$22,125,827

Due to the initial capital cost of the pipeline, at no time over the course of the analysis were the pipeline costs less than the trucking costs.

SUMMARY AND RECOMMENDATION

Based on the results of the study, trucking of the fuel is the most economical case. Because of environmental considerations, the only other viable option is a pipe with secondary containment.

We recommend the following considerations be reviewed closer to the actual generating station service date to determine the most appropriate long-term method of fuel transport to the site.

1. Trucking of fuel, although relatively inexpensive now, could increase dramatically. The 1987 trucking cost used in the Maalaea Fuel Study was $1.42 per bbl, nearly double the trucking cost used in this study. If the delivery cost would increase to this magnitude in the future, it would make a pipeline with secondary containment economically more attractive.

2. Environmental factors should be evaluated to compare the potential environmental impact such as daily truck traffic and damage occurring from a pipeline rupture.

3. The infrastructure required to support 44 daily fuel transports should be reviewed.

SUMMARY COST SHEET

TRUCKING ACCUMULATED PRESENT WORTH COST WAENA GENERATING STATION $9,161,047

PIPELINE ACCUMULATED PRESENT WORTH COST WAENA GENERATING STATION

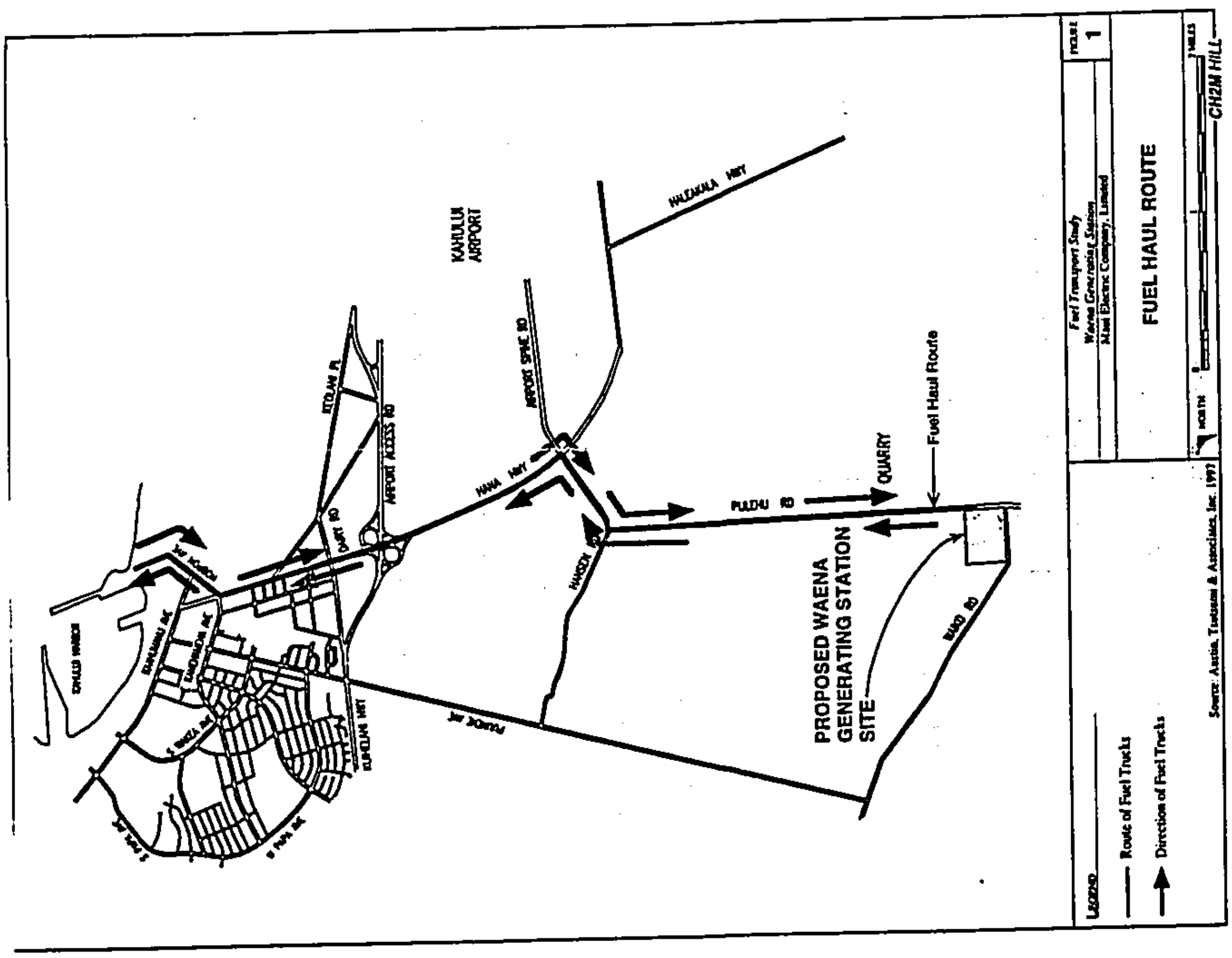
PUMP OP. TIME	CASE 1	CASE 2	CASE 3	CASE 4	CASE 5	CASE 6	CASE 7	CASE 8	CASE 9	CASE 10	CASE 11
20 HOURS	$16,525,830	$16,816,750	$17,121,077	$20,769,804	$21,431,650	$22,106,904	$19,228,293	$20,420,033	$21,360,234	$21,078,890	$22,125,827
16 HOURS	$16,536,205	$16,819,524	$17,122,074	$20,780,179	$21,434,424	$22,107,900	$19,238,668	$20,422,807	$21,361,231	$21,081,307	$22,126,613
12 HOURS		$16,825,839	$17,124,000		$21,440,740	$22,109,827		$20,429,123	$21,363,157	$21,086,119	$22,128,241
8 HOURS		$16,843,106	$17,129,348		$21,458,007	$22,115,174		$20,446,390	$21,368,505	$21,098,809	$22,132,618
4 HOURS			$17,155,155			$22,140,981			$21,394,312		$22,150,853

Note:2004 PW and operational year

File:summar2

SUMMARY COST SHEET
ATTACHMENT 1

A
summar2.xls
5/15/97



SG	0.84	VISCOSITY 2.94 CP	PUMP EFF	0.67	25.6 GPM PER UNIT	204.8 GPM FOR EIGHT UNITS
		DENSITY 52.42 LB/FT^3	MOTOR EFF	0.87	1536 GPH PER UNIT	12288 GPH FOR EIGHT UNITS
					36864 GPD PER UNIT	294912 GPD FOR EIGHT UNITS
						2,562,926 BARRELS/YEAR

PIPE SIZE	4 IN FRP	6 IN FRP	8 IN FRP	10 IN FRP
PIPE ID	4.33	6.39	8.3	10.41
20 HOURS PUMPING				
FLOW RATE(GPM)	246	246	246	246
VELOCITY(FPS)	5.35	2.46	1.46	0.93
RE NO	5.12E+04	3.47E+04	2.67E+04	2.13E+04
FRICTION FACTOR f	0.0210	0.0230	0.0238	0.025
HEAD LOSS/PER 100 FT	2.585	0.404	0.113	0.038
RELATIVE ROUGHNESS	0.00014	0.00009	0.00007	0.00006
16 HOURS PUMPING				
FLOW RATE(GPM)	307	307	307	307
VELOCITY(FPS)	6.69	3.07	1.82	1.16
RE NO	6.40E+04	4.34E+04	3.34E+04	2.66E+04
FRICTION FACTOR f	0.0205	0.0215	0.0228	0.0237
HEAD LOSS/PER 100 FT	3.943	0.591	0.169	0.057
RELATIVE ROUGHNESS	0.00014	0.00009	0.00007	0.00006
12 HOURS PUMPING				
FLOW RATE(GPM)	410	410	410	410
VELOCITY(FPS)	8.91	4.09	2.43	1.54
RE NO	8.53E+04	5.78E+04	4.45E+04	3.55E+04
FRICTION FACTOR f	0.0195	0.0200	0.0213	0.0222
HEAD LOSS/PER 100 FT	6.667	0.977	0.281	0.095
RELATIVE ROUGHNESS	0.00014	0.00009	0.00007	0.00006
8 HOURS PUMPING				
FLOW RATE(GPM)	614	614	614	614
VELOCITY(FPS)	13.37	6.14	3.64	2.31
RE NO	1.28E+05	8.67E+04	6.68E+04	5.32E+04
FRICTION FACTOR f	0.0173	0.0189	0.0194	0.0205
HEAD LOSS/PER 100 FT	13.306	2.077	0.577	0.196
RELATIVE ROUGHNESS	0.00014	0.00009	0.00007	0.00006
4 HOURS PUMPING				
FLOW RATE(GPM)	1229	1229	1229	1229
VELOCITY(FPS)	26.74	12.28	7.28	4.63
RE NO	2.56E+05	1.73E+05	1.34E+05	1.06E+05
FRICTION FACTOR f	0.0163	0.0165	0.0165	0.0162
HEAD LOSS/PER 100 FT	50.156	7.254	1.962	0.621
RELATIVE ROUGHNESS	0.00014	0.00009	0.00007	0.00006

PUMP & PIPELINE SIZING CRITERIA - FRP PIPE
ATTACHMENT 3-1

PIPE SIZE	4 IN C.S.	6 IN C.S.	8 IN C.S.	10 IN C.S.
PIPE ID	[illegible]	[illegible]	[illegible]	[illegible]
20 HOURS PUMPING				
FLOW RATE(GPM)	[illegible]	[illegible]	[illegible]	[illegible]
VELOCITY(FPS)	[illegible]	[illegible]	[illegible]	[illegible]
RE NO	[illegible]	[illegible]	[illegible]	[illegible]
FRICTION FACTOR f	[illegible]	[illegible]	[illegible]	[illegible]
HEAD LOSS/PER 100 FT	[illegible]	[illegible]	[illegible]	[illegible]
16 HOURS PUMPING				
FLOW RATE(GPM)	[illegible]	[illegible]	[illegible]	[illegible]
VELOCITY(FPS)	[illegible]	[illegible]	[illegible]	[illegible]
RE NO	[illegible]	[illegible]	[illegible]	[illegible]
FRICTION FACTOR f	[illegible]	[illegible]	[illegible]	[illegible]
HEAD LOSS/PER 100 FT	[illegible]	[illegible]	[illegible]	[illegible]
12 HOURS PUMPING				
FLOW RATE(GPM)	[illegible]	[illegible]	[illegible]	[illegible]
VELOCITY(FPS)	[illegible]	[illegible]	[illegible]	[illegible]
RE NO	[illegible]	[illegible]	[illegible]	[illegible]
FRICTION FACTOR f	[illegible]	[illegible]	[illegible]	[illegible]
HEAD LOSS/PER 100 FT	[illegible]	[illegible]	[illegible]	[illegible]
8 HOURS PUMPING				
FLOW RATE(GPM)	[illegible]	[illegible]	[illegible]	[illegible]
VELOCITY(FPS)	[illegible]	[illegible]	[illegible]	[illegible]
RE NO	[illegible]	[illegible]	[illegible]	[illegible]
FRICTION FACTOR f	[illegible]	[illegible]	[illegible]	[illegible]
HEAD LOSS/PER 100 FT	[illegible]	[illegible]	[illegible]	[illegible]
4 HOURS PUMPING				
FLOW RATE(GPM)	[illegible]	[illegible]	[illegible]	[illegible]
VELOCITY(FPS)	[illegible]	[illegible]	[illegible]	[illegible]
RE NO	[illegible]	[illegible]	[illegible]	[illegible]
FRICTION FACTOR f	[illegible]	[illegible]	[illegible]	[illegible]
HEAD LOSS/PER 100 FT	[illegible]	[illegible]	[illegible]	[illegible]
PIPE HEAD LOSS SUMMARY				
HEAD LOSS (FT/100FT)				
20 HOURS	[illegible]	[illegible]	[illegible]	[illegible]
16 HOURS	[illegible]	[illegible]	[illegible]	[illegible]
12 HOURS	[illegible]	[illegible]	[illegible]	[illegible]
8 HOURS	[illegible]	[illegible]	[illegible]	[illegible]
4 HOURS	[illegible]	[illegible]	[illegible]	[illegible]

PUMP & PIPELINE SIZING CRITERIA - CARBON STEEL PIPE
ATTACHMENT 2

PIPE HEAD LOSS SUMMARY	4	6	8	10
HEAD LOSS (FT/100FT)				
20 HOURS	2.585	0.404	0.113	0.038
16 HOURS	3.943	0.591	0.169	0.057
12 HOURS	6.667	0.977	0.281	0.095
8 HOURS	13.308	2.077	0.577	0.196
4 HOURS	50.156	7.254	1.962	0.621

HEAD LOSS (FT) 26,140 FT	4 INCH FRP PIPE PIPE HEAD LOSS	PIPE HEAD LOSS + STATIC HEAD 340	PLUS 5% MARGIN (FT)	PRESSURE (PSI)	BHP	EHP	POWER (KW)	DAILY POWER KW-HRS/DAY	ANNUAL POWER KW-HRS/YEAR
20 HOURS	675.65	1015.65	1066.44	388	83	95	71.12	1422.43	519,186
16 HOURS	1030.57	1370.57	1439.10	523	140	161	119.97	1919.49	700,615
12 HOURS	1742.75	2082.75	2186.89	795	284	326	243.06	2916.91	1,064,672
8 HOURS	3478.81	3818.81	4009.75	1,458	780	897	668.53	5348.26	1,952,114
4 HOURS	13110.88	13450.88	14123.42	5,136	5,495	6316	4709.51	18838.02	6,875,879

HEAD LOSS (FT) 26,140 FT	6 INCH FRP PIPE PIPE HEAD LOSS	PIPE HEAD LOSS + STATIC HEAD 340	PLUS 5% MARGIN (FT)	PRESSURE (PSI)	BHP	EHP	POWER (KW)	DAILY POWER KW-HRS/DAY	ANNUAL POWER KW-HRS/YEAR
20 HOURS	105.72	445.72	468.01	170	36	42	31.21	624.24	227,846
16 HOURS	154.42	494.42	519.14	189	50	58	43.28	692.43	252,739
12 HOURS	255.37	595.37	625.14	227	81	93	69.48	833.82	304,343
8 HOURS	542.98	882.98	927.13	337	180	207	154.58	1236.81	451,364
4 HOURS	1896.11	2236.11	2347.91	854	913	1050	782.92	3131.68	1,143,064

HEAD LOSS (FT) 26,140 FT	8 INCH FRP PIPE PIPE HEAD LOSS	PIPE HEAD LOSS + STATIC HEAD 340	PLUS 5% MARGIN (FT)	PRESSURE (PSI)	BHP	EHP	POWER (KW)	DAILY POWER KW-HRS/DAY	ANNUAL POWER KW-HRS/YEAR
20 HOURS	29.59	369.59	388.07	141	30	35	25.88	517.61	188,928
16 HOURS	44.29	384.29	403.50	147	39	45	33.64	538.20	196,443
12 HOURS	73.56	413.56	434.24	158	56	65	48.27	579.19	211,404
8 HOURS	150.74	490.74	515.28	187	100	115	85.91	687.29	250,860
4 HOURS	512.83	852.83	895.48	326	348	400	298.60	1194.40	435,958

HEAD LOSS (FT) 26,140 FT	10 INCH FRP PIPE PIPE HEAD LOSS	PIPE HEAD LOSS + STATIC HEAD 340	PLUS 5% MARGIN (FT)	PRESSURE (PSI)	BHP	EHP	POWER (KW)	DAILY POWER KW-HRS/DAY	ANNUAL POWER KW-HRS/YEAR
20 HOURS	10.01	350.01	367.52	134	29	33	24.51	490.20	178,922
16 HOURS	14.83	354.83	372.58	135	36	42	31.06	496.95	181,386
12 HOURS	24.70	364.70	382.94	139	50	57	42.58	510.77	186,430
8 HOURS	51.32	391.32	410.89	149	80	92	68.51	548.05	200,039
4 HOURS	162.24	502.24	527.35	192	205	236	175.85	703.38	256,735

PUMP & PIPELINE SIZING CRITERIA - FRP PIPE
ATTACHMENT 3-2

PIPELINE COSTS - $/FT AND ADDITIONAL COSTS

PIPE SIZE / CONTAINMENT TYPE	CASE 1 6 in C.S. No containment	CASE 2 8 in C.S. No containment	CASE 3 10 in C.S. No containment	CASE 4 6 in C.S. 10 in C.S. cont	CASE 5 8 in C.S. 12 in C.S. cont	CASE 6 10 in C.S. 14 in C.S. cont	CASE 7 6 in C.S. 10 in FRP cont	CASE 8 8 in C.S. 12 in FRP cont	CASE 9 10 in C.S. 14 in FRP cont	CASE 10 8 in FRP 12 in FRP cont	CASE 11 10 in FRP 14 FRP cont
PIPE - MATERIAL COST											
Pipe Material cost ($/ft)	$11.34	$18.38	$21.42	$50.39	$64.25	$78.11	$37.80	$64.25	$84.41	$85.87	$108.35
Fittings (10% of pipe material cost - $/ft)	$1.13	$1.84	$2.14	$5.04	$6.43	$7.81	$3.78	$6.43	$8.44	$8.57	$10.83
Cathodic Protection ($/FT)	$1.26	$1.26	$1.26	$1.26	$1.26	$1.26	NONE	NONE	NONE	NONE	NONE
Leak Detection Cable ($/ft)	NONE	NONE	NONE	$12.60	$12.60	$12.60	$12.60	$12.60	$12.60	$12.60	$12.60
Total Material cost ($/FT)	$13.73	$19.29	$24.82	$69.29	$84.54	$99.78	$54.17	$83.28	$105.45	$106.84	$131.78
PIPE - INSTALLATION COST											
Installation cost (All inclusive) ($/FT)	$70.56	$73.07	$75.58	$125.99	$128.51	$131.03	$100.79	$103.31	$106.83	$103.31	$105.83
Radiography ($/FT)	$6.30	$6.30	$6.30	$6.30	$6.30	$6.30	$6.30	$6.30	$6.30		
Total Installation cost ($/FT)	$76.85	$79.37	$81.88	$132.29	$134.81	$137.33	$107.09	$109.61	$112.13	$103.31	$105.83
TOTAL MATERIALS AND INSTALLATION COST	$90.58	$98.66	$106.71	$201.58	$219.34	$237.11	$161.26	$192.89	$217.58	$210.15	$237.61
CONTINGENCY 10% Contingency ($/FT)	$9.06	$9.86	$10.67	$20.16	$21.93	$23.71	$16.13	$19.29	$21.76	$21.01	$23.76
TOTAL PIPELINE COST ($/FT)	$99.64	$108.51	$117.38	$221.74	$241.28	$260.82	$177.39	$212.17	$239.34	$231.16	$261.37

PUMP STATION	
Pumps	$45,000
Piping, flanges, valves	$80,000
Controls	$80,000
Electrical	$50,000
CSA Work	$25,000
Mechanical Work	$40,000
Total Pump Station Cost	$260,000
TOTAL COST INCLUDING 2.6% ESC	$327,987
ENGINEERING, PERMITTING & LAND	
Engineering	$260,000
Permitting/Delay	$5,000,000
Land Acquisition	$1,500,000
Total Engineering & permitting	$6,760,000
TOTAL COST INCLUDING 2.6% ESC	$8,516,721
TOTAL ADDITIONAL COST	$8,844,708

NOTES Cost figures are escalated 2.6% annually from 1997 dollar value

PIPELINE COSTS - $/FT AND ADDITIONAL COSTS
ATTACHMENT 4

FILE PIPELINE

FUEL TRUCKING COSTS

TRUCKING COSTS TO WAENA GEN. FAC. 26,140 FT DISTANCE
FUEL RATE BASED ON HECO GEPPS RUN

Year No	Year	Annual Fuel Handling Requirements (bbls)	30-day Required Reserve (bbls)	Daily Fuel Handling Requirements (bbls)	Daily Truckloads of Fuel Required (bbls)	No. of Trucks Required for 1-Shift Operation (Daily)	No. of Trucks Required for 2-Shift Operation (Daily)	% Unit Cost Increase Over Previous Year	Escalation Factor	Annual Trucking Cost ($$/bbl)	ANNUAL TRUCKING COST ($$$)	Revenue Requirement Factor For Trucking Cost (at 108.75%)	Annual Revenue Requirement Trucking Cost ($$$)	Present Worth Factor	Present Worth of RR For Trucking Cost ($$$)	Accumulated Present Worth of RR For Trucking Cost ($$$)
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
			[C/12]	[C/260]	[E/214]	[F/4]	[F/8]		[(1+I)^(A-1)]	[($/bbl)*K]	[K*L]		[M*N]	(1+ROR)^-(A-1)	[P*O]	[sum(P)]
1	2004	0	0	0	0	0	0	2.80%	1.0000	0.6930	$0	1.0875	$0	1.0000	$0	$0
2	2005	11,117	926	43	0	0	0	2.80%	1.0280	0.7110	$7,904	1.0875	$8,675	0.8889	$7,711	$7,711
3	2006	482,181	40,180	1,854	9	2	1	2.80%	1.0527	0.7295	$351,738	1.0875	$386,037	0.7901	$305,017	$312,728
4	2007	685,237	57,103	2,636	12	3	2	2.80%	1.0800	0.7485	$512,880	1.0875	$562,881	0.7023	$395,337	$708,064
5	2008	688,420	57,368	2,648	12	3	2	2.80%	1.1081	0.7679	$528,640	1.0875	$580,206	0.6243	$362,222	$1,070,286
6	2009	692,882	57,740	2,666	12	3	2	2.80%	1.1368	0.7879	$545,920	1.0875	$599,153	0.5549	$332,487	$1,402,774
7	2010	1,041,422	86,785	4,005	19	5	2	2.80%	1.1665	0.8084	$841,868	1.0875	$923,960	0.4933	$455,762	$1,858,535
8	2011	1,358,445	113,204	5,225	24	6	3	2.80%	1.1968	0.8294	$1,126,996	1.0875	$1,236,860	0.4385	$542,185	$2,400,721
9	2012	1,364,756	113,730	5,249	25	6	3	2.80%	1.2279	0.8510	$1,161,360	1.0875	$1,274,604	0.3897	$496,770	$2,897,490
10	2013	1,368,475	114,040	5,263	25	6	3	2.80%	1.2598	0.8731	$1,194,803	1.0875	$1,311,308	0.3464	$454,290	$3,351,779
11	2014	1,370,870	114,239	5,273	25	6	3	2.80%	1.2926	0.8958	$1,228,013	1.0875	$1,347,757	0.3079	$415,037	$3,766,816
12	2015	1,373,466	114,456	5,283	25	6	3	2.80%	1.3262	0.9181	$1,262,327	1.0875	$1,385,418	0.2737	$379,230	$4,146,046
13	2016	1,638,866	136,572	6,303	29	7	4	2.80%	1.3607	0.9430	$1,545,417	1.0875	$1,696,111	0.2433	$412,690	$4,558,736
14	2017	1,972,589	164,382	7,587	35	9	4	2.80%	1.3961	0.9675	$1,908,471	1.0875	$2,094,546	0.2163	$453,014	$5,011,749
15	2018	1,986,747	165,562	7,641	36	9	4	2.80%	1.4324	0.9927	$1,972,145	1.0875	$2,164,449	0.1922	$416,114	$5,427,863
16	2019	1,993,925	166,160	7,669	36	9	4	2.80%	1.4696	1.0185	$2,030,731	1.0875	$2,228,748	0.1709	$380,867	$5,808,730
17	2020	2,425,946	202,162	9,331	44	11	5	2.80%	1.5078	1.0449	$2,534,966	1.0875	$2,782,151	0.1519	$422,610	$6,231,340
18	2021	2,425,946	202,162	9,331	44	11	5	2.80%	1.5471	1.0721	$2,600,875	1.0875	$2,854,486	0.1350	$385,421	$6,616,761
19	2022	2,425,946	202,162	9,331	44	11	5	2.80%	1.5873	1.1000	$2,668,486	1.0875	$2,928,703	0.1200	$351,504	$6,968,265
20	2023	2,425,946	202,162	9,331	44	11	5	2.80%	1.6285	1.1286	$2,737,879	1.0875	$3,004,849	0.1067	$320,571	$7,288,836
21	2024	2,425,946	202,162	9,331	44	11	5	2.80%	1.6708	1.1579	$2,809,064	1.0875	$3,082,975	0.0948	$292,361	$7,581,197
22	2025	2,425,946	202,162	9,331	44	11	5	2.80%	1.7143	1.1880	$2,882,099	1.0875	$3,163,133	0.0843	$266,633	$7,847,831
23	2026	2,425,946	202,162	9,331	44	11	5	2.80%	1.7589	1.2189	$2,957,034	1.0875	$3,245,374	0.0749	$243,170	$8,091,000
24	2027	2,425,946	202,162	9,331	44	11	5	2.80%	1.8046	1.2506	$3,033,917	1.0875	$3,329,754	0.0666	$221,771	$8,312,771
25	2028	2,425,946	202,162	9,331	44	11	5	2.80%	1.8516	1.2831	$3,112,799	1.0875	$3,416,329	0.0592	$202,255	$8,515,026
26	2029	2,425,946	202,162	9,331	44	11	5	2.80%	1.8997	1.3165	$3,193,731	1.0875	$3,506,152	0.0526	$184,456	$8,699,482
27	2030	2,425,946	202,162	9,331	44	11	5	2.80%	1.9491	1.3507	$3,276,768	1.0875	$3,596,286	0.0468	$168,224	$8,867,707
28	2031	2,425,946	202,162	9,331	44	11	5	2.80%	1.9998	1.3858	$3,361,964	1.0875	$3,689,790	0.0416	$153,421	$9,021,127
29	2032	2,425,946	202,162	9,331	44	11	5	2.80%	2.0518	1.4219	$3,449,375	1.0875	$3,785,724	0.0370	$139,920	$9,161,047

TOTAL PRESENT WORTH $9,161,047

Assumptions

Present Worth year for study 2004
First Operational Year 2004
Estimated trucking cost 0.693 $/bbl in 2004 Escalated 2.8% from .5790 $/bbl 1997 estimate from HECO
Levelized after tax rate of return 0.125
Fuel Handling cost escalation 0.028
Daily truckloads based on 5 day week
Truck capacity based on 214 bbl
Single shift based on 8 hour work day
Double shift based on 2 - 8 hour shifts 0.692963068
Revenue Requirement for truck 1.08751

FUEL TRUCKING COSTS
ATTACHMENT 5

FILE PWA2HE

A
pwa2he.xls
5/15/97

PIPELINE COSTS TO WAENA GEN. FAC. 6 INCH C.S. PIPE EPOXY COATEDING CONTAINMENT
FUEL RATE BASED ON HECO GEPPS RUN 940 GPM PUMPS

Year No	Year	Annual Fuel Handling Requirements (bbls)	DAILY PUMPING TIME (HOURS)	Capital Cost ($$$)	Revenue Requirement Factor For Capital	Revenue Requirement For Capital	Present Worth Factor	Present Worth of RR For Capital ($$$)	Accumulated Present Worth of RR For Capital ($$$)	TOTAL MAINTENANCE COSTS ($$$)	Energy Cost to Pump Fuel ($/yr)	% Unit Cost Increase Over Previous Year	O&M Escalation Factor	Maintenance Operator Cost ($/hr)	Required Manhours for Pipeline Operation (hours)	TOTAL OPERATING COSTS ($$$)	Revenue Requirement Factor For O&M (@ 108.751%)	Revenue Requirement For O&M ($$$)	Present Worth Factor	Present Worth of RR For O&M ($$$)	Accumulated Present Worth of RR For O&M ($$$)	TOTAL (CAPITAL + O&M) ($$$)
A	B	C	D	E	F	G	H	I	J	L	M	N	O	P	Q	R	S	T	U	V	W	Y
1	[illegible]	0	0.0	$11,440,872	[illegible]	[illegible]	1.0000	[illegible]	[illegible]	[illegible]	[illegible]	2.80%	1.0000	[illegible]	0	[illegible]	1.0875	[illegible]	1.0000	[illegible]	[illegible]	[illegible]
2	[illegible]	11,117	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	0.2737	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	0.2737	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
					[illegible]	[illegible]																

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kW-hr 1997 [illegible]
Power cost $/kW-hr 2004 [illegible]
O&M Labor Rate $/hr 2004 [illegible]

FILE PWA2EH

6 INCH C.S. PIPE EPOXY COATEDING CONTAINMENT
940 GPM PUMPS
CASE 1
ATTACHMENT 6-1

[illegible]

PIPELINE COSTS TO WAIANAE GEN. FAC.
FUEL RATE BASED ON HECO BBPPS RUN

6 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
207 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	DAILY PUMPING TIME (HOURS) D	Capital Cost ($$$) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($$$) I	Accumulated Present Worth of RR For Capital ($$$) J	TOTAL MAINTENANCE COSTS ($$$) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hr) P	Required Manhours for Pipeline Operation (hrs/yr) Q	TOTAL OPERATING COSTS ($$$) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($$$) T	Present Worth Factor U	Present Worth of RR For O&M ($$$) V	Accumulated Present Worth of RR For O&M ($$$) W	TOTAL (CAPITAL + O&M) ($$$) Y
1	2004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	2005	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	2006	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	2007	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	2008	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	2009	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2010	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	2011	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	2012	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	2013	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	2014	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	2015	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	2016	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	2017	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	2018	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	2019	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	2020	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	2021	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	2022	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	2023	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	2024	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	2025	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	2026	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	2027	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	2028	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	2029	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	2030	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	2031	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	2032	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	2033	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
																					TOTAL PRESENT WORTH	[illegible]

Assumptions

Present Worth year for study	2004
First Operational year	2004
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/KW-hr 1997	[illegible]
Power cost $/KW-hr 2004	[illegible]
O&M Labor Rate $/hr 2004	$42.27

FILE: [illegible]

6 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
207 GPM PUMPS
CASE 1
ATTACHMENT 6-2

[illegible]

PIPELINE COSTS TO WAIANAE GEN. FAC.
FUEL RATE BASED ON HECO BBPPS RUN

6 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
240 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($$$) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($$$) I	Accumulated Present Worth of RR For Capital ($$$) J	TOTAL MAINTENANCE COSTS ($$$) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hr) P	Required Manhours for Pipeline Operation (hrs/yr) Q	TOTAL OPERATING COSTS ($$$) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($$$) T	Present Worth Factor U	Present Worth of RR For O&M ($$$) V	Accumulated Present Worth of RR For O&M ($$$) W	TOTAL (CAPITAL + O&M) ($$$) Y
1	2004	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	2005	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	2006	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	2007	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	2008	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	2009	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	2010	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	2011	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	2012	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	2013	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	2014	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	2015	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	2016	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	2017	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	2018	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	2019	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	2020	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	2021	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	2022	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	2023	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	2024	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	2025	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	2026	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	2027	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	2028	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	2029	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	2030	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	2031	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	2032	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	2033	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
																					TOTAL PRESENT WORTH	[illegible]

Assumptions

Present Worth year for study	2004
First Operational year	2004
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/KW-hr 1997	[illegible]
Power cost $/KW-hr 2004	[illegible]
O&M Labor Rate $/hr 2004	$42.27

FILE: [illegible]

6 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
240 GPM PUMPS
CASE 2
ATTACHMENT [illegible]

[illegible]

PIPELINE COSTS TO WAIAU GEN FAC
FUEL RATE BASED ON HECO GENPPS RUN

8 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
307 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000s) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000s) I	Accumulated Present Worth of RR For Capital ($000s) J	TOTAL MAINTENANCE COSTS ($000s) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/year) P	Required Manhours for Pipeline Operation (hrs/yr) Q	TOTAL OPERATING COSTS ($000s) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000s) Y
1	[illegible]	0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions:

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kWh-yr [illegible]
Power cost $/kWh-yr [illegible]
O&M Labor Rate $/hr [illegible]

FILE: PHASE [illegible]

8 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
307 GPM PUMPS
CASE 2
ATTACHMENT 7-2

[illegible]

PIPELINE COSTS TO WAIAU GEN FAC
FUEL RATE BASED ON HECO GENPPS RUN

8 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
[illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000s) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000s) I	Accumulated Present Worth of RR For Capital ($000s) J	TOTAL MAINTENANCE COSTS ($000s) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/year) P	Required Manhours for Pipeline Operation (hrs/yr) Q	TOTAL OPERATING COSTS ($000s) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000s) Y
1	[illegible]	0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions:

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kWh-yr [illegible]
Power cost $/kWh-yr [illegible]
O&M Labor Rate $/hr [illegible]

FILE: PHASE [illegible]

8 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
[illegible] GPM PUMPS
CASE 2
ATTACHMENT 7-[illegible]

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC.
FUEL RATE BASED ON HECO GENPPS RUN

8 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
614 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hr) P	Required Manhours for Pipeline Operation (hrs/yr) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]												[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/KW-hr 1997	[illegible]
Power cost $/KW-hr 2004	[illegible]
O&M Labor Rate $/hr 2004	[illegible]

FILE: [illegible]

8 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
614 GPM PUMPS
CASE 3
ATTACHMENT 7-4

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC.
FUEL RATE BASED ON HECO GENPPS RUN

10 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
240 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hr) P	Required Manhours for Pipeline Operation (hrs/yr) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/KW-hr 1997	[illegible]
Power cost $/KW-hr 2004	[illegible]
O&M Labor Rate $/hr 2004	[illegible]

FILE: [illegible]

240 GPM PUMPS
10 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
CASE 3
ATTACHMENT 8-1

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC
FUEL RATE BASED ON HECO GENPPS RUN

10 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
307 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (hours) D	Capital Cost ($00s) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($00) I	Accumulated Present Worth of RR For Capital ($00) J	TOTAL MAINTENANCE COSTS ($00) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hr) P	Required Manhours for Pipeline Operation (hours) Q	TOTAL OPERATING COSTS ($00) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($00) T	Present Worth Factor U	Present Worth of RR For O&M ($00) V	Accumulated Present Worth of RR For O&M ($00) W	TOTAL (CAPITAL + O&M) ($00) Y
							(1+ROR)^-(A-1)												(1+ROR)^-(A-1)			
1	2004	0	0.0	[illegible]	[illegible]	[illegible]	1.0000	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	1.0000	543.27	[illegible]	[illegible]	[illegible]	[illegible]	1.0000	[illegible]	[illegible]	[illegible]
2	2005	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	15.2	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study 2004
First Operational year 2004
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/MWh [illegible]
Power cost $/MWh [illegible]
O&M Labor Rate $/hr 2004 543.27

FILE: [illegible]

307 GPM PUMPS
10 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
CASE 3
ATTACHMENT 6-2

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC
FUEL RATE BASED ON HECO GENPPS RUN

10 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
410 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (hours) D	Capital Cost ($00s) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($00) I	Accumulated Present Worth of RR For Capital ($00) J	TOTAL MAINTENANCE COSTS ($00) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hr) P	Required Manhours for Pipeline Operation (hours) Q	TOTAL OPERATING COSTS ($00) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($00) T	Present Worth Factor U	Present Worth of RR For O&M ($00) V	Accumulated Present Worth of RR For O&M ($00) W	TOTAL (CAPITAL + O&M) ($00) Y
							(1+ROR)^-(A-1)												(1+ROR)^-(A-1)			
1	2004	0	0.0	[illegible]	[illegible]	[illegible]	1.0000	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	1.0000	543.27	[illegible]	[illegible]	[illegible]	[illegible]	1.0000	[illegible]	[illegible]	[illegible]
2	2005	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	11.3	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.00%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study 2004
First Operational year 2004
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/MWh [illegible]
Power cost $/MWh [illegible]
O&M Labor Rate $/hr 2004 543.27

FILE: [illegible]

10 INCH C.S. PIPE EPOXY COATED/NO CONTAINMENT
410 GPM PUMPS
CASE 3
ATTACHMENT 6-3

[illegible]

PIPELINE COSTS TO [illegible] GEN. FAC. — 16 INCH C.S. PIPE EPOXY COATED CONTAINMENT
FUEL RATE BASED ON HECO [illegible] RUN — 614 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hour) P	Required Manhours for Pipeline Operation (hr/yr) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2–30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kW-hr [illegible]
Power cost $/kW-hr [illegible]
O&M Labor Rate $/hr [illegible]

FILE [illegible]

16 INCH C.S. PIPE EPOXY COATED CONTAINMENT
614 GPM PUMPS
CASE 3
ATTACHMENT [illegible]

[illegible]

PIPELINE COSTS TO [illegible] GEN. FAC. — 16 INCH C.S. PIPE EPOXY COATED CONTAINMENT
FUEL RATE BASED ON HECO [illegible] RUN — [illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hour) P	Required Manhours for Pipeline Operation (hr/yr) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2–30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kW-hr [illegible]
Power cost $/kW-hr [illegible]
O&M Labor Rate $/hr [illegible]

FILE [illegible]

16 INCH C.S. PIPE EPOXY COATED CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT [illegible]

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC. — 6 INCH C.S. PIPE IN 10 INCH COATED CARBON STEEL CONTAINMENT
FUEL RATE BASED ON HECO [illegible] RUN — [illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	DAILY PUMPING TIME (HOURS) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/man) P	Required Manhours for Pipeline Operation (m/hrs) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M (@ 100.75%) S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kWh [illegible]	[illegible]
Power cost $/kWh [illegible]	[illegible]
O&M Labor Rate $/hr [illegible]	[illegible]

FILE: [illegible]

6 INCH C.S. PIPE IN 10 INCH COATED CARBON STEEL CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT [illegible]

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC. — 6 INCH C.S. PIPE IN 10 INCH COATED CARBON STEEL CONTAINMENT
FUEL RATE BASED ON HECO [illegible] RUN — [illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	DAILY PUMPING TIME (HOURS) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/man) P	Required Manhours for Pipeline Operation (m/hrs) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M (@ 100.75%) S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kWh [illegible]	[illegible]
Power cost $/kWh [illegible]	[illegible]
O&M Labor Rate $/hr [illegible]	[illegible]

FILE: [illegible]

6 INCH C.S. PIPE IN 10 INCH COATED CARBON STEEL CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT [illegible]

[illegible]

8 INCH C.S. PIPE /12 INCH COATED CARBON STEEL CONTAINMENT
246 GPM PUMPS
CASE 5
ATTACHMENT 10-1

8 INCH C.S. PIPE /12 INCH COATED CARBON STEEL CONTAINMENT
287 GPM PUMPS
CASE 5
ATTACHMENT 10-2

PIPELINE COSTS TO MAGMA GEN. FAC
FUEL RATE BASED ON NSCO GENPPS RUN

8 INCH C.S. PIPE /12 INCH COATED CARBON STEEL CONTAINMENT
410 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($00s) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hour) P	Required Manhours for Pipeline Operation (hrs/yr) Q	TOTAL OPERATING COSTS ($00s) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($00s) T	Present Worth Factor U	Present Worth of RR For O&M ($00) V	Accumulated Present Worth of RR For O&M ($00) W	TOTAL (CAPITAL + O&M) ($00s) Y
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kW-hr	[illegible]
Power cost $/kW-hr	[illegible]
O&M Labor Rate $/hr	[illegible]

FILE: [illegible]

8 INCH C.S. PIPE /12 INCH COATED CARBON STEEL CONTAINMENT
410 GPM PUMPS
CASE 3
ATTACHMENT 16-3

ECSCC3
[illegible]

PIPELINE COSTS TO MAGMA GEN. FAC
FUEL RATE BASED ON NSCO GENPPS RUN

8 INCH C.S. PIPE /12 INCH COATED CARBON STEEL CONTAINMENT
[illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($00s) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hour) P	Required Manhours for Pipeline Operation (hrs/yr) Q	TOTAL OPERATING COSTS ($00s) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($00s) T	Present Worth Factor U	Present Worth of RR For O&M ($00) V	Accumulated Present Worth of RR For O&M ($00) W	TOTAL (CAPITAL + O&M) ($00s) Y
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kW-hr	[illegible]
Power cost $/kW-hr	[illegible]
O&M Labor Rate $/hr	[illegible]

FILE: [illegible]

8 INCH C.S. PIPE /12 INCH COATED CARBON STEEL CONTAINMENT
[illegible] GPM PUMPS
CASE 3
ATTACHMENT 16-4

ECSCC4
[illegible]

PIPELINE COSTS TO WAIAU GEN. FAC
FUEL RATE BASED ON HECO BENPPS RUN

16 INCH C.S. PIPE W/ 24 INCH COATED CARBON STEEL CONTAINMENT
[illegible] GPM PUMPS

A	B	C	D	E	F	G	H	I	J	L	M	N	O	P	Q	R	S	T	U	V	W	Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/KW-hr [illegible]
Power cost $/KW-hr [illegible]
O&M Labor Rate $/hr [illegible]

FILE [illegible]

16 INCH C.S. PIPE W/ 24 INCH COATED CARBON STEEL CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT 11-1

PIPELINE COSTS TO WAIAU GEN. FAC
FUEL RATE BASED ON HECO BENPPS RUN

16 INCH C.S. PIPE (COATED CARBON STEEL CONTAINMENT
[illegible] GPM PUMPS

A	B	C	D	E	F	G	H	I	J	L	M	N	O	P	Q	R	S	T	U	V	W	Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/KW-hr [illegible]
Power cost $/KW-hr [illegible]
O&M Labor Rate $/hr [illegible]

FILE [illegible]

16 INCH C.S. PIPE W/ 24 INCH COATED CARBON STEEL CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT 11-2

PIPELINE COSTS TO WAENA GEN. FAC — 16 INCH C.S. PIPE COATED CARBON STEEL CONTAINMENT
FUEL RATE BASED ON HECO GENPPS RUN — 416 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time (Hours) D	Capital Cost ($$$) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($$$) I	Accumulated Present Worth of RR For Capital ($$$) J	TOTAL MAINTENANCE COSTS ($$$) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($$$) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($$$) T	Present Worth Factor U	Present Worth of RR For O&M ($$$) V	Accumulated Present Worth of RR For O&M ($$$) W	TOTAL (CAPITAL + O&M) ($$$) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

[illegible]

16 INCH C.S. PIPE W/ INCH COATED CARBON STEEL CONTAINMENT
416 GPM PUMPS
CASE 6
ATTACHMENT 11-3

PIPELINE COSTS TO WAENA GEN. FAC — 16 INCH C.S. PIPE W/ INCH COATED CARBON STEEL CONTAINMENT
FUEL RATE BASED ON HECO GENPPS RUN — 614 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time (Hours) D	Capital Cost ($$$) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($$$) I	Accumulated Present Worth of RR For Capital ($$$) J	TOTAL MAINTENANCE COSTS ($$$) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($$$) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($$$) T	Present Worth Factor U	Present Worth of RR For O&M ($$$) V	Accumulated Present Worth of RR For O&M ($$$) W	TOTAL (CAPITAL + O&M) ($$$) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

[illegible]

16 INCH C.S. PIPE W/ INCH COATED CARBON STEEL CONTAINMENT
614 GPM PUMPS
CASE 6
ATTACHMENT 11-4

PIPELINE COSTS TO WAENA GEN. FAC
FUEL RATE BASED ON HECO BENPPS RUN

16 INCH C.S. PIPE /14 INCH COATED CARBON STEEL CONTAINMENT
1200 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time D	Capital Cost E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital I	Accumulated Present Worth of RR For Capital J	TOTAL MAINTENANCE COSTS L	Energy Cost to Pump Fuel M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M T	Present Worth Factor U	Present Worth of RR For O&M V	Accumulated Present Worth of RR For O&M W	TOTAL (CAPITAL + O&M) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

[illegible]

FILE: [illegible]

16 INCH C.S. PIPE /14 INCH COATED CARBON STEEL CONTAINMENT
1200 GPM PUMPS
CASE 6
ATTACHMENT 11-6

PIPELINE COSTS TO WAENA GEN. FAC
FUEL RATE BASED ON HECO BENPPS RUN

8 INCH C.S. PIPE /16 INCH FRP CONTAINMENT
240 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	DAILY PUMPING TIME (HOURS) D	Capital Cost E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital I	Accumulated Present Worth of RR For Capital J	TOTAL MAINTENANCE COSTS L	Energy Cost to Pump Fuel M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M T	Present Worth Factor U	Present Worth of RR For O&M V	Accumulated Present Worth of RR For O&M W	TOTAL (CAPITAL + O&M) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

[illegible]

FILE: [illegible]

8 INCH C.S. PIPE /16 INCH FRP CONTAINMENT
240 GPM PUMPS
CASE 7
ATTACHMENT 10-1

PIPELINE COSTS TO [illegible] GEN FAC   6 INCH C.S. PIPE [illegible] INCH FRP CONTAINMENT
FUEL RATE BASED ON [illegible] RUN   [illegible] GPM PUMPS

Year No. A	Year B	C	D	E	F	G	H	I	J	L	M	N	O	P	Q	R	S	T	U	V	W	Y
1	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	11,117	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

FILE: [illegible]

6 INCH C.S. PIPE [illegible] INCH FRP CONTAINMENT
[illegible] GPM PUMPS
CASE 7
ATTACHMENT [illegible]

PIPELINE COSTS TO [illegible] GEN FAC   6 INCH C.S. PIPE [illegible] INCH FRP CONTAINMENT
FUEL RATE BASED ON [illegible] RUN   [illegible] GPM PUMPS

Year No. A	Year B	C	D	E	F	G	H	I	J	L	M	N	O	P	Q	R	S	T	U	V	W	Y
1	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	11,117	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

FILE: [illegible]

6 INCH C.S. PIPE [illegible] INCH FRP CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT [illegible]

PIPELINE COSTS TO WAENA GEN FAC
FUEL RATE BASED ON HECO GENPPS RUN

8 INCH C.S. PIPE /12 INCH FRP CONTAINMENT
387 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/year) P	Required Manhours for Pipeline Operation (mh/yr) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	2004
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kWh 1997	[illegible]
Power cost $/kWh 2004	[illegible]
O&M Labor Rate $/hr 2004	$40.27

FILE: [illegible]

8 INCH C.S. PIPE /12 INCH FRP CONTAINMENT
387 GPM PUMPS
CASE 6
ATTACHMENT 13-2

BCSFC2
[illegible]
[illegible]

PIPELINE COSTS TO WAENA GEN FAC
FUEL RATE BASED ON HECO GENPPS RUN

8 INCH C.S. PIPE /12 INCH FRP CONTAINMENT
410 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/year) P	Required Manhours for Pipeline Operation (mh/yr) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kWh 1997	[illegible]
Power cost $/kWh 2004	[illegible]
O&M Labor Rate $/hr 2004	[illegible]

FILE: [illegible]

8 INCH C.S. PIPE /12 INCH FRP CONTAINMENT
410 GPM PUMPS
CASE 6
ATTACHMENT 13-3

BCSFC2
[illegible]
[illegible]

PIPELINE COSTS TO WAENA GEN. FAC. — 6 INCH C.S. PIPE /12 INCH FRP CONTAINMENT
FUEL RATE BASED ON HECO GENPPS RUN — 614 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
[illegible]																						

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/MWh 1997 [illegible]
Power cost $/MWh 2004 [illegible]
O&M Labor Rate $/hr 2004 [illegible]

FILE: [illegible]

6 INCH C.S. PIPE /12 INCH FRP CONTAINMENT
614 GPM PUMPS
CASE [illegible]
ATTACHMENT [illegible]

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC. — 10 INCH C.S. PIPE /16 INCH FRP CONTAINMENT
FUEL RATE BASED ON HECO GENPPS RUN — [illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
[illegible]																						

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/MWh 1997 [illegible]
Power cost $/MWh 2004 [illegible]
O&M Labor Rate $/hr 2004 [illegible]

FILE: [illegible]

10 INCH C.S. PIPE /16 INCH FRP CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT [illegible]

[illegible]

PIPELINE COSTS TO WAIMEA GEN. FAC
FUEL RATE BASED ON HECO BENPPS RUN

16 INCH C.S. PIPE /14 INCH FRP CONTAINMENT
307 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($00) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($00) I	Accumulated Present Worth of RR For Capital ($00) J	TOTAL MAINTENANCE COSTS ($00) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/year) P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($00) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($00) T	Present Worth Factor U	Present Worth of RR For O&M ($00) V	Accumulated Present Worth of RR For O&M ($00) W	TOTAL (CAPITAL + O&M) ($00) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kWh [illegible]
Power cost $/kWh [illegible]
O&M Labor Rate $/hr [illegible]

FILE: [illegible]

16 INCH C.S. PIPE /14 INCH FRP CONTAINMENT
307 GPM PUMPS
CASE 5
ATTACHMENT 14-2

[illegible]

PIPELINE COSTS TO WAIMEA GEN. FAC
FUEL RATE BASED ON HECO BENPPS RUN

16 INCH C.S. PIPE /14 INCH FRP CONTAINMENT
410 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($00) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($00) I	Accumulated Present Worth of RR For Capital ($00) J	TOTAL MAINTENANCE COSTS ($00) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/year) P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($00) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($00) T	Present Worth Factor U	Present Worth of RR For O&M ($00) V	Accumulated Present Worth of RR For O&M ($00) W	TOTAL (CAPITAL + O&M) ($00) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kWh [illegible]
Power cost $/kWh [illegible]
O&M Labor Rate $/hr [illegible]

FILE: [illegible]

16 INCH C.S. PIPE /14 INCH FRP CONTAINMENT
410 GPM PUMPS
CASE 6
ATTACHMENT 14-3

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC. — 16 INCH C.S. PIPE /14 INCH FRP CONTAINMENT
FUEL RATE BASED ON HECO GENPPS RUN — 614 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($00) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($00) I	Accumulated Present Worth of RR For Capital ($00) J	TOTAL MAINTENANCE COSTS ($00) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/man) P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($00) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($00) T	Present Worth Factor U	Present Worth of RR For O&M ($00) V	Accumulated Present Worth of RR For O&M ($00) W	TOTAL (CAPITAL + O&M) ($00) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kWh [illegible]
Power cost $/kWh [illegible]
O&M Labor Rate $/hr [illegible]

FILE: [illegible]

16 INCH C.S. PIPE /14 INCH FRP CONTAINMENT
614 GPM PUMPS
CASE 8
ATTACHMENT 14-4

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC. — 16 INCH C.S. PIPE /14 INCH FRP CONTAINMENT
FUEL RATE BASED ON HECO GENPPS RUN — 1250 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($00) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($00) I	Accumulated Present Worth of RR For Capital ($00) J	TOTAL MAINTENANCE COSTS ($00) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/man) P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($00) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($00) T	Present Worth Factor U	Present Worth of RR For O&M ($00) V	Accumulated Present Worth of RR For O&M ($00) W	TOTAL (CAPITAL + O&M) ($00) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kWh [illegible]
Power cost $/kWh [illegible]
O&M Labor Rate $/hr [illegible]

FILE: [illegible]

16 INCH C.S. PIPE /14 INCH FRP CONTAINMENT
1250 GPM PUMPS
CASE 9
ATTACHMENT 14-5

[illegible]

PIPELINE COSTS TO [illegible]
FUEL RATE BASED ON [illegible]

[illegible] INCH FRP PIPE [illegible] INCH FRP CONTAINMENT
[illegible] GPM PUMPS

Year	Year	Annual Fuel Handling Requirements	Daily Pumping Time	Capital Cost	Revenue Requirement Factor for Capital	Revenue Requirement For Capital	Present Worth Factor	Present Worth of RR For Capital	Accumulated Present Worth of RR For Capital	TOTAL MAINTENANCE COSTS	Energy Cost to Pump Fuel	% Unit Cost Increase Over Previous Year	O&M Escalation Factor	Maintenance Operator Cost	Required Manhours for Pipeline Operation	TOTAL OPERATING COSTS	Revenue Requirement Factor For O&M	Revenue Requirement For O&M	Present Worth Factor	Present Worth of RR For O&M	Accumulated Present Worth of RR For O&M	TOTAL (CAPITAL + O&M)
A	B	C	D	E	F	G	H	I	J	L	M	N	O	P	Q	R	S	T	U	V	W	Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

[illegible]

FILE [illegible]

[illegible] INCH FRP PIPE [illegible] INCH FRP CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT [illegible]

PIPELINE COSTS TO [illegible]
FUEL RATE BASED ON [illegible]

[illegible] INCH FRP PIPE [illegible] INCH FRP CONTAINMENT
[illegible] GPM PUMPS

Year	Year	Annual Fuel Handling Requirements	Daily Pumping Time	Capital Cost	Revenue Requirement Factor for Capital	Revenue Requirement For Capital	Present Worth Factor	Present Worth of RR For Capital	Accumulated Present Worth of RR For Capital	TOTAL MAINTENANCE COSTS	Energy Cost to Pump Fuel	% Unit Cost Increase Over Previous Year	O&M Escalation Factor	Maintenance Operator Cost	Required Manhours for Pipeline Operation	TOTAL OPERATING COSTS	Revenue Requirement Factor For O&M	Revenue Requirement For O&M	Present Worth Factor	Present Worth of RR For O&M	Accumulated Present Worth of RR For O&M	TOTAL (CAPITAL + O&M)
A	B	C	D	E	F	G	H	I	J	L	M	N	O	P	Q	R	S	T	U	V	W	Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

[illegible]

FILE [illegible]

[illegible] INCH FRP PIPE [illegible] INCH FRP CONTAINMENT
[illegible] GPM PUMPS
CASE [illegible]
ATTACHMENT [illegible]

PIPELINE COSTS TO WAIAU GEN. FAC
FUEL RATE BASED ON HECO GENPPS RUN

8 INCH FRP PIPE /12 INCH FRP CONTAINMENT
610 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hr) P	Required Manhours for Pipeline Operation (mhrs) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kW-hr [illegible]
Power cost $/kW-hr [illegible]
O&M Labor Rate $/hr [illegible]

FILE: [illegible]

8 INCH FRP PIPE /12 INCH FRP CONTAINMENT
610 GPM PUMPS
CASE 16
ATTACHMENT 16-3

[illegible]

PIPELINE COSTS TO WAIAU GEN. FAC
FUEL RATE BASED ON HECO GENPPS RUN

8 INCH FRP PIPE /12 INCH FRP CONTAINMENT
610 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost ($/hr) P	Required Manhours for Pipeline Operation (mhrs) Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	0	0.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
15	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
16	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
17	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
26	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
30	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study [illegible]
First Operational year [illegible]
Levelized after tax rate of return [illegible]
O&M escalation rate [illegible]
Revenue requirement for O&M [illegible]
Power cost $/kW-hr [illegible]
Power cost $/kW-hr [illegible]
O&M Labor Rate $/hr [illegible]

FILE: [illegible]

8 INCH FRP PIPE /12 INCH FRP CONTAINMENT
610 GPM PUMPS
CASE 16
ATTACHMENT 16-4

[illegible]

PIPELINE COSTS TO WAIMEA GEN. FAC.
FUEL RATE BASED ON HECO GENPPS RUN

16 INCH FRP PIPE /24 INCH FRP CONTAINMENT
[illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M T	Present Worth Factor U	Present Worth of RR For O&M V	Accumulated Present Worth of RR For O&M W	TOTAL (CAPITAL + O&M) ($000) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	2004
First Operational year	2004
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kWh [illegible]	[illegible]
Power cost $/kWh 2004	[illegible]
O&M Labor Rate $/hr 2004	[illegible]

FILE AJC1110[illegible]

16 INCH FRP PIPE /24 INCH FRP CONTAINMENT
[illegible] GPM PUMPS
CASE 11
ATTACHMENT 16-1

PIPELINE COSTS TO WAIMEA GEN. FAC.
FUEL RATE BASED ON HECO GENPPS RUN

16 INCH FRP PIPE /24 INCH FRP CONTAINMENT
[illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M T	Present Worth Factor U	Present Worth of RR For O&M V	Accumulated Present Worth of RR For O&M W	TOTAL (CAPITAL + O&M) ($000) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	2004
First Operational year	2004
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kWh [illegible]	[illegible]
Power cost $/kWh 2004	[illegible]
O&M Labor Rate $/hr 2004	[illegible]

FILE AJC1110[illegible]

16 INCH FRP PIPE /24 INCH FRP CONTAINMENT
[illegible] GPM PUMPS
CASE 11
ATTACHMENT 16-2

PIPELINE COSTS TO WAENA GEN. FAC. [illegible]
FUEL RATE BASED ON HECO [illegible] RUN

16 INCH FRP PIPE /14 INCH FRP CONTAINMENT
410 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time (Hours) D	Capital Cost E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital I	Accumulated Present Worth of RR For Capital J	TOTAL MAINTENANCE COSTS L	Energy Cost in Pump Fuel M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M T	Present Worth Factor U	Present Worth of RR For O&M V	Accumulated Present Worth of RR For O&M W	TOTAL (CAPITAL + O&M) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/KW-hr [illegible]	[illegible]
Power cost $/KW-hr [illegible]	[illegible]
O&M Labor Rate $/hr [illegible]	[illegible]

FILE AJC11[illegible]

16 INCH FRP PIPE /14 INCH FRP CONTAINMENT
410 GPM PUMPS
CASE 11
ATTACHMENT 16-3

[illegible]

PIPELINE COSTS TO WAENA GEN. FAC. [illegible]
FUEL RATE BASED ON HECO [illegible] RUN

16 INCH FRP PIPE /14 INCH FRP CONTAINMENT
[illegible] GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements C	Daily Pumping Time (Hours) D	Capital Cost E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital I	Accumulated Present Worth of RR For Capital J	TOTAL MAINTENANCE COSTS L	Energy Cost in Pump Fuel M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manhours for Pipeline Operation Q	TOTAL OPERATING COSTS R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M T	Present Worth Factor U	Present Worth of RR For O&M V	Accumulated Present Worth of RR For O&M W	TOTAL (CAPITAL + O&M) Y
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax rate of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/KW-hr [illegible]	[illegible]
Power cost $/KW-hr [illegible]	[illegible]
O&M Labor Rate $/hr [illegible]	[illegible]

FILE AJC11[illegible]

16 INCH FRP PIPE /14 INCH FRP CONTAINMENT
[illegible] GPM PUMPS
CASE 11
ATTACHMENT 16-4

[illegible]

PIPELINE COSTS TO WAIPAHU GEN FAC
FUEL RATE BASED ON HECO [illegible] RUN

16 INCH FRP PIPE /14 INCH FRP CONTAINMENT
1200 GPM PUMPS

Year No. A	Year B	Annual Fuel Handling Requirements (bbls) C	Daily Pumping Time (Hours) D	Capital Cost ($000) E	Revenue Requirement Factor For Capital F	Revenue Requirement For Capital G	Present Worth Factor H	Present Worth of RR For Capital ($000) I	Accumulated Present Worth of RR For Capital ($000) J	TOTAL MAINTENANCE COSTS ($000) L	Energy Cost to Pump Fuel ($/yr) M	% Unit Cost Increase Over Previous Year N	O&M Escalation Factor O	Maintenance Operator Cost P	Required Manpower for Pipeline Operation Q	TOTAL OPERATING COSTS ($000) R	Revenue Requirement Factor For O&M S	Revenue Requirement For O&M ($000) T	Present Worth Factor U	Present Worth of RR For O&M ($000) V	Accumulated Present Worth of RR For O&M ($000) W	TOTAL (CAPITAL + O&M) ($000) Y
1	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
6	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
7	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
8	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
9	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
11	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
12	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
13	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
14	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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17	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
18	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
19	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
21	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
22	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
23	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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26	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
27	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
28	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
29	[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

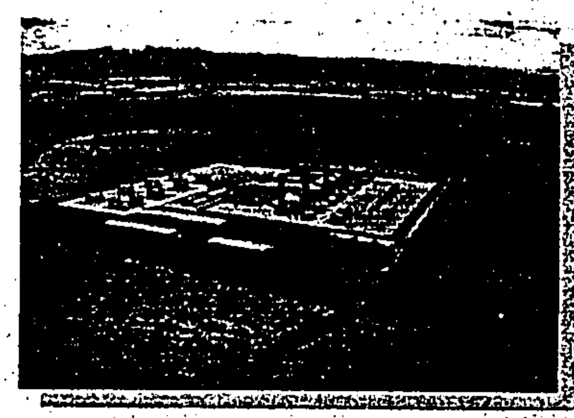
TOTAL PRESENT WORTH [illegible]

Assumptions

Present Worth year for study	[illegible]
First Operational year	[illegible]
Levelized after tax cost of return	[illegible]
O&M escalation rate	[illegible]
Revenue requirement for O&M	[illegible]
Power cost $/kWh [illegible]	[illegible]
Power cost $/kWh [illegible]	[illegible]
O&M Labor Rate $/hr [illegible]	[illegible]

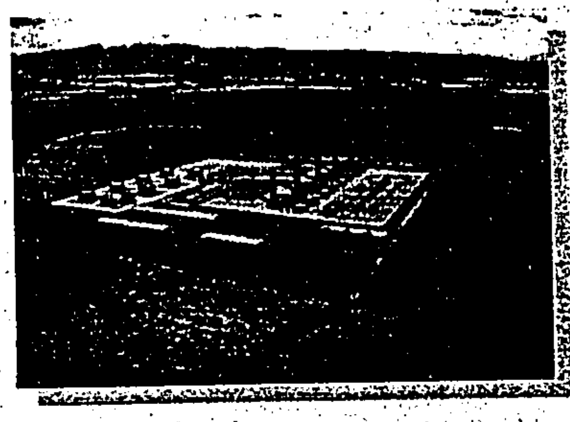
FILE [illegible]

16 INCH FRP PIPE /14 INCH FRP CONTAINMENT
1200 GPM PUMPS
CASE 11
ATTACHMENT 14-[illegible]



APPENDIX B

SUMMARIES FROM SITE SELECTION STUDIES



APPENDIX B1

1994 CENTRAL MAUI SITING STUDY

MECO Central Maui Siting Study

Belt Collins Hawaii
June 1994

EXECUTIVE SUMMARY

The Maui Electric Company (MECO) must install additional generating units over the coming decades to meet the forecast demand for electrical power. Space limitations and other factors prevent MECO from accomplishing this by simply expanding its existing power plants. Consequently, the company is searching for a new site at which it can install up to 232 megawatts (MW) of additional generating capacity. For the purposes of this analysis it is assumed that the additional capacity will be in the form of four oil-fired, dual train combined-cycle generating units as called for in MECO's approved generation expansion plan.

Air quality issues constitute a major area of environmental concern for power plant development; they also strongly influence the design, construction, and operating costs of power plants. Because of this, MECO commissioned Trinity Consultants, Incorporated, to identify the areas in Central Maui which possess the most favorable conditions for complying with State and Federal air quality regulations. (Central Maui was specified because a previous study indicated it was the most appropriate location.) It identified a broad area along the lower slopes of Haleakala as most promising from an air quality viewpoint.

This report is intended as a companion to Trinity Consultants' analysis. It:

- identifies numerous non-air quality factors relevant to the siting of a new generating facility within the zones deemed favorable from an air quality viewpoint;
- combines general information on these factors with the results of air quality analyses to identify possible sites;
- evaluates the identified sites using specific environmental and engineering suitability criteria; and
- integrates the results of these evaluations with other information to identify the sites which are most promising for construction of a new power plant.

Factors considered in the evaluation include air quality, land ownership, existing land use, land use controls and adjacent uses, topography, soils, groundwater availability, wastewater disposal, flooding and drainage characteristics, noise, flora and fauna, aesthetics, subsurface conditions, transmission system requirements, fuel delivery distance, and road improvement costs. Data relating to each of these factors were collected and mapped. This information was used in conjunction with explicit site selection criteria to identify zones which are most favorable for power plant development.

Ten 50-acre sites (the minimum area needed for a 232 MW facility) were identified within these zones. These sites represented the full range of conditions present. After additional screening, six of the ten were selected as "finalist" sites and were analyzed further. The other four sites were eliminated from consideration because they were either so similar to one of the six chosen as finalists that separate analyses would not have been meaningful or were clearly inferior to those six. The locations of the finalist sites are shown on Figure ES-1.

DOCUMENTS CAPTURED AS RECEIVED

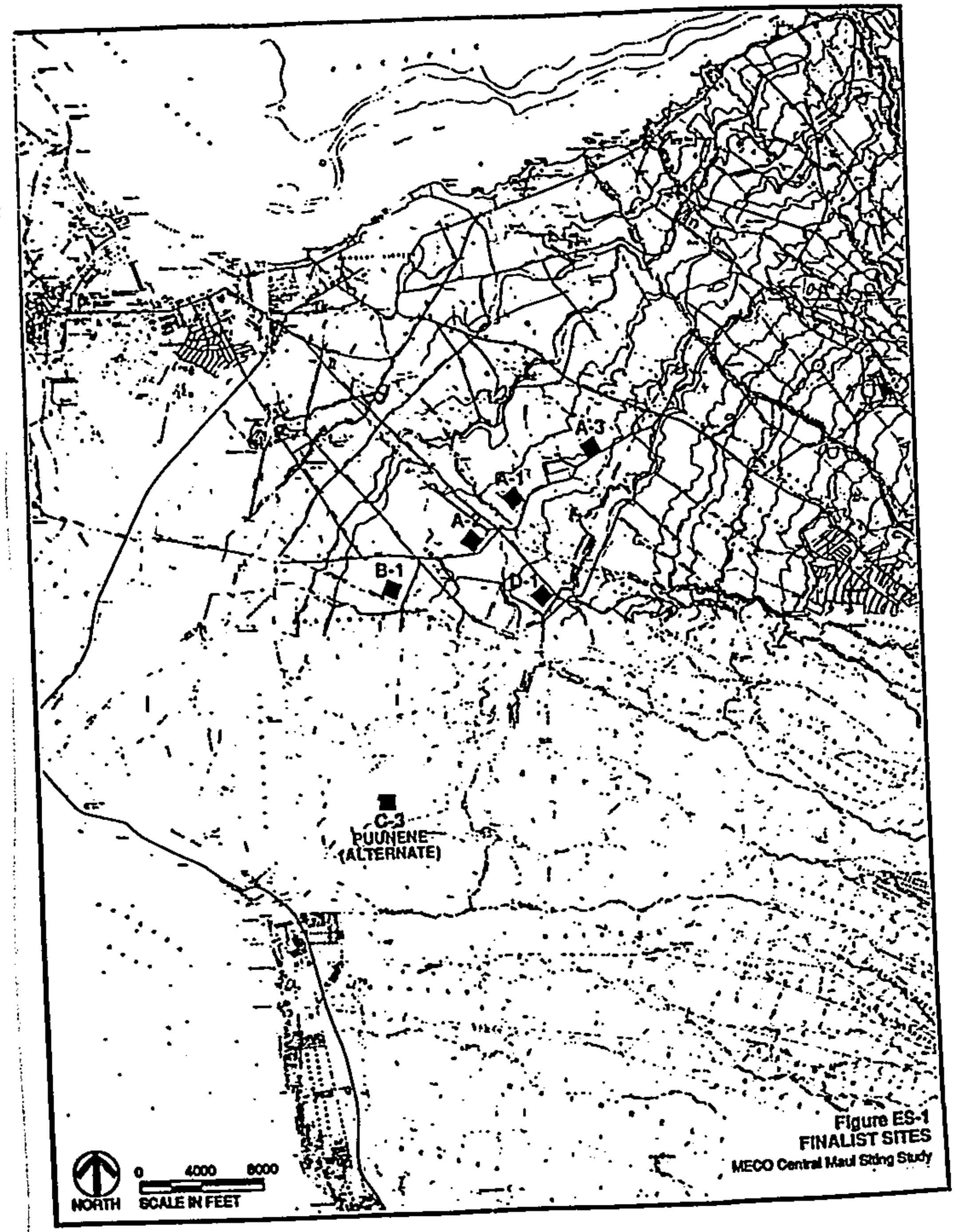


Figure ES-1
FINALIST SITES
MECO Central Maui Siting Study

The suitability of each of the six finalist sites for power plant development was then evaluated. The rating involved two components. The first is a score for each of the sixteen factors listed above. The second component of the rating system represents the importance (or weight) attached to each factor. This reflects the fact that some parameters (such as air quality) are inherently more important than others (e.g., electrical power transmission system improvement costs) in making power plant siting judgements.

Results of the analysis showed that Site A-1, which is located on the northeast side of Kailainui Gulch near the County Landfill) is the most favorable site for power plant development. Site A-2, which is located about 0.4 mile southwest of Site A-1, and Site D-1, which is situated along Pulehu Road approximately one mile to the south, scored nearly as well. They received 94.7% and 93.0% of A-1's score, respectively. The closeness of the scores among the top three sites suggests that the proposed generating facilities might reasonably be developed on any one of them.

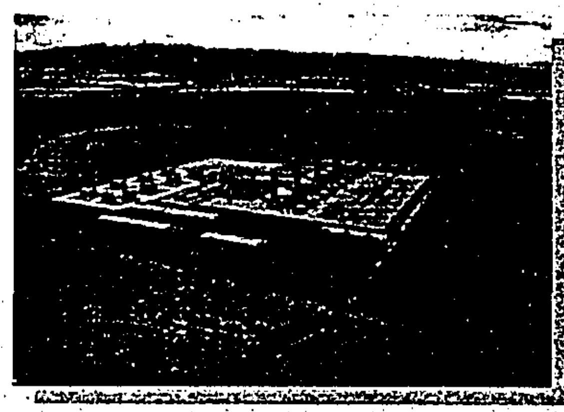
Sites B-1 and C-3, which both received 74.9% of A-1's score, are the best of the three lower-rated sites. Air quality is by far their most significant deficiency; if this problem could be eliminated through appropriate mitigation, their scores would be much closer to those of the higer-rated three top-rated sites. Site A-3 scored 67.4%; it appears to be far less suitable for power plant development than the top-rated sites. A low air quality score plays a significant role in this, but it is relatively low-rated in other factors as well.

Both the weights attributed to each parameter and the scores assigned that parameter involved numerous qualitative judgements. Because of this, alternative weighting schemes were tested to determine the extent to which using them instead of the primary weighting scheme (which was based on the best judgements of the authors of this report) might alter the site rankings. The results of this sensitivity analysis showed that the site rankings are relatively insensitive to changes in the weights that are assigned the various parameters. This tends to confirm the reasonableness of the ranking described above.

Based on the results of the study and discussions with the State Department of Health, MECO identified the region around Sites A-1/A-2/D-1 as its primary area of interest. In the fall of 1993 A&B-Hawaii gave MECO permission to erect a meteorological monitoring tower on Site D-1, and a monitoring station was put into operation at that location in January 1994. The data from it will be used to model the air quality impacts of power plant development at all three sites in this region. While Site C-3 had a relatively low air quality rating in the initial screening, it is the only site which is not presently being used for sugarcane cultivation. Because of this and the landowner's interest in making this site available to MECO, a meteorological monitoring station was established at it as well; it will provide the data needed for more detailed analyses of the ability of a facility at this location to obtain the needed air permits. However, even if it does prove suitable from an air quality standpoint, Site C-3's rating on other factors means that it would probably not be MECO's first choice for the planned generation facilities.

Once a full year of meteorological data is available from the two monitoring stations, the air quality effects of the proposed facilities will be modeled. The results of this modeling will be used to further evaluate the feasibility of power plant construction in the A-1/A-2/D-1 region and at C-3. This final analysis will address the ambient concentrations that can be anticipated, the relationship of these to applicable ambient air quality standards, and the implications that this has for permitting difficulty and the cost of the required pollution control measures.

Several activities that will need to be undertaken in conjunction with the meteorological data collection to assist MECO in making a final site selection. Subjects to be explored include the possible integration with the existing irrigation system (A&B Hawaii); the appropriateness of making minor adjustments in the site boundaries to increase their compatibility with existing land uses on and around the sites (A&B Hawaii); the best access road design and right-of-way (A&B Hawaii/HC&S, Maui County, and the Highways Division of the State Department of Transportation); the best transmission system alignments (MECO); and the timing and scope of walk-through surveys of the most promising sites by qualified biologists and archaeologists to confirm that no unanticipated resources are present.



APPENDIX B2

1995 CENTRAL MAUI SITING STUDY

FINAL

Environmental Screening and Siting Report

for the

Central Maui Generation Project

prepared for:

Maui Electric Company, Limited

prepared by

Dames & Moore

April 8, 1995

EXECUTIVE SUMMARY

Maui Electric Company, Limited (MECO) proposes to design, construct, and operate a nominal 232 megawatt (MW) electrical generation facility. A series of siting studies have been conducted which served to identify the most suitable areas of Maui for such a facility. Results of these studies indicate the Central Maui region has most desirable combination of characteristics for a new generation plant. Previous studies have narrowed the range of acceptable candidate sites to four: A1, A2, D1, and C3. One site, C3, already underwent an environmental screening evaluation. The current Environmental Screening and Siting Study (ESSS) evaluates the remaining three candidate sites.

The current study evaluates Sites A1, A2, and D1 for the following for nine environmental issue areas, identified by MECO as important to their site selection process, and also generally regarded as critical issues to be evaluated in the siting of industrial facilities:

- groundwater
- wildlife
- hazardous materials/waste
- surface water
- archaeology
- natural hazards
- plants
- traffic
- noise

Air quality is an important environmental issue which will influence the site selection process. The results of current air modelling efforts, not available for inclusion to this study, will be incorporated into the site selection process as these results are available.

The nine appendices to this document are memo reports, one for each environmental issue area, which characterize each candidate site, and comparatively evaluate the three sites relative to environmental issue areas. In addition, this study investigates issues related to adjacent land uses which could affect the siting process. Finally, in order to provide a comprehensive and intelligible document with which to evaluate the three candidate sites, and in order to leverage existing studies to the extent possible, the current study incorporates, as appropriate, relevant findings of the most recent past siting evaluation. The current study first evaluates candidate sites for fatal flaws, then comparatively evaluates viable candidate sites (i.e., those not fatally flawed) on the basis of environmental issues.

Results indicate that none of the three candidate sites is fatally flawed. Of the three viable candidate sites evaluated during the current study, Site A2 is the least environmentally constrained and the most preferred location for the proposed project, followed by Site A1, then Site D1.

A comparative evaluation of all four remaining candidate sites including Site C3, or alternatively of Site A2 and Site C3, has not been conducted to date, and is recommended. It is also recommended the most current air quality information be incorporated into future comparative evaluations as that information is made available.

1.0 INTRODUCTION

This introduction provides information regarding the purpose of the current ESSS, a description of the proposed action and facilities requirements, a description of candidate sites evaluated during the current study, and a brief history of the site selection process to date.

1.1 PURPOSE OF THE ENVIRONMENTAL SCREENING/SITING STUDY (ESSS)

The primary purpose of this ESSS is to assist Maui Electric Company, Limited (MECO) to select a preferred site for a proposed nominal 232 MW electrical power generation facility. More specifically, this exercise provides a comparative analysis of three candidate sites relative to environmental issue areas identified as important to MECO's site selection decision-making process. Candidate sites assessed in this study are A1, A2, and D1; the general project area as well as the location of each project site are shown on Figures 1-1 and 1-2, following the text and tables of this report. After the most preferred of the three candidate sites is identified, an additional comparative analysis will be conducted between that site and a candidate site located near Kihei, Site C3. The results of that comparative assessment will identify the final preferred site.

In order to achieve the intended purpose of this study, results of the current analysis should be synthesized with results of ongoing air quality studies to provide adequate information for all environmental site selection factors.

1.2 PROJECT DESCRIPTION

Maui Electric Company, Limited proposes to design, construct, and operate a nominal 232 MW electrical generation facility. The need for this proposed project is established by the *MECO Generating Unit Type and Size Study* (Hawaiian Electric Company, Inc. (HECO), 1990). In addition, MECO intends to relocate its transmission and distribution (T&D) base yard from its current location in Kahului to the selected site. Therefore, the project will comprise both production and T&D facilities. Initial planning indicates a site requirement of approximately 50 acres for the proposed facility.

Major elements of the proposed project include the following:

Generation/transmission

- four diesel oil-fired nominal 58 MW dual-train combined cycle units, exhausted to two Good Engineering Practice (GEP) four-flue stacks
- four steam turbines
- four air-cooled condensers

- four control houses
- a control room, including control equipment, offices, file room, kitchen, rest rooms, showers, lockers, and meeting room
- supply wells
- water treatment facility
- wastewater treatment facility
- evaporation ponds, approximately four acres
- injection wells
- water and air laboratory
- maintenance shop, including offices, showers, lockers, rest rooms, 10-ton overhead crane, compressor, welding area, machinist area, automotive/electric cart area, steam clean area, sand blasting shed, lunch room, parts storage area, and electronic maintenance room
- warehouse, including offices, rest room, storage room, racks, bins, and one elevated loading dock
- relay building
- switch yard, approximately 350 by 200 feet

Fuel

- 8.63 million gallons (MG) of fuel storage in seven 70-foot diameter by 40-foot high and two 50-foot by 40-foot tanks
- fuel unloading area

Administration

- one building, including offices, conference/training room, computer room, lunch room, rest rooms, file rooms, and lobby/reception area

T&D

- warehouse, including offices, training/conference room, lunch room, file room, staging assembly area, parts storage, shop, truck wash area, showers, lockers, rest rooms
- approximately five acres of outdoor storage
- 80 parking stalls for company vehicles
- gasoline storage area

1.3 DESCRIPTION OF CANDIDATE SITES

The current study evaluates three candidate sites, which were identified in prior studies as worthy of additional evaluation. These sites are portrayed on Figure 1-2, following the text and tables of this document.

Site A1 is generally located north of Upper Division Road, approximately 2000 feet east of Pulehu Road, and east of Kalialinui Gulch. Site A1 is approximately 2000 feet southeast of the Central Maui Landfill. Site A1 is a portion of TMK 3-8-03:4, a 2606-acre parcel owned by Alexander and Baldwin, Inc. (A&B-Hawaii), with a leasehold interest by Ameron Honolulu Construction & Dray (HC&D). Ameron operates a quarry on a portion of the parcel, and A&B's subsidiary, HC&S, cultivates sugar cane on the remainder. An "out parcel," formerly the original Ameron quarry site, is now the Central Maui Landfill, operated by the County of Maui; the County is currently proceeding with development of Phases 4, 5, and 6 of the landfill which will be located between Pulehu Road and Kalialinui Gulch. In addition, a waste incinerator is currently being evaluated for the site.

Site A2 is generally located north of Waikapu Road, approximately 1500 feet west of Pulehu Road, and 0.4 mile southwest of Site A1. Site A2 is a portion of TMK 3-8-03:1, a 1071-acre parcel owned by A&B. The site is currently cultivated in sugarcane by HC&S.

Site D1 is located at the northwest quadrant of Pulehu Road and Lowrie Ditch Road, and 1.0 mile south of Site A1. Site D1 is a portion of TMK 3-8-03:2, a 1539-acre parcel owned by A&B. A meteorological station is located on this site, which is accumulating data representative of the three candidate sites. The site is currently cultivated in sugarcane by HC&S.

1.4 BACKGROUND OF PROJECT SITING EFFORTS

The current study builds upon and is the latest addition to a body of work intended to assist development of the proposed project. In addition, ongoing air analyses will add to the existing knowledge base utilized for site selection.

Several siting studies and site assessments have been accomplished to date, each adding an additional level of information to the site selection process, and each affecting the range of candidate sites under consideration. In addition, landowner preferences have resulted in revision of the range of candidate sites under consideration.

1989
An island-wide site selection study was conducted by Stone & Webster in February, 1989. This study assessed ten candidate sites. Of these, three were identified as viable candidate sites for accommodating new generation units: Kahului Power Plant, Puunene HC&S Mill, and Maalaea Power Plant.

1991
A generating facility siting study conducted by Black & Veatch in 1991 identified central Maui as the most appropriate location for a new, stand-alone (not a unit addition to an existing production unit) electrical generation facility. The *Candidate Sites Report and Preferred and Alternate Site/Technology Report* (Black & Veatch, 1991a, b) identified the preferred site as the "Quarry Site," in the general vicinity of Site A1 of the current study, and the alternate site as the "Puunene Airport Site," not assessed in the current study.

1992
Further evaluation of the preferred Quarry and alternate Puunene Airport sites by MECO as well as by the landowner and its subsidiary, A&B-Hawaii and HC&S, respectively, resulted in identification of concerns regarding both sites. In light of these concerns, A&B-Hawaii offered a new land parcel for evaluation and possible purchase by MECO, Site C3. Site C3 is located approximately two miles southeast of the alternate Puunene Airport Site identified in the 1991 Black & Veatch study.

In December, 1992 Belt Collins & Associates conducted an environmental screening of Site C3, comprising four investigations: botany, wildlife, acoustics, and archaeology. The purpose of the environmental screening was to identify potential environmental "fatal flaws" of the site. None were identified, and Site C3 remained a viable candidate site for consideration, and for further environmental evaluation.

1993
Further site evaluations were accomplished in 1993. Belt Collins Hawaii conducted a Phase I Preliminary Site Assessment (PSA, also known as a Phase I Environmental Site Assessment, or ESA) of Site C3, which concluded that no observable evidence exists to indicate the presence of hazardous substances in site soil or groundwater. (Belt Collins, 1993)

Tom Nance Water Resources Engineering assessed groundwater supply and disposal issues for Site C3. This assessment did not identify any substantial groundwater concerns associated with Site C3. (Tom Nance, 1993)

Trinity Consultants, Inc. utilized estimated project emission data in conjunction with known permitted uses to assess effects and permitting issues associated with siting the proposed project within the Central Maui region. This analysis identified areas of moderate, higher, and highest difficulty of air permitting for the proposed project. No areas within Central Maui were found to have a low level of permitting difficulty. (Trinity Consultants, 1993)

1994
Information from previous studies was used by Belt Collins Hawaii to identify ten candidate sites within the Central Maui region potentially suitable for evaluation. Of the ten candidate sites, six were determined to be viable, and were evaluated for a variety of environmental factors. The 1994 *MECO Central Maui Siting Study* identified Sites A1, A2, and D1, in rank order, as most preferred. At 74.9 percent, the normalized score of Site C3 placed it substantially below that of Site A1 (normalized score of 100). (Belt Collins Hawaii, 1994)

Also during 1994, meteorological towers were placed at two locations to collect ambient data. One station is located on Site C3; another is located on Site D1 at the northwest quadrant of Lowrie Ditch and Pulehu Road, and is representative of Sites A1, A2, and D1.

1995
The current study was initiated in January, 1995. The intent of the study is to evaluate the three preferred sites identified in the 1994 *MECO Central Maui Siting Study*–A1, A2, and D1–for environmental factors important to MECO, and to evaluate the sites to a level of detail similar to the evaluation of Site C3 by Belt Collins and their subconsultants in 1992 and 1993. The current study incorporates findings of the 1994 *Central Maui Siting Study* without change, as appropriate, or refines and incorporates findings of that study as appropriate.

The study team for this ESSS effort includes the following firms and subconsultants:

- Dames & Moore
- Char & Associates
- Dr. A. Chiu, et al.
- Cultural Surveys Hawaii
- T.J. Ohashi

2.0 METHODS OF THE CURRENT STUDY

This section described steps taken and methods used in the current study to evaluate and comparatively rank candidate sites A1, A2, and D1. General study steps taken in approximate chronological order are as follows:

- Develop conceptual boundaries
- Develop data factors and evaluation criteria
- Obtain and review existing information
- Conduct baseline inventories and develop discipline reports
- Rank sites/develop screening report

2.1 CONCEPTUAL BOUNDARIES

Hawaiian Electric Company, Inc. (HECO) Engineers developed a conceptual layout for a nominal 232 MW generation facility, which will fit within a typical, generally square, 50-acre site. After reviewing the area of the Central Maui region in the vicinity of Sites A1, A2, and D1, HECO and Dames & Moore personnel identified three 50-acre sites which could be appropriate for development of the proposed project. The three candidate sites are either coterminous with or near the original location of the three candidate sites as described in the 1994 *Central Maui Siting Study*. Major factors considered in the development of these conceptual boundaries included proximity to previous boundaries for the three sites, proximity to existing roadways, and minimizing effects to agricultural operations. These three sites are shown on Figure 1-2.

2.2 ENVIRONMENTAL ISSUE AREAS, DATA FACTORS, AND EVALUATION CRITERIA

For purposes of this ESSS, the following definitions are utilized:

- *Environmental issue areas* are broad areas of concern or interest in the siting of a proposed facility (e.g., groundwater).
- *Data factors* are subsets of environmental issue areas that represent specific interest areas related to the more broad issue areas. For example, for the issue area of groundwater, supply availability and disposal options would be two of several data factors. If no subset of an environmental issue area exists, the issue area itself is considered a data factor.
- *Evaluation criteria* are those specific elements used to measure the suitability of a candidate site in relation to any data factor. For example, groundwater supply availability at a specific candidate site can be measured as a function of depth to groundwater, cost to construct supply wells, well capacity/yield, etc.

A summary of environmental issue areas, data factors, assigned weights, and evaluation criteria is presented in Table 2-1, following the text of this document; detailed descriptions of all data factors and weights are provided in Section 3.

Maui Electric Company, Limited recommended nine general environmental issue areas be investigated for each candidate under the current ESSS. Candidate sites were either not evaluated for these issue areas during previous studies, or are subject to more in-depth investigation of these issue areas under the current ESSS. The nine environmental issue areas are as follows:

- groundwater
- wildlife
- hazardous materials/waste
- surface water
- archaeology
- natural hazards
- plants
- traffic
- noise

In addition, Dames & Moore felt a review of certain land use issues related to adjacent sites and proposed regional projects would assist the site selection process, and added that issue to the original list of nine.

Specific data factors were identified by Dames & Moore. The data factors were assigned weights indicative of the importance of a particular data factor to the site selection process, with one being least and five most important. These data factors and their weights were reviewed and accepted by MECO as the basis for the current study.

2.3 DATA REVIEW

Project team members identified existing published data, documents, mapping, aerial photographs, and regulations which could provide key information regarding existing and reasonably expected future conditions of the three candidate sites or their surrounding areas which could affect any site's suitability for the proposed generation facility. Existing information was obtained from a wide variety of sources; MECO-supplied information included a long-range generation study, siting studies, site evaluations, project description information, and conceptual mapping. The reference section of this document contains a complete listing of materials reviewed for the current ESSS.

Each Dames & Moore team member reviewed information appropriate for the environmental issue area (or "environmental discipline") they were assigned, and identified additional informational requirements necessary to the thorough characterization of candidate sites and their surrounding setting.

2.4 BASELINE INVENTORIES/DISCIPLINE REPORTS

A baseline inventory includes collection of information regarding existing and, in some cases, reasonably expected future conditions of a specific area, as well as the presentation of that information in written, and if appropriate, graphical format. Each Dames & Moore project team member determined if a field reconnaissance or survey would be required to develop primary or verify existing information regarding data factors for their environmental issue area/discipline.

For their environmental issue area/discipline, each key team member developed a memo-format discipline report which describes results of their baseline inventory, and which characterizes existing and reasonably anticipated conditions of Sites A1, A2, and D1. These discipline reports follow the text, tables, and figures of this report, and generally contain the following information, as appropriate:

- relevant regulations and jurisdictional agencies
- data and methods (e.g., map/aerial/list review, site reconnaissance, etc.)
- existing conditions
- assessment of relevant data factors (presence, extent, proximity, etc.)
- unresolved uncertainties
- recommendations for further study/work
- references

2.5 ENVIRONMENTAL SCREENING/SITING ANALYSIS

Based on contents of environmental issue area/discipline studies and reports, as well as initial agency consultation, Dames & Moore conducted an initial screening to identify any as-yet unidentified environmental "fatal flaws." Following that exercise a spreadsheet-based analysis of the relative merit of each viable candidate site was conducted, in order to rank candidate sites in order of preference. The steps taken in the site ranking exercise are as follows:

1) Based on the results of their analyses, key members of the current study team assigned simple ranks[1] to each candidate site for each data factor evaluated during their environmental issue/discipline analysis. Depending on the data factor, these analyses were semi-quantitative or qualitative in nature, and assignment of ranks was based on the professional judgement of key team members. For those data factors evaluated in the 1994 *Central Maui Siting Study* and included in this analysis, the "raw scores" for each site for each data factor (presented

[1] Simple ranks are ideally first, second or third (but "draws" occur when two or more sites rank the same); the lower the rank, the less constrained and more preferred the candidate site relative to a specific data factor.

in Table 4-1 and discussed in Chapter 4 of that document) were utilized to assign simple ranks.

2) For each site, the simple rank was multiplied by the weight assigned the relevant data factor in order to obtain a weighted site score for that factor.

3) For each site, weighted site scores were summed. These sums were normalized relative to the sum of the mst preferred site in order to provide a measure of how closely site score sums were "clustered."

4) The rank order of the sums calculated in step 3) were considered the overall rank for each candidate site; the lower the overall rank, the more preferred a candidate site is relative to the other two sites.

3.0 DESCRIPTION OF DATA FACTORS

This section provides a detailed description of the weighted data factors used in both the current study and the 1994 *Central Maui Siting Study*. The 1994 *Central Maui Siting Study* utilized an array of data factors, some which supplement the current analysis, and some which are being studied to a more in-depth level of detail by the current study. In order that a full array of important issues be included in the current assessment, Dames & Moore incorporated the actual data factors, weights, and results of the 1994 study or a modification of them, where appropriate. In essence, the 1994 study supplements the current study: where methods, findings, or focus of the 1994 study deviate from the current study, the latter prevails.

The following discussion describes the data factors utilized. Environmental issue areas, data factors, and weights utilized in the current study are also presented in summary format in Table 2-1, following the text of this document.

3.1 LAND OWNERSHIP, REGULATION, AND USE

Existing and planned land uses can result in conflicts or create synergies related to the location or operation of a proposed facility.

1994 Study

The *Central Maui Siting Study* assessed the following land ownership, use, and regulation data factors as they relate to candidate sites; the weight assigned each data factor in the 1994 study appears in parentheses immediately after the factor:

- number of owners of the site (1)
- existing use (2)
- location relative to Special Management Area (3)
- State Land Use designation (3)
- Community Plan designation (3)
- zoning (3)

Current Study

The current study incorporates the above criteria without change, and additionally assesses candidate sites for the following land use data factors:

- **Existing and planned land uses of adjacent properties**
  Uses of properties near the proposed project were classified, in order of most to least preferred, as follows: undeveloped; range or fallow; cultivated; or other development. The weight assigned this data factors is 2.

- **Existing and planned regional-level land uses**
  Uses of large blocks of land or development of projects with widespread influence were identified and evaluated for their potential to affect or be affected by the proposed project. The weight assigned this data factor is 3.

3.2 AIR QUALITY

Time and cost associated with air quality permitting, the cost of pollution control devices, and potential restrictions on operation of electrical generation facilities can fluctuate, depending on location.

1994 Study
The *Central Maui Siting Study* evaluated candidate sites by determining if they were located within areas having "moderate" or "higher" degrees of air permitting difficulty. The "moderate" and "higher" designations were determined via modelling of criteria pollutant concentrations by Trinity Consultants, in a separate air quality study. (Trinity Consultants, 1993) The weight assigned this data factor was 5.

Current Study
Air quality and meteorological ambient data are currently being accumulated for candidate sites; information more current than that used in the 1994 study is currently not available for use under this ESSS. Therefore, methods and results of the 1994 study are incorporated into this analysis without change.

3.3 SOILS

The agricultural productivity of the County of Maui and State of Hawaii would be reduced by removal of agriculturally productive land for uses other than agriculture, such as the proposed project.

1994 Study
The *Central Maui Siting Study* utilized the State Land Bureau rating system to determine the agricultural potential of each candidate site. Sites with less agriculturally productive soils—those rated "C," "D," or "E"—were preferred for siting an industrial facility relative to those sites with more agriculturally productive soils rated "A" or "B." The weight assigned this data factor was 2.

Current Study
The current study incorporates methods and results of the 1994 study, without change.

3.4 GROUNDWATER

The availability of groundwater supply for operations as well as the range and difficulty of available disposal options for industrial wastewater can influence the attractiveness of a candidate site.

1994 Study
The *Central Maui Siting Study* utilized several groundwater data factors to evaluate candidate sites:

- **Groundwater availability**
  The study assessed on-site availability, potential interference with other pumping operations, and groundwater quality. The weight assigned this data factor was 1.
- **Groundwater disposal**
  The study assessed subsurface conditions, candidate site proximity to supply wells, and site location relative to the UIC line. The weight assigned this data factor was 3.

Current Study
The current study builds on the information developed during the 1994 study, and places a slightly different emphasis on groundwater supply and disposal issues than does the 1994 study. The following data factors are used in the current study:

- **Groundwater supply, availability**
  Since, from previous studies, all sites are known to have groundwater available, this study focusses on the cost of supply wells, well capacity/yield, and whether optional off-site sources are available. The weight assigned this data factor is 5.
- **Groundwater supply, interference with existing uses**
  The study identifies existing source wells nearest the candidate sites. The weight assigned this data factor is 3.
- **Groundwater supply, quality**
  The current study evaluates relative permitting and treatment costs associated with obtaining sufficient amounts of groundwater. The weight assigned this data factor is 2.
- **Groundwater disposal, proximity to supply wells**
  In order to assess potential to contaminate groundwater supply, distance to nearest supply wells is evaluated. The weight assigned this data factor is 3.
- **Groundwater disposal, regulation**
  The relative ease of on-site UIC permitting, as well as the ease of permitting alternative disposal options are evaluated. The weight assigned this data factor is 4.

3.5 SURFACE WATER

The range and difficulty of available disposal options for storm water runoff can influence the attractiveness of a candidate site.

1994 Study
The *Central Maui Siting Study* did not evaluate candidate sites for disposal issues related to surface (storm) water runoff.

Current Study
For the current study, the following surface water data factors were assessed:

- **Surface water, quality**
  The current study evaluates the receiving waters for off-site surface water disposal, including the quality, proximity to, and sensitive uses between the source and receiving waters. The weight assigned this data factor is 3.
- **Surface water disposal, options**
  The type and feasibility of surface water disposal options for each candidate site are evaluated. The weight assigned this data factor is 2.
- **Surface water disposal, regulation**
  This study evaluates whether an NPDES permit is required for a candidate site, and if so, the relative ease of acquiring such a permit. The weight assigned this data factor is 3.

3.6 NOISE

The noise generated by industrial facilities and associated activities can create a nuisance for sensitive receptors, and can result in community opposition to and rejection of facilities such as the proposed project.

1994 Study
The *Central Maui Siting Study* evaluated candidate sites and associated fuel haul routes by identifying sensitive noise receptors such as schools, hospitals, and residences within specific radii (1.5 and 3.0 miles) of candidate sites, as well as identifying haul routes that traverse residential communities or pass near to other sensitive receptors. The weight assigned this factor was 1.

Current Study
The current study does not incorporate methods or results of the 1994 study. Rather, it focuses on the literal distance to the nearest sensitive receptor to haul routes or candidate sites, as well as the relative potential for the proposed project to generate noise complaints. The current study assumes that a sound level of 70 db(A) will be achieved at the property line, as is required by State Department of Health regulations for the City and County of Honolulu, and which MECO has adopted as a standard for the proposed project. Nuisance generation as a result of actual or perceived

noise related to generation facility or fuel haul receptors evaluated in the current study. The weight assigned this data factor is 3.

3.7 AESTHETICS

The extent to which industrial facilities are visible from sensitive receptors (i.e., important viewpoints) will affect community acceptance of such facilities.

1994 Study
The *Central Maui Siting Study* evaluated candidate sites for aesthetics by considering candidate site distance from important viewpoints, site exposure from important viewpoints, and potential opportunities for effective screening associated with each candidate site. The weight assigned this data factor was 3.

Current Study
The current study incorporates results and methods of the 1994 study without change.

3.8 BIOLOGY

The presence of threatened or endangered species on or in proximity to a candidate site could trigger costly and time-consuming regulatory processes.

1994 Study
The *Central Maui Siting Study* evaluated candidate sites for their potential to contain critical habitat or species based primarily on current land use.

Current Study
The current study does not incorporate methods or results of the 1994 study. Rather, individual site reconnaissances were conducted to determine the actual on-site presence of threatened, endangered, or sensitive plant or wildlife species or habitats. In addition, a qualitative assessment was conducted regarding the likelihood that such species or habitats could be located within 0.25 mile of a candidate site. The weight assigned this data factor is 3.

3.9 CULTURAL RESOURCES

The presence of known or suspected significant State or Federal historic or archaeological resources could trigger costly and time-consuming regulatory processes.

1994 Study
The *Central Maui Siting Study* did not evaluate candidate sites for the presence of historic or archaeological sites.

Current Study
For the current study, individual site reconnaissances were conducted to determine the actual on-site presence of historic structures or archaeological resources. The weight assigned this data factor is 3.

3.10 TOPOGRAPHY

The slope of a site can affect full land utilization, or can create design opportunities or difficulties.

1994 Study
The *Central Maui Siting Study* first established an order of preference for ranges of percent slope for candidate sites as follows in rank order, most to least preferred: 2 to 4 percent; 0 to 2 and 4 to 8 percent; 8 to 16 percent; and greater than 16 percent. The study then determined the slope of each candidate site, and ranked it according to the established preferences. The weight assigned this data factor was 1.

Current Study
The current study incorporates methods and results of the 1994 study, without change.

3.11 NATURAL HAZARDS

Exposure to natural hazards such as floods, tsunami, storm waves, hurricanes, or earthquakes could significantly affect the structural or operational integrity of the proposed project, or could limit full utility of a candidate site.

1994 Study
The *Central Maui Siting Study* evaluated candidate sites for their potential exposure to flooding (no matter the source), via review of Flood Insurance Rate Maps. The weight assigned the natural hazards data factor was 1.

Current Study
The current study incorporates results of the 1994 study, with supplemental information obtained regarding the issue of flooding. The weight assigned this data factor in the current study is 3, increased from 1 in the 1994 study. In addition, the current study assesses candidate sites for their potential exposure to extreme winds (such as those generated by strong trade winds or hurricane conditions) and seismic hazards (earthquake).

3.12 HAZARDOUS WASTE/MATERIALS

The impairment of a candidate site by hazardous materials or wastes can present a costly and time-consuming high-risk issue, and may limit full utility of land.

1994 Study
The *Central Maui Siting Study* did not evaluate candidate sites for the presence of hazardous materials or wastes.

Current Study
For the current study, an environmental site assessment (ESA) was conducted for each candidate site, including data and file searches, literature review, aerial photograph and map review, as well as a site reconnaissance, the latter to the extent current agricultural activities allow. The weight assigned this data factor is 5.

3.13 ENGINEERING CONSIDERATIONS

Technical and engineering factors can affect design/construction/operation effort and cost.

1994 Study
The *Central Maui Siting Study* evaluated candidate sites for the following technical and/or engineering data factors:

- **Geotechnical**
  Subsurface conditions, and their potential to increase construction costs were evaluated.
- **Transmission facilities**
  Candidate site proximity to existing transmission facilities and the need to construct additional transmission lines through residential uses were assessed.
- **Fuel delivery**
  Candidate site proximity to Kahului Harbor, adequacy of existing roadways, and the length of new road construction required were evaluation criteria used to assess sites.

The weight assigned each of these data factors was 1.

Current Study
The current study incorporates methods and results of the 1994 study without change.

3.14 TRAFFIC/TRANSPORTATION

The effect of increased project-related traffic on area roadways, as well as the range of fuel transportation options can influence the relative attractiveness of a candidate site.

1994 Study
As part of the assessment of technical/engineering issues, the *Central Maui Siting Study* evaluated candidate sites for the following traffic/transportation issues:

- **Fuel delivery**
  Candidate site proximity to Kahului Harbor, adequacy of existing roadways, and the length of new road construction required were evaluation criteria used to assess sites. The weight assigned this data factor was 1.

Current Study
The current study incorporates methods and results of the fuel haul distance and road construction assessment components of the technical/engineering evaluation of the 1994 study, without change. The current study also evaluates candidate sites for the following data factors, with respect to delivery of fuel to the proposed project:

- **Traffic**
  The current study evaluates the potential effects of fuel haul on existing traffic patterns, the adequacy of the existing roadway configuration for fuel haul, and the adequacy of existing roadbed integrity for fuel haul trucks. The weight assigned this data factor is 3.
- **Transportation**
  The availability of fuel delivery via pipeline is evaluated. The weight assigned this data factor is 1.

4.0 EVALUATION OF CANDIDATE SITES

This section describes existing and reasonably anticipated conditions of candidate sites and as appropriate their surrounding areas, and presents a comparative evaluation of candidate sites relative to the data factors presented in the previous section. First, an evaluation is made of any fatal flaws that might remove a candidate site from further consideration. This evaluation is followed by a comparative assessment of viable candidate sites relative to data factors. Site scores[2] as well as overall site ranks[3] are determined and discussed. The analysis presented in this section is summarized in Table 4-1. Figures 4-1, 4-2, and 4-3 present mappable information regarding Sites A1, A2, and D1, respectively. An analysis was conducted to test the sensitivity of each candidate site relative to the weight assigned each data factor. The results of the sensitivity analysis are presented at the end of this section and in Table 4-2.

4.1 FATAL FLAW EVALUATION

"Fatal flaws" are those characteristics of a candidate site or its immediately surrounding area that would constrain development of the proposed project to an unacceptable degree. An example of such a fatal flaw would be extensive contamination of a site by hazardous materials or wastes. Presence of a fatal flaw would eliminate a candidate site from further consideration on its face. Review of past siting studies, as well as results of the current ESSS indicate no candidate site is fatally flawed. Therefore, Sites A1, A2, and D1 are carried forward for further investigation and comparative evaluation.

4.2 COMPARATIVE SITE EVALUATION: SITE SCORES

A site score indicates the degree of opportunity or constraint associated with a candidate site relative to a specific data factor; the lower the site score, the less constrained (and more preferred) a candidate site is relative to that data factor. The bases of the following evaluation are discipline reports developed for the current ESSS (and incorporated into this document as appendices), as well as portions of the 1994 *Central Maui Siting Study*. The basis of each individual site score is indicated: the reader is referred to the appendices of this report as well as the *Central Maui Siting Study*, as appropriate, for more detailed information.

[2] Site scores are the product of a candidate site's simple rank for a given data factor times the weight assigned that data factor.

[3] Overall site ranks are the sum of all weighted site scores, in rank order.

4.2.1 LAND OWNERSHIP, REGULATION, AND USE

Candidate sites were evaluated in the 1994 *Central Maui Siting Study* as follows:

Land Ownership
All three candidate sites are privately held by a single owner. Therefore, no distinguishable difference exists between sites on the basis of land ownership; all are assigned a simple rank of 1. Given the assigned weight of 1 for this data factor, the site score related to land ownership for all candidate sites is 1.

Existing Candidate Site Land Use
All three candidate sites are in sugarcane cultivation, and no distinguishable difference exists between sites on the basis of existing site land use; all are assigned a simple rank of 1. Given the assigned weight of 2 for this data factor, the site score related to existing candidate site land use for all candidate sites is 2.

State Land Use Designation
All three candidate sites are designated Agricultural. Therefore, no distinguishable difference exists between sites on the basis of State land use designations; all are assigned a simple rank of 1. Given the assigned weight of 3 for this data factor, the site score related to State land use designation for all candidate sites is 3.

Community Plan Designation
All three candidate sites are designated Agricultural in the Wailuku-Kahului Community Plan. Therefore, no distinguishable difference exists between sites on the basis of Community Plan designation; all are assigned a simple rank of 1. Given the assigned weight of 3 for this data factor, the site score related to Community Plan land use designation for all candidate sites is 3.

Zoning Designation
All candidate sites are zoned Agricultural District. Therefore, no distinguishable difference exists between sites on the basis of county zoning; all are assigned a simple rank of 1. Given the assigned weight of 3 for this data factor, the site score related to zoning for all candidate sites is 3.

Special Management Area
None of the candidate sites is within the SMA. Therefore, no distinguishable difference exists between sites on the basis of the SMA; all are assigned a simple rank of 1. Given the assigned weight of 3 for this data factor, the site score related to Community Plan land use designation for all candidate sites is 3.

In addition to incorporating the above from the 1994 study, the current study further evaluates candidate sites for the following:

Existing and Planned Land Uses of Adjacent Properties
As shown on Figure 1-2, the Maui County Landfill is currently located approximately 1,000 feet northwest of Site A1, and 2,000 feet northeast of Site A2. The landfill, which follows mining activities of Ameron Quarry, is currently filling in a quarried area, and plans to vertically expand its current fill area until a height of 40 feet above grade is reached. Ameron has a 20-year mining agreement with A&B-Hawaii, and plans expansion of its mining activities as shown on Figure 4-4. (Ameron, 1995) The County plans to continue its practice of horizontal and vertical expansion via landfilling mined areas until a height of 40 feet above grade is reached. As the figure indicates, Site A1 is located within the area of Ameron's 20-year mining plan. This would represent a significant land use conflict for Site A1; resolution of this conflict would require extensive renegotiation on the part of Ameron and A&B.

In addition, current conditions at and near the landfill indicate litter control is an unresolved issue, with wind-blown litter evident along Pulehu Road and clinging to vegetation within Kalialinui Gulch. Without much more effective measures in place, blown litter can be expected to continue to accumulate, as the elevation of the waste lift reaches 40 feet above grade. Site A2 is directly and Site A1 is generally downwind of the landfill under prevailing wind conditions. Blown litter as well as dust from mining activities could impose design or even operating restrictions to either of these sites.

The existing and known planned land uses in the vicinity of Site D1 are agricultural. When adjacent sugarcane fields are being plowed or burned, operating restrictions may occur. This would also be true for Sites A1 and A2.

Based on the above, the descending rank order of site preference for this data factor is D1, A2, A1. Given the assigned weight of 2 for this data factor, site scores related to adjacent land use are 2 for Site D1, 4 for Site A2, and 6 for Site A1.

Existing and Planned Regional Land Uses
Other than the existing Maui County landfill and its planned expansions[4], other potentially relevant existing and planned regional land uses include Haleakela National Park, observatories on Haleakela, and the Kahului Airport. Consultation with the National Park Service (NPS) indicates Haleakela National Park is classified as Class I under the Clean Air Act; Denver headquarters of the NPS would review all pertinent air quality information regarding the project in order to determine its potential

[4] While the expansion of the County landfill would be a potentially conflicting existing and planned regional land use, its effect on the suitability of candidate sites was captured in the previous discussion.

impact on park activities and resources. Initial consultation indicates the NPS does not anticipate impacts to the park, nor that distinguishable differences between candidate sites exist relative to potential park impacts; however, a final determination would pend the provision and NPS review of air quality information. (NPS, 1995) Consultation with the University of Hawaii (UH) Institute for Astronomy as well as the United States Air Force (USAF) Space Command, Maui Space Surveillance Site indicates no project-related effects to operations of observatories are anticipated. (UH, 1994; USAF, 1995) Review of the *1982 Kahului Airport Master Plan Report* indicates that Sites A1 and A2 are within planned conical surfaces (or aircraft holding patterns). Consultation with the Federal Aviation Administration (FAA) on this matter indicates the proposed project could be developed on these sites, however modification of flight plans at Kahului Airport would be required, and special lighting could be required. (FAA, 1995)

For this reason, the descending rank order of site preference for this data factor is Site D1, followed equally by Sites A1 and A2. Given the assigned weight of 3 for this data factor, site scores related to regional land use are 3 for Site D1, and 6 for Sites A1 and A2.

4.2.2 Air Quality

Candidate sites were evaluated in the 1994 *Central Maui Siting Study* fundamentally for their "permitability." In that evaluation, the descending rank order of preference for this data factor was Site D1, followed equally by Sites A1 and A2. Given the assigned weight of 5 for this data factor, site scores related to air quality are 5 for Site D1, and 10 for Sites A1 and A2.

4.2.3 Soils

Candidate sites were evaluated in the 1994 *Central Maui Siting Study* for the agricultural productivity of their soils, with the least productive soils the most preferred. In that evaluation, the descending rank order of site preference for this data factor was Site A1, followed equally by Sites A2 and D1. Given the assigned weight of 2 for this data factor, site scores related to soils are 2 for Site A1, and 4 for Sites A2 and D1.

4.2.4 Groundwater

A memo report discussing groundwater issues is attached to this document as Appendix A.

Groundwater Supply, Availability
The depth to groundwater would affect the cost of supply wells. Sites A1 and A2, approximately 100 feet nearer the basal groundwater table than Site D1 would likely incur lower costs for well development than D1. All sites would be approximately equally, and reasonably, located relative to the existing HC&S irrigation water system. Therefore, should HC&S be inclined to make that water

supply source available, the candidate sites would not be distinguishable from one another on this basis. The descending rank order of site preference for this data factor is Sites A1 and A2 (equally), followed by Site D1. Given the assigned weight of 5 for this data factor, site scores related to groundwater supply availability are 5 for Sites A1 and A2, and 10 for Site D1.

Groundwater Supply, Interference with Existing Uses
All three sites are located more than 6,000 linear feet from the nearest supply well, and are therefore not likely to interfere with these wells. Therefore, no distinguishable difference exists between sites on the basis of interference with existing uses; all are assigned a simple rank of 1. Given the assigned weight of 3 for this data factor, the site score related to groundwater supply and interference with existing groundwater uses for all candidate sites is 3.

Groundwater Supply, Quality
The quality of water underlying all three candidate sites is similar, however differences do exist which can be used to distinguish between the sites. The quality of water underlying Site D1 is considered to be potable by regulatory definition, while that underlying Sites A1 and A2 is considered non-potable (brackish). Therefore, the effort to permit wells for industrial purposes could be greater for Site D1 than for Sites A1 and A2. Although these waters differ in quality by definition, the actual difference to treat them to a level necessary for industrial use is minimal, and no distinguishable difference exists between sites in the basis of treatment costs. The descending rank order of site preference for this data factor is Sites A1 and A2 (equally), followed by Site D1. Given the assigned weight of 2 for this data factor, site scores related to groundwater supply quality are 2 for Sites A1 and A2, and 4 for Site D1.

Groundwater Disposal, Proximity to Supply Wells
Due to their distance from other supply wells, the likelihood of contamination of existing wells for all three sites is negligible. Therefore, no distinguishable difference exists between sites on the basis of groundwater contamination of existing wells; all are assigned a simple rank of 1. Given the assigned weight of 3 for this data factor, the site score related to groundwater disposal proximity to other users for all candidate sites is 3.

Groundwater Disposal, Regulation
Both Sites A1 and A2 could be permitted for UIC disposal of all industrial wastewater in the standard manner. Site D1 would be normally permitted only to dispose of non-contact cooling water in this manner; additional and possibly costly permitting efforts would be required to dispose of the remaining industrial wastewater. The descending rank order of site preference for this data factor is Sites A1 and A2 (equally), followed by Site D1. Given the assigned weight of 4 for this data factor, site scores related to groundwater disposal regulation are 4 for Sites A1 and A2, and 8 for Site D1.

4.2.5 SURFACE WATER

A memo report discussing surface water issues is attached to this document as Appendix B. The current study evaluates candidate sites for the following:

Surface Water, Quality
Should surface water runoff be disposed of offsite, the quality of receiving waters could be important to permitting efforts, as well as to the maintenance of Maui water resources. Surface waters near candidate sites include Kalialinui Gulch for Site A1 and irrigation ditches for Sites A2 and D1. Since natural waterways discharging to the ocean are considered more valuable than irrigation ditches, and impacts to valuable water resources are not desirable, the descending rank order of site preference for this data factor is Sites A2 and D1 (equally), followed by Site A1. Given the assigned weight of 3 for this data factor, site scores related to surface water quality are 3 for Sites A2 and D1, and 6 for Site A1.

Surface Water Disposal, Options
The range of surface water disposal options could affect the relative attractiveness of candidate sites. In general, the range of options for surface water disposal investigated for the current study include off-site direct discharge to recieving waters, off-site discharge to a municipal disposal system, onsite impoundment, and onsite discharge via underground injection wells. The descending rank order of site preference for this data factor is Site A2, the most flexible site in terms of feasible disposal options, followed equally by Sites A1 and D1. Given the assigned weight of 2 for this data factor, site scores related to surface water disposal options are 2 for Site A2, and 4 for Sites A1 and D1.

Surface Water Disposal, Regulation
Should surface water be disposed of via injection or offsite discharge, a UIC or NPDES permit would be required, respectively. The "permitability" of candidate sites was assessed, encompassing the ability to permit a site, as well as the anticipated degree of difficulty of such permitting. Site D1 would be more difficult to permit from a UIC Standpoint then Sites A1 or A2; Site A1 would be more difficult to permit from an NPDES standpoint than Sites A2 and D1. Therefore, the descending rank order of preference for this data factor would be Site A2, followed equally by Sites D1 and A1. Given the assigned weight of 3 for this data factor, site scores related to surface water disposal regulation are 3 for Site A2, and 6 for Sites A1 and D1.

4.2.6 NOISE

A memo report discussing noise issues is attached to this document as Appendix C.

The noise analysis evaluated sites based on their distance to existing and planned sensitive uses, surrounding topography, wind direction, and the existing noise environment (i.e., levels of noise). Site

A1 is the most distant from sensitive land uses, especially downwind uses, and is subject to noise generated by plane approaching the Kahului Airport as well as that generated by the landfill and quarry. Site A2 is nearer Puunene and other downwind receptors, and is exposed to the same ambient noise as A1. Site D1 is the nearest to potentially sensitive receptors, and to receptors that may be sensitive to a perceived, if not actual, noise nuisance. Based on the noise evaluation, the descending rank order of preference for this data factor would be Site A1, A2, and D1. Given the assigned weight of 3 for this data factor, site scores related to noise are 3 for Site A1, 6 for Site A2, and 9 for Site D1.

4.2.7 AESTHETICS

Candidate sites were evaluated in the 1994 *Central Maui Siting Study* for their visibility and potential to impair important views. In that evaluation, the descending order of site preference for this data factor was Site D1, followed equally by Sites A1 and A2. Given the assigned weight of 3 for this data factor, site scores related to aesthetics are 3 for Site D1, and 6 for Sites A1 and A2.

4.2.8 BIOLOGY

Two memo reports, one discussing plant (botanical) and the other wildlife resources issues, are attached to this document as Appendices D and E, respectively. The current study evaluates candidate sites for the actual on-site presence of threatened, endangered, or sensitive plant or wildlife species or habitats, and for the likelihood that such species or habitats could be located within 0.25 mile of a candidate site.

The botanical survey of the three candidate sites did not identify any listed or sensitive species. All sites are in sugarcane cultivation, with introduced and native ruderal vegetation along some cane haul roads and on adjacent properties. None of the species identified are listed, and none are otherwise considered sensitive. Therefore, no distinguishable difference between candidate sites exists on the basis of plants.

Because birds are the most abundant wildlife type in the area, the wildlife survey focussed on avifauna. The evaluation of candidate sites focussed on their suitability as habitat for a broad array of bird species, based on observations made in the field. The "richness" of a site indicates the number of species associated with that site; the richer the site, the more species it could support, and the less suitable it would be for development. Based on this evaluation, the descending rank order of site preference for this data factor would be Site A1, the least rich and the most preferred for development, Site A2, and finally Site D1, the most rich. Given the assigned weight of 3 for this data factor, site scores related to biology are 3 for Site A1, 6 for Site A2, and 9 for Site D1.

4.2.9 CULTURAL RESOURCES

A memo report discussing archaeological and historic resources issues is attached to this document as Appendix F.

The archaeological and historic assessment of the three candidate sites did not identify any known or suspected significant sites or resources. All sites are in sugarcane cultivation, and any resources within the plow zone have likely been compromised. Therefore, no distinguishable difference between candidate sites exists on the basis of archaeological and historic resources; all are assigned a simple rank of 1. Given the assigned weight of 3 for this data factor, the site score related to cultural resources for all candidate sites is 3.

4.2.10 TOPOGRAPHY

The slope of candidate sites was evaluated in the 1994 *Central Maui Siting Study* because of topography's role as an indicator of slope stability, erosion potential, and constructability. In that evaluation, the descending rank order of site preference for this data factor would be Site D1 and A2 (equally), followed by Site A1. Given the assigned weight of 1 for this data factor, site scores related to topography are 1 for Site D1 and A2, and 2 for Site A1.

4.2.11 NATURAL HAZARDS

The current study evaluates the natural hazard issue of flooding (based on information which supplements the 1994 study), earthquake, and extreme winds. A memo report discussing extreme wind and seismic hazards issues is attached to this document as Appendix G.

The natural hazards and surface water studies conducted for the current ESSS, concluded the following:

- The Lowrie Ditch is known to overflow its banks during heavy rains (i.e., the 25-year event), resulting in run-on to Site D1; therefore, while Site D1 is not prone to flooding from natural sources, it is known to flood from the irrigation system. (HC&S, 1995) Avoidance of this flooding would likely require additional design and construction effort, and may affect full utility of Site D1.
- Candidate sites are in relative proximity to one another, and the natural hazards study did not distinguish between the three sites on the basis of exposure to seismic hazards.
- The three candidate sites are all located within the central valley area of Maui, and all would be exposed to extreme wind speeds. Wind speeds in the valley increase as they are channeled between Haleakala and the West Maui Mountains, and as they climb in elevation from the

shoreline to the central valley region. The three candidate sites are located near enough to one another that they are not distinguishable on the basis of exposure to extreme wind hazards.

The descending rank order of site preference for this data factor is Sites A1 and A2 (equally), followed by Site D1. Given the assigned weight of 3 for this data factor, site scores related to natural hazards are 3 for Sites A1 and A2, and 6 for Site D1.

4.2.12 HAZARDOUS WASTE/MATERIALS

An environmental site assessment (ESA) report discussing hazardous waste/materials and site contamination issues is attached to this document as Appendix H. This ESA focussed on the extent of potential site contamination as well as potential restrictions on site use due to contamination.

The ESA and its associated site and information investigation did not identify potential site contamination that would distinguish one site from another. Given the assigned weight of 5 for this data factor, the site score related to hazardous waste/materials is 5 for all candidate sites.

4.2.13 ENGINEERING CONSIDERATIONS

Candidate sites were evaluated in the 1994 *Central Maui Siting Study* as follows:

Geotechnical
Candidate sites were not considered distinguishable from one another on the basis of subsurface conditions; all are assigned a simple rank of 1. Given the assigned weight of 1 for this data factor, the site score related to geotechnical conditions is 1 for all candidate sites.

Transmission Facilities
Candidate sites were evaluated for their proximity to existing transmission facilities; the closer the site, the less cost to construct connecting transmission facilities. In the current evaluation, the descending rank order of site preference for this data factor is Site A2 and D1 (equally), followed by Site A1. This takes into account the Maalaea-Lahaina 69 kV transmission line, completed and energized in January, 1995. In the vicinity of candidate sites this line is located along Upper Division Road adjacent to Site A2; the power line then trends southeasterly along Pulehu Road and at one point is located adjacent to Site D1. Given the assigned weight of 1 for this data factor, site scores related to transmission facilities are 1 for Site A2 and D1, and 2 for Site A1.

Fuel Delivery
Candidate sites were evaluated in the 1994 *Central Maui Siting Study* for their proximity to Kahului Harbor as an indicator of fuel delivery cost. In that evaluation, the descending order of site preference for this data factor was Sites A1 and A2 (equally), followed by Site D1. Given the assigned weight

of 1 for this data factor, site scores related to fuel delivery are 1 for Sites A1 and A2, and 2 for Site D1.

Road Improvement Costs
Candidate sites were evaluated in the 1994 *Central Maui Siting Study* for the length of new road construction required to serve each as an indicator of road construction cost. In addition, the current ESSS includes the number of structures required to be built by MECO, which would substantially affect road construction costs. In the 1994 and current evaluations, the descending order of site preference for this data factor is Sites A2 and D1 (equally), located on or near Pulehu Road, followed by Site A1, which requires substantially more privately-constructed access road, as well as construction of a bridge to span Kalialinui Gulch. Given the assigned weight of 1 for this data factor, site scores related to road improvement costs are 1 for Sites A2 and D1, and 2 for Site A1.

4.2.14 TRAFFIC/TRANSPORTATION

A memo report discussing traffic and transportation issues is attached to this document as Appendix I.

Traffic
The evaluation criteria for traffic included roadway configuration and integrity, and traffic operations. The traffic study concluded the following:

- Given recent and reasonably expected planned improvements to Pulehu Road, there is no distinguishable difference between candidate sites on the basis of roadway integrity.
- Given Site A1 would require three bridge crossings, while Sites A2 and D1 would require two, on the basis of roadway configuration, the descending order of site preference for this evaluation criteria is Sites A2 and D1 (equally), followed by Site A1.
- No distinguishable difference exists between candidate sites on the basis of impacts to existing traffic operations.
- Given that required movements for loaded fuel trucks are with-traffic (preferred) to access sites A2 and D1, and are cross-traffic (not preferred) to access Site A1, the descending order of site preference for this evaluation criteria is Sites A2 and D1 (equally), followed by Site A1.

The descending rank order of site preference for this data factor is Sites A2 and D1 (equally), followed by Site A1. Given the assigned weight of 3 for this data factor, site scores related to traffic are 3 for Sites A2 and D1, and 6 for Site A1.

Transportation
Any of the three candidate sites could be served by a fuel pipeline from the Chevron Kahului Harbor bulk terminal facility, and the sites are not distinguishable from each other on the basis of their ability to be served by such a facility. Assuming all three candidate sites can be served from the same pipeline route, and using site distance from the bulk terminal as an indicator of pipeline cost, the descending rank order of site preference for this data factor is Sites A1 and A2 (equally), followed by Site D1. Given the assigned weight of 1 for this data factor, site scores related to transportation are 1 for Sites A1 and A2, and 2 for Site D1.

4.3 COMPARATIVE SITE EVALUATION: OVERALL SITE RANKS, NORMALIZED SCORES, AND SENSITIVITY ANALYSIS

4.3.1 OVERALL SITE RANKS

As Table 4-1 indicates, the sum of site scores[5] for the three candidate sites are 110 for Site A1, 102 for Site A2, and 116 for Site D1; overall site ranks[6] are 2 for Site A1, 1 for Site A2, and 3 for Site D1. Therefore, based on this evaluation, the descending rank order of site preference is Site A2, A1, and D1.

4.3.2 NORMALIZED SITE SCORES

In order to obtain an understanding of how tightly results of the numeric analysis are clustered, results can be evaluated relative to a known result of that analysis. This process is known as "normalizing." The current study normalizes sums of sites scores relative to the score of the least constrained site, A2. The normalized sum for Site A2 is 100, and the normalized sums for A1 and D1, 92.73 and 87.93 respectively, are ratios relative to the normalized sum of A2. This represents a fairly tight cluster, with results of analysis for all sites falling within a range of 12.1 percent. Therefore, while Site A2 is the least constrained and most preferred, neither Site A1 or D1 is substantially inferior in terms of suitability for the proposed project. This result substantiates the results of the 1994 study.

4.3.3 SENSITIVITY ANALYSIS

In order to test the validity of the data factor weighting scheme utilized in this analysis, a sensitivity analysis was conducted. This analysis in essence systematically (i.e., one data factor at a time) distorts or exaggerates the weights utilized in the analysis, in this case by a factor of 10. The corresponding overall site ranks are then reviewed to determine if a different result arises (that is, is

[5] With the lowest score being the least constrained and the most preferred.

[6] With the lowest overall site rank being the most preferred.

the descending order of site preference, A2, A1, D1, altered) with the use of the distorted weight for a particular data factor. This process is repeated 31 times, once for each data factor, with the original weights maintained for all but one factor at a time.

Results of the sensitivity analysis are presented in Table 4-2. In general, the overall order of site preference remains the same as in the original analysis, with Site A2 remaining the most preferred in 24 of 31, or 77.4 percent, of the cases.

When issues regarding soils (agricultural productivity), noise, or biology are emphasized, Site A1 is the most preferred (3 out of 31, or 9.7 percent, of the cases). When issues regarding existing or planned adjacent property or regional land uses, air quality, or aesthetics are emphasized, Site D1 is the most preferred (4 out of 31, or 12.9 percent, of the cases).

In summary, all three candidate sites show a strong tendency to remain in their original overall rank order, even when subjected to substantial distortion of the weighting system utilized in the sensitivity analysis. This result indicates the relative order of site preference resulting from this ESSS–A2, A1, D1–is stable and fairly represents the appropriate order of preference, given the weighting system and data factors utilized.

5.0 RECOMMENDATIONS

This section presents recommendations regarding the most preferred candidate site, based on the evaluation conducted for this study. In addition, this section provides recommendations for further study, analysis, or consultation.

5.1 RECOMMENDATIONS FOR CANDIDATE SITES

Site A2 is identified as most preferred of the three candidate sites evaluated in this study. It is recommended the results of this study be combined with additional information for both Site A2 and C3 regarding air quality, site cost, and community reaction to guide final site selection and landowner negotiations.

5.2 RECOMMENDATIONS FOR FURTHER STUDY, ANALYSIS, CONSULTATION

This section presents recommendations made by the project team members for further study, analysis, or agency consultation. Each heading is followed by a bullet list of summary recommendations.

Land Ownership, Regulation, and Use

- Further investigate the status of Ameron's 20-year mining agreement with A&B-Hawaii.
- Upon selection of the preferred site, notify Mr. Eric Yoshizawa of Ameron (requested by Mr. Yoshizawa).
- Periodically consult with Ameron to obtain status of mining activities.
- Periodically consult with County of Maui Public Works Department to obtain status of landfill expansion plans.
- Complete FAA form 7460-1 for each candidate site and submit to FAA; once determination granted by FAA, request extension for preferred site every 18 months, let other sites lapse.
- Initiate discussions with County of Maui Planning Department regarding re-zone procedures and processes for the proposed project.

Air Quality

- Complete tabulation and organization of meteorological and air quality data.
- Conduct air quality analysis.
- Incorporate findings of air quality analysis into site selection process.
- Provide air quality analysis to the National Park Service Headquarters in Denver for evaluation.

Soils
No recommendations.

Groundwater
- Should Site A1 be selected, periodically consult with County of Maui Public Works Department regarding status of their landfill groundwater monitoring program.
- Investigate further the possibility of obtaining an easement from A&B-Hawaii to allow for offsite UIC injection disposal of industrial wastewater from Site D1.
- Continue to monitor anticipated changes in the administration of UIC regulations between DOA and the U.S. EPA, and determine how these changes might affect site selection.

Surface Water
- Continue consultation with Hawaii State Department of Health regarding potential NPDES and storm water UIC discharge issues.

Noise
- Following site selection, and as part of design, conduct a site-specific noise analysis to develop design-oriented mitigation.
- Continue to monitor the status of DOH noise regulations as they apply to Maui.

Aesthetics
- Develop realistic photosimulations of the proposed project from sensitive viewpoints, as part of the final site selection process.
- Once the preferred site is selected, develop additional visual simulations as part of the community involvement program, including simulations of the proposed generation facility as well as additional required transmission facilities.

Biology
- Conduct survey for Hawaiian hoary bat during months of activity, August through December.
- Evaluate flyways of endangered waterbirds within the area of the candidate sites.

Cultural Resources
No recommendations.

Topography
No recommendations.

Natural Hazards
- Conduct analysis of wind speed data currently being compiled from the meteorological tower located on Site D1.
- Conduct a wind tunnel test, once a preferred site is selected.
- Keep abreast of current recommendations for revision of Maui's seismic zonation.
- Should Site A1 be selected, conduct a surface hydrology investigation (due to its proximity to the gulch)

Hazardous Waste/materials
- Conduct additional research regarding airstrips in the vicinity of candidate sites.
- Review additional information as it becomes available regarding six recorded incidents in the Puunene area.

Engineering Considerations
- Conduct a comprehensive soils and subsurface investigation for the proposed project and access roads after preferred site is selected.

Traffic/Transportation
- Video-document condition of Pulehu Road; possibly conduct deflection testing.
- Periodically consult with County of Maui DOT regarding recommendation of Pulehu Road to Hana Highway after the Airport Access Road/Hana Highway interchange is complete.
- Conduct comprehensive traffic analysis once preferred site is selected and traffic generation information completely developed.
- Continue consultation with Chevron as well as other potential users regarding viability of pipeline development.

6.0 REFERENCES

Detailed references are provided in each technical discipline memo report, included in this document as Appendices A through I.

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Belt Collins & Associates, 1992. *Maui Electric Company 1995 Unit Addition Project: Alternate Puunene Airport Site, Environmental Screening Report.* Note: Site C3 is identified as the "Alternate Puunene Airport Site" in this study.

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TABLE 2-1
ENVIRONMENTAL ISSUE AREAS, DATA FACTORS, WEIGHTS

Environmental Issue Area	Data Factor[1]	Weight	Evaluation Criteria[1,2]
Land Ownership, Regulation, and Use	Land Ownership	1	MECO-owned land
			Private land, 1 owner
			Private land, 2-10 owners
			Private land, >10 owners
			State/County land
			Hawaiian Homelands
			Federal land
	Existing candidate site land use	2	Power generation
			Undeveloped
			Range or fallow
			Cultivation
			Other developed
	State Land Use Districts	3	Urban
			Agriculture
			Rural
			Conservation
	Community Plan designation		Heavy industry
			Agriculture
			Light industry
			Other designation
	Zoning designation	3	M-2, Heavy industry
			Suitable for M-2
			Unsuitable for M-2
	Special Management Area (SMA)		Not within
			Within
	Existing or planned adjacent land use	2	Undeveloped
			Range or fallow
			Cultivation
			Other
	Existing or planned regional uses	3	Uses that would facilitate power plant development
			Uses that would limit power plant development
			Uses that would prohibit power plant development

(1) Shaded data factors or evaluation criteria were previously assessed in the 1994 *MECO Central Maui Siting Study*.
(2) Within each data factor, listed most to least desirable

Environmental Issue Area	Data Factor[1]	Weight	Evaluation Criteria[1,2]
Air Quality	Modelled pollutant concentration in areas identified as having "moderately" or "higher" degrees of air permitting difficulty	5	50 to 60 percent of allowable by AAQS/PSD Increment
			60 to 65 percent of allowable by AAQS/PSD Increment
			65 to 70 percent of allowable by AAQS/PSD Increment
			70 to 75 percent of allowable by AAQS/PSD Increment
			75 to 100 percent of allowable by AAQS/PSD Increment
Soils		2	C, D, or E rated soils
			A or B rated soils
Groundwater	Supply, availability	5	On-site-quantity sufficient, depth <300'
			On-site quantity sufficient, depth >300, <500
			On-site quantity sufficient, depth >500
			On-site quantity not sufficient
			Cost of water supply wells
			Well capacity/yield
			Off-site source available
			Off-site source not available
	Supply, interference with existing source wells	3	>500' from existing supply wells
			<500' from existing supply wells
	Supply, quality	2	Chloride >250 mg/l
			Chloride <250 mg/l
			Relative permitting costs
			Relative treatment costs
	Disposal, proximity to supply wells	3	Potential for contamination of existing supply wells
	Disposal, regulation	4	Makai of UIC line
			Mauka of UIC line
			Relative ease of UIC permitting
			Ease of permitting alternative method

(1) Shaded data factors or evaluation criteria were previously assessed in the 1994 *MECO Central Maui Siting Study*.
(2) Within each data factor, listed most to least desirable

Environmental Issue Area	Data Factor[1]	Weight	Evaluation Criteria[1,2]
Surface Water (stormwater runoff)	Quality	3	Quality of receiving water
			Proximity of site to receiving water
			Sensitive uses between site and receiving water
	Disposal Options	2	On-site
			Off-site
			Municipal system
	Regulation	3	Does not require permit
			Requires NPDES permit
			Relative ease NPDES permitting
Noise (assume 70 db(A) achieved at property line)		3	>3 miles from sensitive receptor, no residential haul routes
			>1.5 miles from sensitive receptors, no residential haul routes
			<1.5 miles from sensitive receptor and/or residential haul routes
			Distance to nearest existing or planned sensitive receptor
			Potential for noise complaints
Aesthetics	Impairment of scenic views	3	Visibility from sensitive receptors
Biology		3	Under current intense cultivation
			Currently fallow, previously under cultivation
			Natural or native vegetation with potential to provide habitat
			Not known to support or be in within .25 mile of threatened, endangered, or sensitive species or habitats
			Not likely to support or be near threatened, endangered, or sensitive species
			Likely to support or be near threatened, endangered, or sensitive species
			Known to support or be near threatened, endangered, or sensitive species or habitats
Cultural Resources		3	Known significant State or Federal cultural sites
			Known burials and their immediate vicinity
			High potential for discovery of significant cultural resources

(1) Shaded data factors or evaluation criteria were previously assessed in the 1994 *MECO Central Maui Siting Study*.
(2) Within each data factor, listed most to least desirable

Environmental Issue Area	Data Factor[1]	Weight	Evaluation Criteria[1,2]
Topography		1	2-4% slope
			0-2% and 4-8% slope
			8-16% slope
			>16% slope
Natural Hazards		3	Tsunami inundation zone
			Flood prone area (100-year)
			Susceptibility to extreme winds
			Susceptibility to seismic hazards
Hazardous Waste/materials		5	Ability to utilize property as planned
			Relative impairment of site
Engineering Considerations	Geotechnical	1	No increased cost associated with conditions
			Increase construction cost by <1%
			Increase construction cost by >1%
	Transmission system	1	Adjacent to existing transmission lines with sufficient capacity
			Within 1 mile of existing transmission facilities/sufficient capacity can be achieved
			Requires construction of 1 to 5 miles of transmission line through non-urban
			Requires construction of >5 miles of transmission or requires construction of transmission through urbanized areas
	Fuel delivery	1	Proximity to Kahului harbor
			Use of existing, adequate roadways
			Use of existing roadways requiring structural improvement to accommodate project
			Construction of new roads
Traffic/Transportation	Traffic	3	Effects on existing traffic patterns and LOS
			Length of new roadway construction
			Adequacy of existing roadway configuration
			Adequacy of existing roadbed integrity
	Transportation	1	Availability of alternative fuel delivery systems (i.e., pipelines)

(1) Shaded data factors or evaluation criteria were previously assessed in the 1994 *MECO Central Maui Siting Study*.
(2) Within each data factor, listed most to least desirable

TABLE 4-1
ANALYSIS OF CANDIDATE SITES

Environmental Issue Area/ Data Factor	Weight	Site Score (1) A1	A2	D1
Land Ownership, Regulation, Use				
Land Ownership	1	1	1	1
Existing candidate site land use	2	2	2	2
State Land Use designation	3	3	3	3
Community Plan designation	3	3	3	3
Zoning designation	3	3	3	3
Special Management Area (SMA)	3	3	3	3
Existing/planned adjacent land use	2	6	4	2
Existing/planned regional uses	3	6	6	3
Air Quality	5	10	10	5
Soils	2	2	4	4
Groundwater				
Supply, availability	5	5	5	10
Supply, interference with existing source wells	3	3	3	3
Supply, quality	2	2	2	4
Disposal, proximity to supply wells	3	3	3	3
Disposal, regulation	4	4	4	8
Surface Water (stormwater disposal)				
Quality	3	6	3	3
Disposal options	2	4	2	4
Regulation	3	6	3	6
Noise	3	3	6	9
Aesthetics				
Impairment of scenic views	3	6	6	3
Biology	3	3	6	9
Cultural Resources	3	3	3	3
Topography	1	2	1	1
Natural Hazards	3	3	3	6
Hazardous Waste/materials	5	5	5	5
Engineering Considerations				
Geotechnical	1	1	1	1
Transmission system	1	2	1	1
Fuel delivery	1	1	1	2
Road improvement costs	1	2	1	1
Traffic/Transportation				
Traffic	3	6	3	3
Transportation	1	1	1	2
Sum of Site Scores (lowest is least constrained, most preferred)		110	102	116
Normalized Sums (100 is least constrained)		92.73	100.00	87.93
Overall Site Rank (2) (lowest is least constrained)		2	1	3

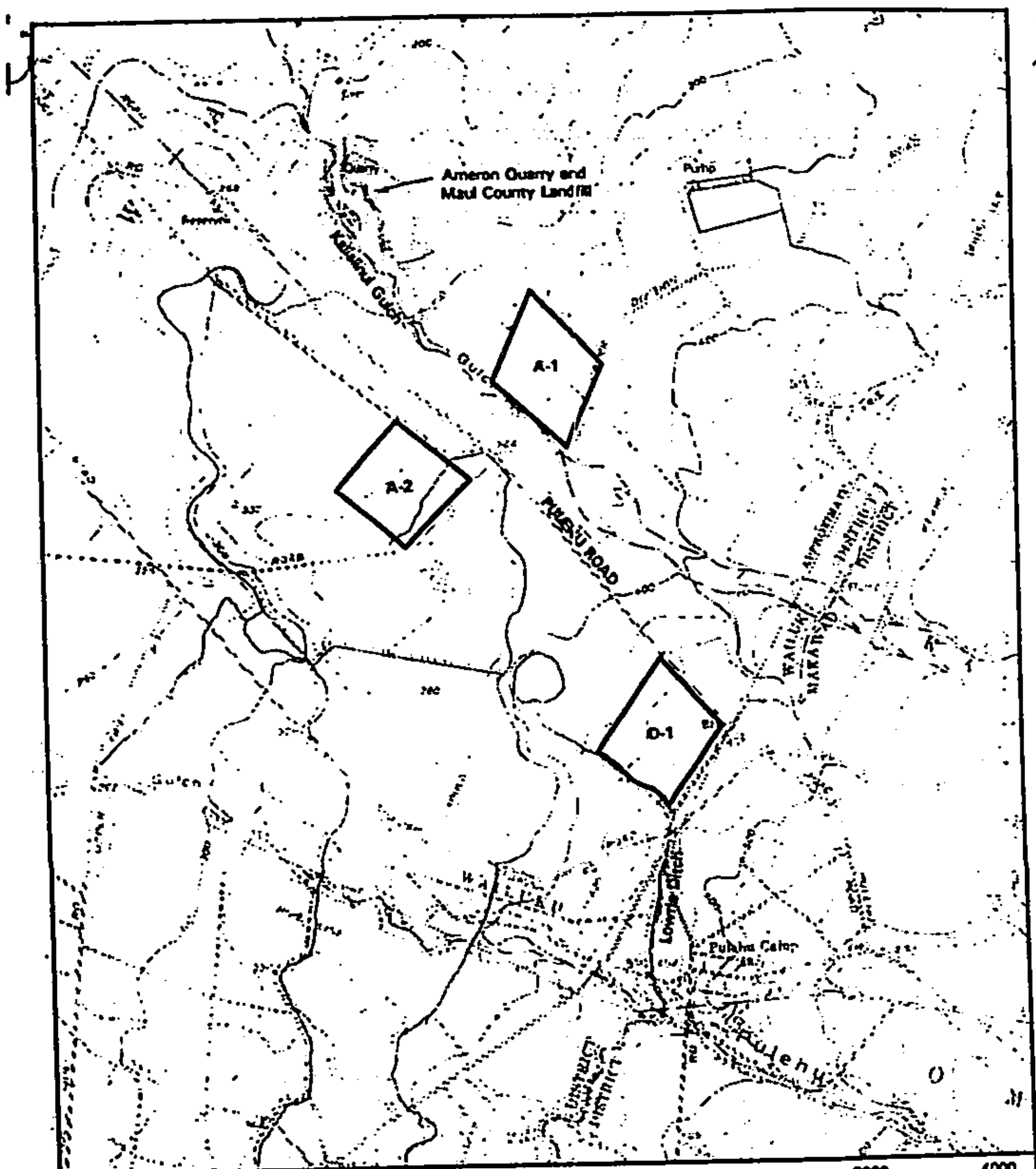
Notes:
(1) Site score is the product of a site's rank for a specific data factor times the assigned weight of the factor.
(2) Overall site rank is the rank order of the summed weighted ranks.

TABLE 4-2
SENSITIVITY ANALYSIS

Environmental Issue Area/ Data Factor	Overall Site Rank w/ Assigned Weight X 10 A1	A2	D1	
Land Ownership, Regulation, Use				
Land Ownership	2	1	3	
Existing candidate site land use	2	1	3	
State Land Use designation	2	1	3	
Community Plan designation	2	1	3	
Zoning designation	2	1	3	
Special Management Area (SMA)	2	1	3	
Existing/planned adjacent land use	3	2	1	
Existing/planned regional uses	3	2	1	
Air Quality	3	2	1	
Soils	1	2	3	
Groundwater				
Supply, availability	2	1	3	
Supply, interference with existing source wells	2	1	3	
Supply, quality	2	1	3	
Disposal, proximity to supply wells	2	1	3	
Disposal, regulation	2	1	3	
Surface Water (stormwater runoff)				
Quality	3	1	2	
Disposal options	2	1	3	
Regulation	2	1	3	
Noise	1	2	3	
Aesthetics				
Impairment of scenic views	3	2	1	
Biology	1	2	3	
Cultural Resources	2	1	3	
Topography	3	1	2	
Natural Hazards	2	1	3	
Hazardous Waste/materials	2	1	3	
Engineering Considerations				
Geotechnical	2	1	3	
Transmission system	2	1	3	
Fuel delivery	2	1	3	
Road improvement costs	3	1	2	
Traffic/Transportation				
Traffic	3	1	2	
Transportation	2	1	3	
Number of Times Site Ranks #1	3	24	4	(n=31)
Percent of Times Site Ranks #1	9.68	77.42	12.90	
Number of Times Site Ranks #2	20	7	4	(n=31)
Percent of Times Site Ranks #2	64.52	22.58	12.90	
Number of Times Site Ranks #3	8	0	23	(n=31)
Percent of Times Site Ranks #3	25.81	0.00	74.19	
Original Overall Site Ranks	2	1	3	

Overall site ranks that deviate from their original overall ranks are in italic boldface.

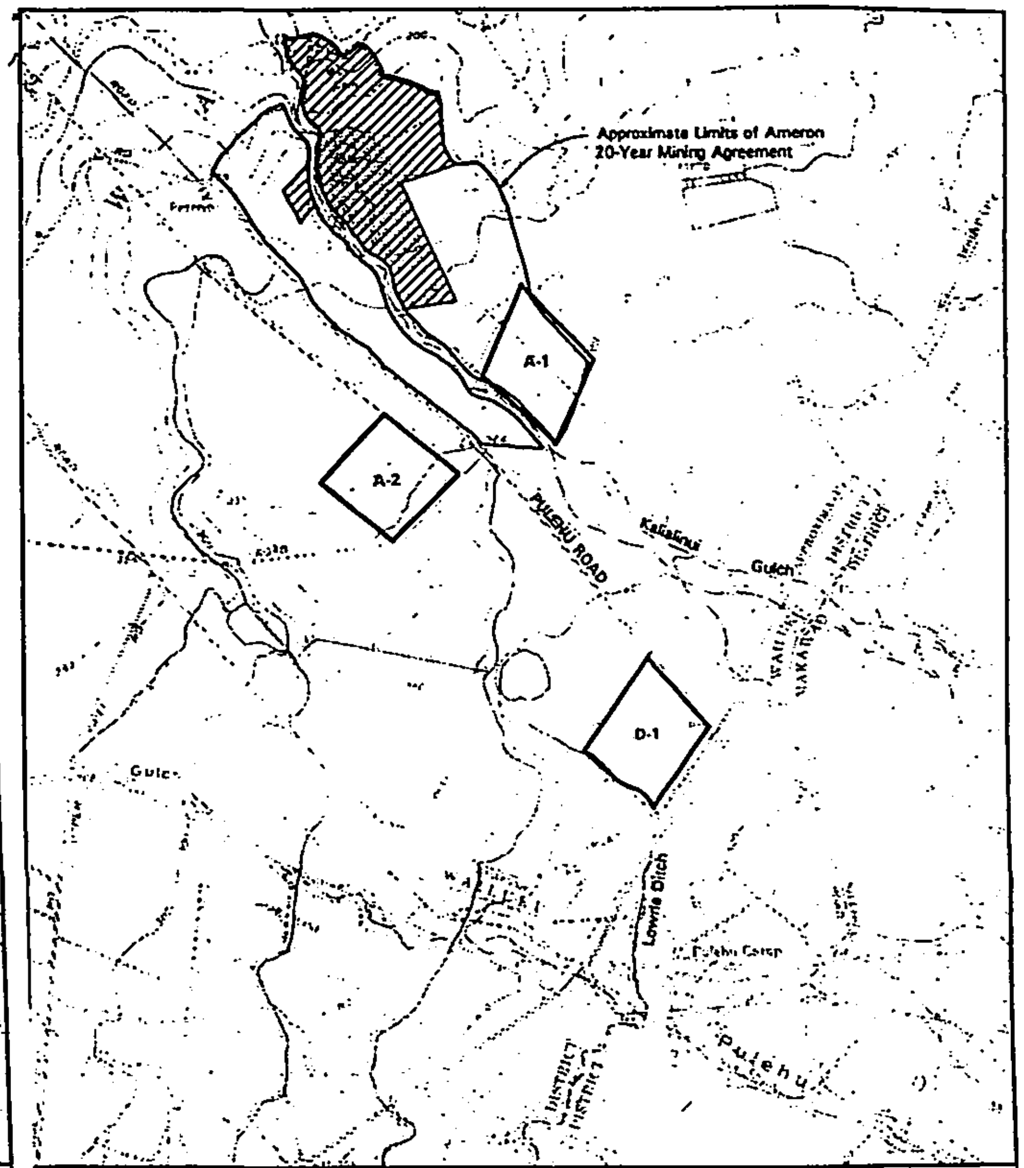
DOCUMENTS CAPTURED AS RECEIVED



LOCATION MAP CANDIDATE SITES

February 1995

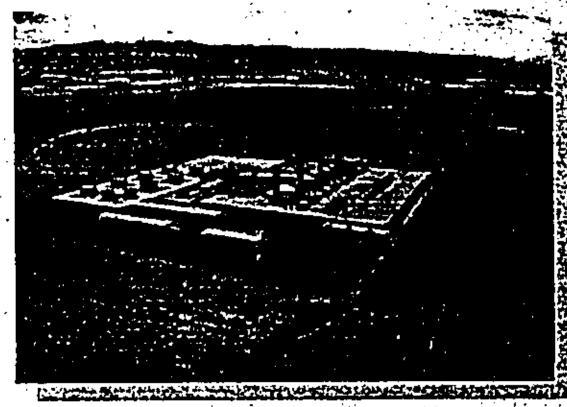
DAMES & MOORE



AMERON MINING AREAS

February 22, 1995

DAMES & MOORE



APPENDIX B3

1995 MECO GENERATION STUDY

MECO GENERATION SITING STUDY

CENTRAL MAUI

232-MW GENERATION STATION

MAUI ELECTRIC COMPANY, LIMITED

NOVEMBER 1995

Prepared By

STONE & WEBSTER ENGINEERING CORPORATION

1.0 INTRODUCTION

1.1 PURPOSE OF THE MECO GENERATION SITING STUDY

MECO proposes to design, construct, and operate a 232-MW electrical generation facility to supply future electric power needs for the Island of Maui. The purpose of this study is to determine the best generation site by evaluating the final three sites, A-2, D-1, and C-3, identified as the most preferred candidate sites through a series of previous siting studies. The study provides a comparative analysis of the final three candidate sites relative to environmental issues, engineering and infrastructure considerations, and the concerns of the Maui community. The general project area and the three site locations are shown on Figures 1-1 and 1-2.

The study includes an evaluation of the nine environmental issues: groundwater, surface water, plants, wildlife, cultural resources, noise, hazardous materials/wastes, natural hazards, and traffic that were included in the *Environmental Screening and Siting Report for the Central Maui Generation Project* (Dames & Moore, 1995) (D&M) and *Central Maui Siting Study* (Belt Collins Hawaii, 1994) (BCH) studies. These environmental issues have been identified as being important to a site selection process, and are also generally regarded as critical issues to be evaluated in the siting of electrical generation facilities. The results of the recently completed air quality analysis have been added to the environmental issues for the selection of the best site from the three candidate sites (Appendix G; Jim Clary & Associates, 1995).

1.2 DESCRIPTION OF THE CANDIDATE SITES

Site A-2 was determined to be highest ranked site by D&M in their *Environmental Screening and Siting Report for the Central Maui Generation Project*. Site D-1 was identified as having the best air quality by Trinity Consultants *Central Maui Siting Study Air Quality Analysis* (1993). Site C-3 was evaluated in previous siting and environmental studies conducted by BCH in the *Central Maui Siting Study* (1994) and Belt Collins & Associates (BCA) in the *Alternate Puunene Airport Site, Environmental Screening Report* (1992). A brief description of each of the candidate sites follows.

1.2.1 Site A-2

Site A-2 is generally located north of Waikapu Road, approximately 700 feet west of Pulehu Road. Site A-2 is a portion of TMK 3-8-03:01, a 1071-acre parcel owned by A&B-Hawaii, Inc. (A&B-Hawaii). The site is currently cultivated in sugarcane by Hawaiian Commercial & Sugar (HC&S) (D&M, 1995).

DOCUMENTS CAPTURED AS RECEIVED

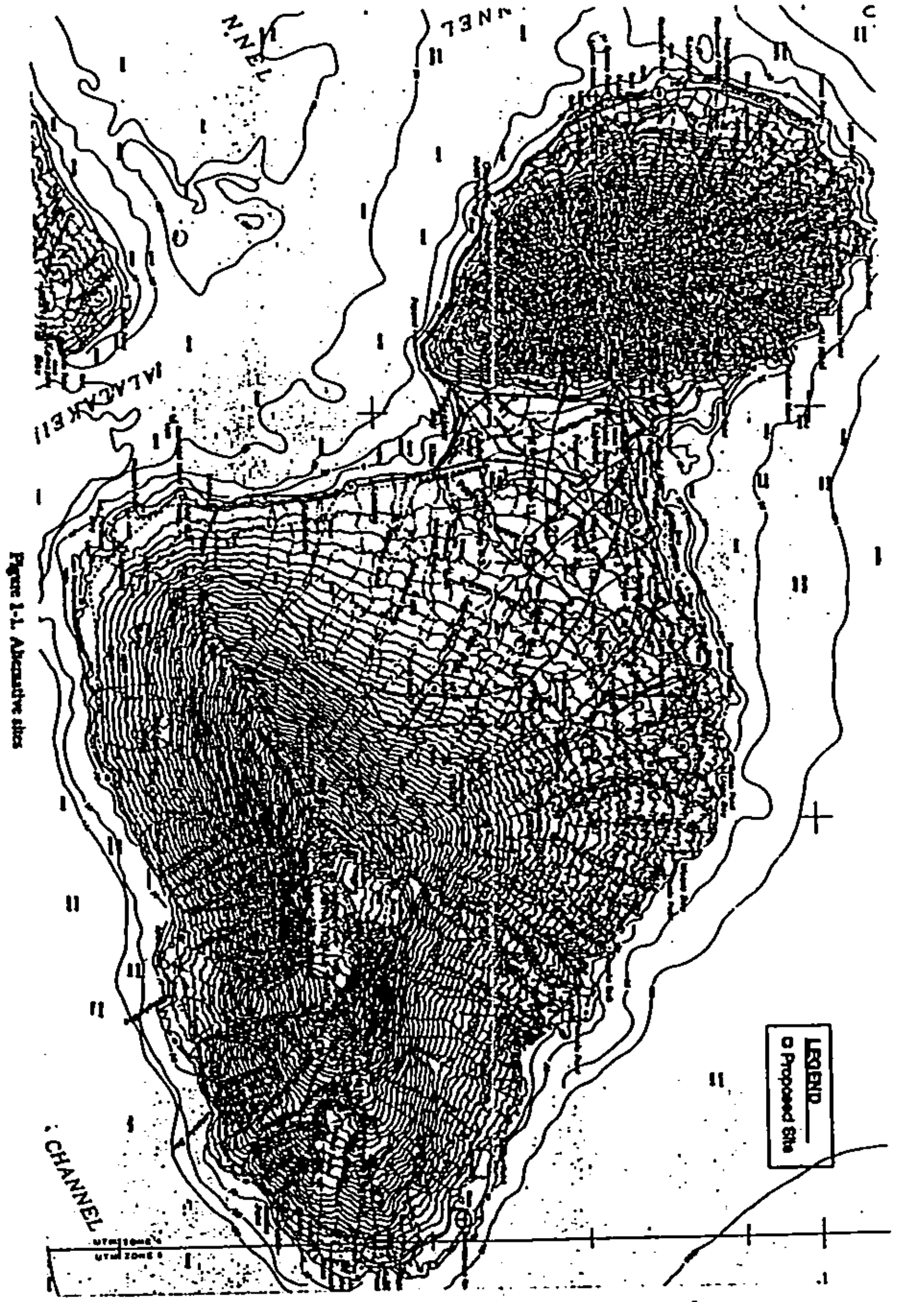


Figure 1-1. Alternative sites

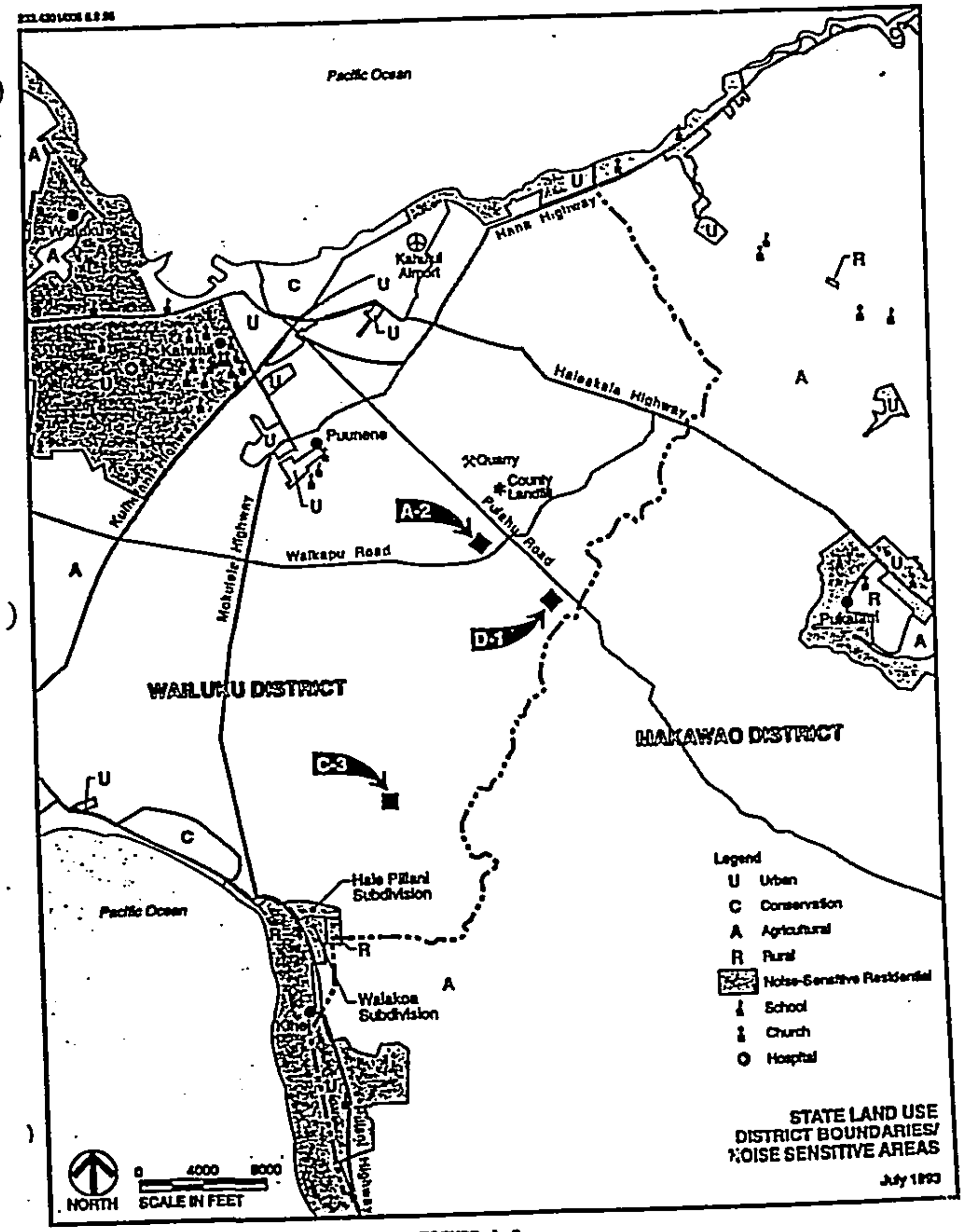


FIGURE 1-2

1.2.2 Site D-1

Site D-1 is located at the northwest quadrant of Pulehu Road and Lowrie Ditch Road. Site D-1 is a portion of TMK 3-8-03:02, a 1539-acre parcel owned by A&B-Hawaii, Inc. A meteorological station was previously located on this site to collect data for the project. This data is representative of Sites A-2, and D-1. The site is currently cultivated in sugarcane by HC&S (D&M, 1995).

1.2.3 Site C-3

Site C-3 is an undeveloped parcel located approximately 2 miles northeast of the Pi'ilani Highway in the *ahupua'a* of Pulehu Nui, Wailuku, Maui. The site is zoned as agricultural land and is a portion of TMK 3-8-04:02, a parcel owned by A&B-Hawaii, Inc. The site is bounded by Upper Kihei Road to the east, an unpaved cane haul road to the north, and to the south and west are cultivated sugarcane fields. The site is uncultivated and covered by boulders, grass, shrubs, and small trees (BCA, 1992). A meteorological station was previously located on this site to collect data for the project.

1.3 BACKGROUND OF PROJECT SITING EFFORTS

The current study builds upon and is the final addition to a body of work intended to assist MECO in selecting the next electrical generation site. This study incorporates the latest air quality data (Appendix G, Jim Clary & Associates, 1995), engineering criteria, and cost estimates into the site selection. A historical log of the siting studies conducted for this project follows. This information was taken from the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) and supplemented with studies completed after that work.

1989

An island-wide site selection study was conducted by SWEC in 1989. This study assessed ten candidate sites. Of these, three were identified as viable candidate sites for accommodating new generation units: Kahului Power Plant, HC&S Puunene Mill, and Mā'alaea Power Plant.

1991

A generating facility siting study conducted by Black & Veatch (B&V) in 1991 identified central Maui as the most appropriate location for a new, stand-alone (not a unit addition to an existing production unit) electrical generation facility. B&V (1991a, 1991b) identified the preferred site as the "Quarry Site," which it approximately 1 mile north of Site A-2, and the alternate site as the "Puunene Airport Site," which is near Site C-3.

1992

Further evaluation of the Quarry and Puunene Airport sites by MECO as well as by A&B-Hawaii and HC&S resulted in the identification of major concerns regarding both sites. In light of those concerns, A&B-Hawaii offered a new land parcel for evaluation and possible purchase by MECO, which is the site now identified as Site C-3. It is located approximately 2 miles northeast of Pi'ilani Highway.

In December 1992, BCA conducted an environmental screening of Site C-3 for four investigations: botany, wildlife, acoustics, and archaeology. The purpose of the environmental screening was to identify potential environmental "fatal flaws" of the site, however, none were identified, and Site C-3 remained a viable candidate site for consideration and further environmental evaluation.

1993

Further site evaluations were accomplished in 1993. BCH conducted a Phase I Preliminary Site Assessment of Site C-3 which concluded that no observable evidence exists to indicate the presence of hazardous substances in site soil or groundwater (BCH, 1993).

Tom Nance Water Resource Engineering assessed groundwater supply and disposal issues for Site C-3. This assessment did not identify any substantial groundwater concerns associated with the site (Tom Nance, 1993).

Trinity Consultants, Inc., utilized estimated project emission data in conjunction with known permitted uses to assess effects and permitting issues associated with siting the proposed project within the Central Maui region. This analysis identified areas of moderate, higher, and highest difficulty of air permitting for the proposed project. No areas within Central Maui were found to have a low level of permitting difficulty (Trinity Consultants, 1993).

1994

Information from previous studies was used by BCH to identify ten candidate sites within the Central Maui region potentially suitable for evaluation. Of the ten candidate sites, six were determined to be viable and were evaluated for a variety of environmental factors. Sites A-1, A-2, and D-1 were identified as the most preferred sites.

In 1994, meteorological towers were placed at two locations to collect ambient data. One station was located on Site C-3 and the other was located on Site D-1 at the northwest quadrant of Lowrie Ditch and Pulehu Road to represent Sites A-1, A-2, and D-1.

1995

In January 1995, D&M initiated an environmental screening and siting study. The intent of the study was to evaluate the three candidate sites, A-1, A-2, and D-1, relative to environmental issue areas identified as important to the site selection decision-making process.

Site A-1, included in the D&M screening study, was eliminated from the previously evaluated candidate sites. In its environmental screening study, D&M ranked Site A-2 as the best site in the Pulehu Road area, however, that study stated that air quality was very important and an air quality study should be performed prior to the selection of a final site. Since Sites A-2 and A-1 were in the same air quality area and Site A-2 ranked better for other environmental issues evaluated, Site A-1 was not selected as a final candidate site. Although Site D-1 was found to be the least environmentally desirable of the three sites in the Pulehu Road area, it was selected as a final candidate site because it was identified as having the best air quality in the earlier air quality study, *Central Maui Siting Study Air Quality Analysis* (Trinity Consultants, 1993). Site C-3 was included as one of the final candidate sites since it is not currently being used for sugarcane production and the landowner indicated it was available.

The air quality collected from the two meteorological towers installed in 1994 at Site C-3 and Site D-1 were used to model the project emissions from Sites A-2, C-3, and D-1 (Appendix G, Jim Clary & Associates, 1995). Predicted air emissions for the project were modeled at various stack heights to meet state ambient air quality standards (SAAQS), national ambient air quality standards (NAAQS), and Federal Prevention of Significant Deterioration (PSD) increment limits. Site A-2 was determined to be the only site for which compliance could be modeled given the existing Maui emissions inventory and assuming 232 MW of generation. Reductions in the emissions inventory would be required to maintain compliance at Site D-1 and even greater reductions would be required to model compliance at Site C-3.

This study was initiated by SWEC in June 1995 to evaluate the three final sites, A-2, C-3, and D-1, and determine the highest ranked site. The study incorporates the recent air quality studies and 5 years of environmental evaluation, engineering analyses, infrastructure considerations, and consultation with the general public, elected officials, agencies, and landowners.

1.4 COMMUNITY MEETINGS

A series of community meetings have been held with area residents to discuss the proposed project and the candidate sites. The discussions at the meetings have been generally favorable toward the proposed project, however, citizens preferred the sites that were away from their community (i.e., Sites A-2 and D-1 were preferred by the Kihei community). The meeting at Makawao was not favorable toward the project at any of the candidate sites. (Ref. Appendix H)

2.0 SYSTEM REQUIREMENTS

2.1 PROJECT PURPOSE AND NEED

MECO is a legally franchised utility responsible for the production, purchase, transmission, distribution, and sale of electricity on the islands of Maui, Moloka'i, and Lāna'i. The Company's total firm capacity for the island of Maui, after its second 58-MW DTCC expansion, will be 239-MW; 223-MW from MECO-owned plants, and 16-MW from HC&S. MECO must install new generating capacity to meet its customers' needs due to increased power demand and the expected retirement of existing generating units as they reach the end of their service life.

Peak power demand by MECO's customers increased an average of 6.6 percent per year between 1985 and 1992, rising from 101.9 MW to 159.7 MW. MECO considers this growth rate above average and expects it to slow considerably after 1995. Even with the slower growth rate expected, it is anticipated that the peak demand load will exceed the current total firm capacity within the next 20 years.

2.2 EXISTING POWER GENERATION AND TRANSMISSION SYSTEM

2.2.1 Generation Resources

MECO presently owns and operates 22 generating units on Maui, four at Kahului and 18 at Maalaea.

In addition to the above company-owned units, MECO purchases electrical energy from two non-utility generators (NUGs). One agreement is with HC&S that commits HC&S to provide 16 MW of firm capacity through 1999. This firm power normally supplements MECO's own generating capacity. An interchange and stand-by power agreement is with Pioneer Mill Company. This power is available only when the mill is producing electricity in excess of its own needs; thus, it cannot be relied upon to meet customer demand, and it is not included in MECO's firm capacity.

2.2.2 Transmission and Distribution Resources

MECO transmits power through the main 69 kV transmission grid. The higher voltage allows efficient transmission of large amounts of power to all major load centers. Substations at these major load centers have transformers that step down the 69 kV current to 12.47 kV for local distribution. Figure 2-1 shows the existing Transmission and Distribution (T&D) power lines and substations. Figure 2-2 shows the T&D power lines and substation that would be needed to transmit the power generated from a full 232 MW plant from the three candidate sites.

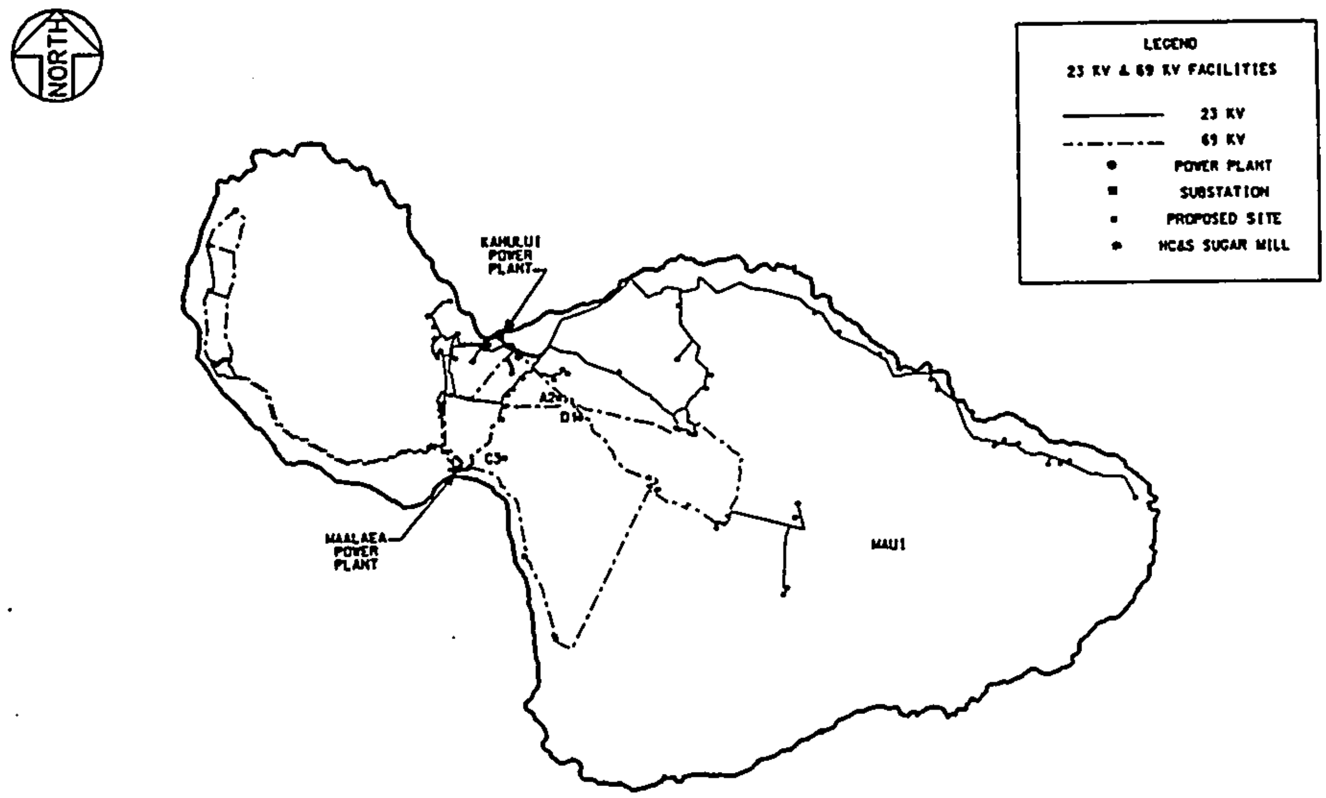
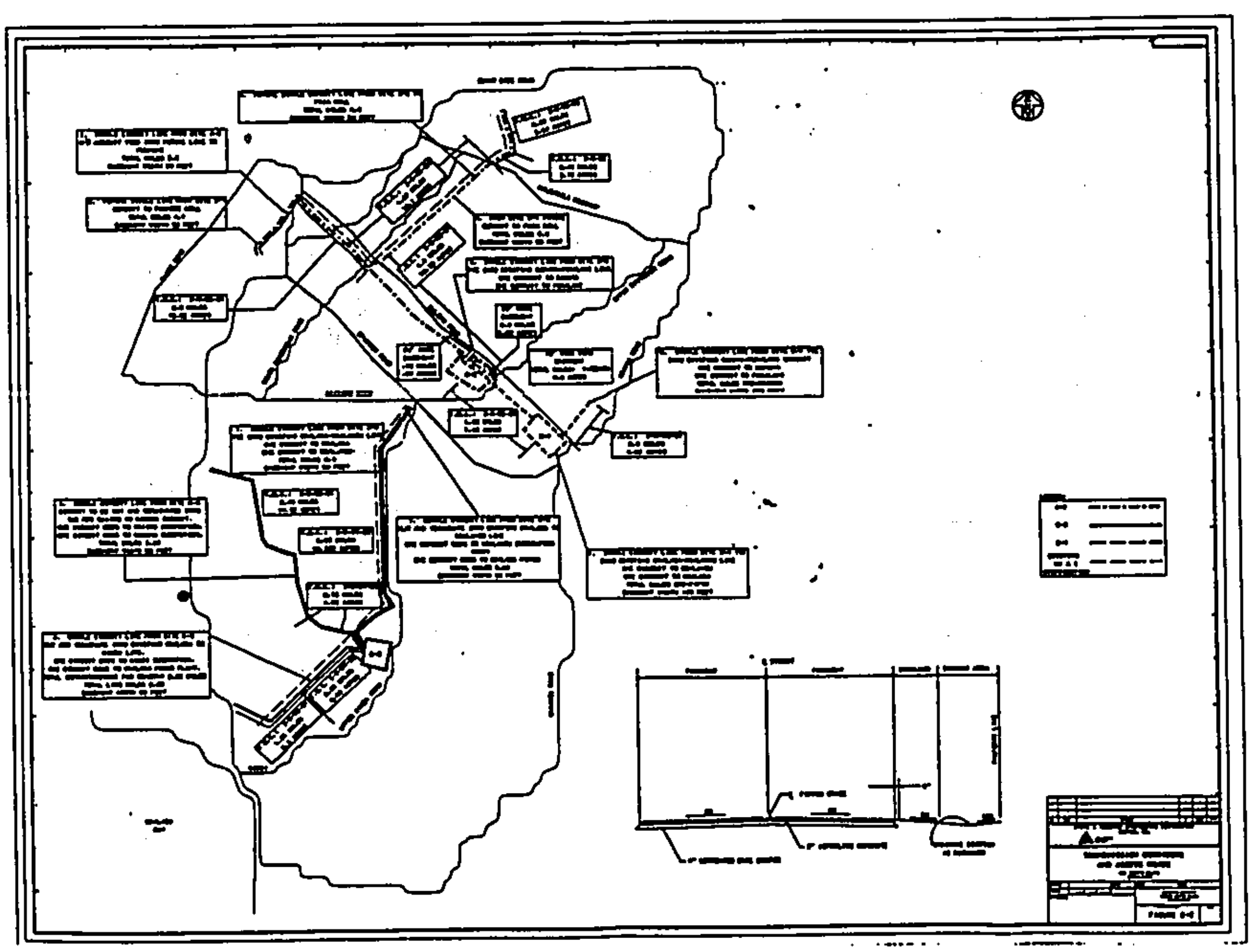


FIGURE 2-1 ALTERNATIVE SITES IN RELATION TO EXISTING ELECTRICAL GENERATION AND DISTRIBUTION

STONE & WEBSTER ENGINEERING CORPORATION



2.3 PROJECT DESCRIPTION

The following is an overview of the features of the generation facility that would be constructed on the candidate site.

2.3.1 Generation Station

The site arrangements for the Sites A-2, D-1, and C-3 are provided in Appendix A.

There will be two entrances to each of the sites. The main entrance will provide access for all vehicles except for the fuel delivery trucks. A separate entrance will provide access for fuel delivery. Parking for power plant personnel will be outside of the fenced area. The only vehicles in the Production area will be MECO vehicles and delivery trucks.

The main office and warehouse will be located near the main entrance to limit delivery traffic in the power block area of the plant. The fire protection tanks and pump house will also be located near the entrance for maximum fire truck accessibility.

The four dual train combined cycle (DTCC) blocks will be arranged with the stacks generally running perpendicular to the prevailing trade winds. Each block will consist of two combustion turbine generators (CTG), two heat recovery steam generators (HRSG), and one steam turbine generator (STG). A steam turbine building will be provided for the first two DTCC blocks with another steam turbine building provided for the last two blocks. The air cooled condensers for the steam turbines will be located adjacent to the steam turbine buildings. The maintenance building and control room will be located between the two steam turbine buildings.

The water treatment building and associated water tanks will be adjacent to the steam turbine buildings.

The switchyard area shown in the site arrangements is located based upon the transmission corridors required for the sites. The switchyard will be approximately 200 feet x 400 feet and contain 12 bays, one for each of the generating units, and one control house.

As an option, T&D Facility baseyard could be located near the entrance to the site. A T&D Facility would consist of three buildings: General Facilities, Warehouse, and Shop. Parking will be available in the T&D area for 85 T&D service trucks.
The General Facilities Building will consist of the engineering center, training center, office space, file storage area, showers, lockers, and rest rooms. The building will be approximately 204 feet x 66 feet and contain 13,464 square feet.

The Warehouse will consist of enclosed and open storage areas, a yard storage area, office space for Warehouse personnel, rest rooms, automotive parts storage, truck washing area, gas station area, and staging/assembly area. The building will be approximately 390 feet x 85 feet with 33,150 square feet.

The Shop will consist of a maintenance shop, meter shop, relay shop, radio shop, communications room, and computer room. The building will be approximately 300 feet x 66 feet with 19,800 square feet.

<u>58-MW DTCC System</u>

A brief description of the major components of a complete 58-MW DTCC System is provided below.

- Two diesel oil-fired CTGs, each with a nominal 20-MW capacity are used as prime movers to turn generators and produce electricity. Each CTG can be operated independently (i.e., in "simple-cycle" mode) or in conjunction with the HRSGs and steam turbine described below ("combined-cycle" mode).
- An HRSG will use the heat in the exhaust gases from each CTG to produce steam. A single, nominal 18-MW capacity STG uses the steam produced by the HRSGs to produce electricity.
- Air-cooled condensers will convert the spent steam exhausted from the STG back to liquid. Pumps will recycle the condensed water back to the HRSGs; makeup water for the steam system is supplied on an "as-needed" basis by the demineralized water system.
- Pumps and piping will provide feedwater to the HRSGs.
- On-site water supply and treatment (demineralization) facilities including water supply wells, a water treatment plant that removes impurities from the well water, storage tanks for the treated water and several small storage tanks for chemicals used in the water treatment process.
- Support equipment, including hydraulic starting units for the CTGs, fuel pumps, fuel pre-filters, turbine control panel, water injection pumps skid, lube oil coolers, and turbine wash water equipment.
- A 24 foot-diameter exhaust stack made of carbon steel; the stack would contain two 8 foot-diameter stainless steel flues, one for each of the combustion turbines. The height will be 150 feet to 210 feet, depending on the site.
- Fuel oil storage tanks (approximate capacity of 1.15 million gallons per tank) for #2 diesel fuel oil used in the combustion turbines.
- Metal buildings for warehouse, office, and shop space (to be erected during the installation of the first DTCC). The administration building located near the main entrance to the generation station will include the administrative offices, a conference/training room, computer rooms, a file storage area, a lunch room, rest rooms, and a lobby/reception area.

- A sanitary wastewater treatment and disposal system consisting of a septic tank for primary treatment (solids removal and anaerobic treatment), a dosing tank (for disinfection using chlorine), and sand filters (for removal of suspended solids and completion of the biological treatment).
- A drain system that collects all wastewater from ongoing on-site activities that might contain oil or other similar contaminants (including HRSG blowdown water, equipment cleaning products, and plant drain fluids) and conveys it to an oil/water separator.
- A wastewater reinjection system mixes treated wastewater from the reinjection tank with other plant wastewater and disposes of it in an injection well. The system would receive wastewater from the reverse osmosis water treatment equipment, regeneration of ion exchange equipment, filter backwash, treated sanitary, and cleaned oil/water separator wastewater.
- A storm water runoff system collects storm water runoff, conveys it to the oil interceptors, and discharges clean storm water.

A detailed listing of the equipment necessary for the DTCC Systems is included in Appendix D.

Transmission Lines

The full 232 MW plant will require three transmission corridors that connect the new switchyard and generating units with Maui's electrical transmission grid. The routing of these corridors is unique to each site. The proposed transmission corridors from each candidate site are shown on Figure 2-2.

The A-2 site has approximately 2.2 miles of double circuit lines and 4.8 miles of single circuit lines. The C-3 site has approximately 8.5 miles of double circuit lines. The D-1 site has approximately 3.6 miles of double circuit lines and 4.8 miles of single circuit lines.

3.0 PROJECT SCHEDULE AND COST

3.1 PROJECT SCHEDULE

3.1.1 Permitting Schedule

The schedule included as Appendix F indicates all the permits and reports required to be filed with County, State, and Federal agencies to support the start of construction for the first CT (CT-1). It is sorted by County, State, and Federal agencies (Reference Appendix E). In order to support a commercial operation date of January 2004 for CT-1, it is estimated that the permitting effort would have to commence in the last quarter of 1998.

The critical path of the project is through the permitting effort for receipt of the PSD permit from the State Department of Health and U.S. EPA. This effort could take as long as thirty months. This permitting effort is presently shown on the CT-1 schedule to start in October 1998. This allows the mechanical contractor to start his efforts on CT-1 in the last quarter of 2002.

3.1.2 Engineering/Construction Schedule

The phased installation of DTCC generating systems has been chosen to be the lowest cost and most flexible generation system for future power production. The 58-MW DTCC expansion, to be installed between 1996 and 2000 at the Mā'alaea Generating Station, will be constructed in three phases and is anticipated to supply generating capacity to meet MECO's customers' current forecasted needs through 2003. It is projected that additional generation will be needed about 2004. To accomplish the January 2004 commercial operation date for the first combustion turbine, the engineering effort would have to commence in November 2000. This represents a total engineering/construction/startup duration of three years and two months. The CT-1 schedule is about three months longer than the CT-2 schedule. The lengthened schedule for CT-1 accommodates the additional facility infrastructure construction for CT-1. It is assumed that the first CT unit construction will include the office/warehouse, control room, and a significant portion of the water treatment facility (Reference Appendix F).

The engineering effort for CT-2 is scheduled to commence in March 2003 and achieve commercial operation in January 2006. The engineering effort for the first Steam Turbine (ST-1) is scheduled to commence in February 2005 and achieve commercial operation in January 2008, thus completing the first of the four DTCCs.

3.2 COST SUMMARY

The overall cost of engineering, procurement and construction of four complete combined cycle units at Site A-2 is estimated at $388,235,000. The overall cost of engineering, procurement, and construction at Site C-3 is estimated at $392,617,000. The overall cost of engineering, procurement, and construction at Site D-1 is estimated at $401,963,000 (Reference Appendix C).

The above estimates are all based on 1995 dollars. No provision for escalation has been made. No provision for contingency, owner's costs, or interest during construction has been made.

The variance in costs between Sites A-2, C-3, and D-1 are explained below.

Structures and Improvements - Site Preparation

Total site preparation costs for Site C-3 are approximately $2,200,000 higher than Site A-2. There is an extensive amount of additional road work required on Site C-3. The projected site preparation costs for D-1 are estimated to be approximately $100,000 lower than the projected costs for Site A-2 due to its location adjacent to Pulehu Road. Site A-2 will require a short access road from Pulehu Road.

Plant Equipment - Water Treatment and Storage

Water treatment costs for Sites A-2 and C-3 are estimated to be the same, and include both water treatment and wastewater treatment equipment.

Since injection wells are not an option for Site D-1, a brine concentrator and crystallizer are required for disposal of the wastewater, increasing the costs at this site. The added cost for this system is estimated to be $3,317,000 per combined cycle unit. It should be noted that the cost for injection wells and reinjection filters of $381,500 per combined cycle unit will not be incurred at Site D-1.

Prime Movers - Stack

Stack costs for Sites C-3 and D-1 are estimated to be $400,000 higher than Site A-2 per combined cycle unit. A 210 foot tall stack is recommended at Sites C-3 and D-1, compared to the 150 foot tall stack recommended for Site A-2.

Station Equipment - Transmission Corridors

The transmission line costs are spread among the first three DTCCs for each site. Each of the three sites has three transmission corridors which connect the new switchyard with Maui's electrical transmission grid. One corridor, with a dual circuit entering and exiting the site, will be installed during the construction of the first CT for DTCC-1. The second corridor will be

installed during construction of the first CT for DTCC-2 and the third corridor installed during construction of the first CT for DTCC-3.

The estimated costs of the three transmission corridors for Site A-2 are $3,082,000; Site C-3, $4,675,000; and Site D-1, $3,835,000.

Indirect - Land Appraised Values

The land appraised values used are based on an appraisal by Medusky & Co., Inc. dated August 1995. The current land appraised values, which include the power plant site, transmission and access easements, and damages to the adjacent lands, are as follows: Site A-2, $1,837,421; Site C-3, $811,512; and Site D-1, $1,569,218.

4.0 SITE EVALUATION

This section describes the steps taken and methods used to evaluate and comparatively rank the candidate sites: A-2, D-1, and C-3. The general steps taken in the study were:

- Develop facility layouts with elevations, transmission corridors, and service routes
- Develop screening factors, weight screening factors, and develop evaluation criteria
- Evaluate candidate sites
- Rank candidate sites
- Obtain and review additional information on fuel delivery methods and cost, capital costs for the facility and infrastructure, major equipment, permitting requirements, scheduling, and air quality for each site

The evaluation of candidate sites by individual resource area presents the results of the Central Maui Generation Project site selection process. First, an evaluation is made of any fatal flaws that might remove a candidate site from further consideration. The fatal flaw evaluation is followed by a list of the screening factors (parameters) used to evaluate the candidate sites, including a description of applicable evaluation criteria for each screening factor and the weight assigned to each screening factor to indicate its importance in the site selection process. Candidate sites are briefly described with respect to each screening factor, and each site is scored according to the pertinent evaluation criteria. Finally, weighted site scores for each screening factor are summed to produce overall site scores, which are then ranked to indicate the order of preference of the sites. A sensitivity analysis is performed to verify the findings of the site selection process.

4.1 FATAL FLAW EVALUATION

"Fatal flaws" are characteristics of a site that would constrain development of the Central Maui Generation Project. An example of such a fatal flaw would be the consumption of more than the allowed AAQS/PSD (Ambient Air Quality Standards/Prevention of Significant Deterioration) increment. The presence of a fatal flaw would eliminate a candidate site from further consideration. Review of past siting studies, i.e., the *Central Maui Siting Study* (BCH, 1994) and the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995), as well as the results of the current study, indicate that no candidate site is fatally flawed. Therefore, Sites A-2, D-1, and C-3 are carried forward for further investigation and comparative evaluation.

4.2 SCREENING FACTORS AND SITE SCORING

This section evaluates the candidate sites according to the screening factors judged to be relevant to assessing their suitability for the proposed generating facilities. In general, the criteria used to evaluate each screening factor are described in decreasing order, beginning with the ones that define the conditions that are most favorable to power plant development and ending with conditions that are least favorable. Weights assigned to each screening factor reflect the importance of that factor in the site selection process, with the most important factors being assigned a weight of 5 and the least important assigned a weight of 1. In the scoring of sites for each screening factor, a score of 1 represents the most suitable conditions and a score of 3 the least suitable conditions.

The evaluation criteria for each screening factor are described and discussed. The evaluation criteria established in the *Central Maui Siting Study* (BCH, 1994) and the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) were used in the evaluation of the candidate sites. Those definitions were incorporated into this study to maintain consistency in the screening factor descriptions. For screening factors that were not included in the two previous studies, evaluation criteria were established by SWEC in consultation with MECO, Hawaiian Electric Company, Inc. (HECO), and BCH. Each screening factor was scored for each site according to the evaluation criteria to obtain a Raw Site Score.

4.2.1 Land Ownership, Use, and Regulations

Land Ownership

The existing ownership of a potential site affects its suitability for power plant development in that it influences the complexity and/or cost of acquisition. At least 50 acres are needed for the proposed power plant.

Evaluation Criteria The *Central Maui Siting Study* (BCH, 1994) used the following criteria to evaluate land ownership, and the same criteria are used in this evaluation of the candidate sites.

- MECO already owns all or part of the site. Areas already owned by MECO (in whole or part) are the best with respect to this factor.
- Areas of at least 50 acres that are controlled by a single owner are considered the second most favorable with respect to this factor because single-ownership would simplify negotiations between the utility and the landowner.
- Areas of at least 50 acres owned by between two and ten owners are considered the next most suitable. The larger number of owners complicates purchase negotiations and decreases the probability that acquisition can be completed without condemnation.
- Areas of at least 50 acres where ownership is split among more than ten owners are the least favorable because the large number of owners complicates the acquisition process.

Weight MECO's power to condemn land needed for utility purposes limits the importance of this factor, but it remains a consideration. Purchasing is simplified if the area being acquired is owned by one or a few parties who are inclined to negotiate an agreement rather than to force condemnation. Land ownership was assigned a weight of 1 (BCH, 1994).

Scoring All sites are under the sole ownership of A&B-Hawaii and, therefore, were given raw site scores of 2 for this factor.

Existing Land Use

The existing uses of prospective sites is relevant because it affects the ease and cost of acquisition.

Evaluation Criteria It was assumed that sites that could be developed without displacing existing uses are preferable to sites already in productive use. Areas already being used were rated according to the relative cost of relocating those uses. The *Central Maui Siting Study* (BCH, 1994) used the following criteria to evaluate land use, and the same criteria are used in this evaluation of the candidate sites.

- Vacant land on existing power plant sites is considered most favorable with respect to this parameter because its development would not preclude any existing or potential economic use.
- Vacant land that is not being used for any purpose, including agriculture, is considered the second most favorable because power plant development would not displace any existing use.
- Land currently used for ranching or other low-density agricultural uses (or that is temporarily fallow) is considered the next most favorable because development of a power plant would have a limited effect on existing economic uses.
- Land currently being cultivated is considered the next most favorable for power plant development. Irrigated lands or lands that are part of a larger integrated operation (e.g., sugarcane cultivation) are less suitable than isolated farm parcels because relocation costs and the economic impact on ongoing operations are likely to be higher.
- Areas already developed for urban uses other than industrial are considered generally unsuitable for power plant development because of the cost of relocating the existing uses and the likelihood that power plant operations would prove to be incompatible with adjacent uses.

Weight Existing land use is often one of the most important in power plant siting decisions. In this case, the largely agricultural nature of the candidate sites moderates the importance of this factor, and existing land use was assigned a weight of 2 (BCH, 1994).

Scoring Sites A-2 and D-1 are part of HC&S's sugar plantation, and power plant development would remove the plant site from cultivation. However, the area required (50 acres) is small enough that its removal would not have a significant secondary effect on operations, e.g., by reducing the area under cultivation to the point where sugar mill operation is uneconomical. Therefore, Sites A-2 and D-1 were given raw site scores of 3 for this factor. Site C-3 is located within a relatively large parcel of vacant land. Because construction of a power plant would not displace any existing uses from the site or from immediately adjacent areas, the site was given a raw site score of 1 for this factor.

State Land Use District Designation

The existing State Land Use designation of a potential site is relevant because it affects the ease and cost of obtaining approval for power plant development.

Evaluation Criteria The *Central Maui Siting Study* (BCH, 1994) used the following state land use designation criteria, and the same criteria are used in this evaluation of the candidate sites.

- Areas already in the Urban District are considered most suitable for power plant development. The Urban District is intended for uses that involve "city-like" concentrations of people, structures, streets, and land uses. Power plants are clearly urban uses and are most appropriately developed within urban areas. In practice, however, land classified as Urban must also be zoned by the county for heavy industrial uses such as power plant development (see Community Plan Designation, below).
- Lands within the Agricultural District are the next most suitable designation with respect to this factor. Such lands are subdivided into two categories depending on the master productivity rating assigned to them by the Land Study Bureau (see Section 5.2.3). Because the productivity ratings reflect an area's potential agricultural importance, the Land Use Commission has been more reluctant to urbanize areas with soils having high ratings (A or B) than areas having lower rated soils (C, D, or E). Thus, lands within the Agricultural District with lower rated soils are considered more suitable for power plant development than lands with higher rated soils.
- Although public utilities are permissible uses in the Rural District, the county zoning needed for power plant development (Heavy Industrial) would not normally be allowed in the Rural District, and any potential site would likely have to be redesignated as Urban for power plant development to take place. Consequently, Rural areas are considered less suitable for power plant development than land in the Urban and Agricultural Districts.
- Uses in the Conservation District are regulated by the State Department of Land and Natural Resources. Power generation facilities are allowable uses in all five subzones of the Conservation District, provided they use the renewable resources of the area, such as hydroelectric, geothermal or wind energy, meaning fossil-fueled power plants would be generally incompatible with Conservation District objectives. Therefore, areas within the Conservation District are considered the least desirable.

Weight Because it is relatively important that a power plant site have the appropriate state land use designation, this factor was assigned a weight of 3 (BCH, 1994).

Scoring All three sites are located in the state Agricultural District. Because the soils at Sites A-2 and D-1 have high productivity ratings (A and B), these sites were given raw site scores of 3 for this factor. The soils at Site C-3 are less suited for agricultural production (C, D, or E) and the site was given a raw site score of 1.

Community Plan Designation

Community Plans govern the character of development in each of the County's planning districts. These plans implement the planning objectives stated in the *Maui County General Plan* by establishing region-specific goals and objectives and through maps showing allowable land uses.

Evaluation Criteria The *Central Maui Siting Study* (BCH, 1994) used the following community plan designation criteria, and the same criteria are used in this evaluation of the candidate sites.

- Areas designated Heavy Industrial by the Community Plan are considered most suitable for power plant development. This designation is reserved for major industrial operations whose effects are potentially noxious due to noise, airborne emissions, or liquid discharges. It is assumed that such effects have been considered in the Community Plan process and that there would be relatively little public objection to power plant development in areas so designated.

- Locations within extensive areas designated Agricultural by the Community Plan are considered the next most suitable because power plant development is unlikely to significantly affect nearby agricultural activities. Locations on the fringe of areas designated Agricultural are less suitable if they are adjacent to residential or other incompatible uses.

- Areas designated Light Industrial by the Community Plan are the next most suitable because power plant development there would require amending the Community Plan. Amendment might be difficult if opposed by neighboring property owners.

- Areas with other designations (e.g., Residential and some public or quasi-public uses such as hospitals, recreation areas, etc.) are considered least suitable because the primary uses of these areas are generally incompatible with power plant operations.

Weight Because it is relatively important that a power plant site have the appropriate county land use designation or that it would be likely that zoning changes could be obtained, this factor was assigned a weight of 3 (BCH, 1994).

Scoring All three sites are located in areas designated Agricultural by the county Community Plan and were given raw site scores of 3 for this factor.

County Zoning

The County of Maui Zoning Ordinance regulates the timing of land development and establishes specific design criteria. The ordinance lists public utility uses as permitted uses in most zoning districts, but does not specifically mention power plants as either permitted or special uses in any zoning district. MECO's two existing power plants are located in the M-2 Heavy Industrial Zoning District, and the Maui County Planning Department has indicated to MECO that it believes the M-2 designation is generally the most appropriate one for future power plants.

Evaluation Criteria The *Central Maui Siting Study* (BCH, 1994) used the following county zoning criteria, and the same criteria are used in this evaluation of the candidate sites.

- M-2 Heavy Industrial designation is considered the most appropriate for power plant development.

- The next most suitable areas are those not yet zoned for heavy industrial use but having characteristics that make them suitable for that use. Such areas would be likely to receive the necessary zone change from the County. They include areas adjacent to existing M-2 zones and areas removed from existing and future uses (such as residential) that are incompatible with anticipated activities at the power plant site.

- Areas least suitable are those close to residential and other uses typically sensitive to the noise, traffic, and other factors generally resulting from power plant operations.

Weight Because it is relatively important that a power plant site have the appropriate County zoning designation or that it is likely that zoning changes can be obtained, this factor was assigned a weight of 3 (BCH, 1994).

Scoring None of the candidate sites is located in the M-2 Heavy Industrial Zoning District. Development at any of the sites would require a county zoning change, and Sites A-2, C-3, and D-1 were given raw site scores of 3 on that basis.

Existing/Planned Adjacent Land Use

Existing and planned uses of lands adjacent to candidate sites could affect the ease of siting approval.

Evaluation Criteria The following criteria were used for the evaluation (D&M, 1995):

- Sites where adjacent land is undeveloped and where no future development is planned are considered most favorable with respect to this parameter because their development would not conflict with any existing or planned use of adjacent land.

- Sites where adjacent land is used or is planned to be used for ranching or other low-density agricultural uses (or that is temporarily fallow) are considered the next most favorable because development of a power plant would have a limited effect on existing or planned uses of adjacent land.

- Sites where adjacent land is cultivated or is planned to be cultivated are considered the next most favorable because power plant development would not have significant effects on existing or planned uses of adjacent land.

- Sites adjacent to areas developed or planned for urban uses other than industrial are considered generally unsuitable because power plant development would be incompatible with such existing or planned uses of adjacent land.

Weight Because it is moderately important to select a site that is not adjacent to an incompatible use or planned use, this factor was assigned a weight of 2 (D&M, 1995).

Scoring Based on the existing and planned agricultural use of lands in the vicinity of all of the site, each site was given a raw site score of 1.

4.2.2 Air Quality

Air quality constitutes one of the most important environmental screening factors in the site selection process. Preliminary air quality data were reported in the *Central Maui Siting Study Air Quality Analysis* (Trinity Consultants, 1993). In this study, the central valley area of Maui was divided into zones of air quality permitting difficulty (moderate, higher, and highest) using modeling data of criteria pollutants. The preliminary study indicated there were no areas of low difficulty. Using the Trinity Consultants data, BCH reported Site D-1 as having the least air quality permitting difficulty, with the permitting difficulty of Site A-2 close to that of Site D-1, and Site C-3 potentially having the most air quality permitting difficulty.

In 1994, with the assistance of Jim Clary & Associates, MECO established two meteorological stations for the purpose of collecting meteorological data for modeling air quality in the areas of Site C-3 and Sites A-2 and D-1. The air quality screening results reported in *Air Quality Screening Analysis for the Central Maui Generation Project* (Jim Clary & Associates, 1995) were used to establish minimum stack height, significant impacts, and required changes in the existing source inventory for each of the three candidate sites. A summary of the results follows:

- At equal stack heights, air quality impacts of a facility at Site A-2 are significant for fewer pollutants and averaging periods and, thus, should be easier to permit.

- Considering the existing source inventory, a 232-MW plant modeled compliance at Site A-2 only. Compliance at Site A-2 would be achieved with a stack height of 150 feet. Sites D-1 and C-3 would require changes in the existing source inventory for 232 MW even with the maximum allowable stack height of 210 feet.

Maximum AAQS/PSD Increment Consumed

Weight The ability to permit the entire 232 MW at a candidate site is an important factor in the site selection process. As reported in the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995), the time and cost associated with air quality permitting, the cost of pollution control devices, and potential restrictions on operation of electrical generation facilities can fluctuate, depending on location. Existing air quality was assigned a weight of 5 to indicate the importance of this site selection factor.

Scoring The following scores were obtained from the air quality screening results reported in *Air Quality Screening Analysis for the Central Maui Generation Project* (Jim Clary & Associates, 1995).

Site A-2 was given a raw site score of 1 for this factor because a 232-MW plant modeled compliance considering the existing source inventory. Site D-1 was given a raw site score of 2 for this factor because it had more significant pollutants (SO_2) than Site A-2 and would require changes in the existing SO_2 emission inventory for even the first 20 MW combustion turbine unit. Site C-3 was given a raw site score of 3 for this factor because it had more significant pollutants (SO_2 and PM_{10}) than Site A-2 and would require changes in the existing SO_2 emission inventory for the first combustion turbine unit and changes in the existing PM_{10} emission inventory for the fourth combustion turbine unit.

Minimum Stack Height Reported

The recommended height of the stack at a candidate site is also relevant because the tallest stack is the least favorable aesthetically. As the height of the stack increases, the visual awareness of the plant is greatly increased.

Weight Due to the importance of aesthetics and cost, minimum stack height was assigned a weight of 5.

Scoring Site A-2 was given a raw site score of 1 because it would have the lowest minimum stack height required (105 feet). Compliance at Site A-2 for the complete facility would be achieved with the recommended stack height of 150 feet. Site D-1 would have the second lowest minimum stack height required (150 feet) and Site C-3 would have the highest minimum stack height required (180 feet). The recommended stack height for Sites C-3 and D-1 would be 210 feet. Sites D-1 and C-3 were given raw site scores of 2.

Distance From Residential Receptor

The distance from an emission source to the surrounding residential receptor will influence the effect of emissions on the surrounding area and subsequent permitting conditions.

Weight A weight of 5 was assigned to this screening factor to indicate the importance of the location of a power plant in relation to surrounding residential areas.

Scoring Sites A-2 and D-1 were given raw site scores of 1 because the sites were not near any major residential areas. Site C-3 was given a raw site score of 3 because it is relatively close to a Kihei residential subdivision.

4.2.3 Soils and Geology

Soils

The potential agricultural productivity of soils is relevant to power plant siting because site development could remove agriculturally productive soils for uses other than agriculture.

Evaluation Criteria The Land Study Bureau has classified soils from "A" (highest productivity) to "E" (lowest productivity). The rating system reflects the relative importance of preserving areas in agricultural use. It is also directly linked to the State Land Use District controls (see Section 5.2.1). The *Central Maui Siting Study* (BCH, 1994) used the following two soils criteria to evaluate this factor, and the same criteria are used in this evaluation of the candidate sites.

- Soils rated C, D, or E are considered preferable to A or B rated soils because withdrawing these less productive soils from agricultural use would have less effect on potential agricultural output.
- Soils rated A or B are considered less suitable for power plant development because their removal from agricultural use would have a greater effect on agricultural potential.

Weight Agriculture is a major part of the economy of Maui, and both state and county governments are dedicated to maintaining viable agricultural sectors in the economy. Because it is considered moderately important to try to avoid sites having the most agriculturally productive soils, this factor was assigned a weight of 2 (BCH, 1994).

Scoring All three candidate sites have deep, nearly level to moderately sloping, well-drained and excessively drained soils that have a moderately fine-textured to coarse-textured subsoil or underlying material. Soils at Sites A-2 and D-1 are classified by the U.S.D.A. Soil Conservation Service (SCS) as Waiakoa silty clay loams (WeB) (Foote et al., 1972). The soil at Site C-3 has not been cleared of surface stones, as has been the case at the other sites and is, therefore, described as being extremely stony Waiakoa silty clay loam (WID2).

Because most of the soils in the vicinity of Sites A-2 and D-1 have high agricultural productivity ratings (A and B), these sites were given raw site scores of 2 for this factor. Site C-3, which is located in an area with soils less suited for agricultural production (C, D, or E) and which is the only site not currently used for agriculture, was given a raw site score of 1.

Geology

Bedrock geology can affect engineering considerations related to the power plant foundation and, consequently, may influence construction costs.

Evaluation Criteria The evaluation is based on the depth to bedrock. Sites with bedrock less than 25 feet from the surface are considered more favorable than sites with bedrock greater than 25 feet from the surface.

Weight Because this factor is not considered of overriding importance in power plant siting, it was assigned a weight of only 1.

Scoring The geologic materials over which the soils have formed are weathered igneous rocks that have been influenced by volcanic ash. The hardrock geologic foundation of all of the candidate sites is basaltic rock. The depth to bedrock is less than 25 feet at all sites. Therefore, all sites were given raw site scores of 1 for this factor.

4.2.4 Topography

Topography affects the difficulty (and, therefore, the expense) of developing heavy industrial facilities. It also influences the potential for soil erosion and other adverse environmental effects.

Evaluation Criteria In general, sites that have moderate topographic relief are preferable to sites with steeper terrain or that are too flat to provide good site drainage. The *Central Maui Siting Study* (BCH, 1994) used the following criteria to evaluate topography, and the same criteria are used in this evaluation of the candidate sites.

- Sites with average slopes of between 2 and 4 percent are considered most favorable for power plant development. Slopes in this range provide positive drainage without requiring special engineering measures or requiring excessive cut volumes or cost.
- Sites with average slopes of less than 2 percent or between 4 and 8 percent and that do not include substantial amounts of steeper terrain are considered next most suitable. Both require some special engineering (either to ensure adequate drainage or to provide suitable building space), but the additional cost of the special provisions is moderate. Significant erosion hazards and other adverse environmental effects can usually be avoided using standard construction techniques.
- Sites with average slopes of 8 to 16 percent and sites with lower average slopes that have substantial amounts of steeper terrain are considered next most suitable. The limitations of the relatively steep terrain can be overcome with appropriate engineering measures, but development costs are higher and the potential for adverse environmental effects (e.g., erosion during construction, unsightly cut slopes, etc.) is greater than for sites with lesser slopes.

- Areas with average slopes in excess of 16 percent are considered generally unsuitable for power plant development because of the additional costs required to provide stable foundations and avoid excessive erosion. Consequently, they are given the lowest suitability rating with respect to this factor.

Weight The average slope of the sites is relatively unimportant for the range of conditions on the sites under consideration. Slopes are not sufficient to create potential problems with respect to slope stability or soil erosion. Therefore, topography was assigned a weight of 1 (BCH, 1994).

Scoring The greater part of all sites have topography that is reasonably suitable for power plant development. Slopes range from 0 to 8 percent. Normal construction techniques can be used without creating a potential for significant environmental harm (BCH, 1994). Sites A-2, D-1, and C-3 were all given raw site scores of 1 for this factor.

4.2.5 Groundwater

Groundwater Supply – Availability

The availability of groundwater supply for operations can influence the attractiveness of a candidate site.

Evaluation Criteria Because all sites investigated in the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) were known to have available groundwater, that study focused on the cost of supply wells based on depth to groundwater, well capacity/yield, and whether optional off-site sources are available. The same criteria are used in this evaluation.

Weight Because of the importance of siting the power plant over or near an aquifer from which sufficient quantities of groundwater can be withdrawn for plant use, this factor was assigned a weight of 5 (D&M, 1995).

Scoring Groundwater in the area of all candidate sites occurs as a basal lens in the Honomanu volcanic series and, to a lesser extent, the Kula volcanic series. The aquifer comprises lava and associated extrusive volcanic rocks, which are highly permeable and readily yield water to pumping. The sites lie within Maui's central sector, which includes four aquifer systems; specifically, all sites lie within the Paia aquifer system (DLNR, 1992). Groundwater flow in the vicinity of the sites is from higher ground elevation toward the coastal reach (D&M, 1995). Sufficient groundwater is available to meet the estimated needs of the proposed generation project. For this reason, all candidate sites were given raw site scores of 1.

Groundwater Supply – Interference with Existing Uses

Potential interference with pumping from existing wells could increase the difficulty of permitting a candidate site.

Evaluation Criteria Areas where pumping groundwater from supply wells is unlikely to interfere significantly with pumping from existing wells are preferable to locations where well interaction might occur (D&M, 1995).

Weight Because this screening factor is considered moderately important to the siting process, it was assigned a weight of 3 (D&M, 1995).

Scoring All three candidate sites are located sufficiently distant from any water supply wells that pumping from the underlying aquifers would be unlikely to interfere significantly with existing uses. Therefore, all sites were given raw site scores of 1 for this factor.

Groundwater Supply – Quality

The quality of groundwater supply for operations can affect water treatment costs and the relative difficulty of permitting a candidate site.

Evaluation Criteria Locations where wells are likely to provide water of lower salinity are considered generally superior because water treatment for use in power plant operations would be less costly. However, areas with potable quality water are considered less desirable than areas where chlorides exceed drinking water standards because permitting industrial supply wells in areas that are potential sources of drinking water has the potential to be more difficult and costly (D&M, 1995).

Weight This screening factor was assigned a relatively low weight of 2 (D&M, 1995).

Scoring Groundwater in the Paia aquifer system is a mixture of brackish and potable water. The estimated sustainable yield of the aquifer is 8 million gallons per day (MGD) (DLNR, 1992), of which about one-half has potable water quality. Wells at Sites A-2 and D-1 would probably provide water of lower salinity than the well at Site C-3. However, it is likely that there would be little difference in the cost of treating the groundwater from any of these sites for industrial use (D&M, 1995). Because Sites A-2 and C-3 overlie non-potable quality portions of the aquifer, permitting may be relatively easy at these locations, and the two sites were each given raw site scores of 1 for this factor. Because Site D-1 overlies a potable quality portion of the aquifer, permitting may be more difficult, and this site was given a raw site score of 2.

CORRECTION

THE PRECEDING DOCUMENTS(S)

HAS BEEN REPHOTOGRAPHED

TO ASSURE LEGIBILITY

SEE FRAME(S)

IMMEDIATELY FOLLOWING

DOCUMENTS CAPTURED AS RECEIVED

- Areas with average slopes in excess of 16 percent are considered generally unsuitable for power plant development because of the additional costs required to provide stable foundations and avoid excessive erosion. Consequently, they are given the lowest suitability rating with respect to this factor.

Weight The average slope of the sites is relatively unimportant for the range of conditions on the sites under consideration. Slopes are not sufficient to create potential problems with respect to slope stability or soil erosion. Therefore, topography was assigned a weight of 1 (BCH, 1994).

Scoring The greater part of all sites have topography that is reasonably suitable for power plant development. Slopes range from 0 to 8 percent. Normal construction techniques can be used without creating a potential for significant environmental harm (BCH, 1994). Sites A-2, D-1, and C-3 were all given raw site scores of 1 for this factor.

4.2.5 Groundwater

Groundwater Supply -- Availability

The availability of groundwater supply for operations can influence the attractiveness of a candidate site.

Evaluation Criteria Because all sites investigated in the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) were known to have available groundwater, that study focused on the cost of supply wells based on depth to groundwater, well capacity/yield, and whether optional off-site sources are available. The same criteria are used in this evaluation.

Weight Because of the importance of siting the power plant over or near an aquifer from which sufficient quantities of groundwater can be withdrawn for plant use, this factor was assigned a weight of 5 (D&M, 1995).

Scoring Groundwater in the area of all candidate sites occurs as a basal lens in the Honomanu volcanic series and, to a lesser extent, the Kula volcanic series. The aquifer comprises lava and associated extrusive volcanic rocks, which are highly permeable and readily yield water to pumping. The sites lie within Maui's central sector, which includes four aquifer systems; specifically, all sites lie within the Paia aquifer system (DLNR, 1992). Groundwater flow in the vicinity of the sites is from higher ground elevation toward the coastal reach (D&M, 1995). Sufficient groundwater is available to meet the estimated needs of the proposed generation project. For this reason, all candidate sites were given raw site scores of 1.

Groundwater Supply -- Interference with Existing Uses

Potential interference with pumping from existing wells could increase the difficulty of permitting a candidate site.

Evaluation Criteria Areas where pumping groundwater from supply wells is unlikely to interfere significantly with pumping from existing wells are preferable to locations where well interaction might occur (D&M, 1995).

Weight Because this screening factor is considered moderately important to the siting process, it was assigned a weight of 3 (D&M, 1995).

Scoring All three candidate sites are located sufficiently distant from any water supply wells that pumping from the underlying aquifers would be unlikely to interfere significantly with existing uses. Therefore, all sites were given raw site scores of 1 for this factor.

Groundwater Supply -- Quality

The quality of groundwater supply for operations can affect water treatment costs and the relative difficulty of permitting a candidate site.

Evaluation Criteria Locations where wells are likely to provide water of lower salinity are considered generally superior because water treatment for use in power plant operations would be less costly. However, areas with potable quality water are considered less desirable than areas where chlorides exceed drinking water standards because permitting industrial supply wells in areas that are potential sources of drinking water has the potential to be more difficult and costly (D&M, 1995).

Weight This screening factor was assigned a relatively low weight of 2 (D&M, 1995).

Scoring Groundwater in the Paia aquifer system is a mixture of brackish and potable water. The estimated sustainable yield of the aquifer is 8 million gallons per day (MGD) (DLNR, 1992), of which about one-half has potable water quality. Wells at Sites A-2 and D-1 would probably provide water of lower salinity than the well at Site C-3. However, it is likely that there would be little difference in the cost of treating the groundwater from any of these sites for industrial use (D&M, 1995). Because Sites A-2 and C-3 overlie non-potable quality portions of the aquifer, permitting may be relatively easy at these locations, and the two sites were each given raw site scores of 1 for this factor. Because Site D-1 overlies a potable quality portion of the aquifer, permitting may be more difficult, and this site was given a raw site score of 2.

Wastewater Disposal – Proximity to Supply Wells

Problems associated with underground injection of wastewater could affect surrounding land uses that rely on groundwater for irrigation or other uses.

Evaluation Criteria The distance to the nearest water supply well was evaluated to assess the potential for contaminating existing water supplies at each site (D&M, 1995).

Weight Because the ability to inject wastewater from the proposed facility without adversely affecting the quality of significant groundwater resources is considered to be a moderately important consideration in the siting process, this factor was assigned a weight of 3 (D&M, 1995).

Scoring All three candidate sites are located sufficiently distant from any water supply wells that the likelihood of contamination of existing wells would be negligible. Therefore, all candidate sites were given raw site scores of 1 for this factor.

Wastewater Disposal – Regulation

The location of candidate sites with respect to subsurface disposal conditions can affect the relative ease of permitting.

Evaluation Criteria Locations below the State Department of Health's Underground Injection Control (UIC) line are considered more favorable than locations above the UIC line. On-site disposal of industrial wastewater is severely constrained at locations above the UIC line because the use of injection wells above the UIC is discouraged by State Department of Health Regulations (D&M, 1995).

Weight This factor is a relatively important consideration in the siting process and was assigned a weight of 4 (D&M, 1995).

Scoring Sites A-2 and C-3 are located below the UIC line and, therefore, are allowed the use of specific types of injection wells for disposal of typical wastewater generated by the operation of a power station, as well as other related wastes. Therefore, Sites A-2 and C-3 were given raw site scores of 1. Because of its location above the UIC line, only disposal of non-contact cooling water by injection well would be permitted. Options exist for wastewater disposal by piping industrial wastewater to injection wells below the UIC line. Because disposal of wastewater at Site D-1 through underground injection is more likely to raise concerns during the permitting process than would injection at the other sites, this site was given a raw site score of 3.

4.2.6 Surface Water

Surface Water – Quality

If surface water runoff is disposed of off site, the quality of receiving waters could be important to permitting efforts, as well as to the maintenance of Maui water resources.

Evaluation Criteria The *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) used the value of surface water runoff receiving waters to evaluate this factor, and the same criteria are used in this evaluation. Natural waterways discharging to the ocean are considered more valuable than irrigation ditches, and sites with characteristics that would result in impacts to natural surface waters are less suitable than sites that would impact irrigation waters. The distance between the project site and the surface receiving waters also influences site suitability in that greater distances would theoretically allow greater opportunities for rainwater infiltration.

Weight Based on the importance of maintaining surface water quality, this screening factor was assigned a moderate weight of 3 (D&M, 1995).

Scoring Surface water in the area of the candidate sites comprises natural streams within Kalialinui and Pulehu Gulches, three reservoirs (designated by HC&S as 80, 84, and 52), and concrete-lined irrigation ditches. The reservoirs and ditches are owned and were created by HC&S specifically and solely for the impoundment and transportation of irrigation water (Moore, 1995). In addition to being integral to sugarcane production, the reservoirs also serve as wildlife habitats. The water quality of the ditch system is unknown.

The streambeds of Kalialinui and Pulehu Gulches are normally dry and heavily vegetated. It is possible that a storm event could cause water to flow in these gulches; therefore, the streams are designated "intermittent" (USGS, 1983). Water quality data are not available for the Kalialinui or Pulehu Gulches.

Site A-2 is approximately 1,000 feet from Kalialinui Gulch and 5,000 feet from Pulehu Gulch. Flow from the site is directed to the northwest, away from both gulches. Reservoir 84 is approximately 2,000 feet from the site and is too far away to be of concern. There is an irrigation ditch bordering the northeast side of the site that could be susceptible to storm water impact from the site, especially during construction along that side of the power plant.

Site D-1 is located approximately 2,000 feet from Kalialinui Gulch and 3,000 feet from Pulehu Gulch. Flow from the site is directed to the northwest and down gradient from Lowrie Ditch. Storm water flow from the site is unlikely to impact Lowrie Ditch water; however, Lowrie Ditch may overflow onto the site during heavy rainfall (25-year event) (Moore, 1995; Chin, 1995). Surface water flows from the Lowrie Ditch through the western-boundary irrigation ditch and ultimately into Reservoir 80, which is less than 100 feet down gradient of the site. Another irrigation ditch is located adjacent to and down gradient from the southwest border of the site and is vulnerable to storm water flows from the site.

There are no ditches down gradient from the C-3 site. Flow from the site is directed to undeveloped land to the south and west. There are no reservoirs within 3,000 feet of the site.

Based on these site characteristics relative to the quality of receiving waters and proximity of the candidate sites to surface receiving waters, each of the three sites was given a raw site score of 1.

Surface Water -- Disposal Options

The range of surface water disposal options could affect the relative attractiveness of candidate sites.

Evaluation Criteria The *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) evaluated the candidate sites with respect to the range of disposal options available at each site, and the same criteria are used in this evaluation. The range of options for surface water disposal includes off-site direct discharge to surface receiving waters, off-site discharge to a municipal disposal system, on-site impoundment, and on-site discharge via underground injection wells. Sites with greater flexibility in terms of feasible disposal options are considered more favorable than sites with fewer disposal options.

Weight Based on its contribution to future project design and layout considerations, the range of viable surface water disposal options was assigned a weight of 2 (D&M, 1995).

Scoring At Sites A-2 and D-1, storm water could be discharged directly into irrigation surface water ditches and reservoirs with HC&S permission. Direct discharge to surface waters is not an option at Site C-3, which has no down-gradient ditch or nearby reservoir. Based on the facts that the existing municipal storm and waste water systems do not currently extend beyond the urbanized areas of Kahului and Kihei and that there are no plans to extend these systems to the vicinity of the candidate sites, it is unlikely that off-site discharge to a municipal disposal system would be available to any of the candidate sites in the near future. Conversely, storm water disposal in an on-site impoundment is an available option at all three sites. Based on existing drainage patterns, inadvertent storm water runoff from impoundments on Sites A-2 and D-1 would likely enter the HC&S irrigation system or run on to adjacent cane fields. Impoundment overflows from Site C-3 would run on to the undeveloped land to the south and west of the site. On-site underground injection is a viable option at Sites A-2 and C-3. Site D-1 is located approximately three-quarters mile above the UIC line, which means that implementation of this option would require attaining an easement to a location below the UIC line, drilling an injection well, and installing a pipeline to the well.

Based on the range of surface water disposal options available, Site A-2 was given a raw site score of 1 and Sites C-3 and D-1 were given raw site scores of 2.

Surface Water -- Disposal Regulation

If surface water is to be disposed of via injection or off-site discharge, a UIC or National Pollutant Discharge Elimination System (NPDES) permit, respectively, would be required.

Evaluation Criteria The *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) evaluated the candidate sites with respect to their "permitability," including the ability to permit the site and the anticipated degree of difficulty of such permitting. The same criteria are used in this evaluation. Obviously, easily permitted sites are preferable to sites where permitting would be difficult, prolonged, or unlikely.

Weight Based on its potential influence on the ease of project permitting, this screening factor was assigned a moderate weight of 3 (D&M, 1995).

Scoring Storm water disposal into HC&S irrigation surface water ditches and reservoirs may require NPDES permitting for Sites A-2 and D-1. Because irrigation waters are not considered "natural," it is anticipated that NPDES permitting would not be unduly difficult; the ease of permitting is anticipated to be equal for the two sites. Off-site disposal into surface waters is not considered a viable option for Site C-3, so NPDES permitting is not applicable to that site.

Disposal into an injection well would require UIC permitting. The relative degree of permitting difficulty can be expected to be higher for Site D-1 than for the other two sites based on the more unusual system configuration required by the site's location above the UIC line (see Surface Water - Disposal Options, above).

Based on the anticipated difficulty of permitting surface water disposal systems, Sites C-3 and A-2 were given a raw site score of 1 and Site D-1 was given a raw site score of 2.

4.2.7 Noise

Noise Production

Noise generated at the power plant site has the potential to affect current and future users of adjacent and nearby sites.

Evaluation Criteria The evaluation is based on whether the proposed facilities would generate less than or greater than 70 db(A), as measured at the power plant property line. Sites with less than 70 db(A) are considered more favorable than sites with greater than 70 db(A). Since Maui County does not have a noise regulation, the noise standard is based upon "Title 11 Administrative Rules, Department of Health, Chapter 43-Community Noise Control for Oahu".

Weight Because MECO has adopted 70 db(A) at the property line as a standard for the proposed project, it is assumed that violations would be infrequent and this screening factor was assigned a relatively low weight of 2.

Scoring Because there is the potential for occasional violations of the noise standard, particularly during plant startup, all sites were given raw site scores of 2 for this factor.

Proximity to Receptors

The 232-MW generation facilities are envisioned to have the potential to produce noise levels that are incompatible with some noise-sensitive uses (e.g., residences, hospitals, schools, etc.).

Evaluation Criteria The *Central Maui Siting Study* (BCH, 1994) used the following criteria to evaluate noise, and the same criteria are used in this evaluation of the candidate sites.

- Areas that are at least 3 miles from the nearest noise-sensitive use and would not require fuel trucks to pass through residential neighborhoods are highest-rated with respect to this factor.
- Areas that are at least 1.5 miles from the nearest noise-sensitive use and would not require fuel trucks to pass through residential neighborhoods are considered the next most favorable.
- Areas that are less than 1.5 miles from the nearest noise-sensitive use or that would require fuel trucks to pass through residential neighborhoods are considered the least favorable with respect to this factor. Noise impacts from facilities located in such areas can be mitigated, but the effort is likely to increase overall construction and/or operating costs.

Weight None of the candidate sites are close to noise-sensitive areas. Moreover, relatively inexpensive mitigation measures are available that can be used to reduce adverse noise impacts. Therefore, this factor was assigned a moderate weight of 3.

Scoring Sites A-2 and D-1 were each given raw site scores of 1 because they are located more than 3 miles from the nearest noise-sensitive receptor and because no residential haul routes would be involved. Site C-3 received a raw site score of 3 because it is closer to the nearest noise-sensitive receptor.

4.2.8 Aesthetics

When fully developed, the 232-MW generating facility will constitute a relatively large industrial complex. The structures housing the generating machinery, support equipment, and offices will be between 15 and 70 feet high and will cover approximately 50 percent of the 50-acre site. The four stacks will be 150 to 210 feet high and 24 feet in diameter. When these features are considered together with the electrical transmission lines, fuel storage tanks, and on-site roadways and storage areas, the overall visual effect will be decidedly industrial. In open terrain, the complex will be visible from a considerable distance (BCH, 1994).

Evaluation Criteria In general, areas that are least visible from residential areas, from scenic points, and from major highways are the most suitable for the project. Visibility is a qualitative criterion that involves a number of factors, including distance from important viewpoints, presence or absence of intervening terrain, and the ease with which screening can be provided to soften the visual impact. It also involves the extent to which generation facilities might be highlighted against the skyline when seen from important viewpoints (BCH, 1994).

Weight Power plants are inherently industrial in nature, and their bulk and height (particularly their stacks) make them highly visible from surrounding areas. Their appearance is generally considered undesirable, even to passers-by. For this reason, aesthetic considerations are considered quite important, and the factor was assigned a weight of 4.

Scoring Views of Site A-2 from Pukalani and from Haleakala Highway, and views of Site C-3 from Kihei Road at Kealia Pond and from Hale Piilani are included in Appendix A.

Sites A-2 and D-1 were judged the best with respect to aesthetic considerations; they were each given raw site scores of 1. The high ratings are related primarily to the sites' distance from residential areas, heavily travelled roads, and public viewpoints. Site C-3 was given a raw site score of 2. Although it is not as visually isolated as the two other sites, its distance from heavily travelled roads, residential areas, and scenic viewpoints makes it unsuitable for power plant development with respect to aesthetics.

4.2.9 Biology

Vegetation

Power plant development typically results in a complete change in the biota present on a project site and, therefore, could have an adverse impact on natural ecosystems, critical wildlife habitats, and threatened or endangered plant species.

Evaluation Criteria The *Central Maui Siting Study* (BCH, 1994) used the following criteria to evaluate vegetation, and the same criteria are used in this evaluation of the candidate sites.

- Areas that are currently under intense cultivation are considered most suitable because they are the most disturbed and the least likely to contain critical habitat or species.
- Areas that were previously disturbed but are not currently cultivated are considered next most suitable because they typically contain common exotic species and do not have critical habitat or species.
- Areas that contain undisturbed natural vegetation are considered least suitable because of the greater possibility that they contain critical habitat or species. Areas known to provide suitable habitat for threatened or endangered species are considered unsuitable.

Weight Given the findings of BCH (1994) and D&M (1995), there is little interest or concern about vegetation at any of the candidate sites studied. Because the sites under consideration are either in sugar cane cultivation or have typical introduced scrub vegetation, vegetation was assigned a moderate weight of 3.

Scoring None of the plants found on any of the candidate sites is a listed, proposed, or candidate threatened or endangered species according to the U.S. Fish and Wildlife Service (USFWS, 1994a, USFWS, 1994b), nor is any plant considered rare and vulnerable (Wagner et al., 1990).

The vegetation of all candidate sites is dominated by introduced or alien species, i.e., plants introduced by humans after Western contact (1778). Because the vegetation of Sites A-2 and D-1 consists of sugar cane fields and the weedy species commonly associated with such agricultural lands, these sites were given raw site scores of 1. The vegetation of Site C-3 consists primarily of buffle grass, kiawe trees, and Klu. A few native plant species occur on Site C-3, including 'ilima, 'uhaloa, and alena. Two species that may be indigenous at Site C-3 are hairy merremia (koali kuahulu) and koali 'ai. Because it is a "natural" ecosystem with a slightly higher possibility of containing significant biota, Site C-3 was given a raw site score of 2.

Wildlife Resources

Four endangered species occur within the general area of the candidate sites, including the Hawaiian duck (koloa), Hawaiian coot (alae keo keo), Hawaiian stilt (aeo), and Hawaiian hoary bat. The waterbirds use and travel between the reservoirs that occur on the central isthmus of Maui. The bat is most probably transient.

Evaluation Criteria Unless the project entails a direct taking of an endangered species, a loss of habitat determined by the USFWS to be "critical" to the species survival, involves an area zoned for conservation or results in a loss of wetlands, there is unlikely to be any jurisdictional concern by either the USFWS or Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) with regard to the siting of the project.

The *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) evaluated candidate sites according to the actual on-site presence of threatened, endangered, or sensitive wildlife species or habitats. In addition, a qualitative assessment was made of the likelihood that threatened, endangered, or sensitive species or habitats are located within 0.25 mile of a candidate site. The same criteria are used in this evaluation.

Weight Because the habitats at the candidate sites are unlikely to support threatened, endangered, or sensitive wildlife species, this factor was assigned a moderate weight of 3 (D&M, 1995).

Scoring Wildlife surveys were conducted for the candidate sites; Sites A-2 and D-1 were surveyed by Mr. Tim J. Ohashi (D&M, 1995), while Site C-3 was surveyed by Mr. Phillip L. Bruner (BCA, 1992). Neither of the surveys documented the presence of any endangered species at the candidate sites. However, federally endangered Hawaiian stilts and Hawaiian coots were observed at Reservoir 50, which is located near Site D-1. Therefore, Site D-1 was given a raw site score of 2 for this factor. Similarly, Site C-3 was given a raw site score of 2 because of its relatively close proximity to Kealia Pond and the West Maui Forest Reserve. Site A-2 was given a raw site score of 1 for this factor based on the absence of threatened or endangered animal species and on its distance from important wildlife habitats.

4.2.10 Cultural Resources

Historical and archaeological resources are relevant to power plant siting because the presence of known or suspected historical or archaeological sites could trigger costly and time-consuming state or federal regulatory processes.

Evaluation Criteria The following criteria were used to evaluate potential historical and archaeological resources.

- Sites that contain no known significant historical or archaeological resources and are considered to have a low potential for discovery of such resources are the most favorable for power plant development with respect to this factor.
- Sites that contain no known significant historical or archaeological resources but are considered to have a high potential for discovery of significant historical or archaeological resources are the next most favorable for power plant development.
- Sites in the immediate vicinity of known burials are the next most favorable.
- Sites known to contain historical or archaeological resources of state or federal significance are the least favorable.

Weight Based on the regulatory consequences of attempting to site a power plant in the presence of significant historical or archaeological resources, this factor was assigned a moderate weight of 3 (D&M, 1995).

Scoring Major sources of background historical and archaeological information were reviewed by archaeologists conducting surveys of the project sites. Sites A-2 and D-1 were surveyed by Cultural Surveys Hawaii, Inc. (D&M, 1995) and Site C-3 was surveyed by International Archaeological Research Institute (BCH, 1992). Sites A-2 and D-1 are both cultivated sugar cane fields. Cane cultivation can generate plow zones of up to 4 feet in depth, which means that, if there were ever archaeological sites at these locations, they have probably been destroyed. Site C-3 has not been cultivated for crops. The only archaeological feature found on the latter property was a double alignment of small (1- to 2-foot-diameter) boulders roughly parallel and 6 feet apart in the south-central portion of the site (BCA, 1992). The alignment appeared to define a trail or narrow road.

The results of both archaeological surveys indicate that there are no known historical or archaeological resources that would preclude power plant development on any of the candidate sites. Therefore, all sites were given raw site scores of 1.

4.2.11 Natural Hazards (Flooding, Wind, and Earthquakes)

Areas that are subject to repeated flooding (whether from surface runoff, storm waves, or tsunami) or other natural hazards such as earthquakes or extreme winds are considered unsuited for power plants. At the very least, such locations require engineering protection that increases costs.

Evaluation Criteria A natural hazards study performed for the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) was not able to distinguish among sites located within the central valley area of Maui on the basis of exposure to seismic hazards or exposure to extreme winds. Therefore, no formal evaluation criteria have been developed for these aspects of the Natural Hazards screening factor.

The *Central Maui Siting Study* (BCH, 1994) used the following flood hazard criteria, and the same criteria are used in this evaluation of the candidate sites.

- Areas that are situated outside any of the flood zones identified on the Flood Insurance Rate Maps are considered most suitable for power plant development.
- Areas whose flood hazards have not been precisely defined on the Flood Insurance Rate Maps but which have topography indicating they are likely to be outside of drainageways are rated just below those in the first category.
- Areas whose flood hazards have not been precisely defined on the Flood Insurance Rate Maps but which have topography indicating they might be affected by flooding from known drainageways are rated the next most suitable.
- Areas within wetlands and flood zones identified on the Flood Insurance Rate Maps are considered unsuited for power plant development.

Weight Because previous stages in the site screening process eliminated locations likely to be subject to flooding or from which storm runoff was likely to be troublesome, this factor was assigned a moderate weight of 3 (D&M, 1995).

Scoring The natural hazards study conducted for the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) concluded that the mountainous topography of both east Maui (Haleakala) and west Maui will tend to channel winds through the

central valley area. This will apply equally to winds blowing from the general northeasterly direction that are associated with trade winds and to winds from the general southwesterly direction (Kona storms). In addition to the channeling effects, the sloping terrain from the shoreline to higher elevations at Sites A-2 and D-1 will tend to escalate wind speeds. As indicated above, the study was unable to distinguish among sites located within the central valley area of Maui with respect to hazards from extreme winds.

The natural hazards study also concluded that, although Maui has had only two recent significant earthquakes, the island's proximity to the Big Island (Hawaii) should be of sufficient concern to warrant a more conservative approach to this natural hazard. The design seismic zonation for Maui was raised from 2 to 2B in the 1991 edition of the Uniform Building Code (UBC). As indicated above, the study was unable to distinguish among sites located within the central valley area of Maui with respect to seismic hazards.

Drainage patterns were determined using U.S. Geological Service (USGS) topographic maps and soils data from the SCS. Flood Insurance Rate Maps were also reviewed for information on flood zones. The Flood Insurance Rate Maps show that all of the candidate sites are in Zone C, "areas of minimal flooding." Although extensive overflow is likely to occur during periods of intense rainfall, none of the candidate sites is subject to major flooding that would influence the design of the project (BCH, 1994). Furthermore, none of the candidate sites are subject to tsunami inundation. The *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) found that, while Site D-1 is not prone to flooding from natural sources, it is known to flood when the Lowrie Ditch irrigation system overflows its banks during heavy rains (i.e., the 25-year event). Additional design and construction effort would likely be required to avoid flooding, and potential flooding may affect full utilization of Site D-1. For this reason, Site D-1 was given a raw site score of 2 for the Natural Hazards screening factor. Sites A-2 and C-3 were each given a raw site score of 1.

4.2.12 Waste Management/Hazardous Materials

Phase I environmental site assessments were prepared for Sites A-2 and D-1 (D&M, 1995) and for Site C-3 (BCH, 1994). Both of these reports were conducted to evaluate the potential presence of hazardous substances and/or groundwater contamination at the sites studied. The conclusions presented were professional opinions based solely upon indicated data, visual observations of the sites and vicinity, and interpretations of the available historical information and documents reviewed. They were not intended to be a definitive investigation of contamination at any of the sites, so the recommendations provided are not necessarily inclusive of all the possible conditions. No subsurface explorations or chemical analyses of soil, water, or potential asbestos-containing building materials samples were conducted as part of the investigations. However, no underground storage tanks, transformers, or other surficial evidence of hazardous materials were observed and no release of hazardous substances within one-quarter mile of the sites were listed in public records reviewed.

Weight A weight of 5 was assigned to hazardous waste/materials because their presence at a site could create potential permitting problems and costly clean-up activities (D&M, 1995).

Scoring As indicated in the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995), the environmental site assessment did not identify potential site contamination that would distinguish one site from another, and raw site scores of 1 were given to each candidate site.

4.2.13 Transmission and Distribution Issues

The *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) evaluated the candidate sites for their proximity to existing transmission facilities; the closer the site, the less cost there would be to construct connecting transmission facilities. Sites A-2 and D-1 were evaluated in that report. Site C-3 was evaluated along with Sites A-2 and D-1 in the *Central Maui Siting Study* (BCH, 1994).

- The location of Sites A-2 and D-1 relative to the existing Mā'alaea-Kealahou 69-kV transmission line along Pulehu Road accounted for the lowest scores for this screening factor. The total lengths of the transmission corridors for the three candidate sites is 7 miles (Site A-2), 8.4 miles (Site D-1) and 8.5 miles (Site C-3). All transmission corridors from Site C-3 are double-circuit, which increases the overall cost. The majority of the transmission corridors from Sites A-2 and D-1 are single-circuit lines.

Weight Transmission and distribution issues were assigned a weight of 1 in the previous two reports because none of the transmission interconnects involve difficult conditions.

Scoring In the *Central Maui Siting Study* (BCH, 1994) and the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995), Sites A-2 and D-1 were each given raw site scores of 1 because the transmission corridors from the sites have a majority of single circuit corridors and the cost is less than double circuit corridors. In this evaluation, Site C-3 was given a raw site score of 3 based on the higher cost of the double circuit transmission corridor from the site. The *Central Maui Siting Study* (BCH, 1994) previously gave Site C-3 a raw site score of 5; however, the transmission corridor length defined by MECO in 1995 for Site C-3 lowered the previous raw site score in this evaluation.

4.2.14 Engineering Issues

Geotechnical

Geotechnical considerations look at the effect existing soil conditions may have on the overall construction costs and whether there are any potential problems that would be difficult to overcome during construction.

The following was taken from the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995):

Weight While subsurface conditions affect construction costs and the specific erosion control and stabilization techniques that are required, they do not constitute a high percentage of project costs or involve adverse effects that are particularly difficult to mitigate for the range of conditions present on the sites under consideration. Because of this, it was given a weight of only 1.

Scoring Based on engineering reviews of these sites, all sites were given raw site scores of 2.

Fuel Delivery

Fuel delivery is an important part of the operations of an oil-fired power plant. All candidate sites are presently within the same delivery zone used by trucking firms to establish charges (BCH, 1994).

All three sites were determined to be located within the same fuel delivery zone as Mā'alaea Power Plant (BCH, 1994), therefore the fuel truck transport costs are equivalent for all three sites.

The following was taken from the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) for fuel delivery by truck:

Weight Fuel delivery costs can form a substantial part of the on-going operational costs of an oil-fired facility such as is proposed. Because of this, fuel delivery distance was given a weight of 2.

Scoring Currently, the cost of fuel delivery by truck is based upon fuel delivery zones. The three candidate sites are all in the same fuel delivery zone, and each of the sites was given a raw site score of 1. The scoring is different from that of the *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) as its scoring was based on distance and not zones. If fuel delivery charges were changed in the future to be based solely on distance, the previous scoring would be applicable.

Road Improvements

Access to the site is an engineering concern for Site C-3. That site would require an access road approximately 2.25 miles long to reach a public roadway. Sites D-1 and A-2 are adjacent to or can reach Pulehu Road with a short access road.

Weight Road improvements require additional engineering and construction time to develop; however, this factor is a small part of the overall design for the facility and was assigned a weight of 1.

Scoring Site C-3 would require construction of approximately 2.25 miles of access road and was given a raw site score of 3. Site D-1 is immediately adjacent to an existing public highway and was given a raw site score of 1. Site A-2 is adjacent to the same public highway as Site D-1 and would require a short access road from the public highway. Site A-2 was also given a raw site score of 1.

4.2.15 Traffic and Transportation

Traffic

The effect of increased project-related traffic on area roadways can influence the relative attractiveness of candidate sites.

Evaluation Criteria The *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) evaluated the potential effects of fuel haul on existing traffic patterns, the adequacy of the existing roadway configuration for fuel haul, and the adequacy of existing roadbed integrity for fuel haul trucks. The same criteria are used in this evaluation.

Weight This screening factor was assigned a moderate weight of 3 (D&M, 1995).

Scoring There is no distinguishable difference between Sites A-2 and D-1 on the basis of roadway configuration or roadway integrity. There would also be no significant impacts to existing traffic operations from Sites A-2 and D-1. Therefore, Sites A-2 and D-1 were given raw site scores of 1. There would, however, be an impact on traffic along Mokulele Highway if the access road to Site C-3 is connected to that highway, and this site was given a raw site score of 2 for this screening factor.

Transportation

The range of fuel transportation options can influence the relative attractiveness of candidate sites.

Evaluation Criteria The *Environmental Screening and Siting Report for the Central Maui Generation Project* (D&M, 1995) concluded that Sites A-2 and D-1 could be served by a fuel pipeline from the Chevron Kahului Harbor bulk terminal facility. This is equally true for Site C-3. This evaluation is based strictly on proximity to the bulk terminal area of Kahului and assumes that the most direct pipeline route could be accomplished and would be the most cost effective.

A study comparing fuel truck transport costs versus underground pipeline transport costs for the three sites is included in Appendix B. The study evaluates 6 inch through 10 inch pipeline sizes and investigates different pumping rates varying from 4 hours to 20 hours to meet the daily fuel requirement for eight combustion turbines. Although federal, state, and local codes do not

currently require secondary containment for underground pipelines, secondary contained pipeline systems were considered along with single un-contained transport pipelines.

The study shows for all three sites, a 6, 8, or 10 inch epoxy coated carbon steel pipeline without secondary containment is economically feasible. The costs were lower or comparable to truck transport costs.

When secondary containment of the pipeline is considered, a 6 inch carbon steel carrier pipe with secondary fiberglass containment is economically feasible for Site A-2 and only $600,000 higher than trucking costs for Site D-1. The cost for this same pipeline system is $3,000,000 higher than trucking costs for Site C-3. All other secondary containment pipe systems are higher than truck transport costs.

Weight Because this screening factor would not be highly important to the site selection process, it was assigned a weight of 1 (D&M, 1995).

Scoring Based on minimum anticipated pipeline length from the Kahului Harbor bulk terminal area to each of the candidate sites, Site A-2 was given a raw site score of 1 for this factor, and Sites D-1 and C-3 were each given raw site scores of 2.

4.2.16 Facility Capital

Facility capital costs look at the overall cost to build the base power plant at any of the candidate sites. The equipment at the candidate sites changes very little based on their location. At Site D-1, an evaporator may be required due to the site's location above the UIC line. At Sites D-1 and C-3, taller emission stacks are recommended than at Site A-2. These changes do not constitute a large percentage change in the overall facility capital cost at any of the candidate sites.

Weight Since facility capital costs represent the majority of the total overall costs associated with development of the power plant, a weight of 5 was assigned.

Scoring Because the facility capital cost would be approximately the same for all candidate sites, a raw site score of 1 was given to each site.

4.2.17 Infrastructure and Land Costs

Infrastructure Cost

The infrastructure costs look at the cost of developing transmission lines and roads to any of the candidate sites.

Weight Since infrastructure costs represent a small portion of the overall costs of the project, a weight of 1 was assigned.

Scoring Site A-2 was given a raw site score of 1 because it would require the shortest length of transmission lines and would require a relatively short access road. Site D-1 would need the shortest access road but has a longer transmission corridor than Site A-2; therefore, Site D-1 was given a raw site score of 2. Site C-3 would require the longest access road and the most expensive transmission corridor and was given a raw site score of 3.

Land Costs

Land costs look at the overall cost of land acquisition for any of the candidate sites.

Weight Due to the relatively low cost of land acquisition compared to the overall cost of the project, a weight factor of 1 was used.

Scoring Based upon appraisal values of the candidate sites, Sites A-2 and D-1 were given a raw site score of 2 and Site C-3 was given a raw site score of 1. The appraisal values are indicated in Project Costs in Appendix C.

4.3 OVERALL SITE SCORES AND RANKS

Overall Site Scores for each site were obtained by summing the Weighted Site Scores for all screening factors. Overall Site Scores were ranked from 1 to 3, with the lowest rank indicating the least constrained site.

Each screening factor was scored for each site according to the evaluation criteria for that factor (Raw Site Score) (see Sections 4.2). Weights assigned each screening factor were then applied to each of the raw scores obtained (Weighted Site Score) (see Sections 4.2). Weighted Site Scores were summed for each site (Overall Site Score), and the Overall Site Scores were ranked.

Table 4-1 gives the Raw Site Scores and Weighted Site Scores by screening factor and the Overall Site Scores and Overall Site Ranks for each site. The Overall Site Scores are: Site A-2 = 129; Site D-1 = 158; and Site C-3 = 169. Site A-2 is the least constrained and highest ranked of the three candidate sites.

4.4 SENSITIVITY ANALYSIS

In order to test the validity of the screening factor weighting scheme utilized in this analysis, a sensitivity analysis was conducted. The sensitivity analysis systematically (i.e., one data factor at a time) distorts or exaggerates the weights utilized in the analysis, in this case by a factor of 10. The corresponding overall site ranks are then reviewed to determine if a different result arises with the use of the distorted weight for that particular data factor. This process is repeated once for each screening factor, with the original weights maintained for all but one factor at a time.

A sensitivity analysis was performed to test the validity of the screening factor weighting scheme. The sensitivity analysis was performed for the 37 screening factors used in the site evaluation.

Results of the sensitivity analysis are presented in Table 4-2. In general, the overall order of site preference remains the same as in the original analysis, with Site A-2 remaining the most preferred in 35 of 37 (over 94 percent) of the cases.

Table 4-1
Alternative Site Analysis

Environmental Issue Area/Screening Factor	Weight	Raw Site Score (1)			Site Weighted Score (2)		
		A-2	D-1	C-3	A-2	D-1	C-3
Land Ownership, Regulation, Use							
Land Ownership	1	2	2	2	2	2	2
Existing Candidate Site Land Use	2	3	3	1	6	6	2
State Land Use District Designation	3	3	3	1	9	9	3
Community Plan Designation	3	3	3	3	9	9	9
Zoning Designation	3	3	3	3	9	9	9
Existing/Planned Adjacent Land Use	2	1	1	1	2	2	2
Air Quality							
Compliance with AAQS/PSD Increment	5	1	2	3	5	10	15
Minimum Stack Height Required	5	1	2	2	5	10	10
Distance from Residential Receptor	5	1	1	3	5	5	15
Soils and Geology							
Soils	2	2	2	1	4	4	2
Geology	1	1	1	1	1	1	1
Topography	1	1	1	1	1	1	1
Groundwater							
Groundwater Supply – Availability	5	1	1	1	5	5	5
Groundwater Supply – Interference with Existing Wells	3	1	1	1	3	3	3
Groundwater Supply – Quality	2	1	2	1	2	4	2
Wastewater Disposal – Proximity to Supply Wells	3	1	1	1	3	3	3
Wastewater Disposal – Regulation	4	1	2	1	4	8	4
Surface Water (storm water disposal)							
Quality	3	1	1	1	3	3	3
Disposal options	2	1	2	2	2	4	4
Regulation	3	1	2	1	3	6	3
Noise							
Noise Produced	2	2	2	2	4	4	4
Proximity to Residential Receptor	3	1	1	3	3	3	9
Aesthetics	4	1	1	2	4	4	8
Biology							
Vegetation	3	1	1	2	3	3	6
Wildlife	3	1	2	2	3	6	6
Cultural Resources	3	1	1	1	3	3	3
Natural Hazards	3	1	2	1	3	6	3
Waste Management/Hazardous Materials	5	1	1	1	5	5	5
Transmission and Distribution	1	1	1	3	1	1	3

Environmental Issue Area/Screening Factor	Weight	Raw Site Score (1)			Site Weighted Score (2)		
		A-2	D-1	C-3	A-2	D-1	C-3
Engineering Considerations							
Geotechnical	1	2	2	2	2	2	2
Fuel Delivery (truck)	2	1	1	1	2	2	2
Road Improvements	1	1	1	3	1	1	3
Traffic/Transportation							
Traffic	3	1	1	2	3	3	6
Transportation	1	1	2	2	1	2	2
Facility Capital	5	1	1	1	5	5	5
Infrastructure and Land Costs							
Infrastructure Costs	1	1	2	3	1	2	3
Land Costs	1	2	2	1	2	2	1
Sum of Site Scores (lowest is least constrained, most preferred)					129	158	169
Normalized Sums (100 is least constrained)					100.00	81.7	76.3
Overall Site Rank (Lowest is least constrained)					1	2	3

NOTES:

(1) Raw Site Score is a site's rank for a specific screening factor.
(2) Site Weighted Score is the site's raw score times the assigned weight of the screening factor.
(3) Overall Site Rank is the rank order of the summed weighted ranks.

Table 4-2
Sensitivity Analysis

Environmental Issue Area/Screening Factor	Overall Site Rank w/ Assigned Weight X10		
	A-2	D-1	C-3
Land Ownership, Regulation, Use			
Land Ownership	1	2	3
Existing Candidate Site Land Use	2	3	1
State Land Use District Designation	2	3	1
Community Plan Designation	1	2	3
Zoning Designation	1	2	3
Existing/Planned Adjacent Land Use	1	2	3
Air Quality			
Compliance with AAQS/PSD Increment	1	2	3
Minimum Stack Height Required	1	2	3
Distance from Residential Receptor	1	2	3
Soils and Geology			
Soils	1	3	2
Geology	1	2	3
Topography	1	2	3
Groundwater			
Groundwater Supply – Availability	1	2	3
Groundwater Supply – Interference with Existing Wells	1	2	3
Groundwater Supply – Quality	1	3	2
Wastewater Disposal – Proximity to Supply Wells	1	2	3
Wastewater Disposal – Regulation	1	3	2
Surface Water (storm water disposal)			
Quality	1	2	3
Disposal options	1	2	3
Regulation	1	2	3
Noise			
Noise Produced	1	2	3
Proximity to Residential Receptor	1	2	3
Aesthetics	1	2	3
Biology			
Vegetation	1	2	3
Wildlife	1	2	3
Cultural Resources	1	2	3
Natural Hazards	1	3	2
Waste Management/Hazardous Materials	1	2	3
Transmission and Distribution	1	2	3

Environmental Issue Area/Screening Factor	Overall Site Rank w/ Assigned Weight X10		
	A-2	D-1	C-3
Engineering Considerations			
Geotechnical	1	2	3
Fuel Delivery (truck)	1	2	3
Road Improvements	1	2	3
Traffic/Transportation			
Traffic	1	2	3
Transportation	1	2	3
Facility Capital	1	2	3
Infrastructure and Land Costs			
Infrastructure Costs	1	2	3
Land Costs	1	3	2
Number of Times Site Ranks #1	35	0	2
Percent of Time Site Ranks #1	94.6	0.0	5.4
Number of Times Site Ranks #2	2	30	5
Percent of Time Site Ranks #2	5.4	81.1	13.5
Number of Times Site Ranks #3	0	7	30
Percent of Time Site Ranks #3	0.0	18.9	73.0
Original Overall Site Rank	1	2	3

5.0 SUMMARY AND RECOMMENDATION

This section presents a summary of the results, and provides a recommendation regarding the highest rated candidate site based upon the evaluation conducted for this study.

5.1 SUMMARY

MECO must install new generating capacity to meet its customers' needs due to increased power demand and the expected retirement of existing generating units as they reach the end of their service life.

MECO proposes to design, construct, and operate a 232-MW electrical generation facility to supply future electric power needs for the Island of Maui. The purpose of this study was to determine the best generation site by evaluating the final three sites, A-2, D-1, and C-3, identified as the most preferred candidate sites through a series of previous siting studies. The study provided a comparative analysis of the final three candidate sites relative to environmental issues, engineering and infrastructure considerations, and the concerns of the Maui community.

The study included an evaluation of the nine environmental issues: groundwater, surface water, plants, wildlife, cultural resources, noise, hazardous materials/wastes, natural hazards, and traffic that were included in the *Environmental Screening and Siting Report for the Central Maui Generation Project* (Dames & Moore, 1995) (D&M) and *Central Maui Siting Study* (Belt Collins Hawaii, 1994) (BCH) studies.

The results of the recently completed air quality analysis have been added to the environmental issues for the selection of the best site from the three candidate sites. Air quality constituted one of the most important environmental screening factors in the site selection process. Considering the existing source inventory, a 232-MW plant modeled compliance at Site A-2 only. Compliance at Site A-2 was achieved with a stack height of 150 feet. Sites D-1 and C-3 would require changes in the existing source inventory for 232 MW even with the maximum allowable stack height of 210 feet. The ability to permit the entire 232 MW at a candidate site was an important factor in the site selection process.

The location of the candidate sites in relation to existing infrastructure (roads and transmission lines), and the distance from residential areas (due to noise impact and visibility) was significant in the evaluation. The location of Sites A-2 and D-1 were rated significantly better than Site C-3.

Overall Site Scores for each site were obtained by summing the Weighted Site Scores for all screening factors. Overall Site Scores were ranked from 1 to 3, with the lowest rank indicating the least constrained site. The Overall Site Scores are: Site A-2 = 129; Site D-1 = 158; and Site C-3 = 169. Site A-2 is the least constrained and highest ranked.

5.2 RECOMMENDATION

Site A-2 is ranked highest of the three candidate sites evaluated. Site A-2 had the largest advantage with respect to air quality. Sites D-1 and C-3 ranked second and third respectively.

It is recommended that landowner negotiations between MECO and A&B-Hawaii, Inc. for procurement of Site A-2 be continued.

6.0 REFERENCES

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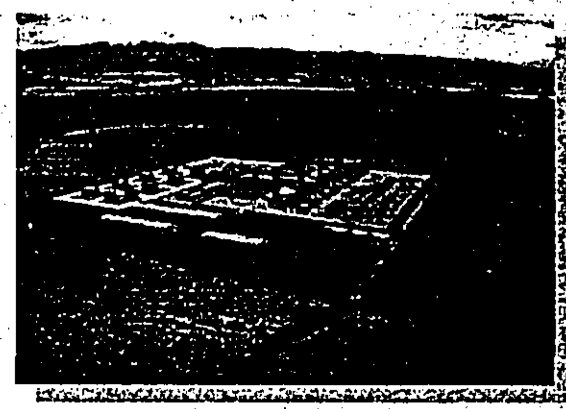
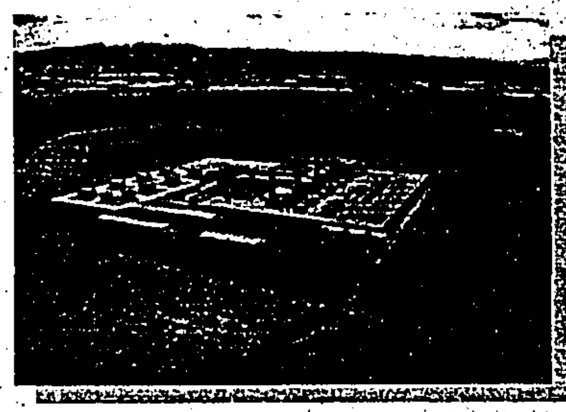


APPENDIX C

AIR QUALITY REPORTS



APPENDIX C1

AIR QUALITY REPORT, 1995 CENTRAL MAUI SITING STUDY

Air Quality Screening Analysis

for the

Central Maui Generation Project

Prepared for
Maui Electric Company, Limited

Prepared by
Jim Clary & Associates

November 15, 1995

JCA Project 94-33

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Executive Summary

This air quality screening analysis will assist Maui Electric Company, Limited (MECO) in the selection of a preferred site for a nominal 232 megawatt (MW) electrical power generation facility. This study provides a comparative analysis of three candidate sites located in the Central Maui Valley.

Factors used in evaluating and selecting the best site are:

- Minimum stack height,
- Significant impact, and
- Required changes in the existing source inventory.

A summary of the results follows:

- The minimum stack height is the height at which emissions from the new combustion turbines only (no existing sources) do not cause any air quality violations. The minimum stack height for Site A-2 is 105 feet. The minimum stack heights for the other sites are higher: 150 feet for D-1, and 180 feet for C-3.
- At equal stack heights, Site A-2 is significant for fewer pollutants and averaging periods and, thus, should be easier to permit.
- Considering the existing source inventory, a 232 MW plant modeled compliance at site A-2 only. Compliance at site A-2 was achieved with a stack height of 150 feet. Sites D-1 and C-3 will require changes in the existing source inventory for 232 MW even with the maximum allowable stack height of 210 feet. This requirement is not a fatal flaw, as there will be some significant changes in the existing source inventory between this report and the time an air permit is prepared.

Site A-2 is the best site, followed in order by sites D-1 and C-3. Site A-2 is the only site that models compliance with the existing emission inventory. Fatal flaws were not found for any candidate site. However, changes in the existing emission inventory must be made for sites D-1 and C-3.

The results of this screening study may be used in determining a recommended stack height for a 232 MW plant at three of the sites. The recommended stack heights are 150 feet for site A-2, and a conditional recommendation of 210 feet for sites D-1 and C-3.

1.0 Introduction

This introduction provides information on the purpose of the air quality screening analysis, a description of the new generating units, locations of the candidate sites and methodology for site recommendation, and a discussion of several uncertainties associated with air quality modeling.

1.1 Purpose of the Air Quality Screening Analysis

The purpose of this air quality screening analysis is to assist Maui Electric Company, Limited (MECO) in the selection of a preferred site for a nominal 232 MW electrical power generation facility. This study provides a comparative analysis of three candidate sites identified as important to MECO. Candidate Sites A-2, C-3, and D-1 are located in the Central Maui Valley. This air quality analysis is intended to supplement the existing base of knowledge and information used for site selection.

1.2 New Generating Units Description

MECO proposes to design, construct, and operate a nominal 232 MW electrical generation facility. The 232 MW generating units are four diesel oil-fired nominal 58 MW dual-train combined cycle combustion turbine units, exhausted through four Good Engineering Practice (GEP) two-flue stacks. In addition, the analysis includes a single 26.9 MW diesel unit, proposed as a possible future generating unit. The proposed diesel unit, however, is not considered in the comparison for site recommendation because of its minimal air quality impact.

1.3 Candidate Sites

This air quality analysis is an evaluation of three candidate sites, which have been identified in prior MECO studies (e.g., Dames & Moore, 1995, and Belt Collins, 1993b) as worthy of further evaluation. Candidate Sites A-2, C-3, and D-1 are illustrated in Figure 1.3-1.

Site A-2 is generally located north of Waikapu Road, approximately 1500 ft west of Pulehu Road. UTM coordinates for this site are 768.3 km east and 2307.6 km north.

Site C-3 is located approximately 1.5 miles northeast of the town of Kihei. The site is just west of Upper Kihei Road. Of the three sites, it is farthest south in Central Maui, located approximately 3.3 miles south-southwest of a central location for Sites A-2, and D-1. UTM coordinates for this site are 766.6 km east and 2302.6 km north.

Site D-1 is located at the northwest quadrant of Pulehu Road and Lowrie Ditch Road. UTM coordinates for this site are 769.7 km east and 2306.4 km north.

1.4 Uncertainties Associated with the Assessment

The Central Maui facility will not reach 232 MW until well after the year 2000, introducing some degree of uncertainties for this study. For example, it is not possible to state that the last 58 MW addition in the year 2010 will meet all air quality regulations that will be in effect in 2010. A discussion of each of these uncertainties follows:

Emission parameters. The first uncertainty associated with the assessment of future air quality is the question of emission parameters. Emission inventories are subject to change year after year. Questions regarding emission sources require careful consideration and sometimes complex engineering solutions. Dispersion model computer programs may accept input data requirements of three principal source types: stack, volume, and area. All of these potential source types need consideration with respect to the calculated emission parameters, which may change from year to year. Associated with an existing source inventory, state and federal air quality regulations do not allow for the reservation of air space for future permitting related to a new facility or modification to an existing facility.

New standards. Another uncertainty for future air quality analyses is the inclusion of additional air quality standards for pollutants. The following examples illustrate that the regulated community may expect changing and/or new requirements to control environmental pollution.

Recently the U.S. EPA solicited comments on the possible need to adopt additional regulatory measures to address short-term peak SO_2 exposures and thereby further reduce the health risk to exercising asthmatic individuals. The alternatives under consideration include:

- Revising the existing NAAQS by adding a new five-minute standard of 0.60 ppm, 1 expected exceedance.
- Establishing a new regulatory program under Section 303 of the Clean Air Act to supplement the protection provided by the existing NAAQS.
- Augmenting implementation of the existing standards by focusing on those sources or source types likely to produce high five-minute peak SO_2 concentrations.

The regulated community has seen the U.S. EPA promulgate a number of regulations within the past few years. For example, the EPA promulgated PSD increments for nitrogen dioxide with revisions to 40 CFR Part 51 effective October 17, 1989, and revisions to 40 CFR Part 52 effective November 19, 1990.

Regulatory models. Still another uncertainty is associated with the ever-changing dispersion models. The current Industrial Source Complex (ISC2) dispersion models are restructured and reprogrammed versions of the original ISC models described in the *ISC Dispersion Model User's Guide - Second Edition (Revised)* (EPA, 1992). The original user's guides are dated December 1979; and the first use of the models outside the U.S. EPA took place in early 1980 (Bowers, 1979). Almost immediately the models came into wide use; and by summer 1980 they had supplanted CRSTER, MPTER, and CDM for most regulatory applications.

The models have been updated a number of times since they were released. For example, the choice of Briggs' urban coefficients was added in the mid 1980's. In 1986 the Schulman-Scire downwash algorithm was added to partially replace the Huber-Snyder algorithm. Changes made in 1990 corrected the wind speed calculation for sources less than anemometer height. The current versions of ISCST2 and ISCLT2 are 93109. The models were reprogrammed to improve the overall quality of the computer code, to improve the user interface, and to improve the end user documentation of the models.

Any regulatory application of the ISC2 models should conform to the guidance set forth in 40 CFR Part 51, Appendix W (Guideline on Air Quality Models [Revised]), including the most recent supplements to the guideline.

In addition to the ISC2 models for simple and intermediate terrain modeling, complex terrain models have also changed considerably over time. The model used in the Central Maui analysis for complex terrain, as well as simple and intermediate terrain, is the Integrated Gaussian Model (IGM), version 93334. IGM is intended to replicate the Complex I, RTDM, and SHORTZ models for complex terrain and to implement the EPA intermediate terrain procedure.

2.0 Methodology of the Air Quality Impact Assessment

2.1 General Approach

The Integrated Gaussian Model, IGM, was used to determine the air quality impacts. The maximum and highest second-high predicted concentrations were used to evaluate PSD Class II increment consumption and to compare with the National Ambient Air Quality Standards/State Ambient Air Quality Standards (NAAQS/SAAQS). The worst-case combustion turbine configurations (100% operating load for SO_2 and 25% for PM_{10} and NO_x) were used in the analysis. All modeling was performed in accordance with current EPA modeling guidance (CFR, 1994).

Several assumptions were made in the analysis. They are summarized below:

- An exceedance of 80% of the any applicable air quality standard is considered as non-compliance for the purposes of this study. This 80% level is the informal Hawaii Department of Health (DoH) rule. When impacts exceed 80% of a standard, DoH must increase their level of review of the air quality analysis in a permit application. In addition to the informal DoH rule, the uncertainties discussed in section 1.4 justify the use of this 80% level.
- Future generating unit stack heights of 105 and 150 feet use the 37-meter transport wind speed and direction.
- Future generating unit stack heights of 180 and 210 feet use the 64-meter transport wind speed and direction.
- The significant impact analysis includes one 58 MW unit addition.
- The existing source inventory analysis is restricted to receptors and hours where one 58 MW unit addition is significant. This is the current EPA/DoH policy.
- The PSD increment consumption analysis for the existing source inventory uses allowable emission rates for all sources (recent actual emissions data are not available).
- The limiting factor at each site will be either PSD Class II increments or the NAAQS/SAAQS.

Factors used in evaluating and selecting the best site are the following:

- *Minimum stack height analysis.* The analysis determines the minimum stack height required for a 232 MW plant considering only the combustion turbines. This minimum stack height is the starting point for the other studies. The addition of existing sources can only increase the required stack height.
- *Significant impact of a single 58 MW unit.* The analysis considers the pollutants for which a 58 MW unit is significant and is conducted per stack height for each candidate site to determine each candidate site's significant pollutants and averaging periods. Generally, the smaller the number of significant impacts, the easier a modeling study for a permit.
- *Pollutants for which changes in the source inventory are required to attain 80% of the standards for the specified number of units.* The analysis is conducted at the candidate stack height of 180 feet for each candidate site. The analysis is done to compare modeling results with 80% of the standards. If the results are above this threshold, changes per pollutant are therefore required in the total sources inventory to bring the results into compliance with the 80% requirement.

The results of this comparison will aid in the identification of a preferred site.

2.2 Air Quality Model Selection

The choice of appropriate dispersion modeling methods for evaluating the air quality impacts of the new generating units is governed by the EPA's modeling guidelines and the topography of the site area. The three proposed sites are located in the Central Maui Valley. To the northwest of the sites, the terrain gently slopes downward toward the center of the valley. The terrain to the southeast of the sites abruptly rises towards Haleakala. There are no significant terrain features (e.g., cliffs, bluffs, hills, etc.) in the immediate area of any site.

Different modeling methods are required for evaluating impacts at receptors in these two terrain areas. Ground-level concentration impacts at receptor locations with elevations equal to or lower than the lowest stack top may be evaluated by means of the EPA Guideline Model ISCST2 (formerly ISCST). Receptors at elevations above the final heights attained by pollutant plumes released to the atmosphere require the use of a model capable of addressing the effects of elevated terrain. The EPA guideline model RTDM is suitable for modeling impacts at these receptors. No EPA-approved model is specifically designed to address impacts at receptors in "intermediate" terrain, i.e., at elevations above stack top, but below plume height. 40 CFR Part 51, Appendix

W (Guideline on Air Quality Models [Revised]), specifies that impacts at intermediate receptors are to be calculated by both simple terrain and complex terrain dispersion algorithms (i.e., ISCST2 and RTDM), with the higher of the two values retained for each hour of the modeling period for each receptor (CFR, 1994).

IGM, a dispersion model developed by United Engineers & Constructors, is designed to incorporate this guidance on intermediate terrain. IGM employs a decision tree to determine the appropriate dispersion algorithm for each hour and each source receptor, pair, based on computed plume heights for all modeled sources. Results for individual sources are summed at each receptor, and multiple hour averages are constructed using the appropriate concentration values determined for consecutive hours. The model is functionally equivalent to, but more computationally efficient than, EPA's POSTIT processor program. (Note: EPA has not updated the POSTIT program for ISCST2.)

2.3 Source Information

Two type of sources, the future generating units and existing sources, are considered.

2.3.1 Candidate Site Locations and Elevations

The locations of the future generating units are discussed above in Section 1.3 and illustrated in Figure 1.3-1. In addition, Table 2.3.1-1 is a summary of the stack locations and elevations for proposed Sites A-2, C-3, and D-1. The locations and elevations are important model input.

Table 2.3.1-1. Stack Locations and Elevations for Proposed Sites

Site	UTM East (m)	UTM North (m)	Elevation (ft)	Elevation (m)
A-2	788,306.1	2,307,571.4	341.1	103.96
C-3	786,551.0	2,302,571.4	229.3	69.90
D-1	789,693.9	2,306,408.2	445.9	135.91

2.3.2 New Generating Unit Source Parameters and Emission Rates

The model-predicted concentrations include the potential emission rates for the proposed combined cycle operations. Included in a separate air quality analysis is a single 26.9 MW diesel unit. Its model input parameters are a ratio from Maalaea M13 Unit (12.5 MW). Although a black start unit is not included in the analysis, it is expected to have negligible impacts. Table 2.3.2-1 is a summary of the potential emission data used in the air quality analysis for one 58 MW diesel train combustion turbine. CO is not expected to be a limiting pollutant and is not considered in the analysis. Four stack heights are analyzed - 105 ft, 150 ft, 180 ft, and 210 ft.

Table 2.3.2-1. Source Emissions and Stack Data

For One 58 MW Dual Train Combined Cycle Combustion Unit and One Diesel Unit

Operation and Load	Stack Height*	Exit Velocity (m/s)	Stack Diameter (m)	Exit Temperature (K)	Emissions (g/s) NO_X	SO_2	PM/PM10
CT-Combined Cycle							
100%	varies	20.0	2.44	427	NA	27.72	NA
25%	varies	10.8	2.44	414	10.66	NA	4.96
26.9 MW Diesel Unit (Parameters from Maalaea M13 Unit (12.5 MW)							
100%	varies	34.8	2.04	644	69.44	14.74	10.61

* Stack height analyzed at 105 ft, 150 ft, 180 ft, and 210 ft.

2.3.3 Good Engineering Practice (GEP) Discussion

40 CFR 51 Section 100 (ii) (1) and (2) regulates GEP with respect to stack heights to insure that excessive concentrations do not occur as a result of atmospheric downwash created by the source itself, nearby structures, or nearby terrain obstacles (CFR, 1994). According to the guidance, GEP stack height means the greater of:

1 65 meters, measured from the ground-level elevation at the base of the stack.

2 A formula value height, H_{GEP} = H + 1.5 L, where H is the height of nearby structure(s) and L is the lesser dimension, height or projected width, of nearby structures.

3 Height demonstrated by a fluid model or a field study approved by the EPA, State, or local control agency.

The use of stack height credit in excess of GEP stack height or credit resulting from any other dispersion technique is prohibited in the development of emission limitations by 40 CFR 51.118 and 40 CFR 51.164.

Based upon previous MECO analyses and the fact that no candidate stack height exceeds 65 meters, a GEP analysis is not required for the current analysis.

2.3.4 Existing Source Inventory Parameters

Tables 2.3.4-1 and 2.3.4-2 are summaries of the inventoried emissions data of non-project sources used in the PSD and NAAQS/SAAQS analyses, respectively. These sources were added to the project sources to determine total impact. A description of the existing source inventory is included in Appendix 1. Sources west of the West Maui mountains were excluded.

2.4 Meteorological Data

Two MECO monitoring stations provided the required hourly meteorological data: Tower 251, located near proposed Sites A-2 and D-1; and Tower 261, located near Site C-3. The data collection period was from February 1994 through January 1995. These data were collected according to EPA's PSD monitoring guidelines and the monitoring plan developed for this project (Clary, 1993). Hourly stability classes were determined from the standard deviation of the horizontal wind direction (sigma theta), using the Meteorological Processor for Regulatory Models (MPRM) as specified in 40 CFR Part 51, Appendix W (CFR, 1994). Hourly mixing heights were obtained from MPRM using Lihue monthly average mixing height data (averaged from 1985-1989) and the MECO surface data.

Figures 2.4-1a through 2.4-1d are annual wind roses for the two levels of data from the two MECO monitoring stations. These figures include a frequency distribution of stability classes.

The use of on-site data allows the use of highest second-high predicted concentration data whenever appropriate for comparisons with short-term averaging periods.

2.5 Receptor Grids

A number of different model receptor grids are used in completing the air quality analysis. Because of the distance between proposed Site C-3 and the other sites, separate receptor grids are used for Site C-3. A fine grid is used in the areas of expected maximum concentrations (i.e., near the facility and plume impact in the terrain).

The receptor grids contain several different receptor grid densities, as defined below in Tables 2.5-1 and 2.5-2.

Table 2.5-1. Base Grid Description

Grid Density Spacing (m)	Minimum East UTM (m)	Maximum East UTM (m)	Minimum North UTM* (m)	Maximum North UTM* (m)
Sites A-2, D-1				
200	763,000	775,000	301,000	313,400
100	767,300	770,700	305,400	309,400
Site C-3				
200	761,500	771,500	297,500	307,500
100	765,500	767,500	301,500	303,500

* USGS north coordinates without leading digit (e.g., 301,000 is 2,301,000 m UTM north).

Receptor elevations are derived from the USGS 30-meter topographic data. The base grid locations used in the analysis are plotted in Figures 2.5-1a and 2.5-1b. To address maximum concentrations due to plume impact in the terrain, a denser grid is used. As seen in Figures 2.5-2a and 2.5-2b, the additional receptor grids for all terrain above 200 meters for Sites A-2, and D-1, as well as terrain above 134 meters for Site C-3, also contain several different receptor grid densities in the following table:

Table 2.5-2. Elevated Terrain Grid Description

Grid Density Spacing (m)	Minimum East UTM (m)	Maximum East UTM (m)	Minimum North UTM* (m)	Maximum North UTM* (m)
Sites A-2, D-1				
100	763,000	775,000	301,000	313,500
50	766,300	771,700	304,400	301,400
25	767,350	770,650	305,450	309,350
Site C-3				
100	761,500	771,500	297,500	307,500
50	764,500	768,500	300,500	304,500
25	765,500	767,500	301,500	303,500

* USGS north coordinates without leading digit (e.g., 301,000 is 2,301,000 m UTM north).

Two grids are identified for each site grouping. Grid 1 for Sites A-2, and D-1 includes receptors below 200 meters above mean sea level (amsl) elevations. Receptor locations for this grid are displayed in Figure 2.5-1a. Grid 1 for Site C-3 includes receptors below 134 meters above mean sea level (amsl) elevations. Receptor locations for this grid are displayed in Figure 2.5-1b. Receptor Grid 2 for Sites A-2, and D-1 consists of all receptors at or above 200 meters. These receptor locations are shown in Figure 2.5-2a. Receptor Grid 2 for Site C-3 consists of all receptors at or above 134 meters. These receptor locations are shown in Figure 2.5-2b. Grids 1 and 2 are used in all modeling analyses.

A coarse grid for each site grouping, Grid 3, is used in addition to Grids 1 and 2. As seen in Figures 2.5-3a and 2.5-3b, these grids extend from the edges of Grids 1 and 2 to 25 kilometers from the source. Receptor elevations are derived from the USGS 30-meter and 3-arc second topographic data. Grid 3 is used in all modeling analyses.

Table 2.5-3. Coarse Grid Description

Grid Density Spacing (m)	Minimum East UTM (m)	Maximum East UTM (m)	Minimum North UTM* (m)	Maximum North UTM* (m)
Sites A-2, D-1				
1000	743,000	795,000	281,000	333,000
Site C-3				
1000	741,500	791,500	277,500	327,500

* USGS north coordinates without leading digit (e.g., 281,000 is 2,281,000 m UTM north).

3.0 Results of the Air Quality Impacts Assessment

3.1 Fatal Flaw Evaluation

Fatal flaws were not found for any candidate site. Based on the future generating units alone, all sites are capable of 232 MW. A-2 is the only site that will not require changes in the existing emission inventory to attain compliance with 80% of the air quality standards. The other two sites, D-1 and C-3, do not attain compliance with 80% of the standard with the existing emission inventory. However, because of the uncertain nature of the existing source inventory this requirement is not considered a fatal flaw.

3.2 Comparative Site Analysis

The candidate site combustion turbine comparison is based on the three factors described in section 2.1 of this report. The results of the diesel unit analysis are also discussed.

3.2.1 Minimum Stack Height Analysis

The minimum stack height required for 232 MW was determined for each site. The minimum stack height results are shown in Tables 3.2.1-1 and 3.2.1-2. At Site C-3 the minimum stack height is 180 ft. With 150 foot stacks, four units at C-3 consume 93.8% of the 24-hour SO_2 increment. The 24-hour PM_{10} standard is the limiting standard at sites D-1 and A-2. With 105 foot stacks, the 24-hour SO_2 increment consumption at site D-1 (99.6%) is almost double the value at site A-2 (56.2%). These heights are the minimum height; existing source impacts may require higher stacks.

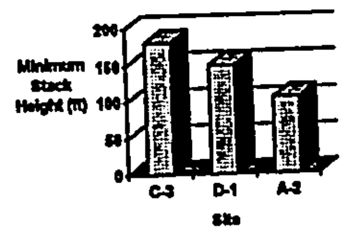


Table 3.2.1-1. Maximum Increment Consumption - CTs Only

Site	Stack Height (ft)	Number of 58 MW Units	Limiting Increment	Maximum Increment Consumption
A-2	105	4	PM_{10} 24-hr	56.2%
D-1	105	4	PM_{10} 24 hr	96.6%
	150	4	PM_{10} 24 hr	59.5%
C-3	150	4	SO_2 24 hr	93.8%
	180	4	PM_{10} 24-hr	73.4%

Table 3.2.1-2. Minimum Stack Height Required for 232 MW Plant

	Site		
	C-3	D-1	A-2
Minimum Stack Height (ft)	180	150	105

3.2.2 Significant Impact Analysis

The second factor for permitting is that the sources remain insignificant. If the project is insignificant, modeling with existing sources is not required. The significant impact analysis determines each candidate site's significant pollutants & averaging periods. A comparison can be made by the number of significant pollutants at each site (i.e., the fewer the number of significant pollutants, the more likely the permitting). The significant pollutants & averaging periods are shown in Table 3.2.2-1. Site C-3, with a stack height of 180 ft, will be significant for SO_2 (3-hr, 24-hr, and annual) and PM_{10} (24-hr). These pollutants & averaging periods will need to be modeled with the existing source inventory to show compliance with the PSD increments and NAAQS/SAAQS. The normalized significance areas for all sites are shown in Figures 3.2.2-1 though 3.2.2-12. In these figures, areas greater than one indicate significance for any pollutant; areas less than one are insignificant.

Table 3.2.2-1. Significant Pollutants & Averaging Periods

Site	Stack Height (ft)			
	105	150	180	210
C-3	Not Applicable; Below minimum stack height	Not Applicable; Below minimum stack height	SO_2 (3-hr, 24-hr, Annual), PM_{10} (24-hr)	SO_2 (3-hr, 24-hr), PM_{10} (24-hr)
D-1	Not Applicable; Below minimum stack height	SO_2 (3-hr, 24-hr)	SO_2 (3-hr, 24-hr), PM_{10} (24-hr)	SO_2 (3-hr, 24-hr)
A-2	SO_2 (3-hr, 24-hr, Annual), NO_X (Annual)	SO_2 (3-hr, 24-hr)	SO_2 (3-hr, 24-hr)	SO_2 (3-hr, 24-hr)

3.2.3 Existing Source Inventory Analysis

For each of the significant pollutants shown in Table 3.2.2-1, an analysis with the existing source inventory is required for permitting. Thus, a complete analysis is performed with the existing source inventory for each candidate site. Table 3.2.3-1 indicates the pollutants which require changes in the inventory to attain 80% of the standards. This table includes the number of 58 MW units requiring changes. For example, the analysis shows that at Site C-3 with 210 foot stacks, changes will be required in the current SO_2 inventory when permitting the first 58 MW unit. The analysis also shows that at Site C-3 changes will be required in the current PM_{10} inventory when permitting the fourth combustion turbine unit. Site A-2 models compliance with all standards with 150-foot stacks. Sites D-1 and C-3 do not model compliance, indicating that changes are required in the existing emission inventory for the two sites.

Table 3.2.3-1. Pollutants for Which Changes in the Inventory Are Necessary To Attain 80% of the Standards for the Specified Number of Units

Site	Stack Height (feet)	Pollutant (Number of Units)	Comments
C-3	210	SO_2 (1), PM_{10} (4)	With one unit, 177.5% of the 24-hr SO_2 increment is consumed.
D-1	210	SO_2 (1)	With one unit, 117.0% of the 24-hr SO_2 increment is consumed.
A-2	150	SO_2 (>4)	With four units, 78.8% of the 24-hr SO_2 increment is consumed.

3.2.4 Diesel Units Analysis

A comparative modeling analysis was performed for a 26.9 MW diesel unit at each site. Results indicate minimal impacts from the diesel unit at all candidate sites and a difference of only 5% of the limiting standard between sites. Therefore, the diesel unit analysis will not be considered in the comparison for site recommendation.

4.0 Conclusions

This section describes the relative rankings of the three candidate sites followed by the recommended stack heights.

4.1 Site Ranking

These rankings and recommendations are provided to assist MECO in the selection of a preferred site for a proposed 232 MW facility.

As noted in section 2.1 of this report, factors used in evaluating and ranking the sites are:

- Minimum stack height,
- Significant impact, and
- Pollutants for which changes in the source inventory are required to attain 80% of the standards for the specified number of units.

Based upon these factors, the following conclusions can be made:

- Site A-2 requires the minimum stack height considered (105 feet) for the proposed 232 MW facility. The other Pulehu Road sites require a higher minimum stack height: 150 feet for D-1. Site C-3 requires a minimum of 180 feet.
- At equal stack heights, Site A-2 is significant for fewer pollutants / averaging periods.
- Site A-2 is the only site that will not require changes in the existing source inventory for 232 MW.

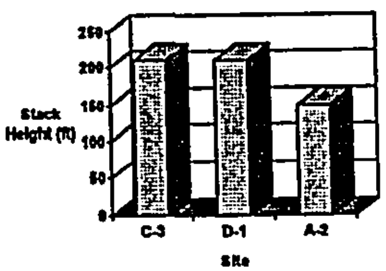
Following the relative evaluation of each candidate site as presented above, the site rankings are determined for each of the three criteria (minimum stack height, significant impact, and required changes in existing source inventory) on the basis of a numerical scale of 1 to 3 with 1 = most favored, 2 = favored, and 3 = least favored. Based on Table 4.1-1, Site A-2 is the most favored for the proposed project.

Table 4.1-1. Site Ranking Based on Air Quality Screening Analysis

	Site		
Criteria	A-2	C-3	D-1
Minimum Stack Height	1	3	2
Significant Impact	1	3	2
Required Changes in Existing Source Inventory	1	3	2
Total (Lowest value is best.)	3	9	6
Site Rank	1st	3rd	2nd

Scoring: 1 = most favored; 2 = favored, 3 = least favored

Site A-2 is the best site, followed in order by sites D-1 and C-3. Fatal flaws were not found for any candidate site. With the exception of site A-2, all sites will require changes in the existing source inventory for 232 MW. This requirement is not a fatal flaw, as there will be some significant changes in the existing source inventory between this report and the time an air permit is prepared.



4.2 Stack Height Recommendations

In order to minimize the visual impact of a plant, it is desirable to minimize the stack height. This must be balanced by air quality considerations; the stack height must be sufficient to allow the plant to comply with all applicable air quality standards. This section describes the process used to determine a recommended stack height and the recommended stack heights for sites A-2, D-1 and C-3.

Table 4.2-1. Recommended Stack Heights

	Site		
	C-3	D-1	A-2
Recommended Stack Height (ft)	210	210	150

4.2.1 Site A-2

The minimum stack height is 105 feet for A-2. However, due to the uncertainties described in section 1.4, the recommended stack height should be, at a minimum, increased to the next stack height increment of 150 feet. At 105 feet, there are significant impacts for both SO_2 and NO_2. At 150 feet, there is still a significant SO_2 impact. However, with a stack height of 150 feet, modeling using the existing SO_2 emission inventory shows compliance with a 232 MW plant. Therefore, the recommended stack height for site A-2 is 150 feet.

4.2.2 Site D-1

The minimum stack height is 150 feet for D-1. However, due to the uncertainties described in section 1.4, the recommended stack height should be, at a minimum, increased to the next stack height increment of 180 feet. At 180 feet, the plant is significant for SO_2 and PM_{10}. At a stack height of 180 feet, compliance with the PSD increments cannot be shown with the existing emission inventory for the first 58 MW addition. Therefore, the stack height must be increased to the maximum allowed height of 210 feet. The 210 foot recommendation is qualified, as compliance with the air quality standards cannot be shown for the first 58 MW. Permitting at D-1 will require changes in the existing emission inventory for the initial 58 MW unit.

4.2.3 Site C-3

The minimum stack height is 180 feet for C-3. However, due to the uncertainties described in section 1.4, the recommended stack height should be, at a minimum, increased to the next stack height increment of 210 feet. At 210 feet, the plant is significant for SO_2 and PM_{10}. At a stack height of 210 feet, compliance with the PSD increments cannot be shown with the existing emission inventory for the first 58 MW addition. However, 210 feet is the maximum stack height allowed for modeling. Thus,

the 210 foot recommendation is qualified, as compliance with the air quality standards cannot be shown for the first 58 MW. Permitting at C-3 will require changes in the existing emission inventory for the initial 58 MW unit.

4.3 Comparison of Sites A-2 and D-1

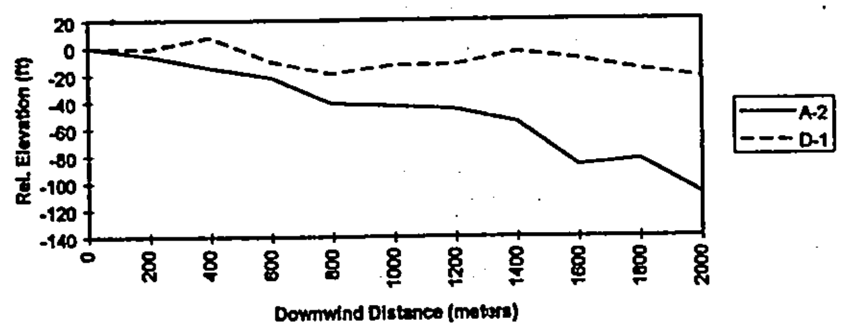
According to an earlier siting study (Belt Collins, 1993a) site D-1 is better than site A-2 for air quality. This modeling, using site-specific, stack-top meteorological data and refined receptor grids, determined that site A-2 is more favorable than site D-1. This section addresses the reasons for site A-2's higher air quality ranking.

The controlling pollutant and averaging period for the minimum 105-foot stack height is the PM_{10} 24-hour average. This pollutant and averaging period was found to be the most restrictive because it resulted in the consumption of the greatest percentage of the available increment and for purposes of this section will be referred to as the "controlling pollutant". A 232 MW plant with 105-foot stacks at site A-2 consumes less than 80% of the available increment. The identical 232 MW plant at site D-1 will consume more than 80% of the available increment.

A detailed study was made of the day containing the controlling pollutant. Impacts on the remaining 364 days have no impact on the site ranking, as the concentrations on those days were less than the controlling pollutant. This study concluded that the interaction of the plumes with the terrain is major reason for the lower controlling concentration at site A-2. The wind direction producing the controlling concentration transports the plumes into more favorable (i.e., lower) terrain at site A-2 than at site D-1.

This phenomenon is illustrated in the figure below. (The relative height shown in this figure is the terrain height relative to the stack base elevation.) The terrain at site D-1 is relatively flat while site A-2 terrain slopes downward at a more rapid rate. In effect, site A-2 gets a stack height advantage equal to the difference between the two relative terrain heights at a given downwind distance. At the point of maximum impact, the relative terrain at site A-2 is 48 feet lower that the terrain at site D-1. This terrain advantage is reflected in the 40-foot difference in the minimum stack heights at the two sites.

Relative Elevations Versus Downwind Distance



In summary, A-2 is preferred over D-1 because of the wind direction causing the controlling concentration. On that day, the plumes from the A-2 site travel over terrain that slopes downward at a more rapid rate than the plumes from site D-1.

5.0 References

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CFR1994. Code of Federal Regulations, Part 51, Section 100 (ii) (1) and (2), Good Engineering Practice (GEP).

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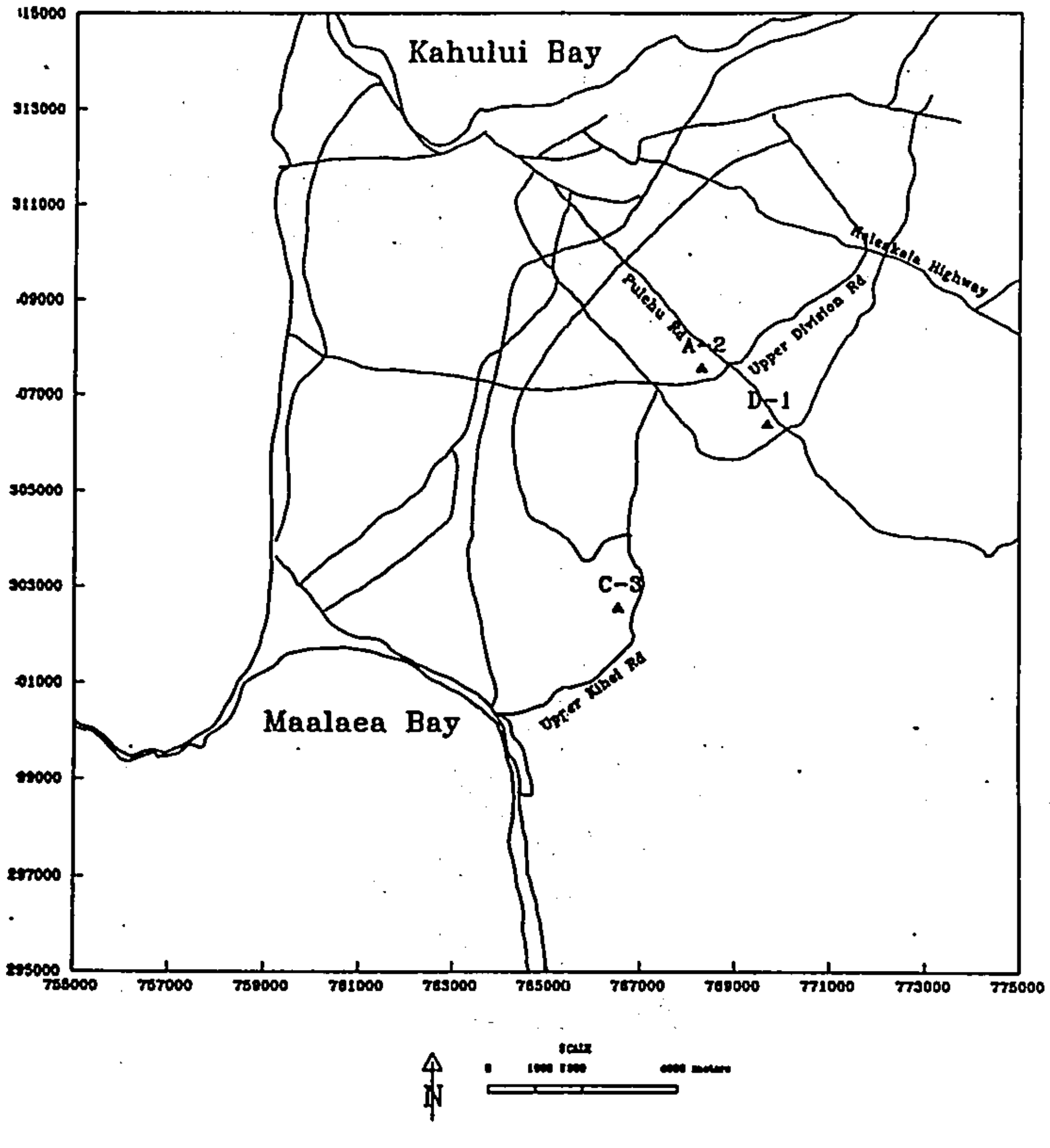


Figure 1.3-1
Candidate Site Locations
Central Maui, Island of Maui, Hawaii

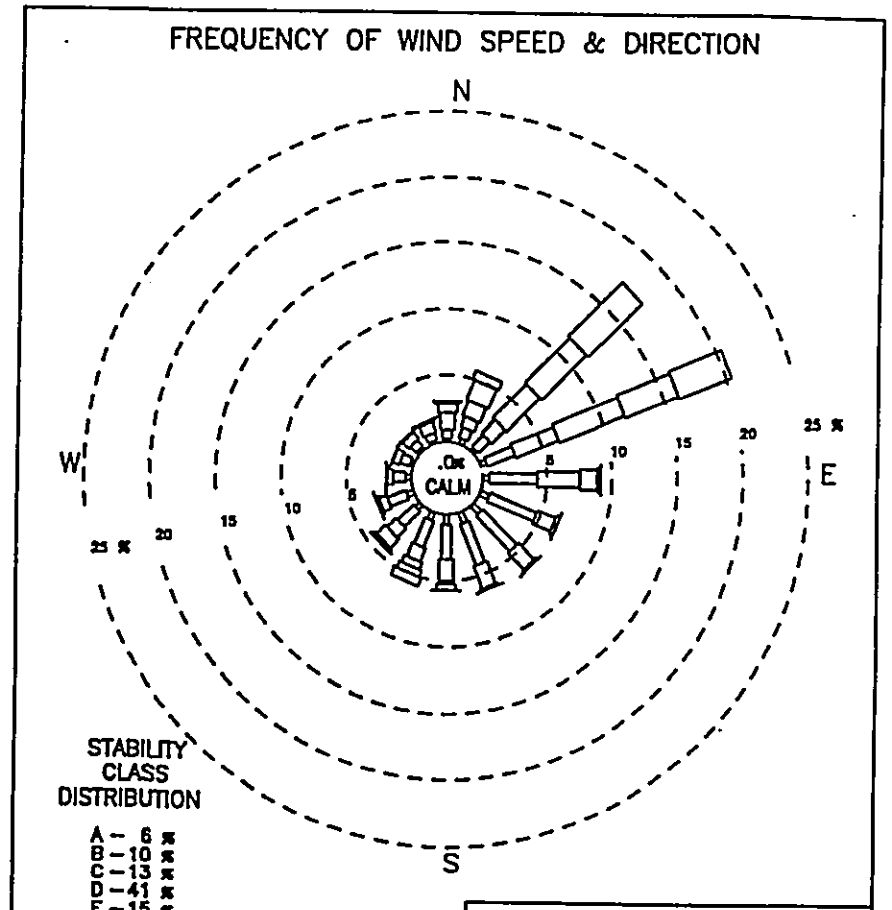


Figure 2.4-1a
Central Maui, Site 251
(D-1 & A-2) 37-meter
2/1/94 - 1/31/95
Prepared by
Jim Clary & Associates

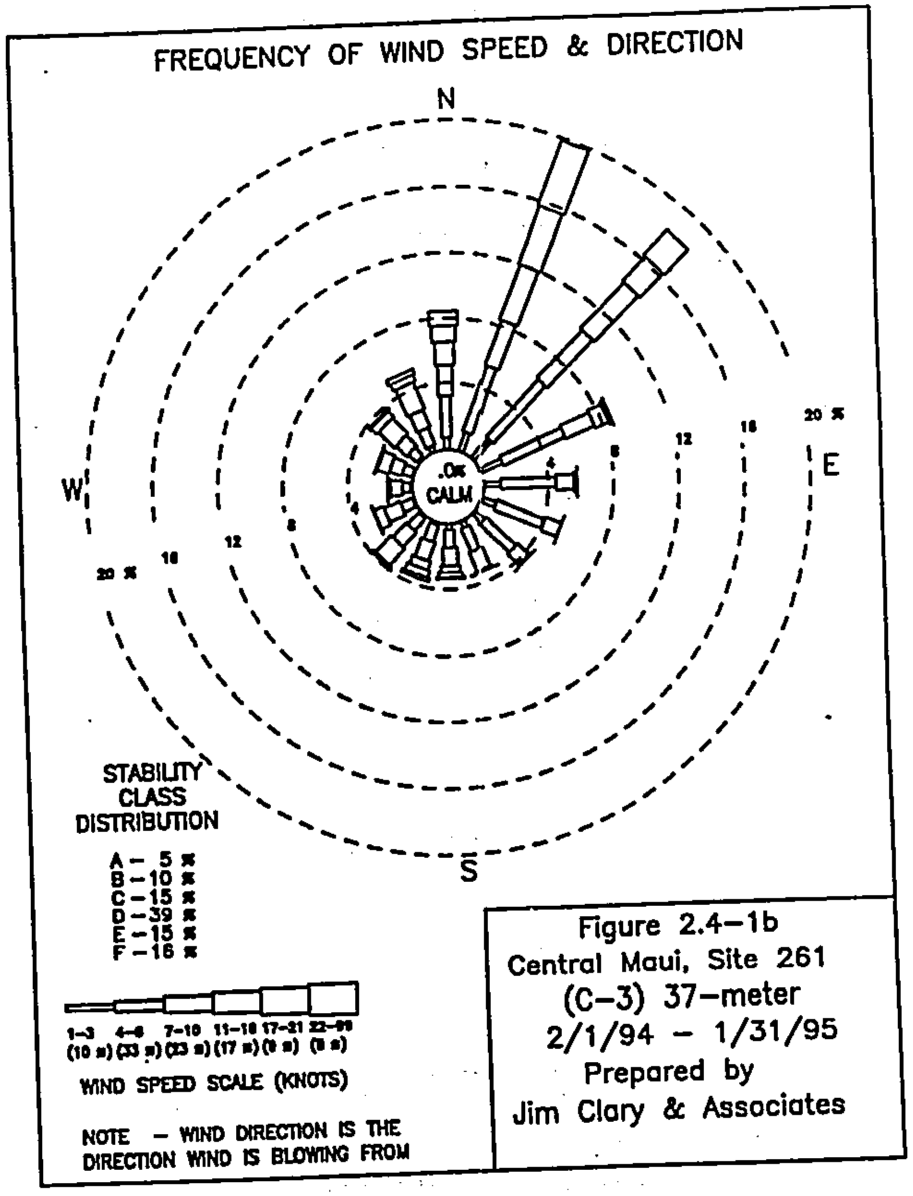


Figure 2.4–1b
Central Maui, Site 261
(C–3) 37–meter
2/1/94 – 1/31/95
Prepared by
Jim Clary & Associates

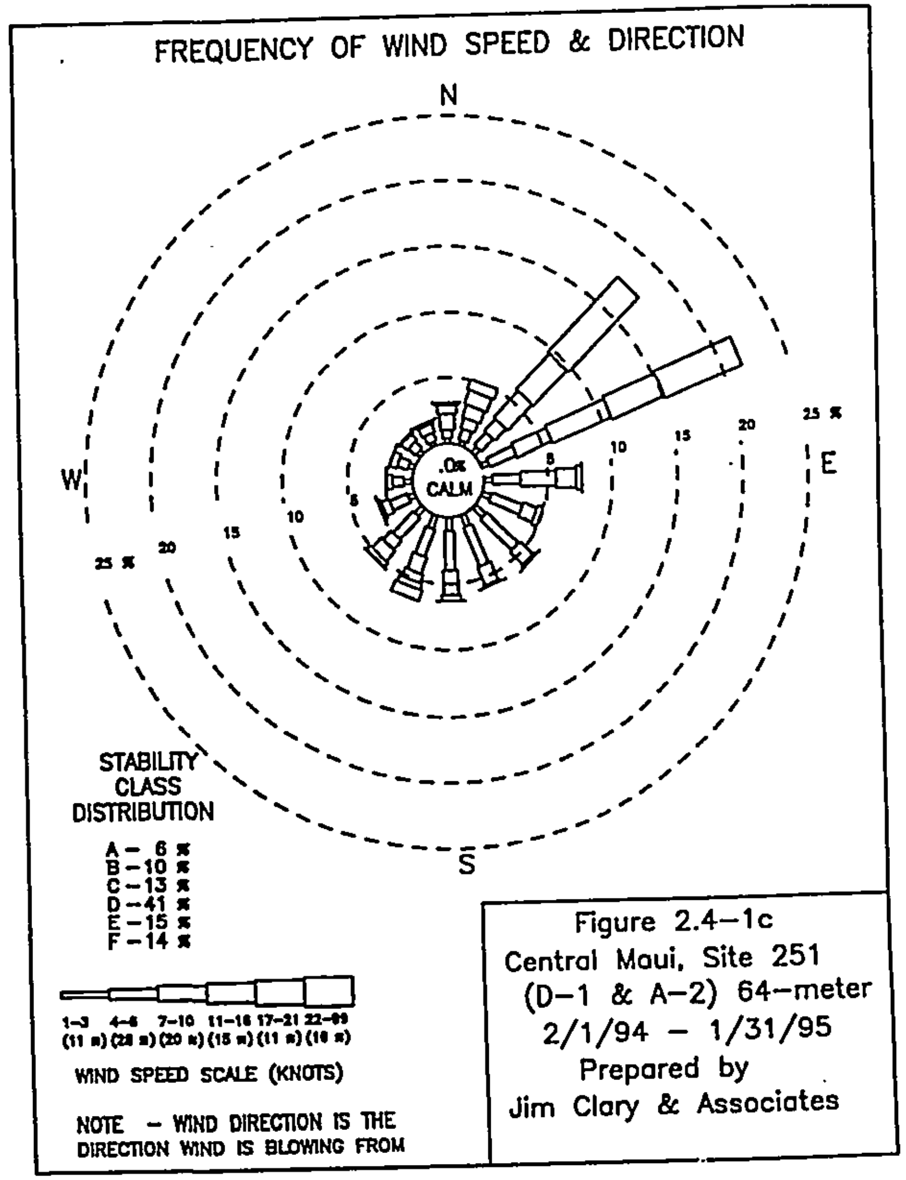


Figure 2.4–1c
Central Maui, Site 251
(D–1 & A–2) 64–meter
2/1/94 – 1/31/95
Prepared by
Jim Clary & Associates

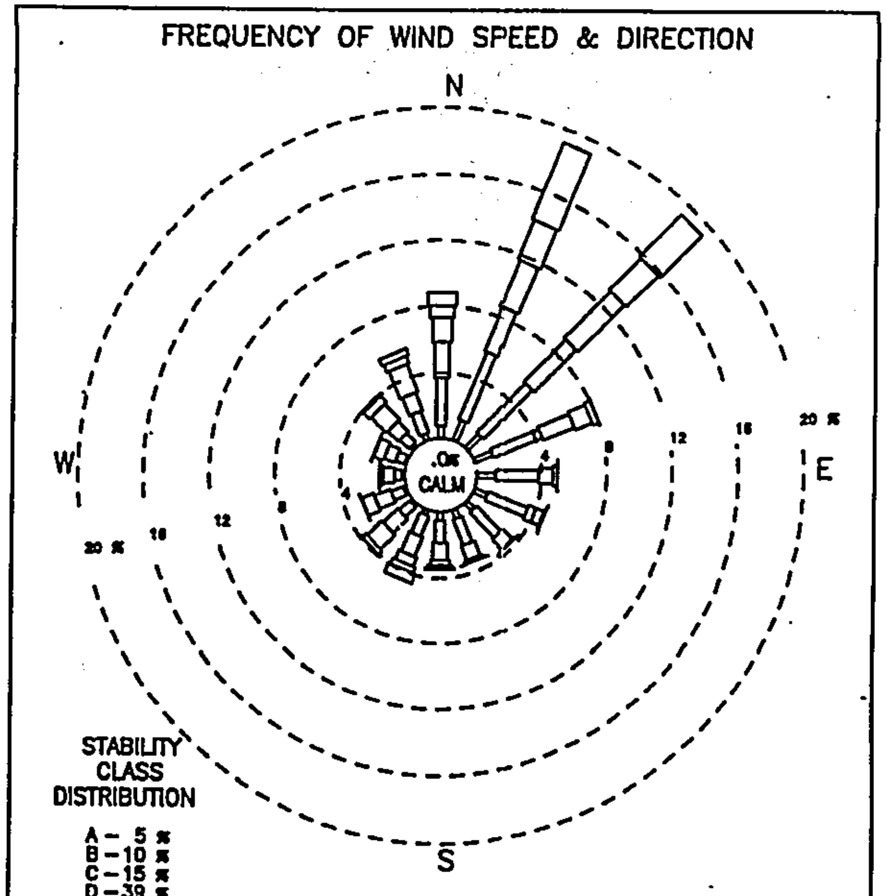


Figure 2.4–1d
Central Maui, Site 261
(C–3) 64–meter
2/1/94 – 1/31/95
Prepared by
Jim Clary & Associates

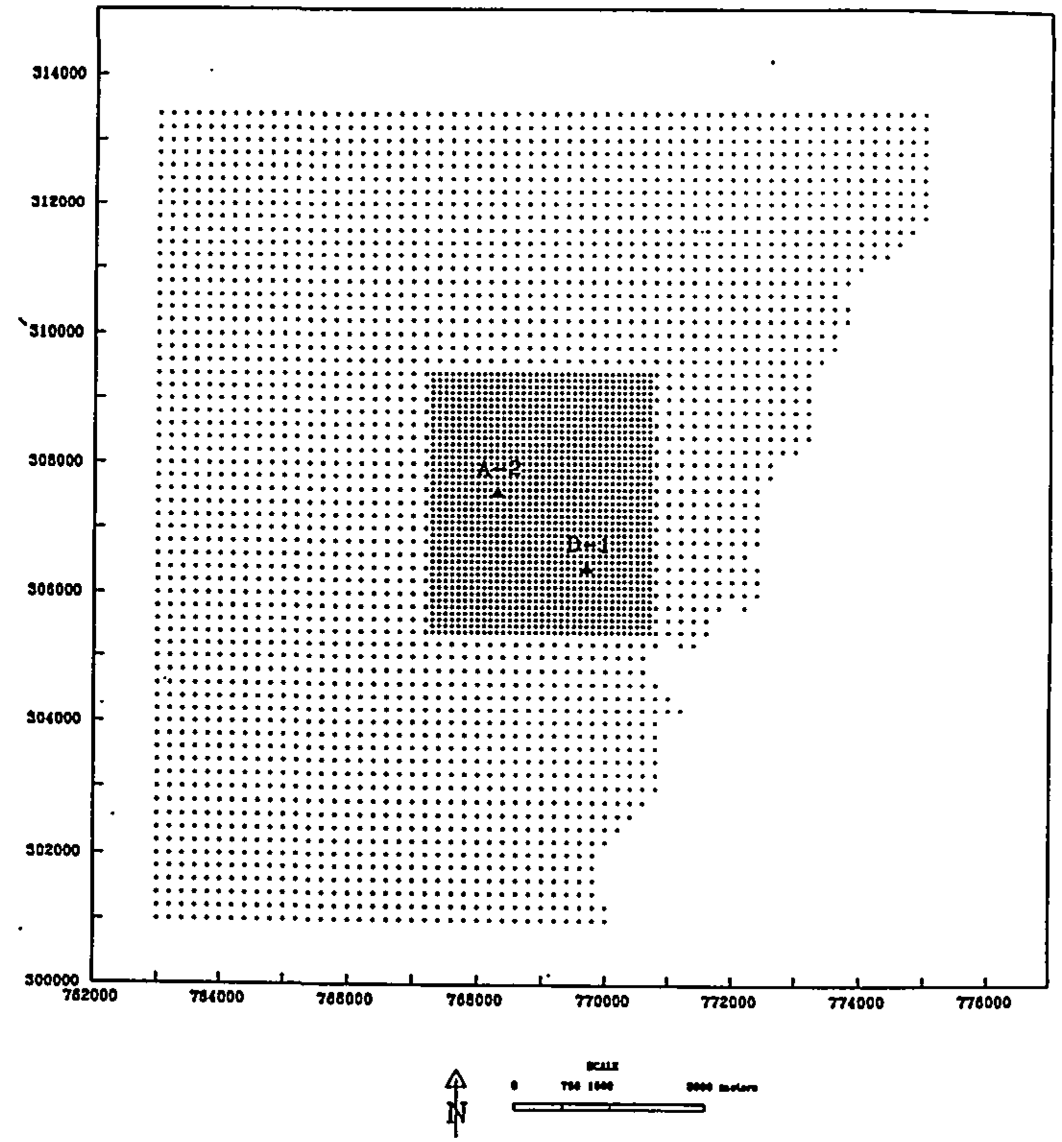


Figure 2.5–1a
Receptor Grid Locations: Grid 1, Base Grid
Central Maui, Sites A–2 and D–1
Island of Maui, Hawaii

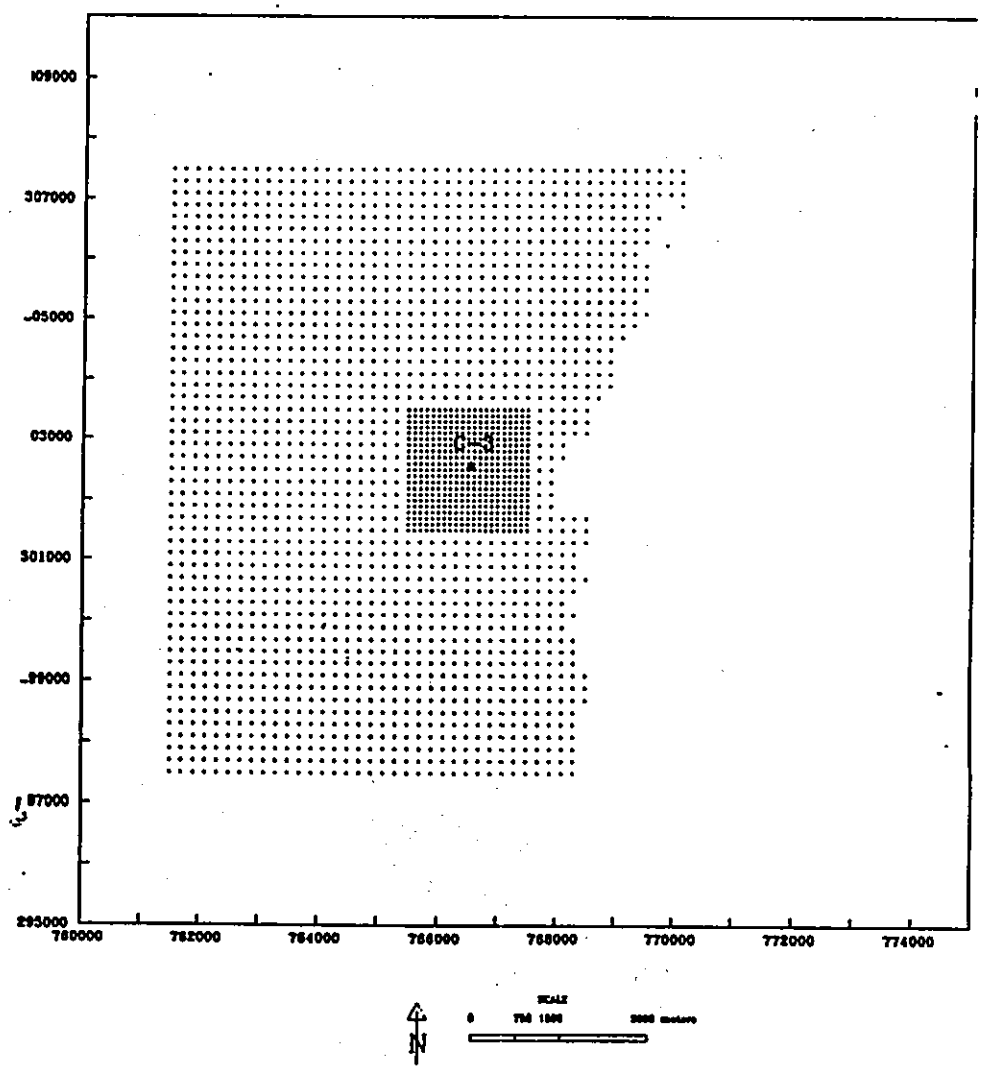


Figure 2.5-1b
Receptor Grid Locations: Grid 1, Base Grid
Central Maui, Site C-3, Island of Maui, Hawaii

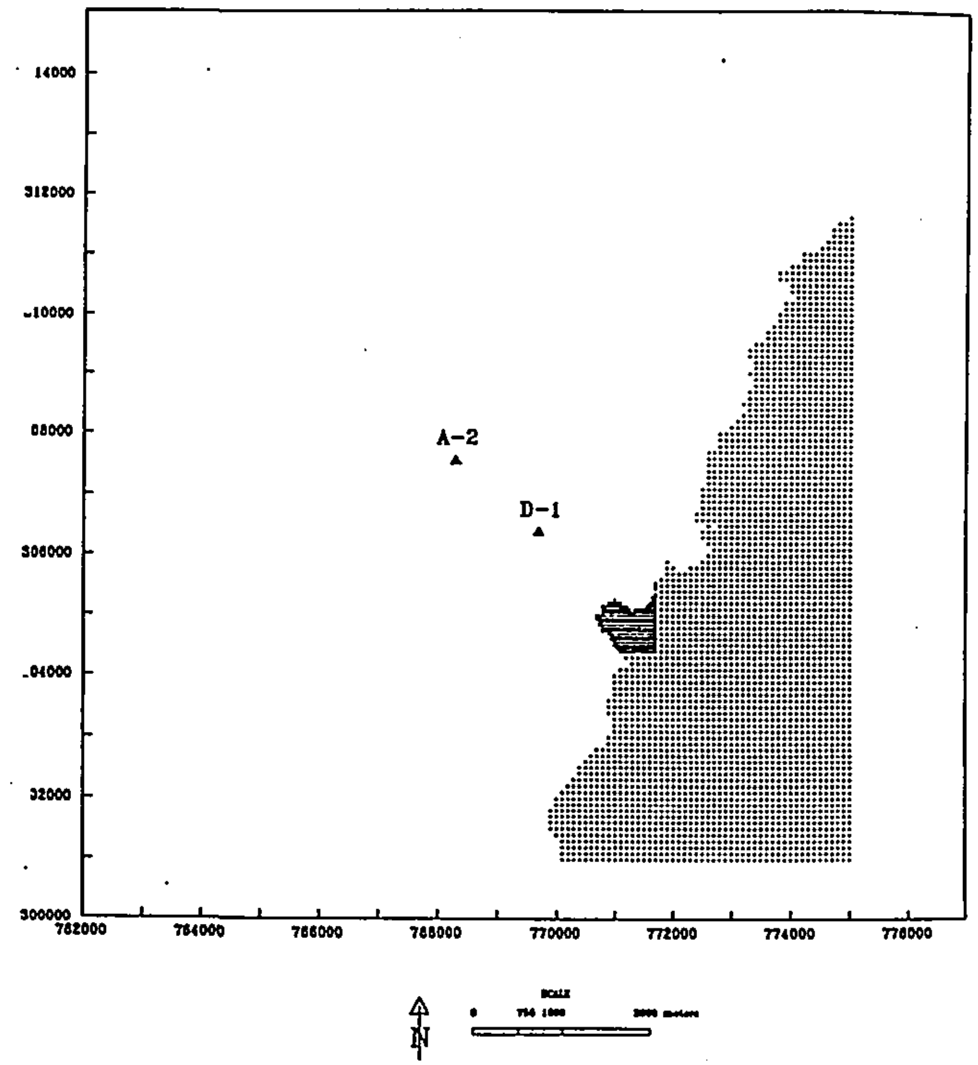


Figure 2.5-2a
Receptor Grid Locations: Grid 2, Terrain Grid
Central Maui, Sites A-2 and D-1
Island of Maui, Hawaii

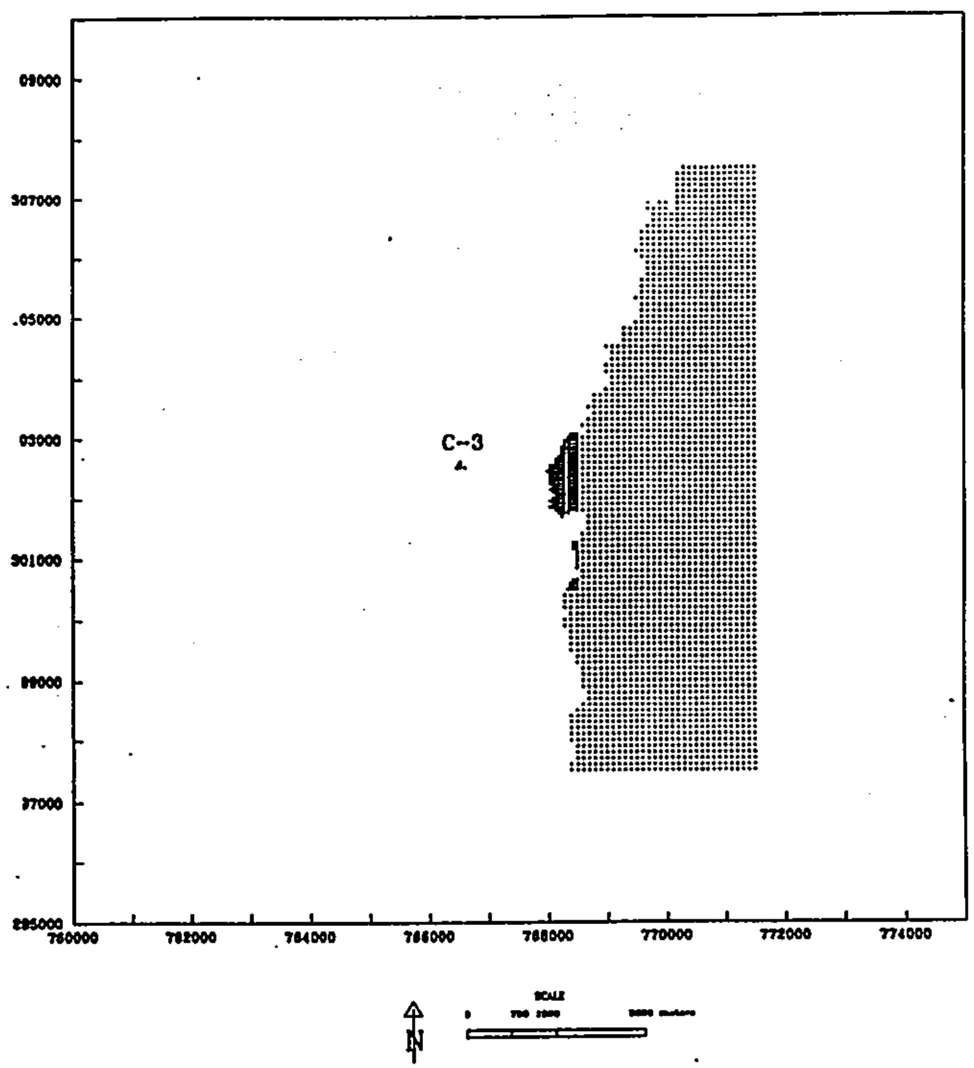


Figure 2.5-2b
Receptor Grid Locations: Grid 2, Terrain Grid
Central Maui, Site C-3, Island of Maui, Hawaii

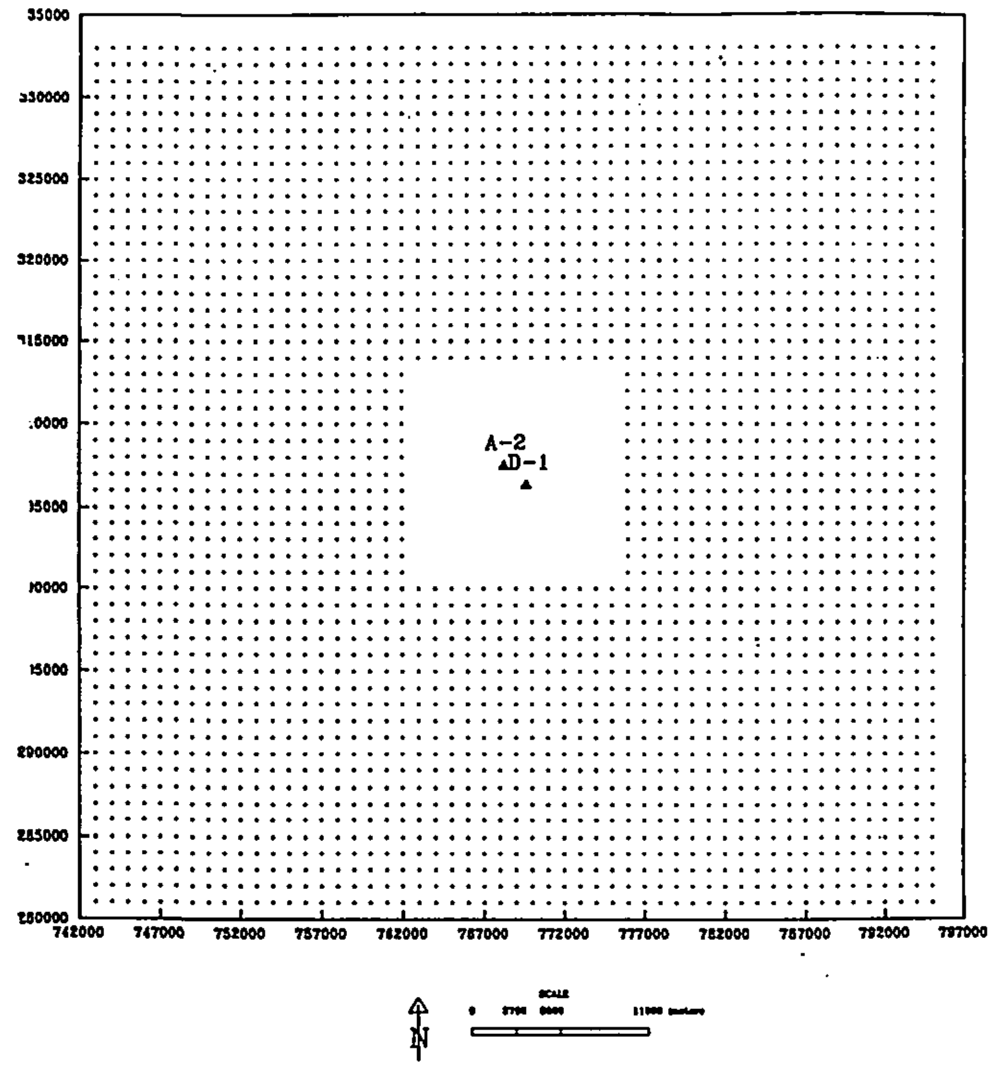


Figure 2.5-3a
Receptor Grid Locations: Grid 3, Coarse Grid
Central Maui, Sites A-2 and D-1
Island of Maui, Hawaii

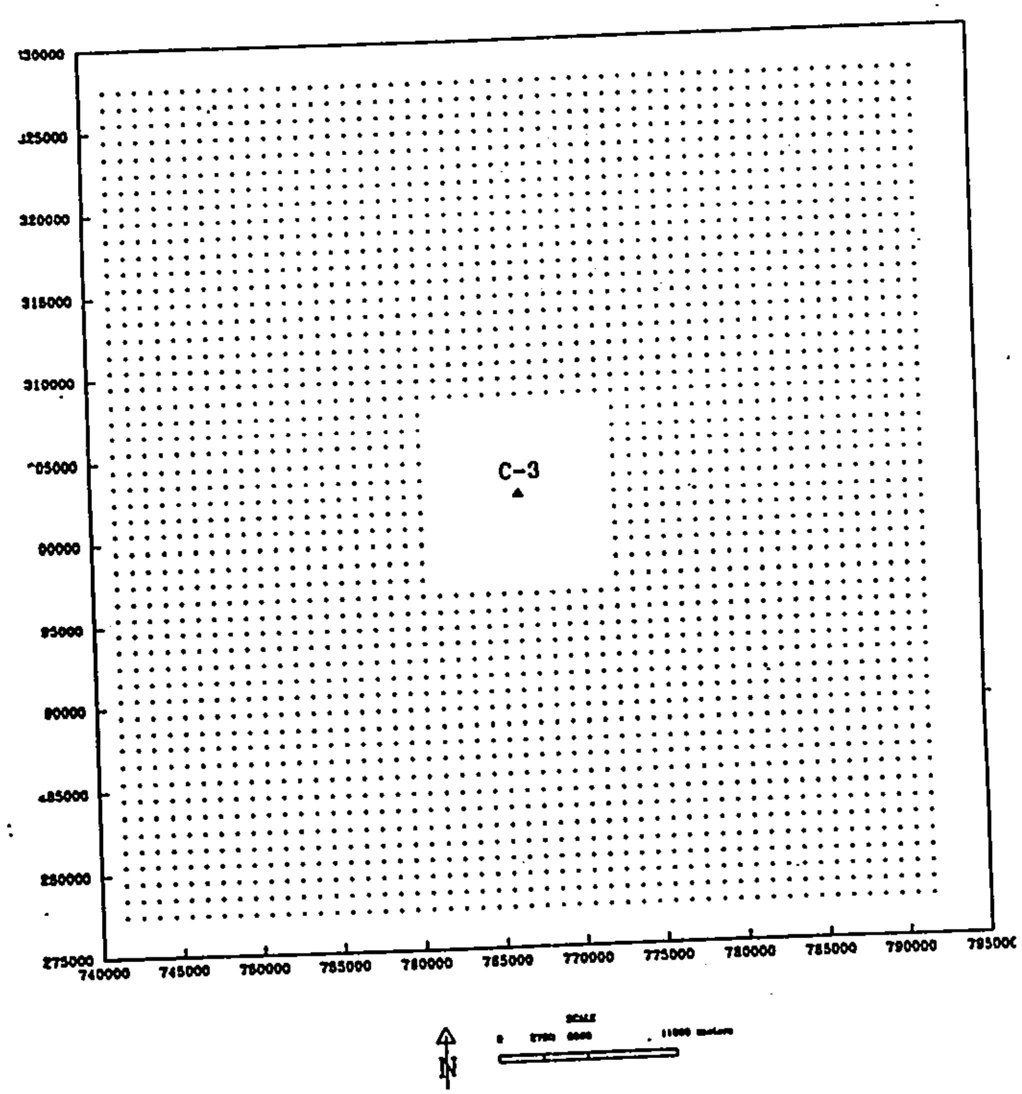


Figure 2.5-3b
Receptor Grid Locations: Grid 3, Coarse Grid
Central Maui, Site C-3, Island of Maui, Hawaii

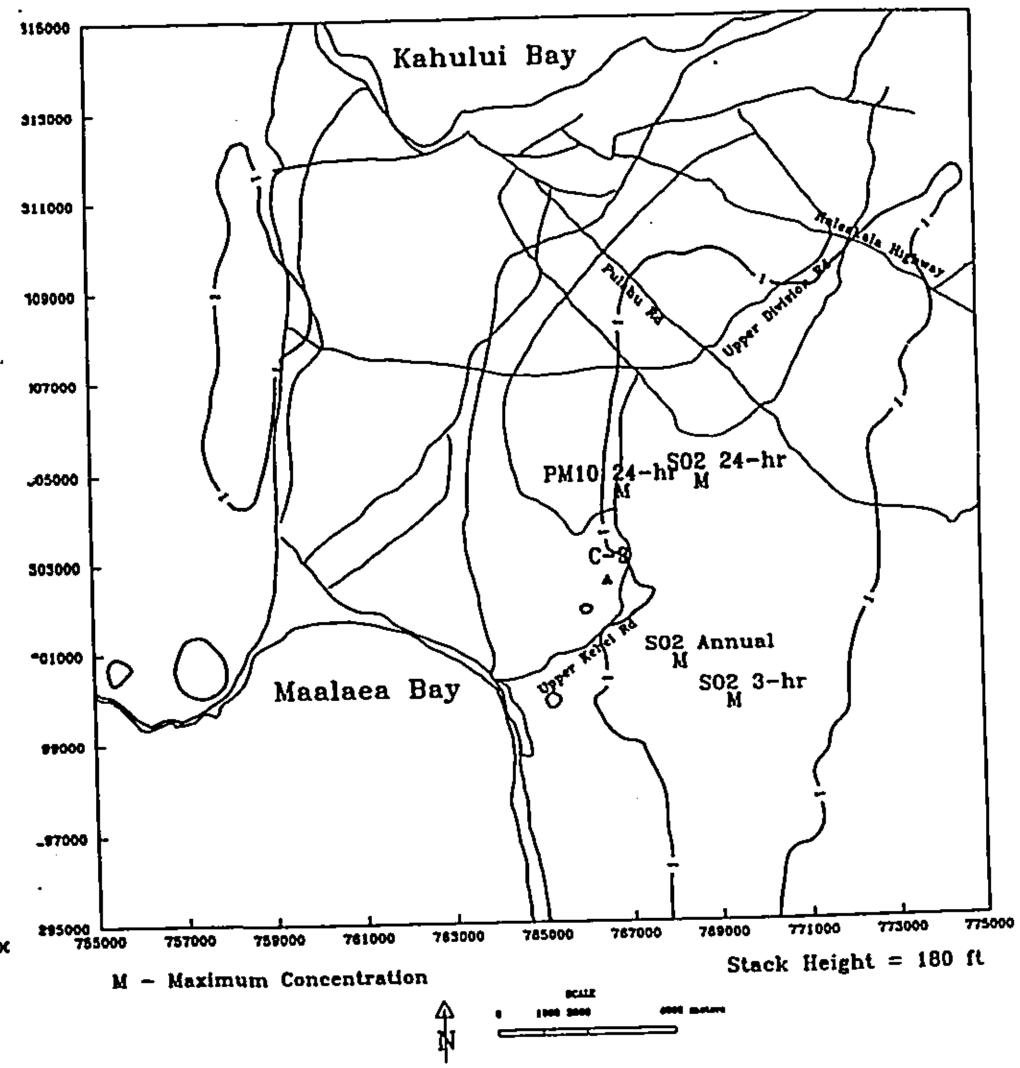


Figure 3.2.2-1
Significance for Any Pollutant (Normalized)
Central Maui, Site C-3, Island of Maui, Hawaii

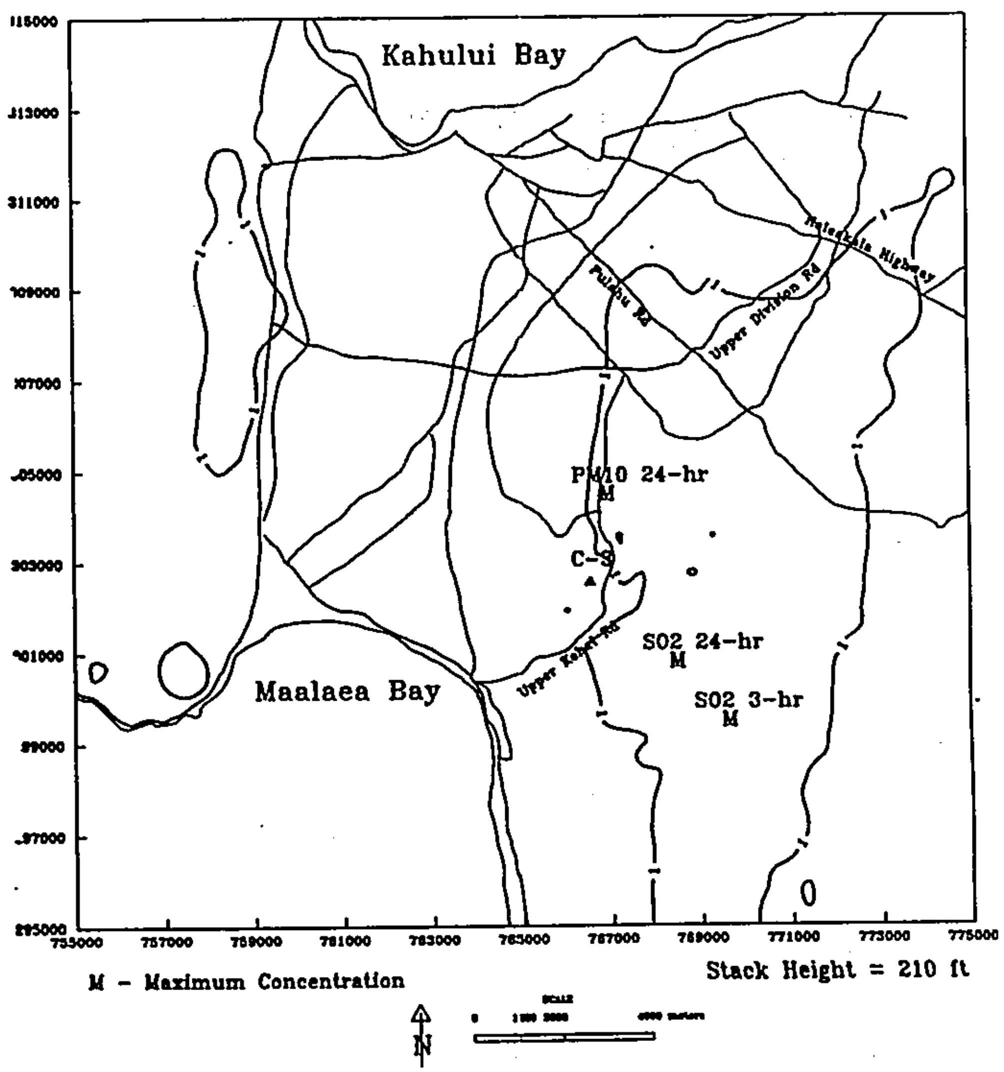


Figure 3.2.2-2
Significance for Any Pollutant (Normalized)
Central Maui, Site C-3, Island of Maui, Hawaii

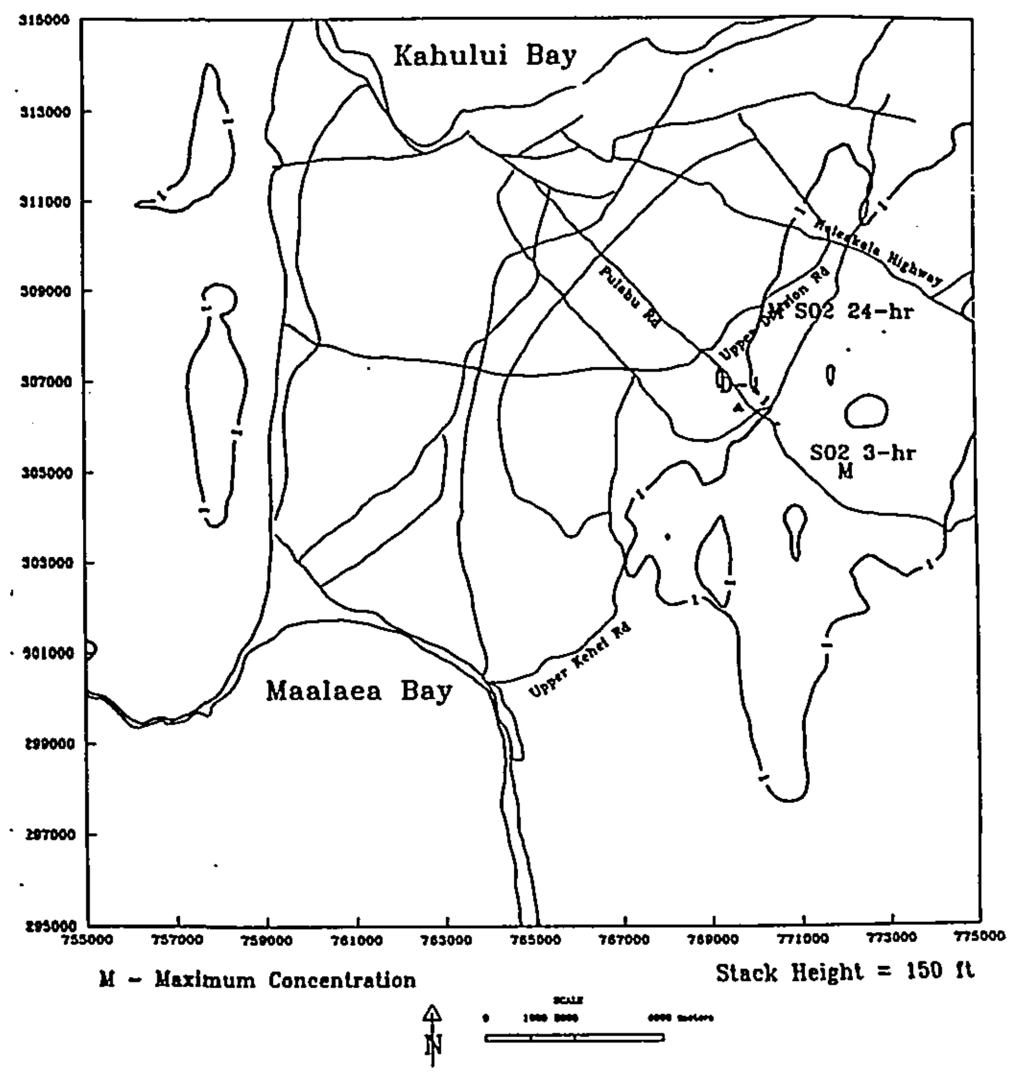


Figure 3.2.2-3
Significance for Any Pollutant (Normalized)
Central Maui, Site D-1, Island of Maui, Hawaii

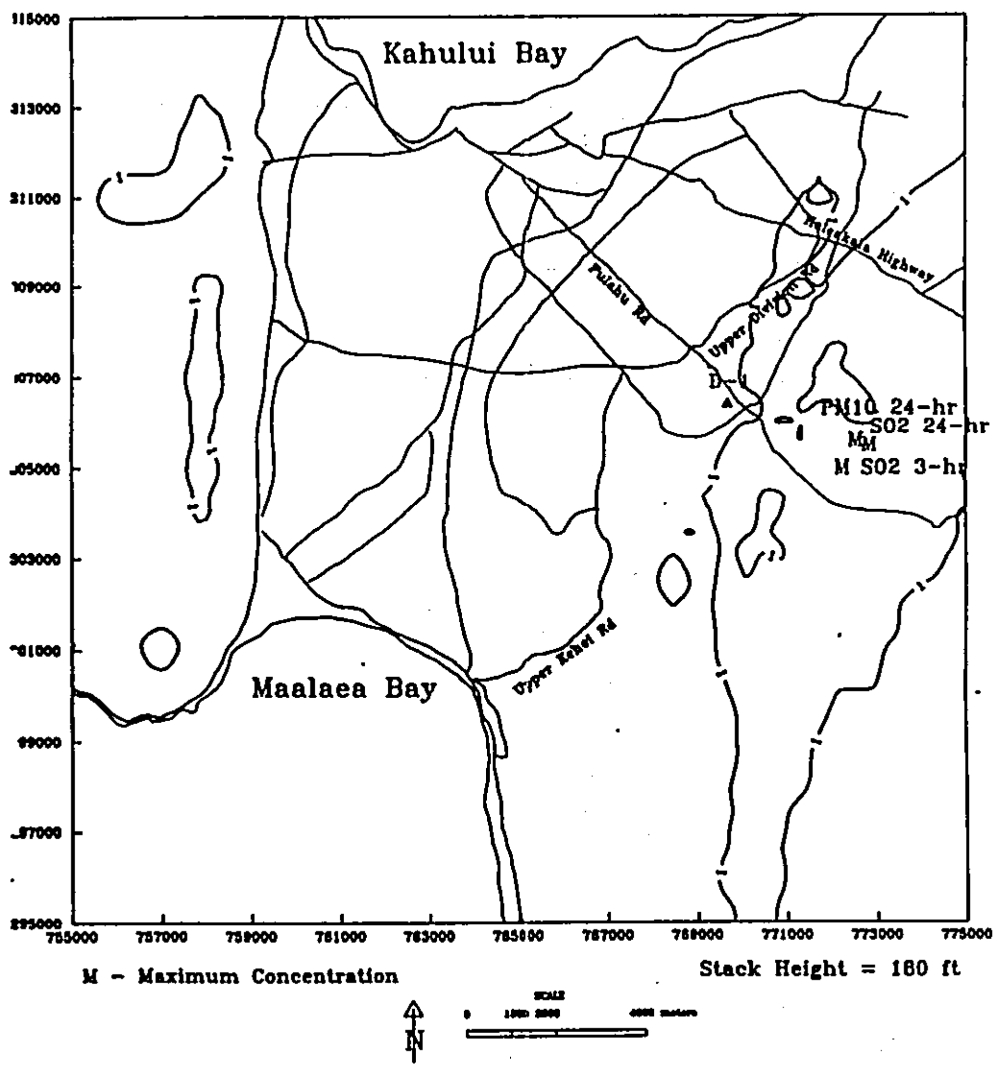


Figure 3.2.2-4
Significance for Any Pollutant (Normalized)
Central Maui, Site D-1, Island of Maui, Hawaii

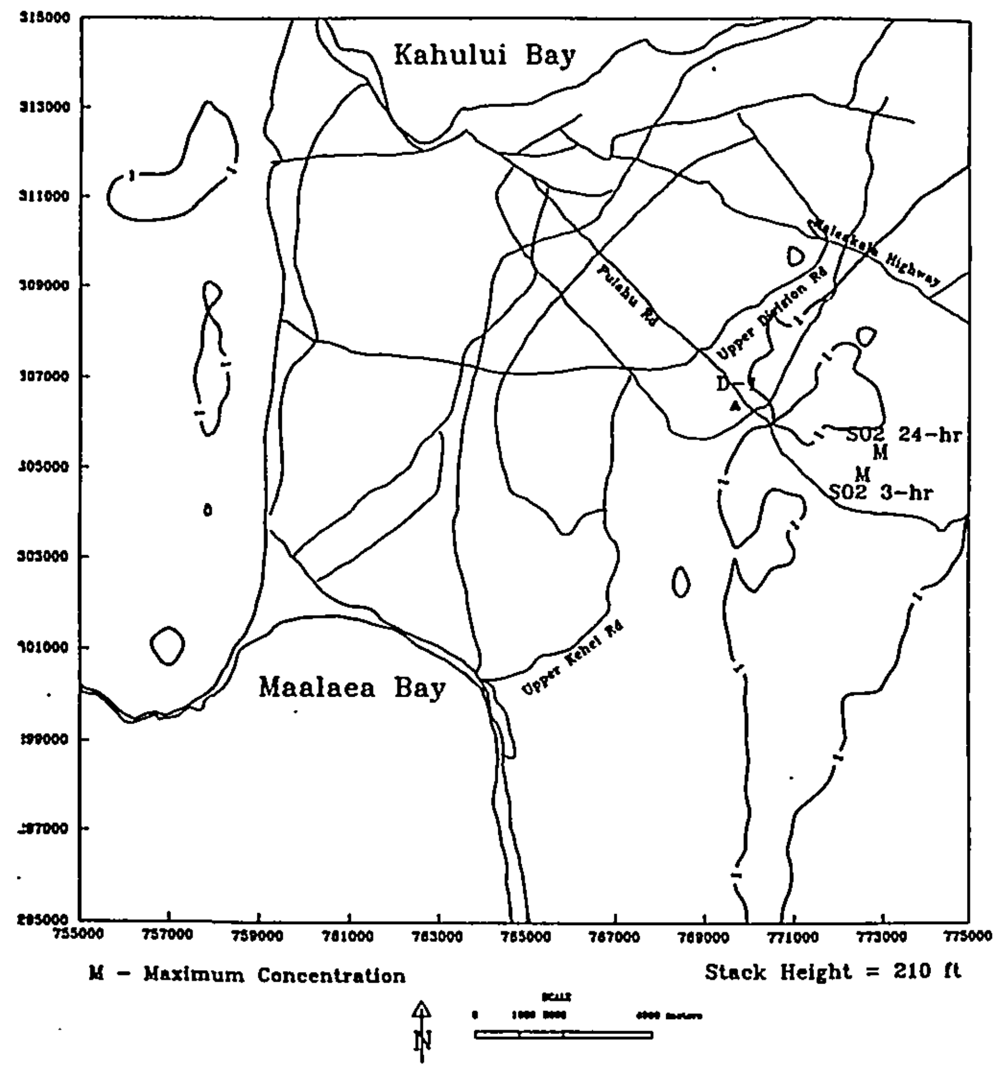


Figure 3.2.2-5
Significance for Any Pollutant (Normalized)
Central Maui, Site D-1, Island of Maui, Hawaii

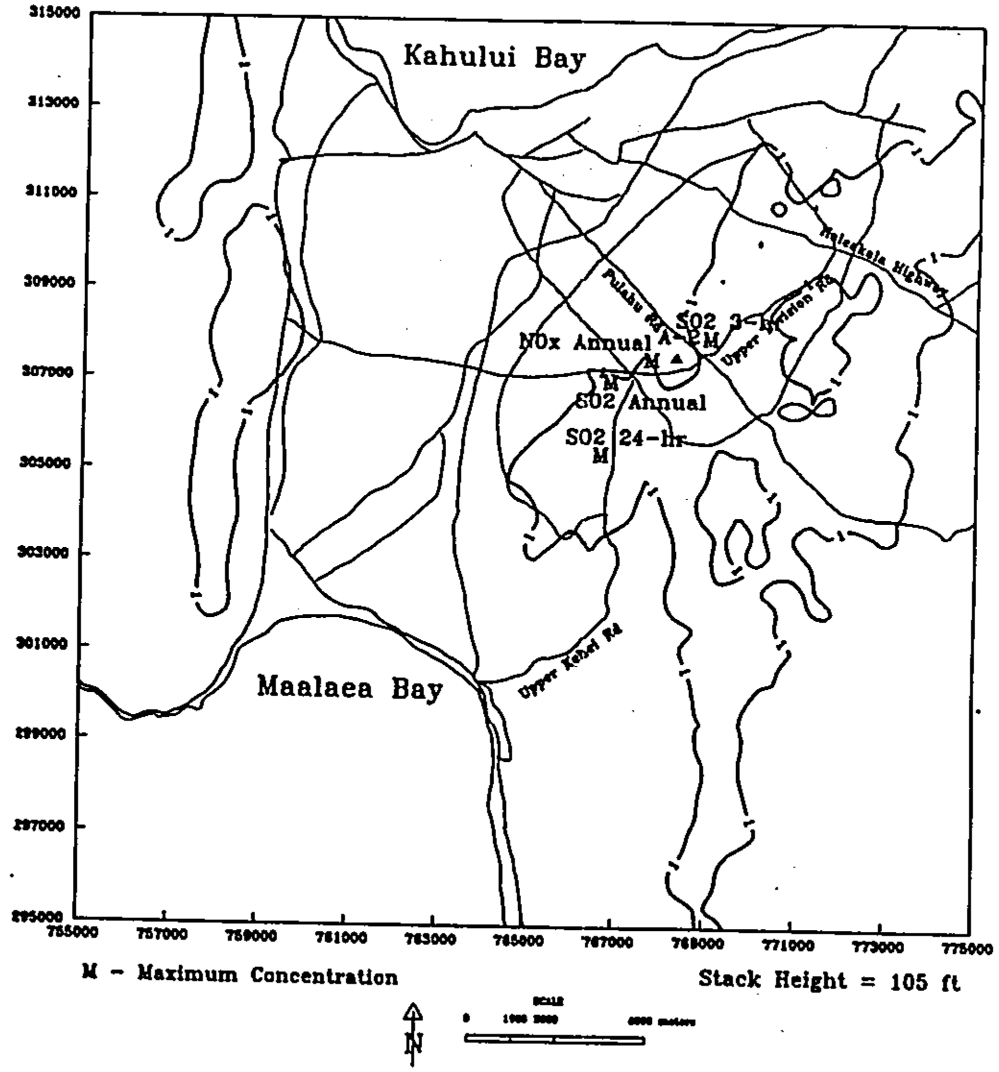


Figure 3.2.2-6
Significance for Any Pollutant (Normalized)
Central Maui, Site A-2, Island of Maui, Hawaii

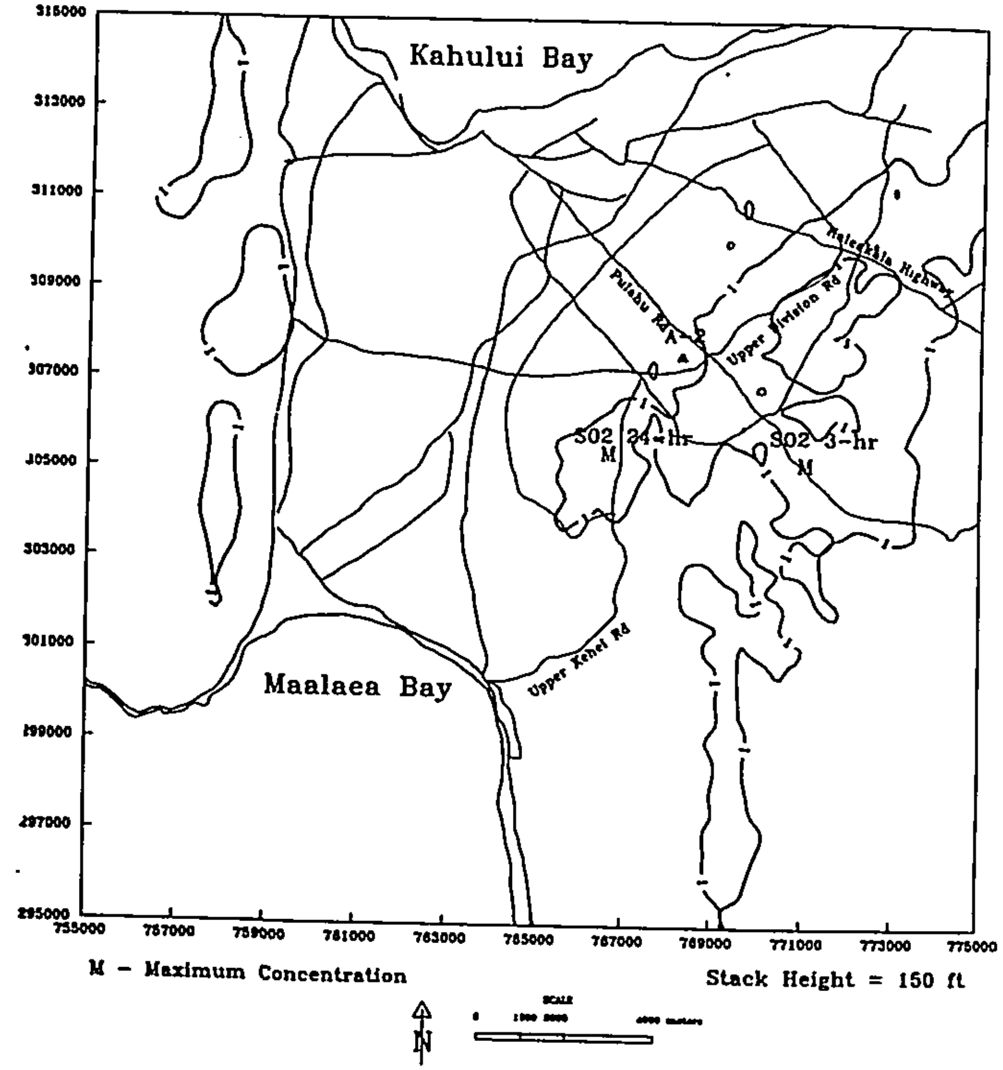


Figure 3.2.2-7
Significance for Any Pollutant (Normalized)
Central Maui, Site A-2, Island of Maui, Hawaii

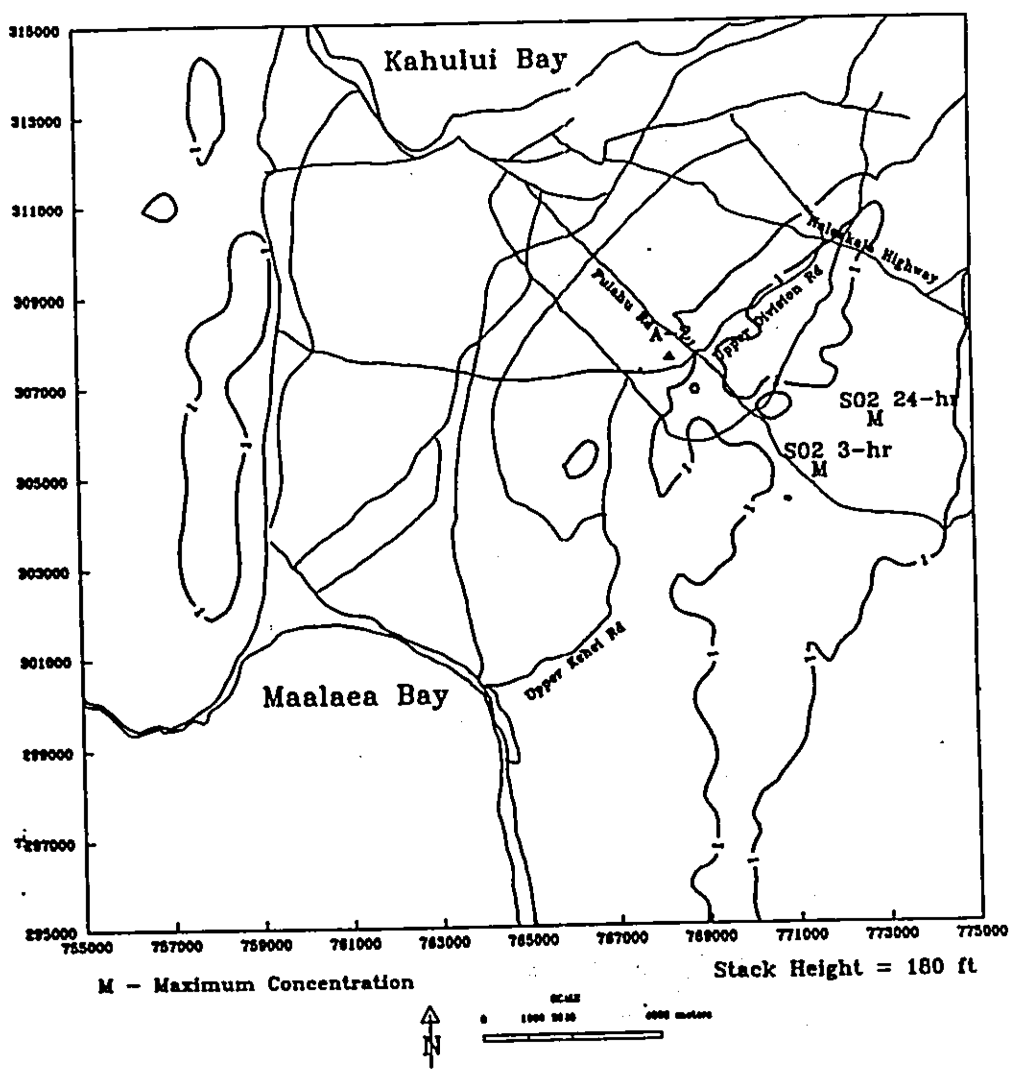


Figure 3.2.2-8
Significance for Any Pollutant (Normalized)
Central Maui, Site A-2, Island of Maui, Hawaii

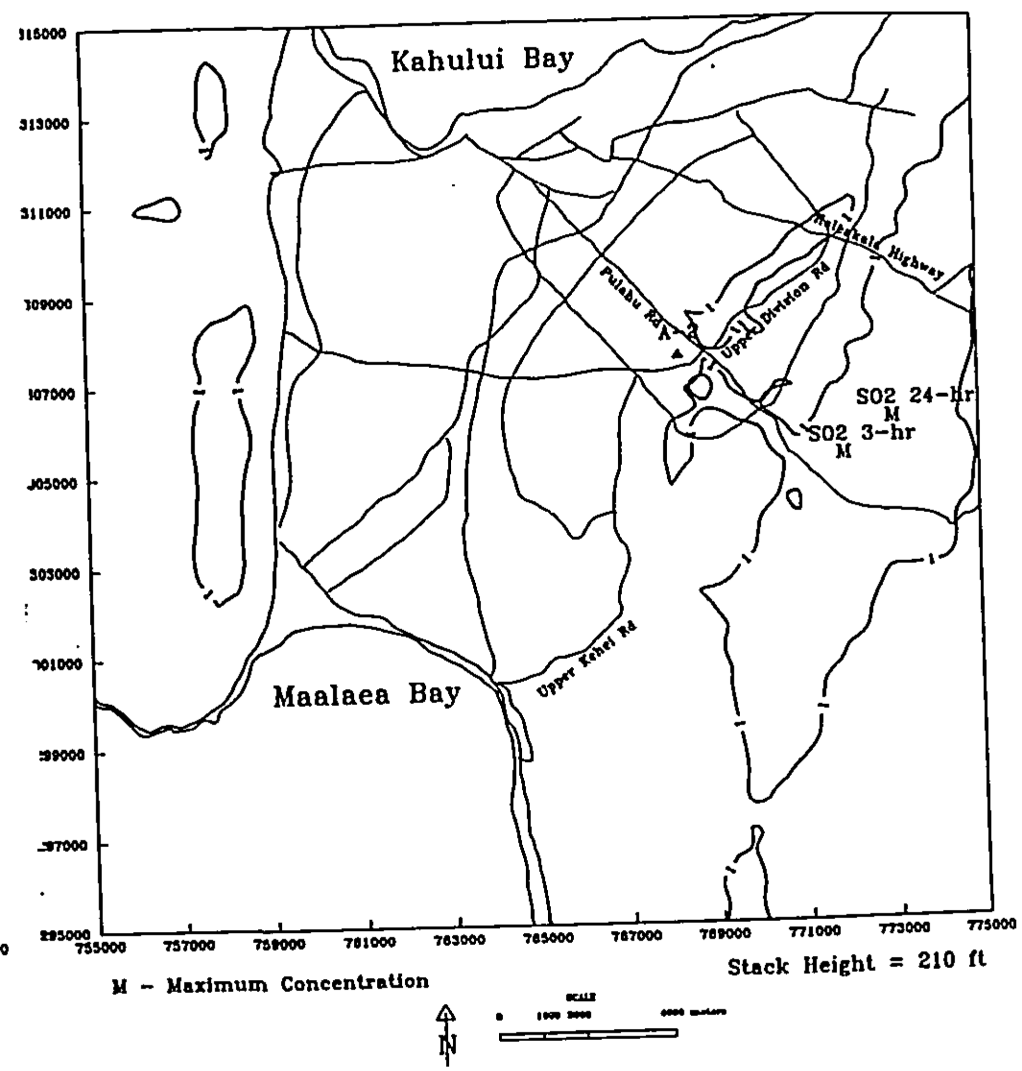


Figure 3.2.2-9
Significance for Any Pollutant (Normalized)
Central Maui, Site A-2, Island of Maui, Hawaii

APPENDIX 1

DESCRIPTION OF THE EXISTING SOURCE INVENTORY

Existing Sources Inventory

General Notes:

1. Source emission rates and parameters are primarily from the Covered Source Applications, Form S-1. Additional information is supplemented from the Trinity Inventory and other information sources (such as current permit applications, maps, USGS terrain data, etc.) as needed.
2. The Trinity Inventory is used to determine if a source consumes increment.
3. Source elevations are derived from USGS 30-meter terrain data.
4. Locations are in Old Hawaiian UTMs (meters).

Ameron HC&D

- Trinity, S-1 form and map did not match. Used map for location.
- Used S-1 parameters with map locations.
- Collocated sources as in S-1 form: Unit 1 (Primary Crusher), Stock Piles, Unit 2, Unit 3.
- Locations determined by Ameron HC&D Camp 10 Quarry General Site Plan.

Hawaiian Bitumuls & Paving Co.

- Trinity, S-1 form and map did not match. Used map for location.
- Used S-1 parameters with map locations.
- Locations determined by Ameron HC&D Camp 10 Quarry General Site Plan.

Grace Pacific Co.

- Trinity, S-1 form and map did not match. Used map for location.
- Used S-1 parameters with map locations.
- Locations determined by Ameron HC&D Camp 10 Quarry General Site Plan.

Hawaiian Cement - Puunene Quarry

- Trinity inventory did not match S-1 form and map. Used map for location.
- Used S-1 parameters with map locations.

Hawaiian Cement - Puunene Dry Ready Mix

- Trinity inventory did not match S-1 form and map. Used map for location.
- Used S-1 parameters with map locations.

Hawaiian Cement - Kihei

- Trinity inventory did not match S-1 form and map. Used map for location.
- Used S-1 parameters with map locations.

Hawaiian Cement - Honokowai

- Located on other side of West Maui Mountains - source not used in Central Maui inventory.

Existing Sources Inventory (Cont.)

Maui Pineapple
- Trinity, S-1 form and map did not match. Used map for location.
- Used S-1 parameters with map locations.

Pioneer Mill
- Located on other side of West Maui Mountains - source not used in Central Maui inventory.

Lahaina Wastewater Reclamation Facility
- Located on other side of West Maui Mountains - source not used in Central Maui inventory.

Wailuku-Kahului Wastewater Reclamation Facility
- No map available, used S-1 form locations and parameters.

HC&S - Paia
- Used most recent data (10/94 permit application).
- Used map for location.
- Source parameters based on S-1 form, coal/oil firing (worst case).

HC&S - Puunene
- Used map for location.
- Diameter and stack height not provided in application.
  - Diameter calculated from exit velocity and flow rate.
  - Stack height determined from Trinity inventory. Used rank by SO_2 emissions for match.

MECO - Maalaea
- Source locations and parameters from the M17/M19 PSD permit application.

MECO - Kahului
- Source locations and parameters from S-1 form.

Goodfellow Brothers

- Applied for temporary permit for their equipment. Location is expected to vary. Could change between islands. Source not used in Central Maui inventory.

Sources from Trinity Inventory (covered source application not required):
- DAGS Maui Memorial Hospital
- PRI Energy Systems
  - Changed location 35 meters to south to obtain derived elevation greater than zero.
- Borthwick Mortuaries
- Ameron HC&D- Kihei
- R & M Service Co.

Table 2.3.4-1

SOURCE OPERATIONS, EMISSIONS DATA, LOCATIONS, AND BASE ELEVATIONS FOR NON-CENTRAL MAUI SOURCES USED IN PSD AIR QUALITY MODELING ANALYSIS

	Source Emissions (g/s)											
Source ID	SO2	NOx	PM10	CO	UTM East (m)	UTM North (m)	Base Elevation amsl (ft)	Stack Height (m)	Stack Temp (K)	Exit Velocity (m/s)	Stack Diam (m)	Source Width (m)
Ameron HC&D					768,224.0	309,000.0	239.0	5.2	818.0	68.90	0.15	n/a
AHCD_01	0.20	1.85	0.13	0.40	768,061.0	309,592.0	192.0	15.2	303.0	357.00	0.30	n/a
AHCD_BH1	0.0	0.0	0.04	0.0	768,061.0	309,592.0	192.0	15.2	303.0	357.00	0.30	n/a
AHCD_BH2	0.0	0.0	0.04	0.0	768,510.0	309,245.0	247.0	15.2	303.0	357.00	0.30	n/a
AHCD_BH4	0.0	0.0	0.04	0.0	768,510.0	309,245.0	247.0	15.2	303.0	357.00	0.30	n/a
AHCD_BH5	0.0	0.0	0.04	0.0	768,224.0	309,000.0	239.0	1.8	n/a	n/a	n/a	3
AHCD_L1	0.0	0.0	1.13	0.0	768,633.0	309,245.0	249.0	3.7	n/a	n/a	n/a	3
AHCD_L2	0.0	0.0	1.13	0.0	768,224.0	309,000.0	239.0	1.0	n/a	n/a	n/a	3
AHCD_CR1	0.0	0.0	5.29	0.0	768,633.0	309,245.0	249.0	5.5	n/a	n/a	n/a	3
AHCD_CR2	0.0	0.0	4.50	0.0	768,633.0	309,245.0	249.0	4.6	n/a	n/a	n/a	1.5
AHCD_CR3	0.0	0.0	24.48	0.0	768,633.0	309,245.0	249.0	12.2	n/a	n/a	n/a	5.5
AHCD_AS1	0.0	0.0	3.02	0.0	768,633.0	309,245.0	249.0	3.4	n/a	n/a	n/a	15.1
AHCD_FS1	0.0	0.0	0.01	0.0	768,061.0	309,592.0	192.0	6.0	n/a	n/a	n/a	0.3
AHCD_BH3	0.0	0.0	0.01	0.0	768,061.0	309,592.0	192.0	6.0	n/a	n/a	n/a	0.3
AHCD_AS2	0.0	0.0	0.15	0.0	768,510.0	309,245.0	247.0	6.0	n/a	n/a	n/a	0.3
AHCD_BH6	0.0	0.0	0.01	0.0	768,510.0	309,245.0	247.0	6.0	n/a	n/a	n/a	0.3
AHCD_AS3	0.0	0.0	0.15	0.0								
Ameron HC&D, Kihei					764,384.0	300,745.0	32.0	1.0	n/a	n/a	n/a	25
AHCD_986	0.0	0.0	2.31	0.0								
Hawaiian Bitumuls & Paving Co.					766,837.0	309,633.0	168.0	10.7	338.5	9.78	1.22	n/a
HBPC_1	0.88	1.02	0.75	1.08								
Grace Pacific Co.					768,031.0	309,204.0	226.0	5.3	415.0	27.09	0.77	n/a
GPC_BH1	0.03	0.68	0.43	0.72	768,031.0	309,204.0	226.0	2.3	705.0	199.45	0.11	n/a
GPC_D1	0.35	2.09	0.05	0.55	768,031.0	309,204.0	226.0	2.3	705.0	199.45	0.11	n/a
GPC_D2	0.35	2.09	0.05	0.55	768,031.0	309,204.0	226.0	1.0	n/a	n/a	n/a	15
GPC_F1	0.0	0.0	0.74	0.0								
Hawaiian Cement, Kihei					765,880.0	295,096.0	33.0	15.0	303.0	1.92	0.40	n/a
HC_K6	0.0	0.0	0.01	0.0	765,880.0	295,096.0	33.0	1.0	n/a	n/a	n/a	15
HC_KA1	0.0	0.0	1.48	0.0								
Hawaiian Cement, Puunene Quarry & Dry Ready Mix					765,327.0	304,341.0	180.0	15.0	303.0	15.24	0.49	n/a
HC_P7	0.0	0.0	0.09	0.0	765,319.0	304,403.0	180.0	15.0	303.0	15.24	0.89	n/a
HC_P16	0.0	0.0	0.12	0.0	765,194.0	304,433.0	171.0	6.1	303.0	1.71	0.60	n/a
HC_P6	0.0	0.0	0.04	0.0	765,415.0	304,362.0	192.0	1.0	n/a	n/a	n/a	15
HC_PA1	0.0	0.0	3.47	0.0	765,327.0	304,340.0	180.0	1.0	n/a	n/a	n/a	15
HC_PA2	0.0	0.0	1.63	0.0	765,311.0	304,400.0	179.0	1.0	n/a	n/a	n/a	15
HC_PA3	0.0	0.0	4.69	0.0	765,200.0	304,400.0	170.0	1.0	n/a	n/a	n/a	15
HC_PA4	0.0	0.0	4.33	0.0								
Maui Pineapple					762,531.0	312,121.0	20.0	22.9	608.0	33.29	0.46	n/a
MPC_D1	0.58	2.57	0.14	0.14	762,531.0	312,121.0	20.0	22.9	608.0	33.29	0.46	n/a
MPC_D2	0.58	2.57	0.14	0.14	762,531.0	312,122.0	20.0	22.9	603.0	40.78	0.51	n/a
MPC_D3	0.88	3.49	0.21	0.20	762,531.0	312,122.0	20.0	22.9	603.0	40.78	0.51	n/a
MPC_D4	0.88	3.49	0.21	0.20	762,469.0	311,910.0	25.0	22.9	599.0	8.54	1.79	n/a
MPC_S1	17.61	3.41	0.19	0.15								
HC&S, Paia					772,600.0	314,200.0	164.0	36.7	330.4	5.62	3.28	n/a
HCS_PA1	75.68	21.48	4.33	30.34								
HC&S, Puunene					764,633.0	309,673.0	89.0	36.6	330.4	7.51	3.96	n/a
HCS_PN1A	48.49	5.63	0.0	0.0	764,633.0	309,673.0	89.0	36.6	344.8	8.01	3.96	n/a
HCS_PN1B	0.0	0.0	3.82	18.70	764,633.0	309,673.0	89.0	45.7	330.4	7.51	3.96	n/a
HCS_PN2A	48.49	5.63	0.0	0.0	764,633.0	309,673.0	89.0	45.7	344.8	8.01	3.96	n/a
HCS_PN2B	0.0	0.0	3.82	18.70	764,633.0	309,673.0	89.0	46.9	323.3	12.71	3.66	n/a
HCS_PN3A	48.49	5.63	0.0	0.0	764,633.0	309,673.0	89.0	46.9	332.9	13.29	3.66	n/a
HCS_PN3B	0.0	0.0	3.14	51.24								
DAOS Maui Memorial Hospital												

Table 2.3.4-1

SOURCE OPERATIONS, EMISSIONS DATA, LOCATIONS, AND BASE ELEVATIONS FOR NON-CENTRAL MAUI SOURCES USED IN PSD AIR QUALITY MODELING ANALYSIS

	Source Emissions (g/s)											
Source ID	SO2	NOx	PM10	CO	UTM East (m)	UTM North (m)	Base Elevation amsl (ft)	Stack Height (m)	Stack Temp (K)	Exit Velocity (m/s)	Stack Diam (m)	Source Width (m)
DMMH_502	0.24	0.68	1.74	0.0	761,184.0	311,445.0	102.0	6.1	1255.4	7.50	0.70	n/a
Borthwick Mortuaries												
BM_501	0.0	0.0	0.03	0.0	760,234.0	310,785.0	213.0	2.8	1089.3	8.02	0.51	n/a
MECO, Maalaea												
M1-M3_ABL	4.56	37.11	1.08	13.32	760,468.0	302,395.0	15.0	13.7	677.6	37.00	0.64	n/a
M4-M7_ABL	12.24	148.16	3.32	39.84	760,501.0	302,373.0	15.0	14.6	711.9	44.20	0.81	n/a
M8-M9_ABL	6.26	56.62	2.82	19.92	760,510.0	302,345.0	15.0	13.4	722.0	69.80	0.71	n/a
M10-M13_ABL	25.52	291.68	3.28	25.36	760,585.0	302,325.0	15.0	36.6	644.3	34.80	1.39	n/a
X1-X2_ABL	2.96	8.62	0.94	8.88	760,623.0	302,384.0	15.0	18.3	677.6	37.00	0.63	n/a
M14-M16_25%	0.0	10.66	4.96	119.84	760,650.0	302,353.0	15.0	36.6	414.0	10.80	2.44	n/a
M14-M16_100%	27.72	0.0	0.0	0.0	760,650.0	302,353.0	15.0	36.6	427.0	20.00	2.44	n/a
M17-M19_25%	0.0	10.66	4.96	119.84	760,719.0	302,423.0	15.0	36.6	414.0	10.80	2.44	n/a
M17-M19_100%	27.72	0.0	0.0	0.0	760,719.0	302,423.0	15.0	36.6	427.0	20.00	2.44	n/a
MBS_ABL	0.33	0.08	0.05	0.53	760,650.0	302,353.0	15.0	36.6	724.8	57.40	0.25	n/a

Table 2.3.4-2

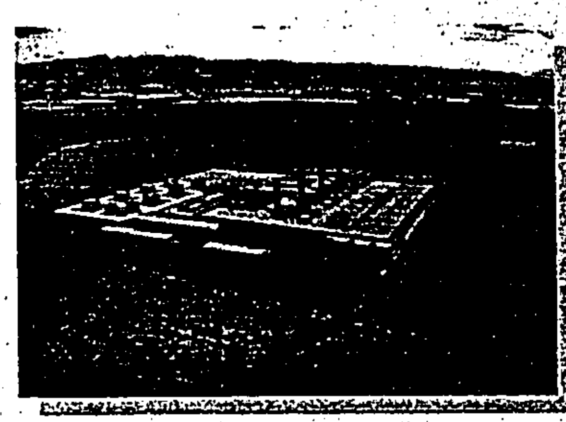
SOURCE OPERATIONS, EMISSIONS DATA, LOCATIONS, AND BASE ELEVATIONS FOR NON-CENTRAL MAUI SOURCES USED IN NAAQS/SAAQS AIR QUALITY MODELING ANALYSIS

Source ID	Source Emissions (g/s) SO2	NOx	PM10	CO	UTM East (m)	UTM North (m)	Base Elevation amsl (ft)	Stack Height (m)	Stack Temp (K)	Exit Velocity (m/s)	Stack Diam (m)	Source Width (m)
Ameron HCAD												
AHCD_G1	0.20	1.85	0.13	0.40	768,224.0	309,000.0	239.0	5.2	818.0	68.90	0.15	n/a
AHCD_BH1	0.0	0.0	0.04	0.0	768,061.0	309,592.0	192.0	15.2	303.0	357.00	0.30	n/a
AHCD_BH2	0.0	0.0	0.04	0.0	768,061.0	309,592.0	192.0	15.2	303.0	357.00	0.30	n/a
AHCD_BH4	0.0	0.0	0.04	0.0	768,510.0	309,245.0	247.0	15.2	303.0	357.00	0.30	n/a
AHCD_BH5	0.0	0.0	0.04	0.0	768,510.0	309,245.0	247.0	15.2	303.0	357.00	0.30	n/a
AHCD_L1	0.0	0.0	1.13	0.0	768,224.0	309,000.0	239.0	1.8	n/a	n/a	n/a	3
AHCD_L2	0.0	0.0	1.13	0.0	768,633.0	309,245.0	249.0	3.7	n/a	n/a	n/a	3
AHCD_CR1	0.0	0.0	5.29	0.0	768,224.0	309,000.0	239.0	1.0	n/a	n/a	n/a	3
AHCD_CR2	0.0	0.0	4.50	0.0	768,633.0	309,243.0	249.0	5.5	n/a	n/a	n/a	3
AHCD_CR3	0.0	0.0	24.48	0.0	768,633.0	309,243.0	249.0	4.6	n/a	n/a	n/a	1.5
AHCD_AS1	0.0	0.0	3.02	0.0	768,633.0	309,245.0	249.0	12.2	n/a	n/a	n/a	5.5
AHCD_FS1	0.0	0.0	0.01	0.0	768,633.0	309,245.0	249.0	3.4	n/a	n/a	n/a	15.1
AHCD_BH3	0.0	0.0	0.01	0.0	768,061.0	309,592.0	192.0	6.0	n/a	n/a	n/a	0.3
AHCD_AS2	0.0	0.0	0.15	0.0	768,061.0	309,592.0	192.0	6.0	n/a	n/a	n/a	0.3
AHCD_BH6	0.0	0.0	0.01	0.0	768,510.0	309,245.0	247.0	6.0	n/a	n/a	n/a	0.3
AHCD_AS3	0.0	0.0	0.15	0.0	768,510.0	309,245.0	247.0	6.0	n/a	n/a	n/a	0.3
Ameron HCAD, Kihei												
AHCD_986	0.0	0.0	2.31	0.0	764,384.0	300,745.0	32.0	1.0	n/a	n/a	n/a	25
Hawaiian Bitumuls & Paving Co.												
HBPC_1	0.88	1.02	0.75	1.08	766,837.0	309,633.0	168.0	10.7	338.5	9.78	1.22	n/a
Grace Pacific Co.												
GPC_BH1	0.03	0.68	0.43	0.72	768,031.0	309,204.0	226.0	5.3	415.0	27.09	0.77	n/a
GPC_D1	0.35	2.09	0.05	0.55	768,031.0	309,204.0	226.0	2.3	705.0	199.45	0.11	n/a
GPC_D2	0.35	2.09	0.05	0.55	768,031.0	309,204.0	226.0	2.3	705.0	199.45	0.11	n/a
GPC_F1	0.0	0.0	0.74	0.0	768,031.0	309,204.0	226.0	1.0	n/a	n/a	n/a	15
Hawaiian Cement, Kihei												
HC_K6	0.0	0.0	0.01	0.0	765,880.0	295,056.0	33.0	15.0	303.0	1.92	0.40	n/a
HC_KA1	0.0	0.0	1.48	0.0	765,880.0	295,056.0	33.0	1.0	n/a	n/a	n/a	15
Hawaiian Cement, Puunene Quarry & Dry Ready Mix												
HC_P7	0.0	0.0	0.09	0.0	765,327.0	304,348.0	180.0	15.0	303.0	15.24	0.49	n/a
HC_P16	0.0	0.0	0.12	0.0	765,319.0	304,403.0	180.0	15.0	303.0	15.24	0.89	n/a
HC_P6	0.0	0.0	0.04	0.0	765,194.0	304,433.0	171.0	6.1	303.0	1.71	0.60	n/a
HC_PA1	0.0	0.0	3.47	0.0	765,415.0	304,362.0	192.0	1.0	n/a	n/a	n/a	15
HC_PA2	0.0	0.0	1.63	0.0	765,327.0	304,348.0	180.0	1.0	n/a	n/a	n/a	15
HC_PA3	0.0	0.0	4.69	0.0	765,311.0	304,400.0	179.0	1.0	n/a	n/a	n/a	15
HC_PA4	0.0	0.0	4.33	0.0	765,200.0	304,400.0	170.0	1.0	n/a	n/a	n/a	15
Maui Pineapple												
MPC_D1	0.58	2.37	0.14	0.14	762,531.0	312,122.0	20.0	22.9	608.0	33.29	0.46	n/a
MPC_D2	0.58	2.37	0.14	0.14	762,531.0	312,122.0	20.0	22.9	608.0	33.29	0.46	n/a
MPC_D3	0.88	3.49	0.21	0.20	762,531.0	312,122.0	20.0	22.9	603.0	40.78	0.51	n/a
MPC_D4	0.88	3.49	0.21	0.20	762,531.0	312,122.0	20.0	22.9	603.0	40.78	0.51	n/a
MPC_81	17.61	3.41	0.19	0.15	762,469.0	311,980.0	25.0	22.9	599.0	8.54	1.79	n/a
Wailuku-Kahului Wastewater Reclamation Facility												
WWRF_1	0.60	1.05	0.12	0.37	764,000.0	313,000.0	5.0	7.3	791.0	49.00	0.15	n/a
WWRF_2	0.03	1.25	0.09	0.27	764,000.0	313,000.0	5.0	7.3	787.0	90.00	0.15	n/a
WWRF_3	0.03	1.25	0.09	0.27	764,000.0	313,000.0	5.0	7.3	769.0	54.00	0.15	n/a
HC&S, Paia												
HCS_PA1	75.68	21.48	4.33	30.34	772,600.0	314,200.0	164.0	36.7	330.4	5.62	3.28	n/a
HC&S, Puunene												
HCS_PN1A	48.49	5.63	0.0	0.0	764,633.0	309,673.0	89.0	36.6	330.4	7.51	3.96	n/a
HCS_PN1B	0.0	0.0	3.82	18.70	764,633.0	309,673.0	89.0	36.6	344.8	8.01	3.96	n/a
HCS_PN2A	48.49	5.63	0.0	0.0	764,633.0	309,673.0	89.0	45.7	330.4	7.51	3.96	n/a

Table 2.3.4-2

SOURCE OPERATIONS, EMISSIONS DATA, LOCATIONS, AND BASE ELEVATIONS FOR NON-CENTRAL MAUI SOURCES USED IN NAAQS/SAAQS AIR QUALITY MODELING ANALYSIS

Source ID	Source Emissions (g/s) SO2	NOx	PM10	CO	UTM East (m)	UTM North (m)	Base Elevation amsl (ft)	Stack Height (m)	Stack Temp (K)	Exit Velocity (m/s)	Stack Diam (m)	Source Width (m)
HCS_PN2B	0.0	0.0	3.82	18.70	764,633.0	309,673.0	89.0	45.7	344.8	8.01	3.96	n/a
HCS_PN3A	48.49	5.63	0.0	0.0	764,633.0	309,673.0	89.0	46.9	323.3	12.71	3.66	n/a
HCS_PN3B	0.0	0.0	3.14	51.24	764,633.0	309,673.0	89.0	46.9	332.9	13.29	3.66	n/a
DAGS Maui Memorial Hospital												
DMMH_502	0.24	0.68	1.74	0.0	761,184.0	311,445.0	102.0	6.1	1255.4	7.50	0.70	n/a
PRI Energy Systems												
PRI_517	0.0	0.05	0.0	0.0	762,290.0	312,515.0	9.0	11.3	410.9	2.77	0.09	n/a
PRI_518	0.0	0.05	0.0	0.0	762,290.0	312,515.0	9.0	11.3	410.9	2.77	0.09	n/a
PRI_519	0.0	0.05	0.0	0.0	762,290.0	312,515.0	9.0	11.3	410.9	2.77	0.09	n/a
PRI_520	0.0	0.05	0.0	0.0	762,290.0	312,515.0	9.0	11.3	410.9	2.77	0.09	n/a
R&M Service Co.												
RM_521	0.0	0.02	0.0	0.0	759,504.0	308,545.0	410.0	3.7	449.8	2.59	0.30	n/a
RM_54	0.0	0.0	0.20	0.0	759,504.0	308,545.0	410.0	1.0	n/a	n/a	n/a	100
Borthwick Mortuaries												
BM_501	0.0	0.0	0.03	0.0	760,234.0	310,785.0	213.0	2.8	1089.3	8.02	0.51	n/a
MECO, Maalaea												
M1-M3_ABL	4.56	37.11	1.08	13.32	760,468.0	302,395.0	15.0	13.7	677.6	37.00	0.64	n/a
M4-M7_ABL	12.24	148.16	3.32	39.84	760,501.0	302,373.0	15.0	14.6	711.9	44.20	0.81	n/a
M8-M9_ABL	6.26	56.62	2.82	19.92	760,510.0	302,345.0	15.0	13.4	722.0	69.80	0.71	n/a
M10-M13_ABL	25.52	291.68	3.28	25.36	760,585.0	302,325.0	15.0	36.6	644.3	34.80	1.39	n/a
X1-X2_ABL	2.96	8.62	0.94	8.88	760,623.0	302,384.0	15.0	18.3	677.6	37.00	0.63	n/a
M14-M16_25%	0.0	10.66	4.96	119.84	760,650.0	302,353.0	15.0	36.6	414.0	10.80	2.44	n/a
M14-M16_100%	27.72	0.0	0.0	0.0	760,650.0	302,353.0	15.0	36.6	427.0	20.00	2.44	n/a
M17-M19_25%	0.0	10.66	4.96	119.84	760,719.0	302,423.0	15.0	36.6	414.0	10.80	2.44	n/a
M17-M19_100%	27.72	0.0	0.0	0.0	760,719.0	302,423.0	15.0	36.6	427.0	20.00	2.44	n/a
MBS_ABL	0.33	0.08	0.05	0.53	760,650.0	302,353.0	15.0	36.6	724.8	57.40	0.25	n/a
MECO, Kahului												
K1	26.09	6.83	4.56	0.78	763,673.0	313,143.0	12.0	56.4	450	11.00	1.20	n/a
K2	26.09	6.83	4.56	0.78	763,673.0	313,143.0	12.0	56.4	422	10.90	1.20	n/a
K3	47.73	13.38	17.40	1.44	763,673.0	313,143.0	12.0	56.4	436	12.20	1.50	n/a
K4	50.23	15.30	12.12	1.51	763,673.0	313,143.0	12.0	56.4	433	12.60	1.70	n/a



APPENDIX C2

ASSUMPTIONS AND RESULTS OF 'VISCREEN' MODELING

Attachment 1 - Visibility Study

The EPA VISCREEN model was used to determine the impact, if any, of the plume from the proposed Waena Generating Station on the visibility in Haleakala National Park. The total project emissions from four 58-MW units were considered for the analysis. The procedure used to evaluate plume visual impacts conforms to the EPA guidance for plume visual impact studies (EPA 1988). The first step, a level-1 analysis, determines the potential visibility impacts under the most restrictive meteorological conditions. If the level-1 analysis indicates a potentially significant impact, then a level-2 analysis is performed. Under the level-2 analysis, actual meteorological conditions are used to determine the worst-case conditions possible.

When the level-1 analysis was performed for the proposed Waena Generating Station, potentially significant impacts were identified. Therefore, a level-2 analysis was performed. The worst-case plume dispersion conditions were determined following the EPA guidance. The on-site meteorological data from MECO Site 251 were used for this visibility analysis. The Haleakala National Park is downwind from the proposed site only when wind directions are between 290° and 315°. Therefore, wind vector data in sectors to the east-southeast, southeast, and south-southeast were used in the analysis. Dispersion conditions (the product of the vertical dispersion coefficient and the wind speed, $s_z u$) were determined for each possible wind speed/stability class combination. The dispersion conditions were ranked in ascending order, corresponding to decreasing visibility impacts (the more restrictive dispersion conditions are associated with the largest visibility impacts). Plume travel time, to the Class I area based on the distance and wind speed, was also determined for each category.

The relative frequency of occurrence for each dispersion condition was determined for four time-of-day categories. The cumulative frequency was determined by adding the maximum relative frequency found in the four time-of-day categories. As recommended in the guidelines, categories with travel times of more than 12 hours were not included in the cumulative frequency summation. It is unlikely that steady-state plume conditions will persist for more than 12 hours. The worst-case meteorological conditions are defined when the cumulative frequency reaches the one-percent level. This is equivalent to the worst-case conditions occurring about four days per year.

This attachment contains the determination of the worst-case meteorological conditions to be used in the level-2 visibility analysis. The most restrictive of the one-percentile dispersion conditions determined for the four time periods is stability class C, wind speed 5 m/s. In order to account for complex terrain (i.e., the observer is located on terrain greater than 500 meters above the effective stack height for stable conditions), the worst-case stability class is shifted one category less stable (i.e., B,5) per EPA guidance.

The VISCREEN model denotes the entire visibility study area as the "Class I area." Thus, exceedances of the screening criteria thresholds outside the "Class I area" (i.e., the visibility study area) are acceptable. The level-2 VISCREEN modeling results for the proposed Waena Generating Station are provided in this attachment. The results show that the proposed Waena Generating Station does not exceed the Inside Class I Area Screening Criteria.

Attachment 1 - Visibility Study (continued)

06/10/94 09:54 2143063594 JIM CLARY & ASSOCIATES PAGE 01
12/28/93 13:38 303 969 2822 DENVER 001/002

United States Department of the Interior

NATIONAL PARK SERVICE
AIR QUALITY DIVISION
P.O. BOX 25287
DENVER, CO 80225

FACSIMILE

DATE: 12/28/93 TIME: 1:32

FAX PHONE NO. (303) 969-2822

NUMBER OF PAGES TO FOLLOW: 1

TO: GREGG GUTHRIE
PHONE: 214 233-5463

FROM: John Notar
National Park Service PHONE: 303-969-2071

SUBJECT: VISUAL RANGE DATA FOR HALEAKALA NP FOR THE MAALAEA (UNITS 14-16, AS90-03)

REMARKS: VISCREEN ANALYSES ARE PERFORMED FOR THE 4 DIFFERENT SEASONS. ATTACHED ARE STANDARD VISUAL RANGES (SVR) FOR EACH SEASON. OZONE MONITORING IN THE PARK INDICATES THE FOLLOWING O_3 VALUES SHOULD BE USED IN THE VISCREEN ANALYSES. IF YOU HAVE ANY QUESTIONS GIVE ME A CALL.

SPRING = .047 PPB
SUMMER = .033 PPB
FALL = .036 PPB
WINTER = .041 PPB

FROM : Jim Clary & Associates PHONE NO. : 214 306 5594 Mar. 15 1996 10:53AM P1

NATIONAL PARK SERVICE
AIR RESOURCES DIVISION

P.O. BOX 25287, Denver, CO 80225-0287

FACSIMILE COVER SHEET

Date: 5/21/97

Telephone: (303) 2077
Fax: (303) 969-2822

To: ABBY GOODMAN

From: John NOTAR

Subject: REGIONAL HAZE CALCULATIONS

ABBY: GIVE ME A CALL AND I WILL EXPLAIN ANY QUESTIONS

JL

Number of Pages: 13
(Including this cover sheet)

12795 W. Alameda Parkway, Lakewood, CO 80228

SUMMARY STATISTICS -HAVO
BUDGETS ASSUMING 1/2 OF THE ORGANIC MASS IS SOLUBLE

---------- SEASON=spring GROUP=10 SVR=177 ----------

MASS TYPE	EXTINCTION BUDGET NON-RAYLEIGH	EXTINCTION BUDGET WITH RAYLEIGH	NON-RAYLEIGH EXTINCTION 1/KM
SULFATE	0.34833	0.19082	0.004220
NITRATE	0.02533	0.01388	0.000307
ORGANICS	0.33479	0.18341	0.004056
SOOT	0.04191	0.02296	0.000508
COARSE	0.24965	0.13676	0.003025
GROUP	1.00000	0.54783	0.012115

SUMMARY STATISTICS -HAVO
BUDGETS ASSUMING 1/2 OF THE ORGANIC MASS IS SOLUBLE

---------- SEASON=summer GROUP=10 SVR=194 ----------

MASS TYPE	EXTINCTION BUDGET NON-RAYLEIGH	EXTINCTION BUDGET WITH RAYLEIGH	NON-RAYLEIGH EXTINCTION 1/KM
SULFATE	0.40397	0.20372	0.004110
NITRATE	0.04675	0.02357	0.000476
ORGANICS	0.14163	0.07142	0.001441
SOOT	0.03100	0.01563	0.000315
COARSE	0.37665	0.18994	0.003832
GROUP	1.00000	0.50428	0.010173

SUMMARY STATISTICS -HAVO
BUDGETS ASSUMING 1/2 OF THE ORGANIC MASS IS SOLUBLE

---------- SEASON=autumn GROUP=10 SVR=180 ----------

MASS TYPE	EXTINCTION BUDGET NON-RAYLEIGH	EXTINCTION BUDGET WITH RAYLEIGH	NON-RAYLEIGH EXTINCTION 1/KM
SULFATE	0.28434	0.15339	0.003340
NITRATE	0.02203	0.01190	0.000259
ORGANICS	0.36837	0.19898	0.004327
SOOT	0.03696	0.01997	0.000434
COARSE	0.28829	0.15572	0.003386
GROUP	1.00000	0.54015	0.011746

SUMMARY STATISTICS -HAVO
BUDGETS ASSUMING 1/2 OF THE ORGANIC MASS IS SOLUBLE

---------- SEASON=winter GROUP=10 SVR=175 ----------

MASS TYPE	EXTINCTION BUDGET NON-RAYLEIGH	EXTINCTION BUDGET WITH RAYLEIGH	NON-RAYLEIGH EXTINCTION 1/KM

Attachment 1 - Visibility Study (continued)

SULFATE	0.43524	0.24023	0.005362
NITRATE	0.06679	0.03687	0.000823
ORGANICS	0.36111	0.19932	0.004449
SOOT	0.02143	0.01183	0.000264
COARSE	0.11543	0.06371	0.001422
GROUP	1.00000	0.55193	0.012319

Attachment 1 - Visibility Study (continued)

LEVEL-2 VISIBILITY SCREENING ANALYSIS
WORST-CASE PLUME DISPERSION CONDITIONS

Dispersion Condition (stability, wind speed)	Sigma-Z x Wind Speed (m**2/s)	Transport Time (hours)	Frequency of Occurrence of Given Dispersion Condition Associated with Worst-Case Wind Direction(1) for Given Time of Day (percent) 1-6	6-12	12-18	18-24	Frequency and Cumulative Frequency (percent) f	cf
F, 1	6.053E+01	11	.023	.000	.000	.000	.023	.023
E, 1	1.086E+02	11	.000	.000	.000	.011	.011	.034
F, 2	1.211E+02	4	.160	.034	.000	.103	.160	.195
F, 3	1.816E+02	2	.023	.011	.000	.034	.034	.229
D, 1	1.994E+02	11	.000	.000	.000	.023	.023	.252
E, 2	2.172E+02	4	.023	.011	.000	.023	.023	.275
F, 4	2.421E+02	2	.011	.000	.000	.000	.011	.286
E, 3	3.258E+02	2	.023	.011	.000	.034	.034	.321
D, 2	3.987E+02	4	.000	.011	.000	.034	.034	.355
E, 4	4.344E+02	2	.000	.000	.000	.023	.023	.378
D, 3	5.981E+02	2	.000	.023	.000	.069	.069	.446
D, 4	7.974E+02	2	.000	.000	.000	.057	.057	.504
C, 1	9.447E+02	11	.000	.034	.000	.000	.034	.538
D, 5	9.968E+02	1	.000	.000	.000	.034	.034	.572
D, 7	1.395E+03	1	.000	.000	.011	.000	.011	.584
D, 8	1.595E+03	1	.000	.000	.011	.000	.011	.595
C, 2	1.889E+03	4	.000	.160	.000	.023	.160	.755
D,10	1.994E+03	1	.000	.000	.011	.000	.011	.767
C, 3	2.834E+03	2	.000	.069	.011	.023	.069	.836
B, 1	2.861E+03	11	.000	.023	.000	.000	.023	.859
C, 4	3.779E+03	2	.000	.011	.069	.034	.069	.927
C, 5	4.723E+03	1	.000	.000	.217	.069	.217	1.145

* Transport times to Class I areas during these conditions are longer than 12 hours, so they are not added to the cumulative summation.

(1) For a given Class I area.

Note: Distance downwind, values of sigma-z and transport times are based on 19.9 Km. The following wind flow vector sectors were considered: ESE, SE, SSE,

Attachment 1 - Visibility Study

```
"Waena Generating Station"
"Haleakala
   1   1
   19.840    42.640      .000      .000      .000
   19.870    19.870    27.260   194.000
   1     1.500     3
   1     2.500     8
   1     2.500     6
   1     2.000     1
   1     1.500     4
   1      .040     1.000      6
   1    11.250
 34
 1 0      5.0  163.8     6.2    13.9    16.5   .68    .050    2.00   37.60
2.00  12.37    2.00  51.03    2.00  13.05
 2 0     10.0  158.8     9.5    10.7    14.2  1.06    .050    2.00   30.53
2.00  12.62    2.00  48.14    2.00  10.36
 3 0     15.0  153.8    11.6     8.8    12.5  1.40    .050    2.00   26.03
2.00  12.37    2.00  46.30    2.00   8.79
 4 0     20.0  148.8    13.1     7.5    11.3  1.72    .050    2.00   22.61
2.00  11.37    2.00  44.89    2.00   7.41
 5 0     25.0  143.8    14.2     6.6    10.3  2.02    .050    2.00   20.13
2.00  10.49    2.00  43.71    2.00   6.43
 6 0     30.0  138.8    15.1     5.9     9.6  2.30    .050    2.00   18.26
2.00   9.76    2.00  42.67    2.00   5.72
 7 0     35.0  133.8    15.8     5.4     9.0  2.56    .050    2.00   16.80
2.00   9.14    2.00  41.76    2.00   5.18
 8 0     40.0  128.8    16.4     5.0     8.6  2.80    .050    2.00   15.66
2.00   8.62    2.00  40.94    2.00   4.77
 9 0     45.0  123.8    16.9     4.7     8.2  3.02    .050    2.00   14.75
2.00   8.20    2.00  40.21    2.00   4.45
 10 0    50.0  118.8    17.4     4.4     8.0  3.21    .050    2.00  .14.02
2.00   7.85    2.00  39.54    2.00   4.19
 11 0    55.0  113.8    17.8     4.2     7.8  3.38    .050    2.00   13.45
2.00   7.56    2.00  38.94    2.00   3.99
 12 0    60.0  108.8    18.2     4.1     7.7  3.53    .050    2.00   12.99
2.00   7.34    2.00  38.39    2.00   3.82
 13 0    65.0  103.8    18.5     4.0     7.6  3.64    .050    2.00   12.65
2.00   7.16    2.00  37.89    2.00   3.69
 14 0    70.0   98.8    18.9     3.9     7.6  3.73    .050    2.00   12.40
2.00   7.03    2.00  37.44    2.00   3.58
 15 0    75.0   93.8    19.2     3.9     7.7  3.79    .050    2.00   12.24
2.00   6.94    2.00  37.01    2.00   3.50
 16 0    80.0   88.8    19.6     3.9     7.8  3.82    .050    2.00   12.15
2.00   6.90    2.00  36.62    2.00   3.43
 17 1    85.0   83.8    19.9     3.9     8.0  3.82    .050    2.00   12.15
2.00   6.89    2.00  36.24    2.00   3.38
 18 1    90.0   78.8    20.3     4.0     8.2  3.79    .050    2.00   12.22
2.00   6.92    2.00  35.88    2.00   3.34
 19 1    95.0   73.8    20.6     4.0     8.6  3.73    .050    2.00   12.37
2.00   6.99    2.00  35.51    2.00   3.31
 20 1   100.0   68.8    21.0     4.2     9.0  3.65    .050    2.00   12.61
2.00   7.10    2.00  35.14    2.00   3.30
```

Attachment 1 - Visibility Study (continued)

```
 21 1   105.0   63.8    21.4     4.3     9.6  3.53    .050    2.00   12.94
2.00   7.25    2.00  34.74    2.00   3.30
 22 1   110.0   58.8    21.8     4.5    10.3  3.39    .050    2.00   13.38
2.00   7.44    2.00  34.28    2.00   3.30
 23 1   115.0   53.8    22.3     4.8    11.3  3.22    .050    2.00   13.93
2.00   7.69    2.00  33.74    2.00   3.32
 24 1   120.0   48.8    22.9     5.2    12.5  3.03    .050    2.00   14.63
2.00   7.98    2.00  33.08    2.00   3.33
 25 1   125.0   43.8    23.5     5.6    14.2  2.81    .050    2.00   15.50
2.00   8.33    2.00  32.22    2.00   3.34
 26 1   130.0   38.8    24.3     6.2    16.5  2.57    .050    2.00   16.58
2.00   8.74    2.00  31.05    2.00   3.32
 27 1   135.0   33.8    25.3     7.0    19.9  2.31    .050    2.00   17.94
2.00   9.19    2.00  29.40    2.00   3.25
 28 1   140.0   28.8    26.6     8.1    25.3  2.03    .050    2.00   19.67
2.00   9.67    2.00  26.93    2.00   3.07
 29 0   145.0   23.8    28.3     9.6    35.1  1.74    .050    2.00   21.89
2.00  10.12    2.00  22.98    2.00   2.69
 30 0   150.0   18.8    30.9    12.1    58.3  1.42    .050    2.00   24.79
2.00  10.38    2.00  15.84    2.00   2.01
 31 0   155.0   13.8    35.3    16.3   174.3  1.09    .050    2.00   28.60
2.00  10.18    2.00   2.36    2.00    .40
 32 0      .6  168.2     1.0    18.9    19.4   .18    .050    2.00   55.04
2.00  18.59    2.00  57.07    2.00  26.09
 33 1    84.4   84.4    19.9     3.9     7.9  3.82    .050    2.00   12.15
2.00   6.89    2.00  36.29    2.00   3.38
 34 1   142.2   26.5    27.3     8.7    28.9  1.90    .050    2.00   20.59
2.00   9.88    2.00  25.41    2.00   2.93
 34
 1 0    5.000   .050    .854    .559   -.366    .254    .640    .456  -
.401    .306   .733    .595   -.334    .255
 2 0   10.000   .050    .624    .504   -.312    .166    .404    .452  -
.418    .256   .550    .509   -.256    .160
 3 0   15.000   .050    .512    .461   -.271    .121    .323    .437  -
.403    .205   .450    .451   -.211    .118
 4 0   20.000   .050    .446    .426   -.236    .095    .297    .416  -
.370    .160   .385    .408   -.181    .094
 5 0   25.000   .050    .398    .397   -.210    .078    .275    .397  -
.342    .130   .339    .375   -.159    .079
 6 0   30.000   .050    .361    .373   -.191    .066    .256    .379  -
.319    .109   .305    .348   -.143    .068
 7 0   35.000   .050    .332    .353   -.176    .058    .240    .364  -
.299    .094   .279    .326   -.131    .061
 8 0   40.000   .050    .309    .337   -.164    .052    .227    .351  -
.283    .083   .258    .308   -.121    .055
 9 0   45.000   .050    .291    .323   -.154    .047    .216    .339  -
.269    .074   .242    .293   -.114    .051
 10 0  50.000   .050    .276    .311   -.146    .044    .207    .329  -
.258    .068   .229    .281   -.108    .047
 11 0  55.000   .050    .265    .302   -.140    .041    .200    .320  -
.249    .063   .219    .272   -.103    .045
 12 0  60.000   .050    .256    .294   -.135    .039    .195    .313  -
.242    .059   .211    .264   -.099    .043
```

Attachment 1 - Visibility Study (continued)

```
 13 0  65.000   .050   .249   .288  -.132   .038  .190  .307  -
.237   .057   .205   .258  -.096   .041
 14 0  70.000   .050   .244   .283  -.129   .037  .187  .302  -
.233   .055   .201   .253  -.094   .040
 15 0  75.000   .050   .241   .279  -.127   .036  .185  .298  -
.230   .053   .198   .250  -.093   .039
 16 0  80.000   .050   .239   .277  -.126   .035  .183  .295  -
.228   .053   .197   .248  -.092   .039
 17 1  85.000   .050   .239   .276  -.126   .035  .183  .293  -
.228   .052   .197   .247  -.092   .039
 18 1  90.000   .050   .240   .276  -.127   .036  .184  .291  -
.229   .053   .198   .248  -.093   .039
 19 1  95.000   .050   .243   .277  -.129   .036  .186  .291  -
.232   .054   .201   .249  -.094   .040
 20 1 100.000   .050   .248   .279  -.131   .037  .189  .290  -
.235   .055   .205   .252  -.096   .041
 21 1 105.000   .050   .254   .282  -.135   .038  .193  .290  -
.240   .057   .211   .257  -.099   .042
 22 1 110.000   .050   .263   .286  -.139   .040  .198  .290  -
.246   .060   .218   .262  -.102   .044
 23 1 115.000   .050   .274   .290  -.145   .042  .204  .290  -
.254   .063   .228   .268  -.107   .046
 24 1 120.000   .050   .287   .295  -.152   .045  .212  .288  -
.264   .067   .240   .276  -.113   .048
 25 1 125.000   .050   .304   .299  -.161   .048  .221  .283  -
.275   .072   .255   .285  -.120   .052
 26 1 130.000   .050   .325   .302  -.172   .052  .232  .274  -
.289   .077   .275   .293  -.129   .056
 27 1 135.000   .050   .351   .300  -.186   .057  .244  .256  -
.304   .081   .299   .301  -.140   .061
 28 1 140.000   .050   .383   .290  -.203   .061  .258  .224  -
.322   .082   .330   .304  -.155   .066
 29 0 145.000   .050   .423   .258  -.224   .063  .272  .168  -
.339   .074   .371   .294  -.1
```

Attachment 1 - Visibility Study

```
Visual Effects Screening Analysis for
  Source: Waena Generating Station
  Class I Area: Haleakala

      ***   Level-1 Screening   ***
Input Emissions for

   Particulates     19.84  G  /S
   NOx (as NO2)     42.64  G  /S
   Primary NO2        .00  G  /S
   Soot               .00  G  /S
   Primary SO4        .00  G  /S

  **** Default Particle Characteristics Assumed

         Transport Scenario Specifications:

   Background Ozone:                   .04 ppm
   Background Visual Range:         194.00 km
   Source-Observer Distance:         19.87 km
   Min. Source-Class I Distance:     19.87 km
   Max. Source-Class I Distance:     27.26 km
   Plume-Source-Observer Angle:      11.25 degrees
   Stability:   6
   Wind Speed:   1.00 m/s

                 R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening
:riteria
```

Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E Crit	Delta E Plume	Contrast Crit	Contrast Plume
SKY	10.	142.	27.3	27.	2.00	20.592*	.05	.400*
SKY	140.	142.	27.3	27.	2.00	9.883*	.05	-.212*
TERRAIN	10.	84.	19.9	84.	2.00	36.287*	.05	.276*
TERRAIN	140.	84.	19.9	84.	2.00	3.383*	.05	.035

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

Backgrnd	Theta	Azi	Distance	Alpha	Delta E Crit	Delta E Plume	Contrast Crit	Contrast Plume
SKY	10.	1.	1.0	168.	2.00	55.040*	.05	1.455*

Attachment 1 - Visibility Study (continued)

```
SKY      140.    1.     1.0    168
```

Attachment 1 - Visibility Study

```
"Waena Generating Station"
"Haleakala
    1   1
    19.840    42.640       .000      .000       .000
    19.870    19.870    28.260   194.000
    0     1.500    3
    0     2.500    8
    0     2.500    6
    0     2.000    1
    0     1.500    4
    0      .040      5.000    2
    0    11.250
 34
  1 0      5.0  163.8     6.2    13.9    16.514.04   .084   4.26    .65
2.30     .26   2.82   1.98   2.00    .18
  2 0     10.0  158.8     9.5    10.7    14.227.47   .165   8.13    .33
4.39     .14   5.16   1.13   2.99    .09
  3 0     15.0  153.8    11.6     8.8    12.538.27   .230  11.12    .22
6.01     .10   6.81    .84   3.96    .06
  4 0     20.0  148.8    13.1     7.5    11.346.47   .279  13.32    .17
7.19     .08   7.92    .69   4.61    .04
  5 0     25.0  143.8    14.2     6.6    10.352.63   .316  14.93    .14
8.07     .07   8.65    .60   5.04    .04
  6 0     30.0  138.8    15.1     5.9     9.657.27   .343  16.13    .12
8.71     .06   9.15    .54   5.34    .03
  7 0     35.0  133.8    15.8     5.4     9.060.82   .365  17.03    .10
9.20     .05   9.49    .49   5.54    .03
  8 0     40.0  128.8    16.4     5.0     8.663.57   .381  17.72    .09
9.58     .05   9.73    .46   5.68    .02
  9 0     45.0  123.8    16.9     4.7     8.265.73   .394  18.26    .08
9.87     .04   9.91    .43   5.79    .02
 10 0     50.0  118.8    17.4     4.4     8.067.44   .404  18.69    .08
10.10     .04  10.04    .41   5.87    .02
 11 0     55.0  113.8    17.8     4.2     7.868.80   .413  19.03    .07
10.28     .04  10.15    .39   5.93    .02
 12 0     60.0  108.8    18.2     4.1     7.769.88   .419  19.29    .07
10.42     .04  10.25    .37   5.99    .02
 13 0     65.0  103.8    18.5     4.0     7.670.73   .424  19.50    .06
10.54     .04  10.33    .36   6.04    .02
 14 0     70.0   98.8    18.9     3.9     7.671.38   .428  19.66    .06
10.62     .03  10.42    .34   6.09    .02
 15 0     75.0   93.8    19.2     3.9     7.771.87   .431  19.79    .06
10.69     .03  10.51    .33   6.14    .02
 16 0     80.0   88.8    19.6     3.9     7.872.21   .433  19.87    .06
10.73     .03  10.60    .32   6.19    .01
 17 1     85.0   83.8    19.9     3.9     8.072.42   .434  19.92    .06
10.76     .03  10.70    .31   6.25    .01
 18 1     90.0   78.8    20.3     4.0     8.272.50   .435  19.94    .06
10.77     .03  10.81    .30   6.32    .01
 19 1     95.0   73.8    20.6     4.0     8.672.45   .435  19.93    .06
10.77     .03  10.94    .30   6.39    .01
 20 1    100.0   68.8    21.0     4.2     9.072.28   .433  19.89    .06
10.74     .03  11.08    .29   6.47    .01
```

Attachment 1 - Visibility Study (continued)

```
 21 1   105.0   63.8   21.4    4.3   9.671.97   .432  19.81   .06
10.70     .03  11.24    .28   6.55    .01
 22 1   110.0   58.8   21.8    4.5  10.371.52   .429  19.70   .06
10.64     .03  11.42    .27   6.65    .01
 23 1   115.0   53.8   22.3    4.8  11.370.91   .425  19.55   .06
10.56     .03  11.62    .26   6.77    .01
 24 1   120.0   48.8   22.9    5.2  12.570.11   .420  19.35   .07
10.46     .03  11.85    .25   6.89    .01
 25 1   125.0   43.8   23.5    5.6  14.269.10   .414  19.10   .07
10.32     .04  12.11    .24   7.03    .01
 26 1   130.0   38.8   24.3    6.2  16.567.81   .407  18.78   .07
10.15     .04  12.41    .23   7.19    .01
 27 1   135.0   33.8   25.3    7.0  19.966.20   .397  18.38   .08
9.93      .04  12.76    .21   7.37    .01
 28 1   140.0   28.8   26.6    8.1  25.364.16   .385  17.87   .09
9.66      .04  13.18    .18   7.57    .01
 29 0   145.0   23.8   28.3    9.6  35.161.57   .369  17.22   .09
9.30      .04  13.70    .15   7.80    .01
 30 0   150.0   18.8   30.9   12.1  58.358.22   .349  16.37   .10
8.84      .04  14.37    .10   8.05    .01
 31 0   155.0   13.8   35.3   16.3 174.353.84   .323  15.24   .12
8.24      .04  15.04    .01   8.17    .00
 32 0      .6  168.2    1.0   18.9  19.4 1.41   .050   2.00  5.82
2.00     2.01   2.00  13.35   2.00  1.82
 33 1    84.4   84.4   19.9    3.9   7.972.40   .434  19.92   .06
10.76     .03  10.69    .31   6.24    .01
 34 1   144.9   23.8   28.3    9.6  34.961.62   .370  17.23   .09
9.31      .04  13.69    .15   7.80    .01
 34
  1 0   5.000   .084   .011   .015  -.006   .002   .008   .014  -
.010     .004   .010   .014  -.005   .002
  2 0  10.000   .165   .006   .008  -.003   .001   .004   .008  -
.005     .002   .005   .007  -.002   .001
  3 0  15.000   .230   .004   .005  -.002   .001   .003   .005  -
.004     .001   .003   .005  -.002   .001
  4 0  20.000   .279   .003   .004  -.002   .000   .002   .004  -
.003     .001   .003   .004  -.001   .001
  5 0  25.000   .316   .003   .004  -.001   .000   .002   .004  -
.002     .001   .002   .003  -.001   .000
  6 0  30.000   .343   .002   .003  -.001   .000   .002   .003  -
.002     .000   .002   .003  -.001   .000
  7 0  35.000   .365   .002   .003  -.001   .000   .002   .003  -
.002     .000   .002   .002  -.001   .000
  8 0  40.000   .381   .002   .002  -.001   .000   .001   .003  -
.002     .000   .001   .002  -.001   .000
  9 0  45.000   .394   .002   .002  -.001   .000   .001   .002  -
.002     .000   .001   .002  -.001   .000
 10 0  50.000   .404   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .002  -.001   .000
 11 0  55.000   .413   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .002  -.001   .000
 12 0  60.000   .419   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .002  -.000   .000
```

Attachment 1 - Visibility Study (continued)

```
 13 0  65.000   .424   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 14 0  70.000   .428   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 15 0  75.000   .431   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 16 0  80.000   .433   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 17 1  85.000   .434   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 18 1  90.000   .435   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 19 1  95.000   .435   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 20 1 100.000   .433   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 21 1 105.000   .432   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 22 1 110.000   .429   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 23 1 115.000   .425   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 24 1 120.000   .420   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 25 1 125.000   .414   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 26 1 130.000   .407   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .002  -.001   .000
 27 1 135.000   .397   .001   .002  -.001   .000   .001   .001  -
.001     .000   .001   .002  -.001   .000
 28 1 140.000   .385   .002   .002  -.001   .000   .001   .001  -
.001     .000   .001   .002  -.001   .000
 29 0 145.000   .369   .002   .001  -.001   .000   .001   .001  -
.002     .000   .001   .002  -.001   .000
 30 0 150.000   .349   .002   .001  -.001   .000   .001   .000  -
.002     .000   .002   .001  -.001   .000
 31 0 155.000   .323   .002   .000  -.001   .000   .001   .000  -
.002     .000   .002   .000  -.001   .000
 32 0    .592   .050   .100   .118  -.053   .028   .061   .104  -
.076     .047   .091   .117  -.043   .025
 33 1  84.375   .434   .001   .002  -.001   .000   .001   .002  -
.001     .000   .001   .001  -.000   .000
 34 1 144.908   .370   .002   .001  -.001   .000   .001   .001  -
.002     .000   .001   .002  -.001   .000
```

Attachment 1 - Visibility Study

Visual Effects Screening Analysis for
Source: Waena Generating Station
Class I Area: Haleakala

*** User-selected Screening Scenario Results ***

Input Emissions for

Particulates	19.84	G	/S
NOx (as NO2)	42.64	G	/S
Primary NO2	.00	G	/S
Soot	.00	G	/S
Primary SO4	.00	G	/S

PARTICLE CHARACTERISTICS

	Density	Diameter
Primary Part.	2.5	6
Soot	2.0	1
Sulfate	1.5	4

Transport Scenario Specifications:

Background Ozone:	.04 ppm
Background Visual Range:	194.00 km
Source-Observer Distance:	19.87 km
Min. Source-Class I Distance:	19.87 km
Max. Source-Class I Distance:	28.26 km
Plume-Source-Observer Angle:	11.25 degrees
Stability:	2
Wind Speed:	5.00 m/s

R E S U L T S

Asterisks (*) indicate plume impacts that exceed screening criteria

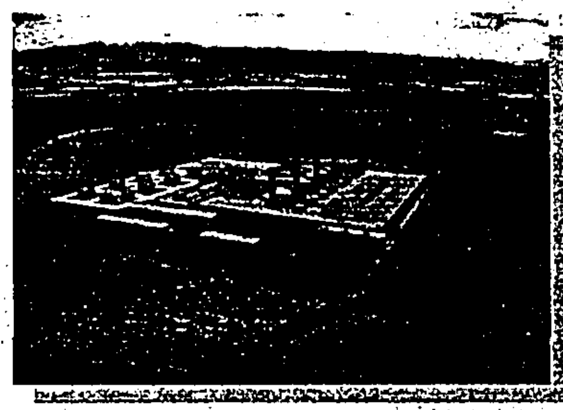
Maximum Visual Impacts INSIDE Class I Area
Screening Criteria ARE NOT Exceeded

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	145.	28.3	24.	17.23	.093	.37	.002
SKY	140.	145.	28.3	24.	9.31	.042	.37	-.001
TERRAIN	10.	84.	19.9	84.	10.69	.314	.43	.002
TERRAIN	140.	84.	19.9	84.	6.24	.014	.43	.000

Maximum Visual Impacts OUTSIDE Class I Area
Screening Criteria ARE Exceeded

Attachment 1 - Visibility Study (continued)

					Delta E		Contrast	
Backgrnd	Theta	Azi	Distance	Alpha	Crit	Plume	Crit	Plume
SKY	10.	1.	1.0	168.	2.00	5.824*	.05	.100*
SKY	140.	1.	1.0	168.	2.00	2.012*	.05	-.053*
TERRAIN	10.	1.	1.0	168.	2.00	13.350*	.05	.118*
TERRAIN	140.	1.	1.0	168.	2.00	1.818	.05	.028



APPENDIX C3

MAUI VORTEX POTENTIAL IMPACTS ON PROPOSED WAENA GENERATING STATION

Maui Vortex
Potential Impacts on Proposed Waena Generating Station

Prepared for:

Maui Electric Company, Limited

Prepared by:
Dr. Thomas A. Schroeder
and
Jim Clary & Associates

JCA

July 2, 1997

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1. Summary

This study evaluates the potential impact of the Maui Vortex on emissions from the proposed Maui Electric Company, Limited (MECO) Waena Generating Station. Because of the location of the proposed generating station, part of the generating station's emissions (i.e., plume) could be entrained into the Maui Vortex. This plume entrainment may result in an accumulation of generating station emissions in the vortex.

Numerical models indicate a semi-permanent vortex. However, other studies and MECO's tower observations suggest that diurnal cycling between vortex and drainage would result in vortex dissipation, reducing the vortex persistence.

This study finds no significant plume impacts inside the Maui Vortex. Streamline analysis and a simple box model show that even a persistent vortex would not result in the accumulation of significant SO_2, PM_{10}, NO_2, sulfuric acid mist (H_2SO_4) and ethylene concentrations. Significant findings are (1) only a small portion of the generating station's plume may enter the vortex, and (2) this small amount of plume material will disperse in the relatively large vortex volume.

2. Origin of the Maui Vortex

The Hawaiian Islands are tall volcanoes intercepting a prevailing wind current (i.e., the trade winds) which are capped by a stable layer (i.e., the trade wind inversion). Most features of the resulting local wind patterns can be understood by the analogy of a rock (or group of rocks) protruding through a stream (Schroeder, 1993). Each island represents a different scenario. Some mountains on Hawaii (Mauna Loa, Mauna Kea) and Maui (Haleakala) stick out and completely divert the trade winds. Lower mountains (West Maui, Kohala) divert part of the flow, but some crosses the summits. The first scientist to carefully describe the diverse trade wind-island interactions was Luna Leopold, who worked for the Pineapple Research Institute (PRI) and Hawaiian Sugar Planters Association (HSPA) during the late 1940s and early 1950s. The primary goal of the program was to apply the recently-developed weather modification concepts to rainmaking in support of Hawaiian agriculture. The efforts failed, but the by-product was the basis of modern Hawaiian mesometeorology. In his classic paper, Leopold (1949) first discussed the feature he named the "Maui Circulation Cell" a.k.a. the Maui Vortex.

3. The Maui Vortex (Observations)

Leopold (1949) recognized that flow traversing the Maui Isthmus (Central Valley) passes the north face of Haleakala and then encounters the West Maui barrier. Winds divert to a northerly direction and exit the Isthmus at Maalaea. The winds move along the coast but eventually interact with an anabatic wind driven by slope heating on Haleakala. The result is a cyclonic eddy or vortex. The motion was clearly seen in movies taken at the time and tracked by pilot balloons (Figure 3.1). In Leopold's model, the vortex is a diurnal feature, disappearing when the slope cooled in the evening.

In 1966 the National Weather Service reexamined wind patterns on Maui to develop forecast rules (Peterson, 1966). They concentrated on surface winds (nominally 10 m agl). The resulting models (Figures 3.2 and 3.3) resemble Leopold's model. In 1978, Daniels and Schroeder (1978) produced an additional wind analysis for the Central Valley. They were interested in trade wind flows and the potential for wind power development. Their analysis did not extend far enough up slope and south to capture the vortex flow.

The vortex concept reappeared during public controversies over sugar cane harvest fires in the Central Valley. By the 1980s substantial development had occurred in Kihei. Some residents were displeased with smoke from cane fires which would drift through Kihei and be trapped along the slope by the vortex. Agricultural interests invested in a mesoscale observation network, the data from which were used to develop burn forecasts. The vortex was "rediscovered" and the concept ingrained in the local population.

4. Development of Numerical Models

Mesoscale numerical models have developed rapidly through the 1970s and 1980s. Model developers recognized that the Hawaiian Islands represent a perfect test bed for these models. The initial and boundary conditions are relatively simple; prevailing unidirectional flow, relatively straightforward topography and a lid (the inversion). A number of simulations were attempted with the Big Island as the test bed. The complexity of the models escalated. Nickerson and Magaziner (1976) modeled orographic cloud formation. Their model had no diurnal cycle but nevertheless produced onshore winds in the lee of Mauna Loa. The next major effort was that of a group at the National Center for Atmospheric Research. In a sequence of elegant studies they predicted formation of barrier rainbands (Smolarkiewicz, Rasmussen and Clark, 1988), development and shedding of vortices at the mountain corners (Smolarkiewicz and Rotunno, 1989), evolution of individual cloud elements (Rasmussen and Smolarkiewicz, 1993) and, eventually, thermal cycle influences (Reisner and Smolarkiewicz,1994). The initial model results disagreed with Leopold's interpretation. In 1990 a major field program was conducted to test these model predictions. The outcome was that Leopold was vindicated (Wang and Chen, 1995). Model predictions explained barrier clouds but failed to properly describe actual rain at Hilo. Predictions of vortex shedding were also questioned (Smith and Grubisic, 1993).

Ueyoshi et al (1997) used a commercially available model to simulate monthly properties of the winds and related weather for Maui. They modeled the month of July ,1988. They initialized the model with National Meteorological Center analyses, then ran those winds into Maui. July is the month of most regular trade winds and hence should represent the typical climatology. They compared their results with surface weather reports from the mesonetwork discussed earlier. The results were surprising. The model Maui vortex is a persistent feature (Figure 4.1). It wobbled a bit during the day but never dissipated as long as the trades blew. They accepted the Smolarkiewicz and Rotunno theory which attributed the vortex formation to interaction of the flow with a ridge. They reasoned that the presence of West Maui prevented the vortex from being shed by Haleakala. The model winds did not perfectly match surface observations and the model overpredicted rain for the west slope of Haleakala but, in general, the result was reasonable.

5. Vortex Persistence

A persistent vortex poses a potential concern because emissions from the proposed Waena Generating Station may accumulate in the vortex. Previous thinking (ala Leopold) suggests that diurnal cycling between vortex and drainage would preclude long-term build ups. We have undertaken the analysis of wind and temperature data from a nearby tower to test the validity of the Ueyoshi et al vortex persistence theory.

MECO's tower 251 provided the multi-level wind and temperature data for the analysis. We used a July sample to compare the results with model predictions at that site. The lowest model wind level (38.4 m) closely matches the mid-level tower anemometer (37 m). Temperatures allow us

to examine whether drainage winds are present at night. Nocturnal drainage winds would support Leopold's model.

Tower 251 was located near the candidate site. Instrumentation included thermometers at 2, 10, 37 and 64 m and anemometers at 10, 37 and 64 m. We used data from July 1994 because July is the month of most steady trade winds. Since trades crossing over the northwest flank of Haleakala are the source of the vortex in both Leopold's and Ueyoshi's models, July should be the month of the most persistent vortex. Figure 5.1 shows the wind roses for 0200 at each anemometer height. The resultant wind at 37 m is overlain on the Ueyoshi et al 0200 38.4 m wind fields (Figure 5.2). The winds differ. The temperature profiles (Figure 5.3) indicate that a low-level inversion is present during the evening and early morning. A drainage wind moves down the slope of Haleakala and reaches Tower 251, and the stable air extends to about 64 m. If there is a vortex aloft, it is decoupled from the surface layer. Thus, the existence of a nocturnal vortex is not confirmed.

This result has major implications for air quality impacts. The proposed Waena Generating Station will have stacks below the 64 m level. Thus, effluent will emerge beneath any vortex. We have identified conflicting hypothesis regarding the vortex persistence. Ueyoshi's model found that the vortex was present as long as the trades blew. However, Leopold's model and MECO's tower observations suggest significant nocturnal vortex dissipation.

Balancing these conflicting suppositions, a vortex duration of one month represents a worst-case scenario. This one month assumption requires that:

1. the trades blow continuously for a month,
2. no nocturnal vortex dissipation occurs in a month, and
3. any emission entering the vortex does not leave the vortex, but recirculates within the vortex for a month.

6. Worst Case Air Quality Modeling Analysis

Although the data described above do not support the presence of a persistent vortex, we will assume its presence as described in the 0200 Ueyoshi et al case for purposes of the worst case scenario air quality modeling. The 0200 hour represents the most conservative scenario because of the light winds and poor dispersion.

If one assumes the plume follows the model streamlines, and the horizontal plume dispersion is Gaussian, then one may easily predict the quantity of stack emissions entering the vortex. Furthermore, assuming the stack emissions inside the vortex are well-mixed (i.e., no stack emission gradient) and no removal of stack emissions from the vortex allows for the use of a simple box model. The concentration of any stack emission inside the vortex is simply the amount of the stack emission entering the vortex divided by the vortex volume.

The remainder of this section describes the determination of the fraction of the plume entrained into the vortex, the stack emission concentrations in the vortex and the concentrations for selected stack emissions.

6.1. Generalized Model

Figure 6.1 shows the plume centerline and the distance to 2.7 sigmas from the plume centerline. The sigmas are the horizontal dispersion coefficients from the EPA ISCST3 model for stability class D (neutral). Stability class D represents the worst-case scenario because it results in the greatest nighttime horizontal dispersion, and thus the largest sigmas. Careful examination of Figure 6.1 shows that none of the plume elements within 2.7 sigmas of the plume centerline are entrained into the vortex. Plume elements must be more than 2.7 sigmas from the plume centerline before they are entrained into the vortex. 2.7 sigmas contain 99.30% of the plume mass. Therefore, only 0.70% of the plume mass is found outside 2.7 sigmas. One-half of that value, or 0.35% of the plume mass would be found beyond 2.7 sigmas on the vortex side of the plume and may be entrained into the vortex.

The simplest model describing the concentrations inside the vortex is the box model. Assuming the stack emissions inside the vortex are well-mixed (i.e., no stack emission gradient) and no removal of stack emissions from the vortex allows for the use of a simple box model. The concentration inside the vortex is simply the amount of stack emission entering the vortex divided by the vortex volume.

The vortex volume is the product of the vortex height, width and length. With the following assumptions, the vortex volume is 3.65×10^{11} m^3:

Depth = 900 m (cloud base)

X direction = 15,000 m (767,000 m to 782,000 m UTM Easting)

Y direction = 27,000 m (2,283,000 m to 2,310,000 m UTM Northing).

The following general equation calculates the concentration within the vortex for any stack emission and time period:

$$Cs(\mu g/m^3) = \frac{t(days) \times Q(lb/h) \times P}{V(m^3)} \times \frac{24(hours)}{1(day)} \times \frac{453.59(g)}{1(lb)} \times \frac{10^6(\mu g)}{1(g)} \quad \text{(equation 6.1)}$$

Where:

- t = Amount of time in days
- V = Volume of box in cubic meters (3.65×10^{11} m^3)
- Cs = Concentration level in micrograms per cubic meter
- Q = Emission rate in pounds per hour
- P = Fraction of plume to be entrained (0.0035)

6.2. SO_2, PM_{10}, and NO_2 Concentrations

Concentrations of three criteria pollutants[1]: SO_2, PM_{10}, and NO_2 are an important indicator of the vortex significance. Using equation 6.1, and the one month vortex duration described in section 5, one may determine the worst-case vortex concentrations for these criteria pollutants:

$$Cs(\mu g/m^3) = \frac{31(days) \times Q(lb/h) \times P}{V(m^3)} \times \frac{24(hours)}{1(day)} \times \frac{453.59(g)}{1(lb)} \times \frac{10^6(\mu g)}{1(g)} \quad \text{(equation 6.2)}$$

For the purposes of this study, the threshold concentration was defined as EPA's 24-hour significance level of 5 μg/m^3. EPA considers 24-hr concentrations below 5 μg/m^3 to be insignificant.

[1] The Hawaii Department of Health and the U. S. Environmental Protection Agency have established ambient, health-based air quality standards for all *criteria pollutants*.

Table 6.1 shows the worst-case concentrations for a vortex with a one-month duration. This table demonstrates that the potential impact of the Maui vortex on these criteria pollutants is insignificant, as each worst-case concentration is less than EPA's 24-hour significance level.

6.3. Ethylene and Sulfuric Acid Mist (H_2SO_4)

Because of their potential impact on vegetation, this report also considers the impact of ethylene and sulfuric acid mist (H_2SO_4). The emission rate of ethylene and sulfuric acid mist (H_2SO_4) from one dual train combined cycle unit is 0.20 lb/hr, and 11.2 lb/hr, respectively.

6.3.1. Ethylene

The following formula describes the ethylene concentration as a function of time:

$$Cs(\mu g/m^3) = \frac{t(days) \times 0.20(lb/hr/unit) \times 0.0035}{3.65x10^{11}(m^3)} \times \frac{24(hr)}{1(day)} \times \frac{453.59(g)}{1(lb)} \times \frac{10^6(\mu g)}{1(g)} \bullet N\ (DTCC\ units)$$

Solving for time:

$$t(days) = Cs(\mu g/m^3) \times \frac{3.65x10^{11}(m^3)}{0.20(lb/hr/unit) \times 0.0035} \times \frac{1(day)}{24(hr)} \times \frac{1(lb)}{453.59(g)} \times \frac{1(g)}{10^6(\mu g)} \times \frac{1}{N\ (DTCC\ units)}$$

Where:

t = Amount of time in days
Cs = Ethylene concentration level in micrograms per cubic meter
N = Number of dual-train, combined-cycle units.

Assuming four dual-train, combined-cycle units, the time required to reach 0.1 ppm (114 $\mu g/m^3$) is:

$$t(days)\ to\ 0.1ppm = 114(\mu g/m^3) \times \frac{3.65x10^{11}(m^3)}{0.20(lb/hr/unit) \times 0.0035} \times \frac{1(day)}{24(hr)} \times \frac{1(lb)}{453.59(g)} \times \frac{1(g)}{10^6(\mu g)} \times \frac{1}{4\ DTCC\ units}$$

$$t = 1.37 \times 10^6\ days\ to\ 0.1ppm$$

The time required for ethylene concentrations to reach 0.01 ppm is one-tenth the value for 0.10 ppm, or $1.37x10^5$ days.

6.3.2. Sulfuric Acid Mist (H_2SO_4)

Some of the SO_2 emissions may convert into H_2SO_4. This conversion begins with the SO_2 oxidizing into SO_3. This oxidation of SO_2 is quite slow. The SO_3 may then react with the water, forming H_2SO_4. The H_2SO_4 will continue to change into other compounds such as $(NH_4)_2SO_4$.

For the purposes of this study, the conservative assumption is made that all the SO_2 is converted into H_2SO_4 and that none of the H_2SO_4 converts into other more stable compounds. Thus, the total "effective" H_2SO_4 emission rate for one combined-cycle unit is the sum of the SO_2 emissions (adjusted for differences in molecular weight) and the H_2SO_4 emissions:

$$H_2SO_4\ (total) = 220\,{}^{lb}\!/_{hr}\ SO_2 \times \frac{98 \frac{lb}{lb-mole} H_2SO_4}{64 \frac{lb}{lb-mole} SO_2} + 11.2\,{}^{lb}\!/_{hr}\ H_2SO_4 = 348\,{}^{lb}\!/_{hr}$$

With this conservative assumption, the following formula (based on equation 6.2) describes the H_2SO_4 concentration for four combined-cycle units for a one month vortex duration:

$$Cs(\mu g/m^3) = \frac{31 days \times 348\ (lb/hr/unit) \times 0.0035}{3.65x10^{11}(m^3)} \times \frac{24(hr)}{1(day)} \times \frac{453.59(g)}{1(lb)} \times \frac{10^6(\mu g)}{1(g)} \times 4\ (DTCC\ units$$

$$Cs = 4.5\ \mu g/m^3$$

Therefore, the worst-case H_2SO_4 concentration in the vortex is 4.5 $\mu g/m^3$.

Assuming four dual-train combined-cycle units and 100% conversion of all sulfur to H_2SO_4, the time required to reach an H_2SO_4 concentration of 0.01 ppm (39.8 μg/m³) is:

$$t(days)\ to\ 0.01ppm = 39.8(\mu g/m^3) \times \frac{3.65x10^{11}(m^3)}{348(lb/hr/unit) \times 0.0035} \times \frac{1(day)}{24(hr)} \times \frac{1(lb)}{453.59(g)} \times \frac{1(g)}{10^6(\mu g)} \times \frac{1}{4\ DTCC\ unit}$$

$$t = 274\ days\ to\ 0.01ppm$$

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FIGURE 3.1 LEOPOLD'S VORTEX

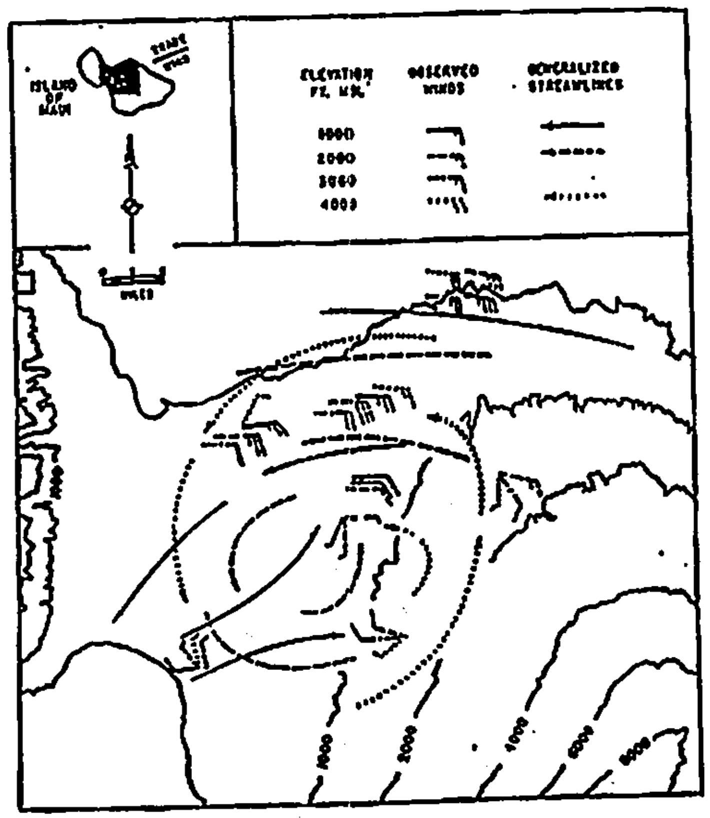

FIGURE 3.2 NWS VORTEX MODEL - DAYLIGHT HOURS

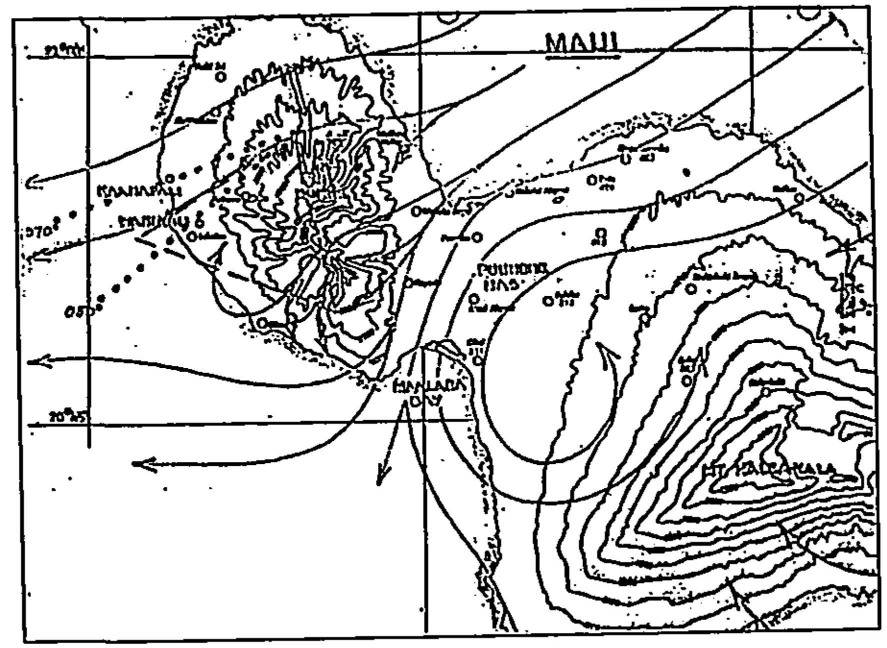

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FIGURE 3.3 NWS VORTEX MODEL - NIGHT HOURS

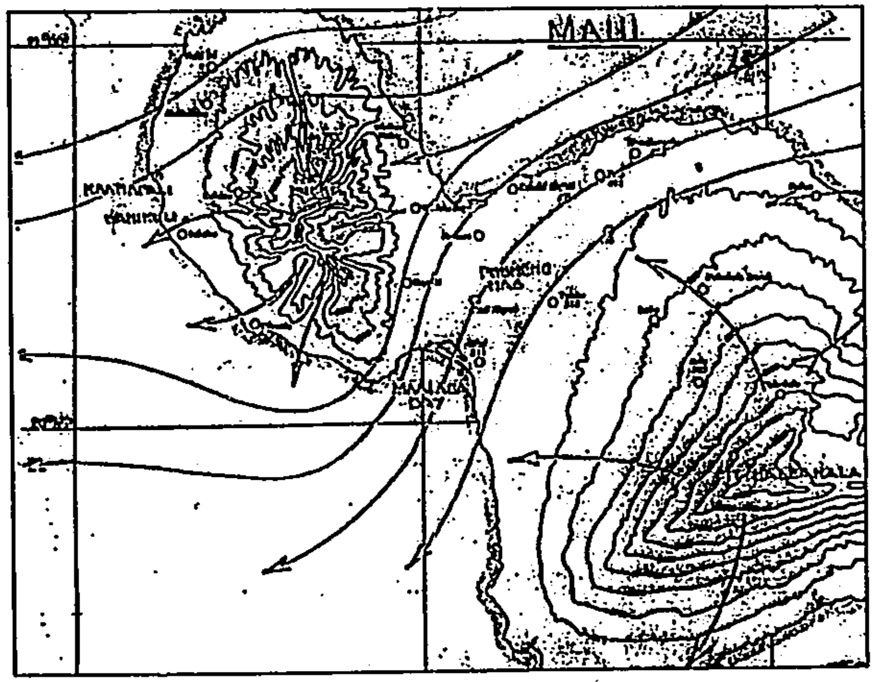


FIGURE 4.1 UEYOSHI ET AL MODEL FOR 0200 JULY 1988

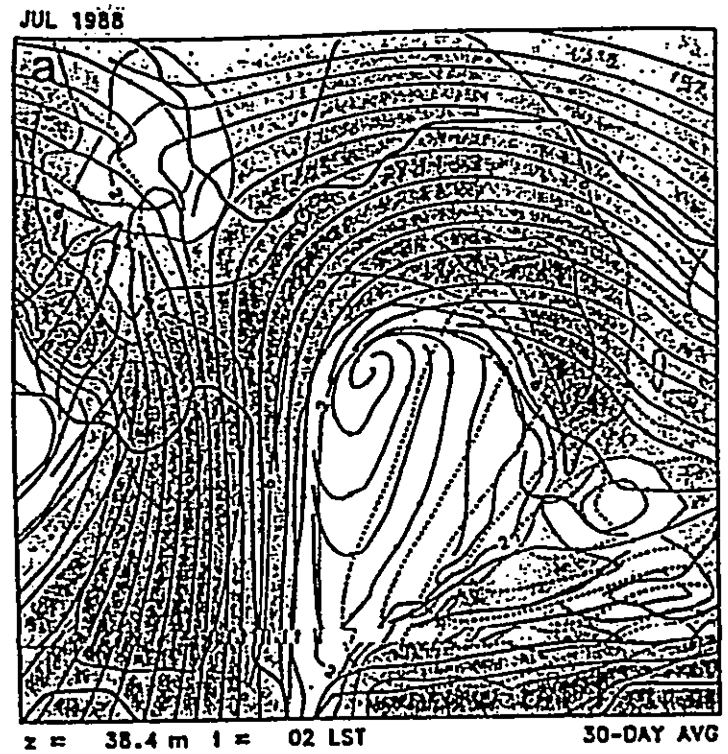


FIGURE 5.1 JULY 0200 WIND ROSES FROM TOWER 251

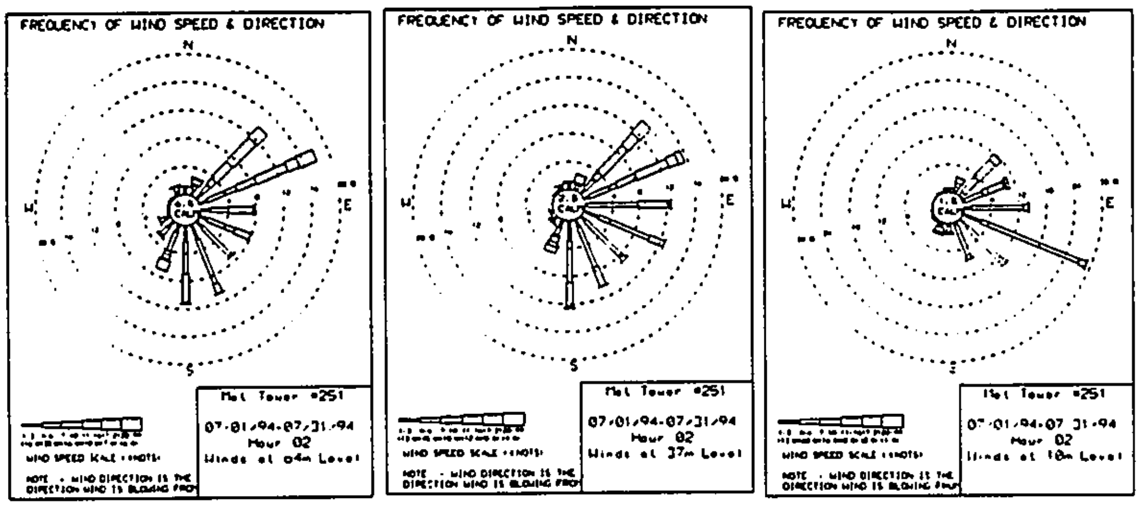


FIGURE 5.2 RESULTANT 0200 WIND VECTOR FROM TOWER 251 AT 37M LEVEL

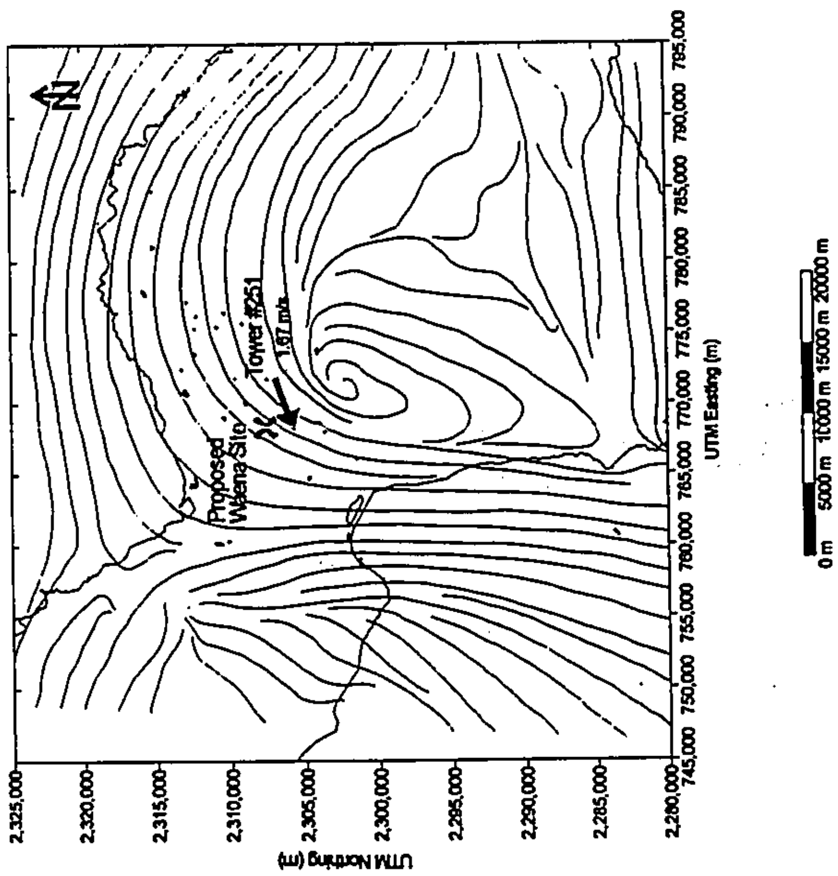


FIGURE 5.3 TEMPERATURE PROFILES FOR 0100, 0400 & 0700 LST

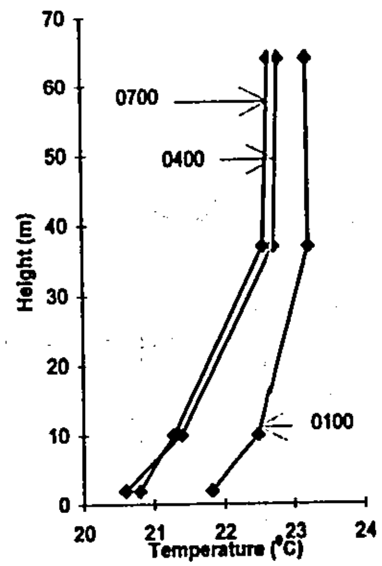


FIGURE 6.1 PLUME CENTERLINE PATH AND 2.7 SIGMAS

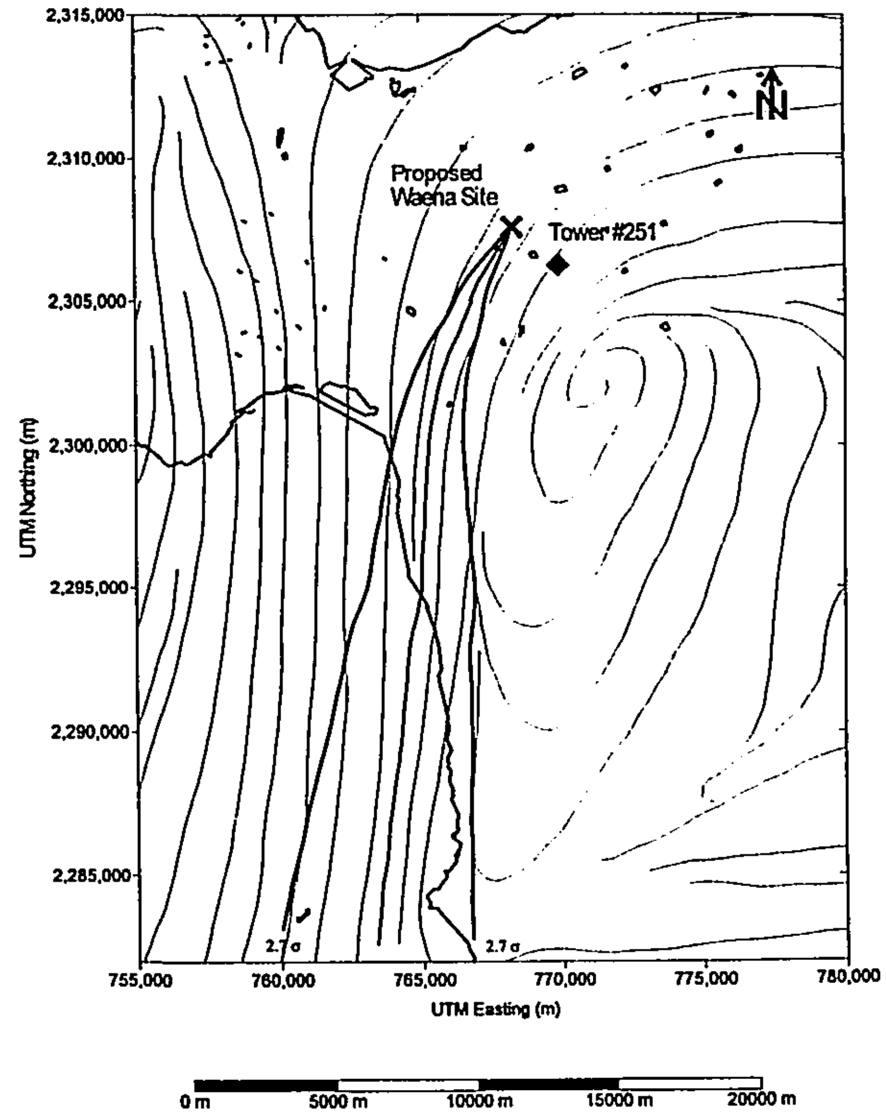
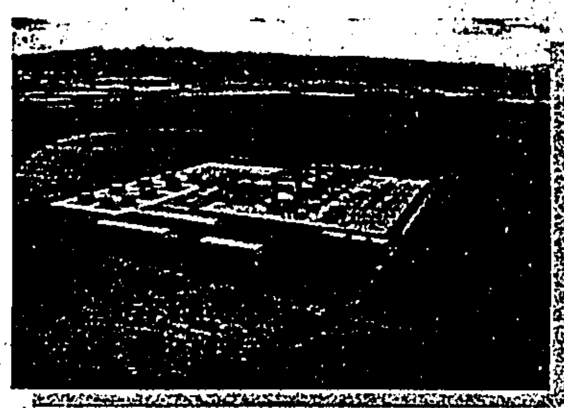


Table 6.1 Worst-Case SO_2, NO_2 and PM_{10} Concentrations

Pollutant	Number of 58 MW DTCC[a] Units	Emission Rate (lb/hr) per Unit[b]	Fraction of Plume Entrained	Vortex Volume (m^3)	Vortex Duration (Days)	Worst-Case Concentration (ug/m^3)
SO_2	1	220	0.0035	3.65E+11	31	0.7
	2	220	0.0035	3.65E+11	31	1.4
	3	220	0.0035	3.65E+11	31	2.1
	4	220	0.0035	3.65E+11	31	2.8
NO_2	1	84.6	0.0035	3.65E+11	31	0.3
	2	84.6	0.0035	3.65E+11	31	0.5
	3	84.6	0.0035	3.65E+11	31	0.8
	4	84.6	0.0035	3.65E+11	31	1.1
PM_{10}	1	39.4	0.0035	3.65E+11	31	0.1
	2	39.4	0.0035	3.65E+11	31	0.3
	3	39.4	0.0035	3.65E+11	31	0.4
	4	39.4	0.0035	3.65E+11	31	0.5

Notes:
[a] DTCC - Dual Train Combined Cycle
[b] Maximum emission rate from the "Air Quality Screening Analysis for the Central Maui Generating Project" (Jim Clary & Associates, September 1995)



APPENDIX C4

POTENTIAL ETHYLENE AND SULFURIC ACID IMPACTS OF PROPOSED WAENA GENERATING STATION

Potential Ethylene and Sulfuric Acid Impacts of Proposed Waena Generating Station

Prepared For:

Maui Electric Company, Ltd.

Prepared By

Robert E. Paull

1997 June 23

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1. Summary

Ethylene is a natural plant growth regulator used in agriculture on Maui and elsewhere to induce flowering of pineapple and ripening of bananas. The major urban and rural source of ethylene are gasoline, diesel engines and fires. These sources would only lead to a localized increase in ethylene to the plant response threshold increases level and may influence plant growth.

Maui Electric Company Limited, is proposing the construction of a new generating station in central Maui, to be known as the Waena Generating Station. An evaluation was made of the potential effects of ethylene emissions from the generating station on plants and crops in the area. Modeling of ethylene release from the proposed generating station and the time necessary (1.37×10^5 days) to reach the plant threshold level for response makes it most unlikely that the proposed expansion will have any effect on plant growth and yield of central Maui including the upcountry Kula area.

The time required to reach 0.01 $\mu l\ l^{-1}$ sulfuric acid is modeled to be 274 days assuming complete conversion and no decay. This implies very low concentrations will be experienced in the agricultural areas in central Maui and upcountry Kula, well below the concentration for plant injury or yield reduction.

2. Literature Survey

Ethylene (ethene) is a volatile gas that has considerable effect as a regulator of plant growth. This is one of many volatiles released by plants. Ethylene is an unsaturated two-carbon gas (MW 28.05) and, besides being biologically significant, it is used commercially (Abeles et al., 1992). For example, ethylene is used commercially to induce pineapple flowering and fruit coloring in Hawaii, to ripen bananas worldwide and to induce flowering in crops such as guava. Stress such as drought, disease, insect attack, cold or heat all can induce ethylene synthesis by plants. This stress ethylene plays a crucial role in modifying plant development (Dolan, 1997).

Ethylene is flammable and colorless, with low solubility in water. Ethylene can be

expressed as $\mu l\ l^{-1}$ or on a mass basis $\mu g/m^3$ that avoids temperature differences. The specific volume of ethylene is 861.5 ml g^{-1} at 21°C, the same as nitrogen, therefore 1 $\mu l\ l^{-1}$ ethylene equals 1.15 mg m^{-3}. It has full biological activity at 1 $\mu l\ l^{-1}$ (Abeles, 1973). Its use as an anesthetic in operations was discontinued in the 1930s (Chipman, 1931), due to fires and explosions (Guthrie and Woodhouse, 1940).

The analogues of ethylene; acetylene and propylene, are also phytotoxic air pollutants (Lonneman et al., 1974). These olefins cause similar symptoms to ethylene, but require higher concentrations (100 to 1,000 fold) to produce similar injury as ethylene (Burg and Burg, 1967).

Sulfur dioxide (SO_2) is the main sulfur compound emitted into the atmosphere. This is oxidized to SO_3 that form sulfuric acid (H_2SO_4) when hydrated.

$$SO_2 \text{ ------oxidation------> } SO_3$$

$$SO_3 + H_2O \text{ ------> } H_2SO_4 \text{ ------> Aerosol ------> } (NH_4)_2SO_4$$

Plants respond to both sulfur dioxide and sulfuric acid, with long term, low level exposures in some instances being beneficial, especially if the soil is deficient in sulfur. Sulfur, especially as the sulfate in sulfuric acid, is an essential plant nutrient. Ammonium sulfate is sold commercially as a plant fertilizer. It is also much easier to routinely measure SO_2 in the atmosphere that the amount of sulfuric acid aerosol (Smil, 1985). Sulfates are the leading aerosol in the fine size category in the atmosphere from H_2SO_4 to $MgSO_4$, the latter from sea spray, while the former is a secondary air pollutant derived from SO_2.

A. Sources of Ethylene and Sulfuric Acid

Three major sources of ethylene are fires, automobiles and industry (Abeles et al., 1992). Plants do not produce enough ethylene to alter levels in the air above the fields (Lonneman et al., 1974) High levels of ethylene (0.6 $\mu l\ l^{-1}$) can be found in soil due to microbial activity associated application of organic compost and soil compaction (Perret and Koblet, 1984; Campbell and Moreau, 1979).

Fires lead to localized production of ethylene (Sandberg et al., 1975). The conversion factors can vary from 0.002% for efficient incinerators to 1.5% for open fires (Feldstein et al., 1963). Rice stubble smoke has 4 $\mu l\ l^{-1}$ ethylene near the fire dropping to ambient levels within 1 mile of the fire (Sawada, 1985). Automobiles, trucks and other gas engines are the major sources of ethylene in the urban environment (30 to 75% of the total in the environment) (Lonneman et al., 1974; Mayrsohn et al., 1977). These engines also produce methane and other hydrocarbons (Nelson and Quigley, 1984). Car engines without catalytic converters produce about 300 $\mu l\ l^{-1}$, a converter reducing this by 60% (Nelson and Quigley, 1984).

Stress ethylene is produced by plants and can confuse the effect of external ethylene sources (Abeles et al., 1992). This stress ethylene is produced in response to both environmental and biotic (disease and insects) stresses constantly impacting plants in the field (Abeles et al., 1971). Another source of ethylene is organic material applied to a field to improve soil condition (Perret and Koblet, 1984). This ethylene may play a significant role in root growth and development.

The proposed Waena Generating Station will consist of up to four 58 megawatt dual train combined cycle (DTCC) combustion turbine generator systems. The generators will be fired on diesel fuel. According to MECO, tests of similar equipment at the Maalaea Generating Station show that ethylene will be emitted at a maximum rate of 0.20 lb/hr per DTCC system. This ethylene emission rate was used in the plume dispersion studies of T. Schroeder and J. Clary to determine ethylene impacts of the proposed generating station.

The most common anthropogenic source of sulfur dioxide in the atmosphere is the combustion of fossil fuel, coal and oil. In parts of the Hawaiian islands, the major source is volcanism, where sulfur dioxide is the primary plant noxious gas in the plume (Winner and Mooney, 1980). Another source of sulfate in the atmosphere is sea spray and in Hawaii this is probably the single largest incessant source. Sodium sulfate is the second most abundant compound in dissolved seawater (Smil, 1985). The other major additional source of sulfur in the atmosphere are the numerous reduced forms that become oxidated to sulfuric acid. These volatile compounds are released by bacteria, algae and plants. In this evaluation, since the SO_2 released by the generating plant is less than the EPA significance levels of 5 $\mu g\ m^{-3}$, it is assumed that all is converted to H_2SO_4 and none is converted to the more stable form such as

$(NH_3)_2SO_4$.

Background concentrations of SO_4^{2-} over remote oceans and clean continental air are less than 5 $\mu g\ m^{-3}$ (Smil, 1985). More common values in non-industrial areas over continents is 10 mg m^{-3} with many urban areas having a mean of 106 mg m^{-3}. The values vary widely with weather, with rainfall reducing levels dramatically. These values are for total SO_4^{2-} that includes sulfuric acid whose contribution will depend in general upon the amount of SO_2 emissions and the rate of oxidation to SO_4^{2-}, without conversion to other salts ($(NH_3)_2SO_4$, $MgSO_4$, etc.). The acidity due to H_2SO_4 and a complex mixture of other acidic compounds have been monitored on Mauna Loa and have all been in the acid range (pH 3.3 to 6.7; median pH 5.0). In the Mauna Loa data, the rains coming from every quadrant were acid. Rain at lower elevation (Kapoho - sea level) was less acidic (pH 5.6) (Sequeira, 1982).

B. Ethylene and Sulfuric Acid Effects on Plants

Ethylene effects on plants had been described in detail from laboratory and green house studies (Abeles et al., 1992). In general, the adverse symptoms include general reduction in growth, stimulation of lateral growth, leaf chlorosis and abscission, bud and flower abscission, and fruit chlorosis and ripening (Heck and Pires, 1962; Heck et al., 1970). Acute responses do not occur, responses are associated with chronic exposure (Abeles, 1973).

Ethylene can inhibit or promote the elongation of growing stems, roots and other organs (Dolan, 1997). Inhibition of elongation by ethylene is the normal response in intact plants and is both rapid and reversible. Growth promotion occurs in stems, petioles and fruit peduncle especially in aquatic plants (Abeles, 1973). Epinasty, the downward curvature of leaves, is a reversible symptom of ethylene exposure. It is, however, not a common response. Of 202 species tested, only 72 exhibited marked epinasty (Crocker et al., 1932). When it does occur, it is rapid usually occurring within 6 hours (Palmer, 1972).

The symptoms of SO_2 damage on plants are well known. The injury appears generally on the leaves a bleached brownish or yellowish spots or blotches interveinal chloric with areas of dead tissue. Species variation in sensitivity to SO_2 is significant, where beans are sensitive, celery, corn and potatoes are quite tolerant (Rennie and Halstead, 1977).

Sulfuric acid damage has only been described for acute injury. In this case, the symptoms include chlorosis and rapid death of leaves and stems that have been treated. The injury does not spread beyond the affected areas. Species differ widely in their response to lower concentrations (Glass et al., 1982). Crops grown to harvest exposed to 30 millimeters of H_2SO_4 rain per week at pH 3.0, 3.5 and 4.0, had yield reduction in 5 crops including tomato, green pepper and strawberry, variable results with potato and no significant response in 15 other plant species. Sulfuric acid aerosols did not damage soybean and bean plants (Herzfeld, 1982), while $(NH_4)_2SO_4$ aerosols cause chlorosis and necrosis of bean plants (Gmur et al., 1983). In these last two studies, the aerosol concentrations were orders of magnitude higher than ambient concentrations. Dicotyledonous plants are more sensitive than grasses (monocotyledons). This overall resistance of plants to H_2SO_4 bears out the older finding of Thomas et al. (1943) that SO_2 is 30 fold more toxic than SO_4^{2-} to plants.

C. Ethylene and Sulfuric Acid Concentrations and Time Responses

Ethylene response is dependent upon three major factors, dose, exposure time and biological sensitivity. A difficulty arises in extrapolating from laboratory, greenhouse studies to real world exposures. These studies are most commonly based upon continuous exposure at dose levels known to give phytotoxicity after a certain period.

The difficulty is compounded by a lack of information on the sensitivity of many crops to ethylene (Heck and Pires, 1962). To indicate a range of sensitivity, cut dendrobium flower sprays are injured by exposure to 3 mg l^{-1} for 48 hours, while only 6-hr continuous exposure at 0.1 mg l^{-1} is necessary for the more ethylene sensitive *Cattleya* spp (Goh et al., 1985). The half maximum effective concentration for most physiological effects is between 0.1 to 1 $\mu l\ l^{-1}$ (Abeles et al., 1992). The threshold concentration are about 1/10 of these values: 0.01 $\mu l\ l^{-1}$, with saturation response occurring in the range of 10 to 100 $\mu l\ l^{-1}$ (Abeles et al., 1992). Additional ethylene to supraoptimal concentrations have no other toxic effects on plant cells. These values are obtained using continuous exposure to ethylene and from dose response curve

studies of leaf and fruit abscission, epinasty, fruit ripening, flower senescence, hook closure, inhibition of root elongation and seed germination.

The duration of applied ethylene necessary for an effect decreases with plant age (Abeles, 1973). This reflects, in part, tissue sensitivity to ethylene, this sensitivity varies from plant species, tissue, stage of development and inherent stress response. Minimum exposure periods vary with concentration, for example 1 hour at 80 $\mu l\ l^{-1}$, 2 $\mu l\ l^{-1}$ for 6 hours, or 0.3 $\mu l\ l^{-1}$ for 24 hours for iris flowering (Yue and Imanishi, 1988).

Plant responses to sulfate in the atmosphere depend very much on the cation. The secondary pollutant, sulfuric acid (H_2SO_4) being more reactive than the $MgSO_4$ derived from sea spray. Strong sulfuric acid causes rapid acute damage to plants, however, exposing plants to 95% H_2SO_4 aerosols for two weeks showed no toxicity symptoms (Wedding et al., 1979). Exposure of plants to SO_2 can cause damage with a threshold for growth reduction being 0.5 ppm (131 $\mu g\ m^{-3}$) (Darrall, 1989). Dry deposition of sulfates on plants can cause serious damage. Many plants can also take a large share of their sulfur needs (25 to 50%) directly from the air (Noggle, 1980).

The difficulty with the work on H_2SO_4 and plant injury is to calculate a threshold. In the data cited above from Glass et al. (1982) a 30 mm rainfall of pH 3.0 H_2SO_4 per week translated to spray with 1¼" of simulated rate with about 1mM H_2SO_4. This acid strength is equal to 102 mg l^{-1} H_2SO_4 (102 ppm) or 40.6 mg m^{-3}.

D. Air Standards for Ethylene

The unpolluted air ethylene ranges from 0.001 to 0.005 $\mu l\ l^{-1}$, with urban roadside levels of 10.8 $\mu l\ l^{-1}$ and remote maritime location being as low as 0.00004 $\mu l\ l^{-1}$ (Derwent, 1995). The concentration in the air varies with time of day and season (Dollard et al., 1995). Urban air levels are 10 to 100 fold higher than rural; 0.5 $\mu l\ l^{-1}$ California, 0.2 $\mu l\ l^{-1}$ Germany, 0.03 $\mu l\ l^{-1}$ New York City and 0.7 $\mu l\ l^{-1}$ Washington D.C. (cf. Abeles et al., 1992). There are no national standards; recommended levels in California are 0.5 $\mu l\ l^{-1}$ for 1 hour or 0.1 $\mu l\ l^{-1}$ for 8 hours (Anon, 1962). The American Industrial Hygiene Association has set recommended levels of ethylene for rural air of 0.25 $\mu l\ l^{-1}$, 0.5 $\mu l\ l^{-1}$ residential, both for 1 hour and 0.05 and 0.1 $\mu l\ l^{-1}$ for 8 hours respectively (Anon, 1968).

Ethylene is removed rapidly from the atmosphere by a number of mechanisms. The mechanisms include photochemical oxidation, photolysis, and reaction with other reactive species (Derwent, 1995). Lifetime of 0.4 to 4 days have been reported. Plants also metabolize ethylene.

The threshold concentration for ethylene response is continuous exposure to 0.01 $\mu l\ l^{-1}$ and the half maximal response continual exposure concentration is between 0.1 to 1 $\mu l\ l^{-1}$ (see above discussion). The air standards for ethylene cited above should therefore prevent most injury to plants. Numerous plants have been ranked as to their ethylene sensitivity (Table 1) with the ranking based upon exposure to ethylene at up to 15 $\mu l\ l^{-1}$ for 24 hours to 10 days. For example, carnation, cucumber, lettuce, rose and tomatoes are all regarded as sensitive showing some effects to such exposure, while sugar cane, cabbages and onions are not sensitive.

3. Current Ethylene and Sulfuric Acid Levels in Area

Ethylene was measured in the atmosphere at three sites in and near the agriculture park on Maui (Table 2). The sites are above the proposed generating station location. The highest value detected was 0.397 $\mu l\ l^{-1}$ on a relatively calm day with some smoke in the area. The concentration is within the range expected for a rural area. The amount detected is in the lower range expected for a rural area and surrounded by a maritime environment with no major pollution sources in the vicinity.

There is no known published data for Maui of H_2SO_4 concentrations in the air. Some data exists for the Big Island associated with samples taken at Mauna Loa and Kapoho. However, volcanism makes extrapolation to Maui difficult.

4. Frequency and Plume Impacts on Plants

I am not able to evaluate the plume dispersion studies and must accept the findings as those of the professionals (T. Schroeder and J. Clary & Assoc., 1997). The models developed in that

report indicate only a small fraction (0.35%) of the plume mass will enter the vortex over central Maui. Using the model and 4 units in operation, it would take 1.37×10^6 days for an ethylene concentration of 0.1 $\mu l\ l^{-1}$ (11.4 $\mu g\ m^{-3}$) to be reached. It would take 1.37×10^5 days of continuous vortex and no loss of ethylene from the vortex to reach a plant response threshold concentration of 0.01 $\mu l\ l^{-1}$ (11.4 $\mu g\ m^{-3}$). It could therefore be anticipated that higher concentration of ethylene will be generated in the agricultural park from normal farm operation involving diesel and gas engines.

The model developed for plume impact indicates that the time for H_2SO_4 concentration to reach 0.01 ppm is 8,519 days, if we assume no conversion of SO_2 to SO_4. However, the very conservative assumption that 100% of the sulfur is converted to H_2SO_4 and that no H_2SO_4 decay occurs, then the 'effective' H_2SO_4 emission rate is much higher. The time required to reach an H_2SO_4 concentration of 0.01 ppm under these conditions is 274 days. This infrequent and very low concentration is below the projected thresholds for plant chronic injury and concentrations would never reach acute plant injury concentrations. Other sources of H_2SO_4 and SO_4^{2-} (sea spray, plants, algae and bacteria) may be expected to have a more significant impact.

5. Impact of Future Power Plant Expansion on Ethylene Levels

The proposed generating station would be expected to have no effect on plants in the central Maui area. The dilution of ethylene emitted from the plume would take the ethylene concentration below the threshold level (0.01 $\mu l\ l^{-1}$) for any plant response. The long period (1.37×10^5 days) of continuous vortex necessary to accumulate this threshold concentration is a most unlikely event.

6. Conclusions.

The overall conclusion is that the planned expansion of the proposed generating station will have no significant effect in increasing ethylene or sulfuric acid concentrations in central Maui that would adversely influence plant growth or yield. Sources other than the proposed generating station could lead to localized increases in ethylene levels.

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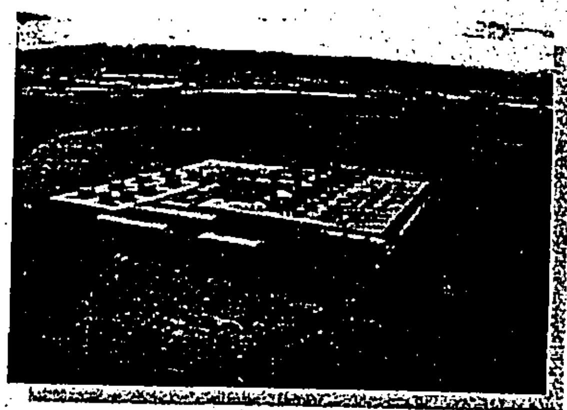
Table 2 Ethylene levels and environmental condition at sampling dates on Maui. Ethylene samples (100 or 200/ml) were taken at each site and returned to Honolulu for analysis. One ml was injected into the gas chromatograph with a detection limit of 0.001 nl l^{-1}. The concentrations are within the ranges reported for agricultural areas. Samples were collected by Mr. James Tavares, University of Hawaii, College of Tropical Agriculture and Human Resources, Cooperative Extension Services.

	Sampling Date (nl l^{-1})				
	96 March 07	96 April 02	96 May 07	96 July 22	96 Aug 28
Agricultural Park	0.001	0.168	0.033	ND	0.068
Pulehu	ND	ND	0.045	ND	0.124
Uradomo (Omaopio)	ND	ND	0.093	ND	0.397
Wind Direction	NE	Variable (AP) S (U & P)	SW	SW(AP & P) NE (U)	Variable warm
Wind Speed (mph)	15-25	< 5 (AP & P) 5-10 (U)	5-10	5-10 (AP & U) 0-5 (P)	0-5 mph calm (P)
Sky	Clear	Partly Cloudy (U) Clear (AP & P)	Cloudy Hazy (Vog)	Cloudy Hazy (Vog)	Clear (U) Light Smoke (AP & P)

Table 1. Sensitivity of Selected Plants to Ethylene from Heck and Pires (1962), Goh et al. (1985) and Woltering (1987). These observations are based upon continuous exposure of up to 15 μl l^{-1} ethylene from 24 hr. to 10 days. • Indicated crops grown in the Kula area.

Sensitive	Immediate	Resistant
Begonia	Azalea	Anthurium
• Carnation	• Broccoli	• Cabbage
Cattelya Orchid	• Carrot	Cordyline
• Cucumber	Cyclamen	Dendrobium Orchids
Euphorbia keysii	Gardenia	Dieffenbachia
Fuschia	Pelargonin	Dracaena marginata
• Lettuce	Primula	Oncidium Orchids
Marigold	Soybean	• Onion
Philodendron	• Squash	Radish
• Rose		
Sweet Potato		
• Tomato		
Vanda Orchid		



APPENDIX D

GEOTECHNICAL AND GEOLOGICAL CONSULTATION

FINAL REPORT

GEOTECHNICAL AND GEOLOGICAL CONSULTATION

PGE Job No. 5000-013

for

ENVIRONMENTAL IMPACT STATEMENT/PERMITTING
MECO WAENA GENERATING STATION
MAUI, HAWAII

for

MAUI ELECTRIC COMPANY, LIMITED

May 27, 1997

Submitted by:

Pacific Geotechnical Engineers, Inc.
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FOR CH2M HILL

SUMMARY

A review of available data on geologic and soil conditions in the vicinity of the site was performed. The data review was followed by a helicopter and site reconnaissance. The helicopter reconnaissance was conducted over the proposed transmission corridors, generating station site, and a nearby aggregate quarry. The site reconnaissance was performed by accessing existing government and private cane haul roads around and through the site and along the transmission corridors. Exposed rock cuts at the quarry were also observed.

Based on our data review and observations during our site visit, subsurface conditions at the generating site and along the corridors are anticipated to consist of a relatively thin layer of clayey and silty soil on the surface underlain by massive a'a lava on the order of 20 feet or more in thickness. Based on available soil data, it is anticipated that the thickness of the overburden soils may vary from roughly less than one foot to greater than 10 feet.

Based on these anticipated subsurface conditions and the planned structures, it is our opinion that it is geotechnically feasible to construct the proposed generating station at the subject site.

More detailed discussions are presented in the text of this report.

1.0 INTRODUCTION

This report presents the results of the geotechnical and geological consultation that Pacific Geotechnical Engineers, Inc. (PGE) performed for an Environmental Impact Statement (EIS) for the proposed Maui Electric Company, Limited (MECO) Waena Generating Station, Maui, Hawaii. The general location of the site is shown on the Island Map, Plate 1.

2.0 PROJECT CONSIDERATIONS

MECO is planning to construct a new 232-KW power generating station and transmission corridors at a site located in central Maui and identified during previous site selections studies as site A-2. This site comprises an area of approximately 67 acres at a portion of Tax Map Key (TMK) 2-3-8-003-001. In general, it is located approximately 3 miles south of Kahului Airport, north of Waiko Road, at its intersection with Pulehu Road.

The transmission corridors will generally follow Pulehu Road and existing sugar cane haul roads leading towards the Puunene Sugar Mill on the west and Paia Sugar Mill on the east. The location of the proposed generating station and transmission corridors are shown as heavy dashed lines on our Vicinity Plan, Plate 2.

According to a Stone & Webster study (November 1995), the generating station may include generating units made up of four-58 megawatt (MW) dual train combined cycle (DTCC) blocks with combustion turbine, heat recovery steam generators, and steam generators. This station may also include exhaust stacks, water supply wells, water treatment system and tanks, wastewater treatment plant and injection wells to dispose of plant wastewater, storm water runoff system, diesel fuel storage facility with seven (7) approximately 1.15 million gallon tanks, office, maintenance shop and warehouse, switchyard, transmission lines, and transmission and distribution facility baseyard. A sketch of possible plant structures is shown on the Conceptual Site Plan, Plate 3.

3.0 PURPOSE AND SCOPE OF SERVICES

The purpose of our work consisted of providing consultation and feedback regarding anticipated site soils and geology based on a review of available published data, aerial photos, site reconnaissance, personal communications, and a preliminary assessment of seismic hazards based on a review of available historical earthquake data, current building code requirements, and possible analytical methodologies.

To accomplish this purpose, the following scope of work was performed:

1. Review of Available Data - Available data on general geologic and soil conditions in the vicinity of the site were reviewed. The sources of our review included available information in our files, United States Department Agriculture Soil Conservation Service (SCS) and United States Geological Survey (USGS) reports, aerial photographs, personal communications, other available published information in the general vicinity of the project site.

2. Site Reconnaissance - After our data review, an engineering geologist and principal from our office visited the site to observe and photograph general site surface conditions and any major geologic features identified in our data review

that may affect the planned construction. Our site visit started with a helicopter flyover of the sites using a subcontracted helicopter operating from the Kahului Airport.

The helicopter flyover was followed by 2 days of site reconnaissance to check and observe specific major geologic conditions identified during our data review and flyover. Major surface geological features, such as general topography and drainage channels, surface soil and rock exposures, and other major geological and geotechnical features that may affect the suitability of the site for the proposed construction were checked and roughly mapped. Our general mapping was based on available topographic plans and our geologist's field measurements.

3. Engineering Analysis and Report Preparation - Based on the available published information and our site observations, comments and feedback were developed regarding the following:

   a. General geologic conditions,
   b. Site surface and anticipated subsurface conditions,
   c. Potential major on-site geotechnical and geological conditions that may affect site development, such as lava tubes and cavities, expansive soils, and liquefiable deposits,
   d. Potential external geologic hazards,
   e. Possible engineering properties of the major geotechnical and geological features identified in this study, and
   f. Anticipated foundation support methods for the planned structures.

The results of our review of available data, site reconnaissance, and preliminary seismic hazard evaluation are summarized in this report.

4.0 GEOLOGY

4.1 GENERAL HAWAIIAN ISLAND GEOLOGY

The Hawaiian Archipelago lies in the central Pacific Ocean, over 2,300 miles from the nearest continent. This archipelago consists of a chain of 12 islands, and many small islets, reefs, and shoals extending approximately 1,500 miles from Kure Island in the northwest to the island of Hawaii in the southeast. These islands are the summits of huge volcanic mountains rising over 15,000 feet from the ocean floor.

The volcanoes are fed by magma generated by a relatively stationary hot spot in the earth's upper mantle. As the Pacific Plate on which the Hawaiian Islands sit, moves in a northwestward direction, the volcanoes move away from the hot spot becoming inactive and progressively older towards the northwest. The island of Hawaii, with its two active volcanoes, Mauna Loa and Kilauea, is the youngest in the chain and almost untouched by erosion. Erosion by streams and ocean waves has removed large portions of the older volcanoes on islands such as Oahu and Kauai. The older islands to the northwest of Oahu and Kauai consist of coral reefs resting on truncated volcanoes that have submerged beneath the sea.

As Hawaiian volcanoes are born and eventually die, they pass through eight stages of development. First, is the deep submarine stage as the shield volcano builds upward from the ocean floor with outpourings of dense lava. The Loihi seamount, located approximately 20 miles southeast of the island of Hawaii, is presently in the deep submarine stage and is expected to become a new island within the next few ten thousand years. As the mound builds closer to the ocean surface, it enters the shallow submarine stage. In this stage, as the restraining effect of the weight of the overlying water on the release of volcanic gases diminishes, eruptions become explosive, resulting in the predominant deposition of explosion debris rather than lava. As the volcano enters the subaerial shield-building stage, the eruptions occur above water with generally non-explosive outpouring of lava, and a caldera usually forms at the summit. Kilauea and Mauna Loa on the island of Hawaii are presently in this stage of development. The post caldera stage, also called the capping stage, is characterized by less frequent eruptions, caldera-filling lavas, and more violent eruptions resulting in a cap of lava and pyroclastic material at the top of the volcano.

The post caldera stage is followed by an erosional stage which is characterized by volcanic inactivity and the carving of deep valleys by streams and steep cliffs by ocean waves. Coral reefs and terrestrial sediments begin to accumulate in offshore areas during this stage. As a volcano enters the stage of reef growth, besides continued erosion, it also experiences tectonic sinking as it moves away from the inflated crustal region at the hot spot. Reef growth in this stage is marked by the development of extensive fringing coral reefs which grow both laterally and vertically as the island sinks. This stage is followed by a stage of post-erosional eruptions, also called the stage of rejuvenated volcanic activity. It has been estimated that on Oahu, over one million years elapsed between the last post-caldera eruption and the first post-

erosional eruption. At Haleakala on Maui, both cinder and lava from post-erosional eruptions filled the deep valleys carved-out during the erosional period (Macdonald and others, 1983). The eighth and final stage is the atoll stage in which the volcano has completely submerged below sea level and has been covered by coral reefs, lagoons, and sand island.

4.2 REGIONAL GEOLOGY

The island of Maui was formed by two shield volcanoes. The older of the two is the West Maui volcano, also called the West Maui Mountains. It is deeply dissected with peaks as high as about 5,800 feet separated by canyons. The younger volcano is Haleakala, or East Maui volcano, which rises to a height of about 10,025 feet above sea level. The broad, gently sloping Maui Isthmus, which connects the two volcanoes, was made by lavas of Haleakala banking against the West Maui volcano.

The West Maui volcano appears to have passed through a stage of post erosional eruptions and the likelihood of a future eruption from this volcano seems remote (Mullineaux and others, 1987). Haleakala, however, appears to be in a stage of post erosional eruptions. The average frequency of eruptions on Haleakala as a whole has been nearly one per 100 years during the last roughly 1,000 years or so (Crandell, 1983). The latest eruption occurred about 1790 when lava erupted from two vents along the southwest rift zone and flowed into the ocean forming the peninsula west of La Perouse Bay.

The growth of Haleakala mainly developed by eruptions from vents at the summit and along the rifts, or rift zones. Rifts are zones of weakness consisting of nearly vertical fractures through which magma migrates from the central conduit through the flanks of the volcano. Haleakala has three rift zones. Two prominent rift zones extend in east northeastward and southwestward directions from the summit and are termed the northeast and the southwest rift zones. The most recent post erosional stage eruptions occurred along these rift zones. The third, least prominent rift zone extends in a north-northwestward direction from the summit and is defined by a row of cinder cones. This rift zone, termed the north rift zone, has been inactive since the conclusion of the post caldera stage eruptions approximately 350,000 years ago.

Haleakala is the younger of the two major shield volcanoes that compose the island of Maui. The primitive Haleakala shield was built by lavas of the Honomanu Volcanic Series which consisted of frequent and voluminous eruptions of highly fluid lava. This lava is mainly composed of pahoehoe and a'a flows of tholeiite, tholeiitic basalt, and oceanite. The shield built by these lavas rose about 8,000 feet above sea level.

The project site is located on the west flank of the north rift zone of Haleakala on post caldera lava flows of the Kula Volcanic Series. The Kula flows are predominantly composed of the andesitic rock, Hawaiite, with lesser amounts of alkalic olivine basalt and ankaramite. These mainly alkalic rocks are typical of late stage, caldera filling eruptions which generally signal the approaching end of the volcanoes principal period of volcanism. Late stage eruptions generally consist of magma with higher viscosity. The higher viscosity of the Kula magma produced relatively explosive eruptions marked by cones of scoriaceous cinder at the caldera and along the rift zones and ash deposited over widespread areas. The higher viscosity also resulted in the predominance of the more viscous a'a rather than the more fluid pahoehoe type lavas. The Kula eruptions produced a relatively thin cap of lavas overlying the main shield-building, predominantly tholeiitic lavas of the Honomanu Volcanic Series. It has been estimated that the depth to the Honomanu lavas in the vicinity of the site is less than a few hundred feet (Stearns, 1942).

The Kula Volcanic Series was followed by the post-erosional eruptions of the Hana Volcanic Series. Unlike the Kula lavas, the Hana lavas were erupted only along two of the three rift zones, the southwest and east rift zones. The only noted historic eruption of Haleakala occurred about two hundred years ago along the southwest rift zone. Although Haleakala is presently inactive, because of this relatively recent eruption, Haleakala is regarded as dormant and future eruptions can be expected. Based on the locations of the Hana eruptions, it is anticipated that rejuvenated volcanic activity is more likely to occur along the east and southwest rift zones rather than along the north rift zone, where the project site is located.

4.3 SITE GEOLOGY

The lava flows at the ground surface in the vicinity of the proposed generating station and transmission corridors have weathered to form a mantle of clayey and silty soil over the flows. In various areas of the proposed transmission corridors, the weathered lavas have been overlain by alluvial soils derived from the weathered lavas. The various soils encountered in the study area and the general site geology based on available soils (SCS, 1972) and geological (Stearns, 1942) maps, and our observations, are shown on the General Soil and Geologic Map, Plate 4.

4.3.1 Generating Station Site

The United States Department of Agriculture Soil Conservation Service (SCS) has lassified the soils at the generating station site as the Waiakoa Series (W). The Waiakoa eries consists of soils derived from weathered a'a lavas with the upper part of the soil profile nfluenced by volcanic ash. This soil is generally very stoney, grading to hard bedrock within depth of approximately 5 feet or so. Because the lava flows over the site are the a'a rather han the pahoehoe type, voids such as lava tubes and gas blisters in the near surface portions of he bedrock are anticipated to be relatively infrequent.

Although perched water may be present in clinker zones overlying relatively low ermeability beds, or perching members, such as weathered volcanic ash or massive a'a core ock, its occurrence is less likely at this site than it would be on the eastern side of Haleakala here a wetter climate generally results in increased groundwater percolation.

.3.2 Transmission Corridors

The various soils within the bounds of the proposed transmission corridors have been lassified by the SCS as the Molokai Series (M), Paia Series (Pc), Waiakoa Series (W), Ewa eries (E), Iao Series (I), Alae Series (A), Pulehu Series (Ps), and Rock Land (R). The folokai and Paia Series, like the Waiakoa Series, consist of soils derived from weathered a'a ivas and volcanic ash. However, the Molokai and Paia soils appear to be older than the Vaiakoa soils. These soils are more deeply weathered than the Waiakoa soils and their eneral soil profiles consist of silty clay loam at the ground surface grading to saprolite then to soft, highly weathered rock at a depth of approximately six feet. These soils are, in areas, overlain by the soils of the Waiakoa Series.

The Ewa, Iao, Alae, and Pulehu Series consist of recent alluvial soils derived from the weathered a'a lava flows. The Alae soils also contain weathered volcanic ash. According to the SCS, these soils range from loams to clays with varying amounts of sands, stones, and cobbles. The SCS estimates the depth of these soils to the underlying bedrock is generally greater than 5 feet.

Two gulches cross the proposed transmission corridors. These areas are classified as Rock land by the SCS and consist of stream channels where much of the a'a bedrock has been exposed. The soils in Rock land areas appear to be generally shallow with clays having high shrink swell potential. Water was observed flowing in these channels at the time of our geologic reconnaissance.

5.0 SITE CONDITIONS

5.1 SURFACE CONDITIONS

5.1.1 Generating Station Site

According to the United States Geological Survey, Paia Quadrangle, existing ground elevations at the generating station site range from approximately +335 feet on the western side nearer Puunene to +365 feet on the eastern side near the intersection of Waiko and Pulehu Roads based on Mean Sea Level (MSL) datum. The average slope from the southeast to northwest across the site is about one degree.

The generating station site is covered by sugar cane. Two cane haul roads, running approximately parallel to Pulehu Road, extend from Waiko Road northwestward across the site. Alongside the cane haul road near Pulehu Road is an aqueduct, or concrete lined irrigation ditch. The irrigation ditch is approximately 4 to 5 feet wide and 4 to 5 feet deep and borders the eastern side of the site. At the time of our site reconnaissance, water was flowing in the ditch at a level of approximately 6 inches below the top of the ditch.

Concrete ruins possibly for a former underground tank structure, and some kiawe trees were observed in an area located just east of the irrigation ditch. The walls of the ruins appeared to be founded on rock near the surrounding ground surface. The ruins are bordered

by two dirt roads on the northwest and south and Pulehu Road on the east. Weathered rock was observed in some places on the surface of the dirt roads and along the surface of the shoulders of Pulehu Road near this area. Gravel particles present with the rock matrix appeared to be weathered clinker. Existing transmission lines are adjacent to the site along Waiko and Pulehu Roads.

Surface soils at the generating station site generally consists of reddish brown to brown clayey silt of the Waiakoa Series with some gravel. The majority of the generating station site is currently vegetated with sugar cane.

5.1.2 Transmission Corridors

Existing transmission lines are adjacent to the site along Waiko and Pulehu Roads. The proposed transmission corridors are mainly located along existing Maui County and HC&S roads. A short section of the corridor extends from Pulehu Road towards the southwest along the Haiku Ditch aqueduct. From the generating station site, the east bound corridor generally follows Pulehu Road to North Firebreak Road. From this location, it runs along Makapit road to Sunny Side Road and ends at the Paia Sugar Mill. The west bound corridor generally follows Pulehu Road to the Haiku Ditch then to a cane haul road irrigation ditch that lies to the west and parallel to Pulehu Road. It then extends in a westerly direction along another cane haul road towards the Puunene Sugar Mill.

Pulehu road is a county road open for public access. Traffic on Pulehu Road appeared to be light to moderate during our visit and generally consisted of passenger vehicles, pickup trucks, with a few trailers, and other larger trucks. The existing pavement along most of Pulehu Road appeared to be in fairly good condition. Some areas of localized alligator cracking and distress were observed near Firebreak Road. Other roads along the proposed transmission corridors consist of cane haul roads with restricted access. Traffic on these roads appeared to generally consist of HC&S pickup trucks and cane haul trucks. These roads are generally partially paved. Many potholes partially filled with gravel were observed along some of these roads. Parts of the roads along the west bound corridor off of Pulehu Road consist of unpaved dirt roads.

The vegetation along the proposed transmission corridors generally consists of sugar cane. Relatively large trees roughly 30 feet in height or higher were observed along sections of Pulehu Road.

Existing transmission and telephone lines with wooden poles were observed along Pulehu Road. Existing metal transmission poles were observed along Waiko Road, south of the generating station site.

Concrete-lined irrigation ditches, reservoirs, and pump stations were observed along the proposed transmission corridors.

Surface soils along these corridors generally consisted of clays and clayey silts with some sugar cane debris and gravel.

5.2 ANTICIPATED SUBSURFACE CONDITIONS

5.2.1 Generating Station Site

The surface soils at the generating station site have been mapped as Waiakoa silty clay loam by the SCS. It is anticipated that these soils are underlain by hard andesitic a'a bedrock at relatively shallow depths of on the order of 5 feet or so below the existing ground surface. Because of the undulating nature of the surface of a'a flows, the depth to a'a bedrock will likely vary across the site.

An a'a formation is being mined at Ameron HC& D's quarry located north of the site. The flow presently being mined is located within approximately 2,000 feet of the project site. Based on available geological information, it is anticipated that this formation underlies the proposed generating station. The flow in a rock cut at the quarry appeared to be approximately 25 to 35 feet thick and consisted of clinker zones above and below a massive, highly to moderately fractured a'a core. Photographs of this flow are presented on Plates 5.1 and 5.2. According to Ameron's quarry manager (1997), the a'a flow appears to be thicker in the direction of the generating station site. The high degree of fracturing in the rock presented on Plates 5.1 and 5.2 is probably the result of the quarry blasting operations. The a'a bedrock at the project site may be much less fractured than the rock shown in these photographs.

5.2.2 Transmission Corridors

Subsurface conditions along the proposed transmission corridors are anticipated to generally consist of clays and clayey silts underlain by hard andesitic bedrock. The approximate thickness of the clays and clayey silts in a particular area along the corridors can be roughly estimated based on its soil type. Refer to the soil map presented on Plate 3 for further guidance.

Along most of Pulehu Road, the corridor extends across Waiakoa Series soils which consist of the youngest a'a flows in the study area. Hard bedrock is anticipated to be present within about 3 feet below the existing ground surface.

In the vicinity of Haiku ditch and in much of the eastern part of the study area, the corridor extends across Molokai and Paia Series soils which consist of older a'a flows. The weathered volcanic ash in these soils is anticipated to be thicker than in the Waiakoa soils and the upper part of the underlying bedrock is likely more highly weathered. Hard bedrock is anticipated to be present at depths greater than 5 feet below the existing ground surface.

Along most of the cane haul road north of South Firebreak Road and along North Firebreak and Makapit Roads, the corridor extends across Ewa, Iao, and Pulehu Series soils, which consist of alluvium derived from surrounding a'a flows and ash deposits. Hard bedrock is anticipated to be present at depths greater than 5 or 6 feet below the existing ground surface. Near the intersection of Pulehu and Central Power Plant Roads, in an area mapped as Ewa Series soil, the walls of the abandoned pump station appear to be founded on an a'a flow at a depth of about 12 to 15 feet below the existing ground surface.

6.0 DISCUSSION

6.1 POTENTIAL ON-SITE GEOTECHNICAL AND GEOLOGICAL CONCERNS

6.1.1 Generating Station Site

Most of the structures at the generating station site are anticipated to be constructed at or near existing site grades. Because of the gently sloping topography, some amount of cutting and filling may be needed to level the site. This could result in non-uniform foundation bearing conditions across the site. To reduce the potential for excessive differential settlements, the foundations for a particular structure should be supported on the same bearing materials, either completely on the natural surface soils or completely on the underlying bedrock anticipated at the site. It is anticipated that lighter structures probably could be supported on shallow foundations in the surface soils. Heavier structures, such as the new generators, air cooled condensers, and other heavy plant structures, will probably need to be founded on foundations in the underlying lava flow. Injection wells for disposal of the station's waste water will also likely be installed deep into the lava flow.

Potential *geotechnical* and *geological* concerns associated with the proposed generating station include:

- *Geotechnical engineering properties of the site subsurface materials, such as strength and compressibility.* The geotechnical engineering properties of the site subsurface materials will need to be properly evaluated during detailed geotechnical investigations for these structures to develop appropriate parameters for design. It is anticipated that the plant structures could probably be supported on shallow foundations on the surface soils or underlying bedrock. The near surface clayey soils appeared to be wet and soft during our reconnaissance, possibly due to recent rains, and likely contain organic material from the sugar cultivation. After removal of the soft and disturbed portions of this strata to firm material, lighter structures probably could be supported on this material. Heavy structures should be supported on the underlying bedrock;

- *Possible shrink and swell tendencies of the surface soils.* The surface soils consist of clays and clayey silts. These soils appear to have moderate plasticities and may have some shrink and swell tendencies. In general, soils with these tendencies will shrink upon drying and swell and soften upon wetting. These volumetric changes could result in cracking of slabs-on-grade, lightly loaded masonry structures, and pavements. Overexcavation and replacement with non-expansive fills, in-place treatment, and thicker pavement sections may be needed because of these soils.

- *Presence of major cavities or voids in the bedrock, such as lava tubes and gas blisters.* Although voids such as these are more associated with pahoehoe lava flows rather than a'a lava flows, they may be present in localized areas of the site. Appropriate testing and investigation should be conducted during construction to check for the presence of major cavities, voids or lava tubes under the new structures. Foundation probing, proofrolling with heavy compaction equipment, and geophysical surveying are possible methods that may be considered to check for the presence of major cavities or voids.

- *Rock excavatability.* Because of the slightly sloping terrain, some amount of site cutting and filling may be required during grading operations to level the site. This could result in potential excavations into rock. Underground utilities, injection wells, and other below grade structures may also require hard rock excavations to install these structures. Rock excavations could be accomplished using large bulldozers with rippers, hydraulic rock breakers, drilling and blasting or by other

suitable rock excavation methods. The selection of a particular excavation method will depend on factors such as, rock hardness, strength, degree of weathering and fracturing, joint and fracture orientation and spacing, and environmental considerations.

- *Availability of suitable structural fill materials for site development.* It is anticipated that suitable quantities of granular structural fill that may be needed for the new structures will need to be imported. No suitable borrow pits are anticipated at this site. A possible source of fill materials may be the Ameron HC&D quarry located roughly ½ mile from the site.

- *Liquefaction potential of site subsurface materials.* Because of the clayey nature of the surface soils, anticipated shallow bedrock conditions, and probable absence of saturated deposits, the potential for liquefaction of the site soils is anticipated to be low.

- *Percolation rates of site subsurface materials.* Percolation rates in the surface clayey soils is anticipated to be relatively slow. Percolation rates in underlying rock materials will likely be higher than in the surface soils, and may depend on such properties as degree of fracturing and extent of clinker zones and voids in the rock.

- *Vibrations and/or blasting effects from the nearby quarrying operations.* According to Ameron HC&D personnel, blasting operations are typically performed once every two weeks or so to excavate the lava flow. If quarrying operations proceed further south, closer to the new generating station, and continue during the period after the facility is put into service, appropriate vibration and blast studies should be performed to check for possible effects of the quarrying operations on the new facility and to establish reasonable setbacks from the project site and operational guidelines, if appropriate.

6.1.2 <u>Transmission Corridors</u>

It is anticipated that the power poles along the proposed transmission corridors will probably be founded on drilled, cast-in-place reinforced concrete piers Major geotechnical and geological concerns regarding the transmission pole installations are not anticipated. However, potential geotechnical and geological conditions that may affect the pole foundation designs nclude:

- *Geotechnical engineering properties of the site subsurface materials, such as strength and compressibility.* The size and depth of the drilled piers for the transmission poles will depend on structural loads. It is anticipated that the piers for these poles may need to be installed to depths of approximately 10 feet or deeper. Along the majority of the corridor alignment, the drilled holes are anticipated to extend through the soil and penetrate to some depth into the underlying bedrock.

The geotechnical engineering properties of the near surface soils and underlying rock should be properly evaluated to check on lateral, and vertical compressive and uplift capacities of the piers.

- *Rock excavatability.* Rock excavatability in the drilled pier holes are not anticipated to be a significant construction concern provided suitable drilling equipment is utilized.
- *Liquefaction potential of site subsurface materials.* Because of the clayey nature of the surface soils, anticipated shallow bedrock conditions, and probable absence of saturated deposits, the potential for liquefaction of the site soils along the corridors is anticipated to be low.

6.2 POTENTIAL EXTERNAL GEOLOGIC HAZARDS

6.2.1 Lava Flow Hazards

Lava flow hazards in the Hawaiian Islands have been quantified on a classification map based on lava-flow coverage of different areas during specific time periods (Mullineaux and others, 1987). The island of Maui is divided into 5 hazard zones, with Zone 1 having the highest lava flow risk and Zone 5 having the lowest risk. The generating station site is located in Zone 5. Zone 5 includes areas that have not been affected by lava flows for at least 20,000 years.

6.2.2 Volcanic Ash-fall Hazards

Volcanic ash-fall hazards in the Hawaiian Islands have been quantified on a classification map based on estimated frequency and range of thickness of future ash-falls (Mullineaux and others, 1987). The island of Maui is divided into 3 hazard zones, with Zone 1 having the highest ash-fall risk and Zone 3 having the lowest risk. The generating station site is located in Zone 3. Zone 3 includes areas in which less than 1 centimeter of ash is expected to fall at an average rate of once per 1,000 years. This zone also includes areas where 10 centimeters or more of ash may fall at least once per 3,000 years.

6.2.3 Other Volcanic Hazards

Other volcanic hazards include pyroclastic surges, volcanic gases, lava bombs, dome collapse, fumaroles, debris avalanches, ground fracture and subsidence, and earthquakes. Pyroclastic surges, volcanic gases, lava bombs, dome collapse, fumaroles, and debris avalanches

generally occur as part of volcanic eruptions. The generating station site is located in an area that is least likely to be affected by volcanic hazards on Maui (Mullineaux and others, 1987). Ground fracture and subsidence are also often associated with eruptions and are anticipated to occur in areas away from the project site. Most of the earthquakes in Hawaii are generated by volcanic activity, mainly the movement of magma within the volcano. Earthquakes are discussed in the following subsection on potential seismic hazards.

6.2.4 Seismic Hazards and Zonation

The majority of the earthquakes in Hawaii occur on the volcanically active Big Island and are generated by magma moving at shallow depth. These earthquakes seldom cause any damage. Occasional larger scale earthquakes are associated with structural readjustment within the volcano. On Maui, the most likely area to experience structural readjustment would be in the region of the most recent volcanic activity, along the southeast and east rift zones of Haleakala.

In historic time, two larger scale earthquakes felt on Maui have occurred as a result of tectonic rather than volcanic activity. These were major earthquakes that occurred in 1871 and 1938, with magnitudes in the range of 7. It is believed that these earthquakes were generated along the Molokai fracture zone (Furumoto and others, 1990). The Molokai fracture zone stretches from an area off the Baja coast towards the major Hawaiian Islands, where it splays, with one strand heading toward northeast Molokai and the other strand heading toward eastern Maui. This fracture zone continues to the southwest of the islands. It is believed that most future earthquakes on Maui probably will be generated along the Molokai fracture zone and thus, could affect all or most parts of the island (Mullineaux and others, 1987). The largest historic earthquake felt on Maui occurred in 1938. Its epicenter was located approximately 40 kilometers north of the island in the Molokai fracture zone. This earthquake damaged roads and buildings on both Maui and Molokai and caused minor damage on Oahu. The intensity of this earthquake has been estimated to be IX - VIII based on the Modified Mercalli Scale (Furumoto and others, 1990). The Lanai earthquake of 1871 also damaged roads, buildings, and other structures on Maui and had an estimated intensity of VIII (Furumoto and others, 1990). Its epicenter was also in the Molokai fracture zone a few miles southwest of Lanai.

A screening study of possible natural hazards for this project was conducted in 1995 by Dr. Arthur Chiu, Dr. Ed Cheng, and Dr. Thomas Schroeder of the University of Hawaii for this project. One of the natural hazards identified in their report was from earthquakes. The 1995 report stated "...the earthquake hazards should be adequately addressed because of the proximity of Maui to the island of Hawaii which frequently experiences earthquakes". It further stated that "the island of Maui ... had only two reported significant earthquakes: in 1871 and 1938. With only these two significant local events, it becomes a formidable task to make estimates of the level of the earthquake hazard ... Additionally, a study of the soil conditions surrounding the sites will be advisable to assess the possibility of liquefaction."

Liquefaction of the site soils was identified by Chen, Chiu and Schroeder (1995) as a possible natural hazard. Liquefaction is generally defined as a loss of strength in submerged granular soil deposits due to a buildup of excess hydrostatic water pressures during an earthquake. Ground failure in the form of lateral displacement and excessive settlements may occur as a result of liquefaction. As stated earlier in this report, based on the results of our site reconnaissance and data review, the potential for liquefaction of the site soils appears to be low. Appropriate subsurface exploration and testing should be performed during design to check if these deposits are present at this site.

Maui is currently classified as seismic zone 2B according to the 1991 UBC (Tavarez, 1997). At this time, the Hawaii State Earthquake Advisory board has no current plans to review the seismic zone for Maui (Yanagi, 1997).

7.0 RECOMMENDATIONS FOR FURTHER STUDY

This report includes information on general geology, anticipated subsurface conditions, and preliminary geotechnical and geological comments for EIS project planning purposes. MECO should retain a qualified and licensed geotechnical engineer and engineering geologist to perform detailed geotechnical and geological investigations during design of the generating station and transmission line structures to explore subsurface and groundwater conditions at each structure location and to develop appropriate geotechnical engineering parameters for design. In

general, this investigation should consist of soil test borings, test pit excavations, in situ permeability tests, geophysical surveys, laboratory testing, and appropriate engineering analyses. The information and discussions presented in this report are considered to be preliminary in nature and should not be used for final design.

8.0 LIMITATIONS

This report has been prepared for the use of CH2M HILL, Maui Electric Company, Limited, and their designated consultants in accordance with generally accepted soils and foundation engineering practices. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has been developed for the use of CH2M HILL, Maui Electric Company, Limited, and their designated consultants to provide preliminary feedback regarding anticipated geological and geotechnical conditions at the MECO Waena Generating Station Site and associated transmission lines for EIS planning purposes. It does not contain sufficient information for the purpose of other parties and users

The comments and discussions regarding anticipated geotechnical engineering properties and foundation support methods provided herein are preliminary in nature. It is highly recommended that detailed geotechnical and geological investigations be performed to develop appropriate recommendations for the design and construction of the proposed generating station and transmission corridors.

The scope of our services for this project was limited to conventional geotechnical and geological engineering services and did not include any environmental assessments or evaluations. Silence in this report regarding any environmental aspects of the site does not indicate the absence of potential environmental problems.

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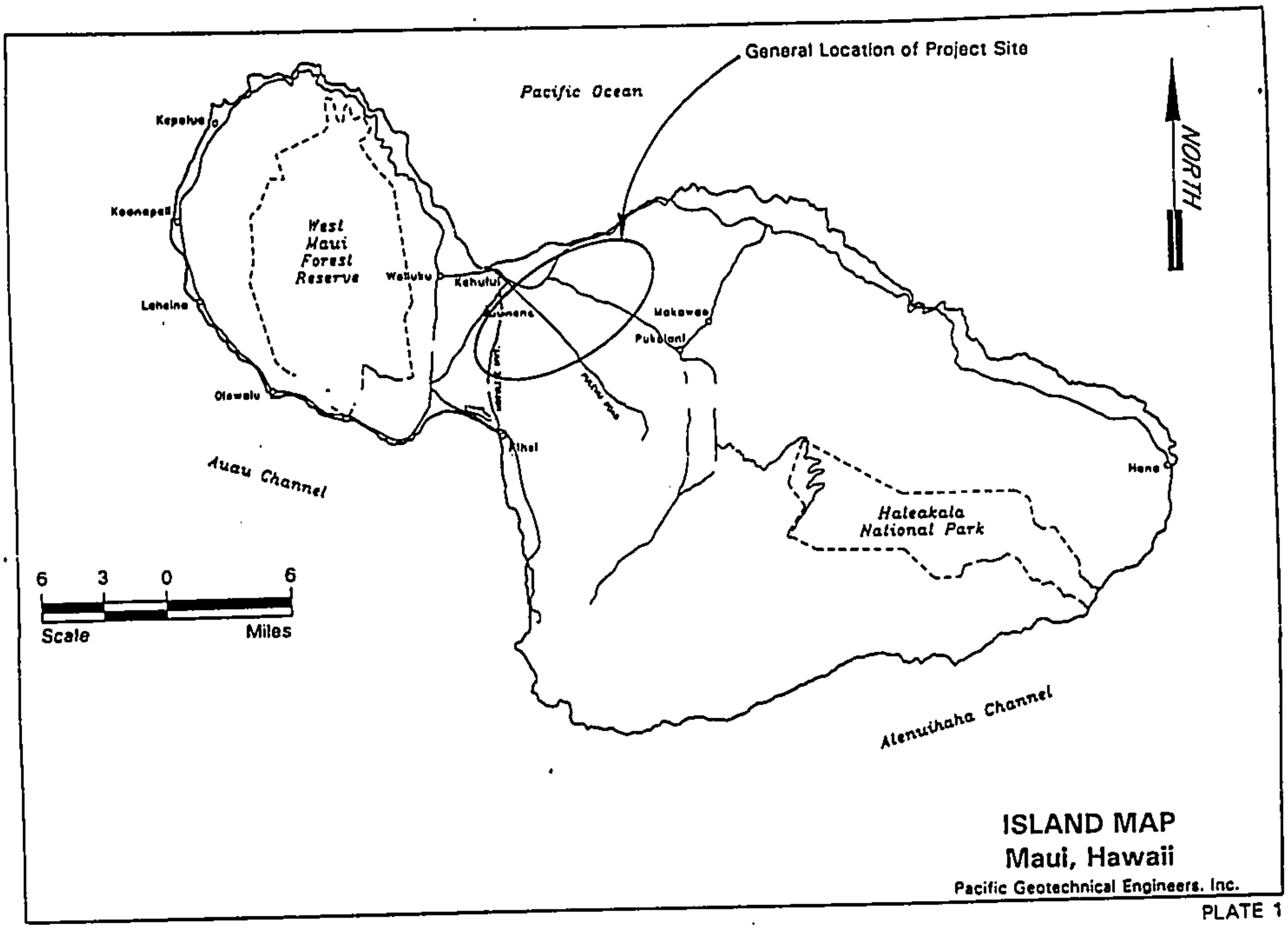
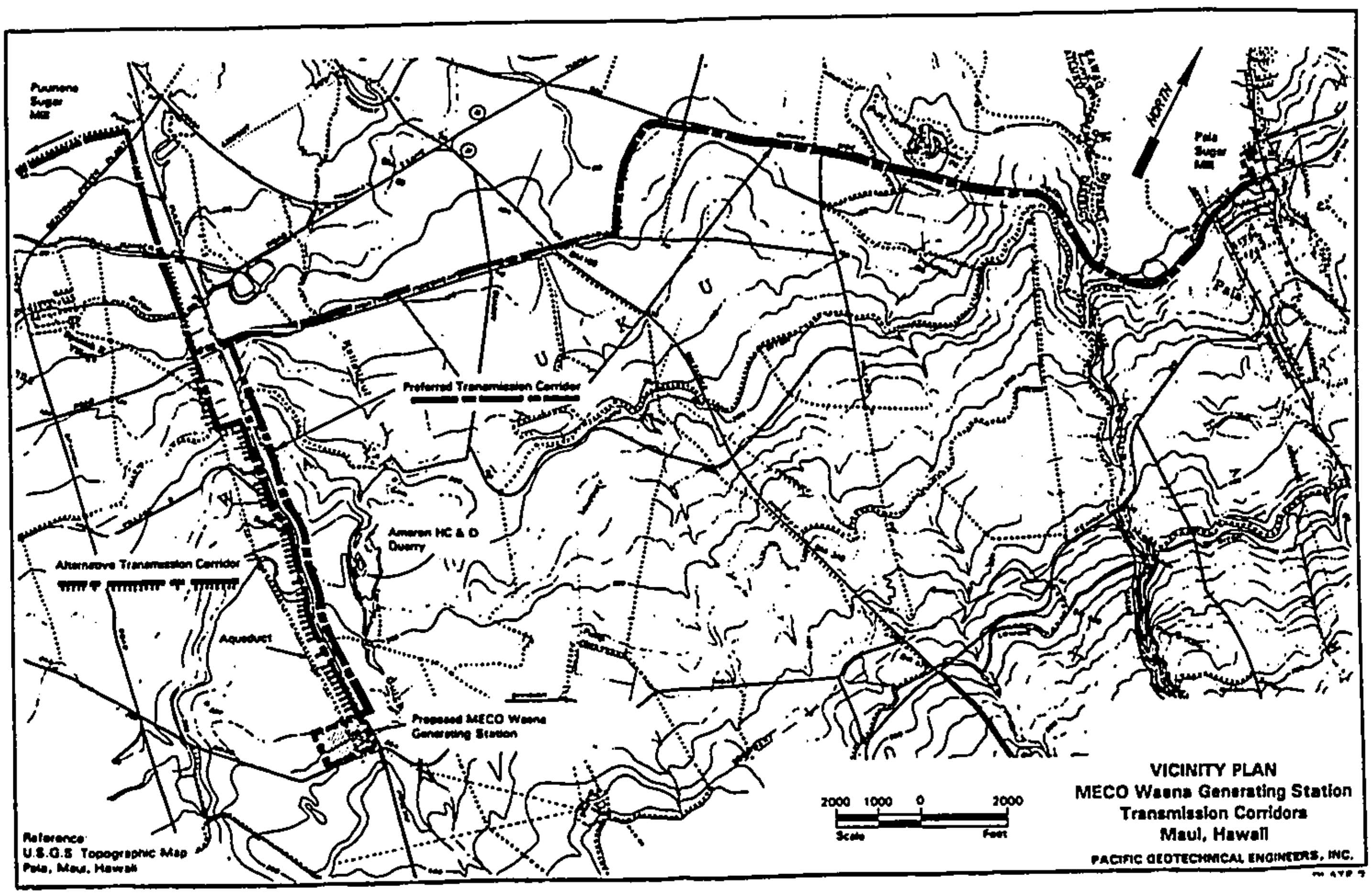
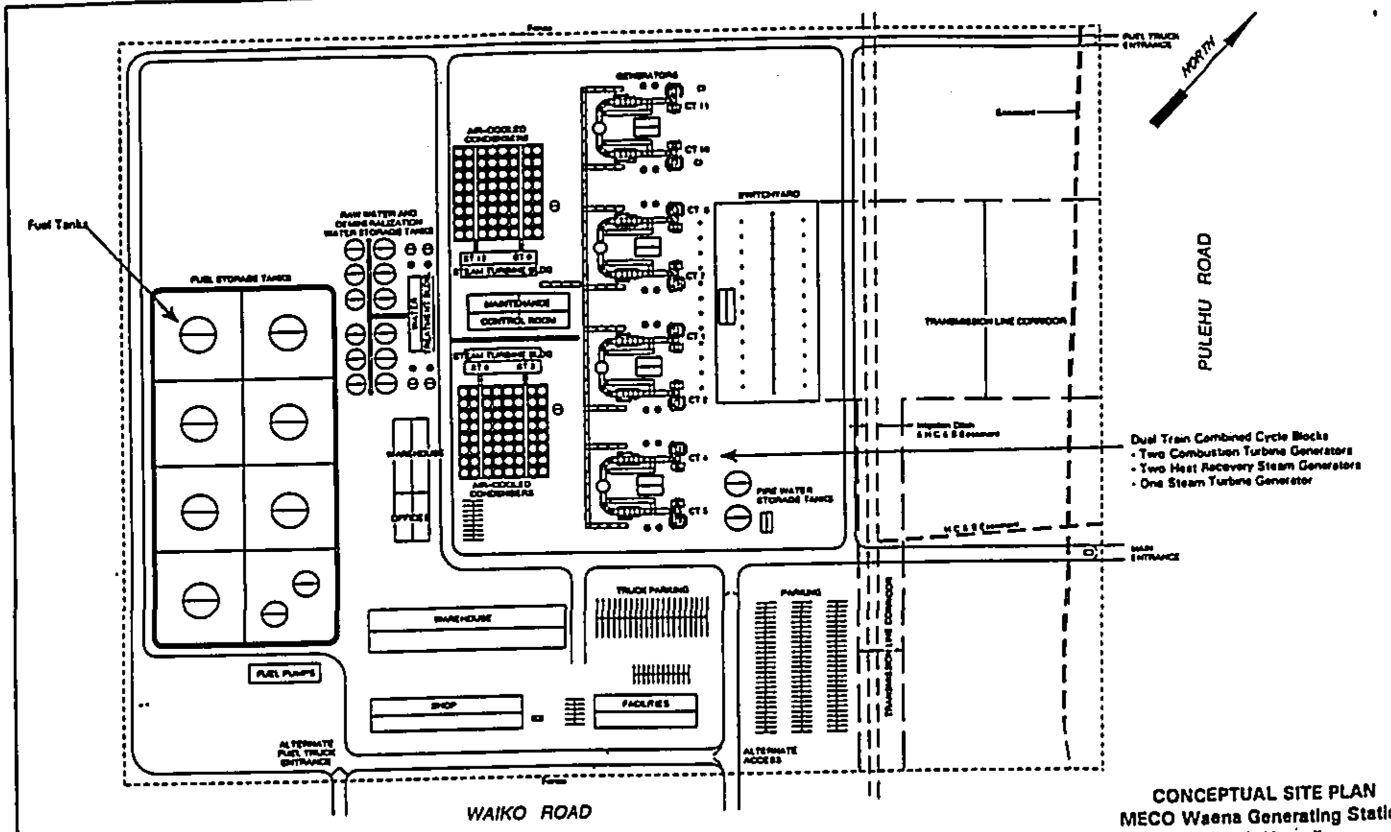

General Location of Project Site
Pacific Ocean
NORTH
Kapalua
Kaanapali
Lahaina
Olowalu
West Maui Forest Reserve
Wailuku
Kahului
Puunene
Makawao
Pukalani
Maalaea
Kihei
Hana
Auau Channel
Haleakala National Park
Alenuihaha Channel
6 3 0 6
Scale
Miles
ISLAND MAP
Maui, Hawaii
Pacific Geotechnical Engineers, Inc.

PLATE 1


Puunene Sugar Mill
NORTH
Paia Sugar Mill
Paia
Preferred Transmission Corridor
Ameron HC & D Quarry
Alternative Transmission Corridor
Aqueduct
Proposed MECO Waena Generating Station
Reference
U.S.G.S Topographic Map
Paia, Maui, Hawaii
2000 1000 0 2000
Scale
Feet
VICINITY PLAN
MECO Waena Generating Station
Transmission Corridors
Maui, Hawaii
PACIFIC GEOTECHNICAL ENGINEERS, INC.



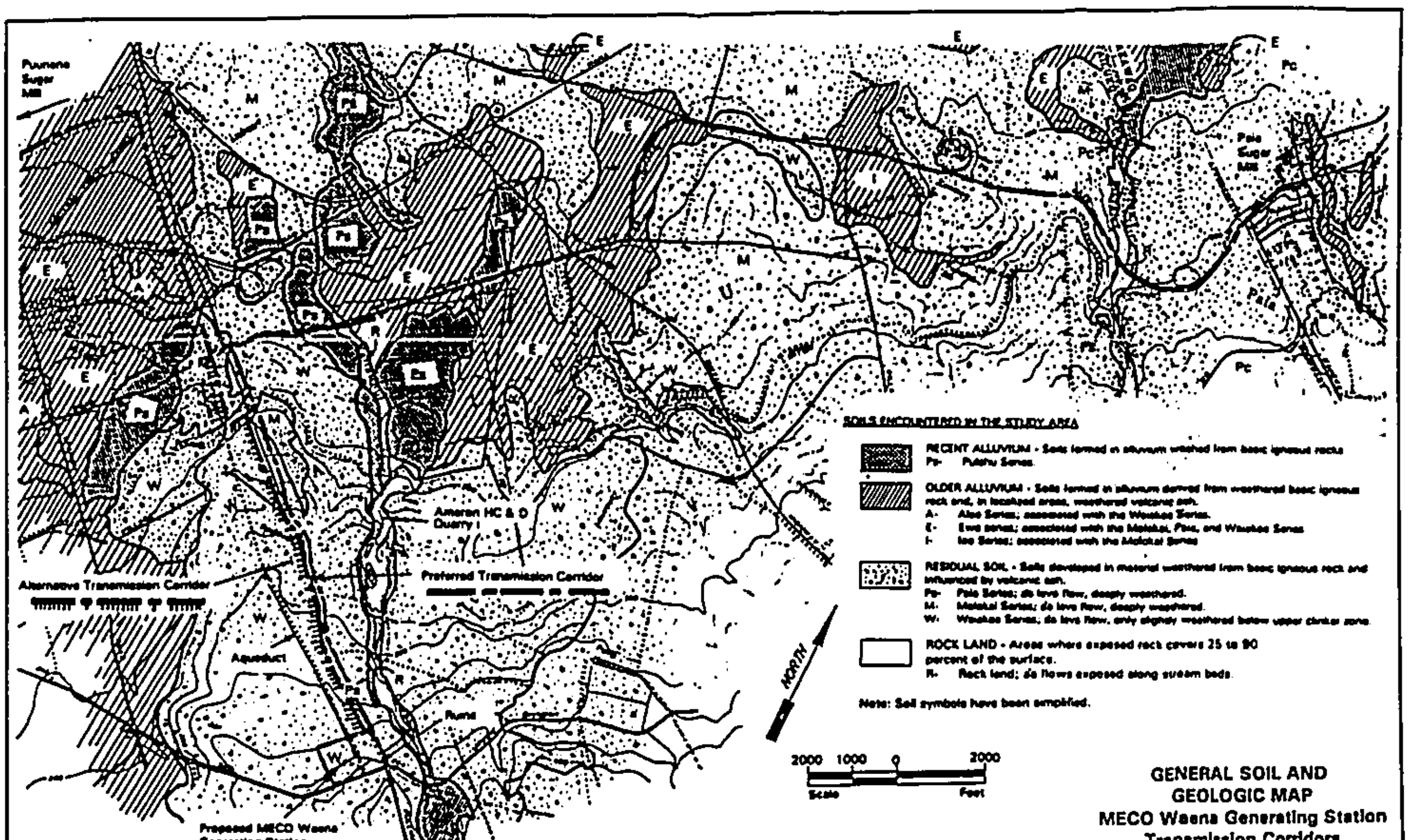
CONCEPTUAL SITE PLAN
MECO Waena Generating Station
Maui, Hawaii

NOT TO SCALE

Prepared by: CH2M HILL
Received: May 1997

PACIFIC GEOTECHNICAL ENGINEERS, INC.

PLATE 3

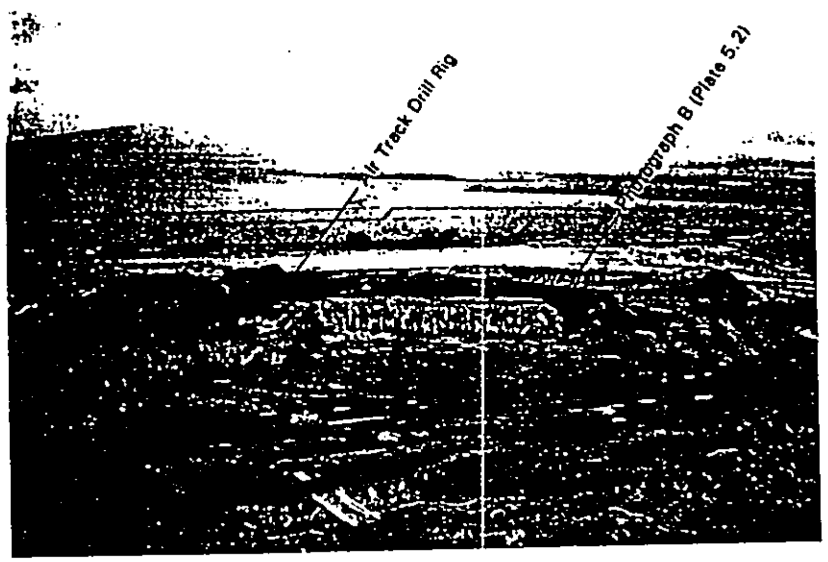


GENERAL SOIL AND GEOLOGIC MAP
MECO Waena Generating Station
Transmission Corridors
Maui, Hawaii

Reference
United States Department of Agriculture Soil Conservation Service
Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii
Issued August 1972

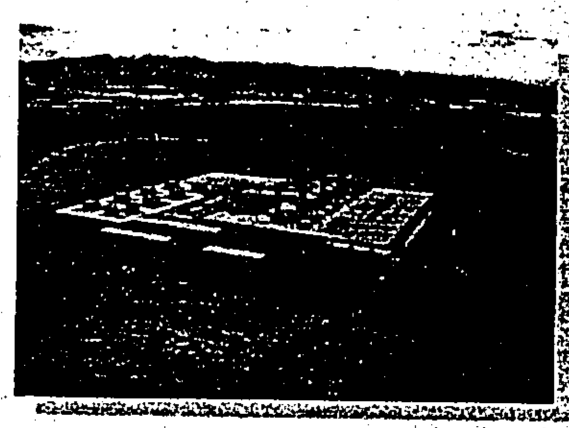
PACIFIC GEOTECHNICAL ENGINEERS, INC.

PLATE 4



Photograph A Southwestern corner of the quarry, approximately 2,000 feet from the site of the proposed MECO Waena Generating Station. The subsurface conditions at the proposed power plant site are expected to be very similar to the subsurface conditions at this part of the quarry. The a'a lava flow being quarried is approximately 25 to 35 feet high. The overlying soil, mainly consisting of weathered clinker and volcanic ash, has been cleared. The air track drill rig on the cleared surface above the a'a flow is drilling holes in preparation for blasting.

Photograph B Southwestern corner of quarry. The a'a lava flow is approximately 30 feet high. Dark brown weathered clinker is exposed at the base of the massive a'a core. Nearly all of the clinker and overburden soil above the a'a core have been removed. The highly fractured nature of the rock may be due to the blasting during excavation work. Fresh surfaces are gray in color.



APPENDIX E

GROUNDWATER RESOURCE ASSESSMENT

GROUNDWATER RESOURCE ASSESSMENT

For

Maui Electric Company, Limited's
Proposed Waena Generating Station

Wailuku District, Maui

Prepared for

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Honolulu, Hawaii

Prepared by

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Honolulu, Hawaii
June 1997

CONTENTS

EXECUTIVE SUMMARY

Maui Electric Company, Limited, in its effort to increase its capacity to meet future energy demands on the island of Maui, plans to build a 232-MW generating facility on approximately 67 acres of land in central Maui.

This report analyzes pertinent hydrogeologic data, assesses regional geology and groundwater resources as they relate to the proposed project, and discusses potential impacts of the project on groundwater resources.

Hydrogeologic Conditions

The project site is underlain by a thin cover of topsoil lying on top of andesitic lava flows of the Kula volcanic series, which in turn overlie much older basaltic lava flows of the Honomanu volcanic series. These series erupted from Haleakala (East Maui) Volcano.

The project site is located in a dry area, with median rainfall amounting to only 17 inches a year. Rainfall in the central Maui basin is somewhat evenly distributed, averaging approximately 28 inches a year over an area of approximately 200 square miles.

The Central Hydrologic Sector, in which the groundwater resources of the project area occur, embraces the entire western slopes of Haleakala Volcano. All explored areas of the hydrologic sector consist of brackish basal ground water, except where diluted by large quantities of irrigation water. The project site is located within the Paia Aquifer System, one of four systems in the hydrologic sector.

The lands surrounding the project site are irrigated with surface waters collected from various streams on the windward slopes of East Maui by an elaborate irrigation ditch system and distributed throughout the Paia Aquifer System by the Haiku, Lowrie, Kauhikoa, and Hamakua Ditches.

Existing Wells and Water Use

The project site is surrounded, laterally and downgradient, by five large capacity wells (actually water development shafts) within a 3-mile radius. These five wells produce 80.6 mgd of brackish or nonpotable ground water from a thin

basal aquifer for irrigation of sugarcane by Hawaiian Commercial and Sugar Co. (HC&S). Other existing wells within the 3-mile radius include three monitor wells in the nearby Central Maui Landfill which provided data on groundwater quality expected in the project site. The nearest producing well lies 1.5 mile downgradient of the project site.

Potential Impacts on Ground Water

The development of 0.88 mgd of nonpotable water required for the project at full buildout can be met by drilling and developing one or more wells onsite without any adverse impact on the basal groundwater aquifer. Well drawdown is estimated to be less than a foot based upon pumping test data from Hamakuapoko Well 2 which presumably taps the same Honomanu basalts underlying the project site. No measurable effect or adverse impact is expected on existing wells or water quality from the withdrawal of 0.88 mgd, which represents only 1.1% of 80.6 mgd of ground water currently being withdrawn within a radius of 3.3 miles of the project site. Actually, the project's net withdrawal of ground water is half of the 0.88 mgd water supply needed for the project's DTCC units. This is because the resultant wastewater totals 0.44 mgd, which will be returned to the basal aquifer by means of injection wells. The existing wells within the 3.3 radius produce nonpotable ground water with chloride contents ranging from 430 to 700 mg/l and therefore no measurable effects on the water quality is expected.

The use of injection wells for the disposal of 0.44 mgd of wastewater will not impact the basal aquifer or any existing wells for several reasons. First, the rate of wastewater injection is extremely small when compared to the rate of groundwater movement which is indicated by the large withdrawals of ground water in the area. Secondly, the quality of the wastewater is estimated to be similar to the existing groundwater quality. Thirdly, the wastewater plume (Figure 2) will be diluted by mixing and diffusion and is not expected to be detectable at any existing well or coastal area as the plume becomes dispersed and diluted to ambient groundwater quality.

GROUNDWATER RESOURCE ASSESSMENT
For
Maui Electric Company, Limited's Proposed Waena Generating Station

INTRODUCTION

Maui Electric Company, Limited (MECO) is proposing to construct and operate a 232-MW generating station on approximately 67 acres of sugarcane land in central Maui, at the intersection of Pulehu Road and Waiko Road (see Figure 2). The station will include four 58-MW dual-train combined cycle (DTCC) units constructed in phases, with the first DTCC unit scheduled for completion in the year 2006, with full buildout by the year 2017 or later. Ancillary facilities will include administration buildings, a switching yard, fuel storage tanks, water treatment facility, wastewater treatment facility, warehouses, and possible transmission and distribution facilities.

This report analyzes pertinent hydrogeologic data, assesses regional geology and groundwater resources as they relate to the proposed project, and discusses potential impacts of the project on groundwater resources.

PHYSICAL ENVIRONMENT

Topography, Geology, and Soils

The project site is located at an elevation of approximately 350 feet where the gently dipping slopes of East Maui begin to flatten into the isthmus of central Maui. Slopes in the vicinity averages less than 5 percent and drain northwestward. The project area is drained by Kalialinui Gulch, located a quarter mile to the north, and by Pulehu Gulch, located a mile to the south of the project site. Both gulches are normally dry and extend radially from the upper slopes of Haleakala toward the isthmus.

The project area is underlain by a stratigraphic section consisting of a thin cover of topsoil lying on top of andesitic lava flows (Kula volcanic series) which in turn overlie much older basaltic lava flows (Honomanu volcanic series) that erupted from Haleakala (East Maui) Volcano. Generally, the Kula lavas tend to be more massive and less permeable than the underlying Honomanu basalts which are typically more thin-bedded and permeable. The Kula lavas are approximately 40 feet thick in the project area, based upon exposures in an existing quarry located nearby. The Kula lavas rest unconformably upon 10 feet of reddish brown clay which represents the residually weathered surface of the underlying Honomanu basalt.

The topsoil in the project area is thin and residually weathered in place from the andesitic lava flows. Foote et al, 1972, described the top soil in a former quarry site now occupied by the existing Central Maui Landfill located approximately 2,000 feet north of the project site as deep, well-drained, and moderately fine-textured. Adjacent to the landfill is an existing quarry site which indicate a topsoil layer of 5 to 6 feet underlain by about 40 feet of Kula basalts (Kula volcanic series). The Kula basalts are in turn underlain by approximately 10 feet of clay which separate the underlying Honomanu basalts (Masa Fujioka & Associates, 1996).

Climate

The climate in the project area is typically mild and dry, reflecting the climate of the central Maui isthmus. Temperatures range from the low 60's during the winter months to the high 90's during the summer months. The project area is exposed to the northeast tradewinds which predominate approximately 70 percent of the time, based upon wind data at Kahului Airport (located approximately 4 miles away). In the project area, the tradewinds are deflected to a more northerly direction due to the larger influence of the mountain masses of East and West Maui in funneling the tradewinds around the mountains and through the central Maui isthmus (R.M. Towill, 1986).

Rainfall

The project area is located in a dry area, with the median rainfall amounting to only 17 inches a year. Rainfall in the central Maui basin is somewhat evenly distributed, averaging approximately 28 inches n year over an area of approximately 200 square miles. Rainfall ranges from a low of 15 inches a year in the southern isthmus southwest of the project site and gradually increases at higher elevations to 50 inches and more over the North and Southwest Rift Zones of Haleakala. With dry and windy conditions prevailing, only a small percentage of rainfall is able to percolate deep enough below the ground surface to become groundwater recharge.

REGIONAL GEOLOGY

Three major eruptive periods of Haleakala Volcano created East Maui and produced three volcanic series of formations known as Honomanu, Kula, and Hana. The Honomanu series (the oldest) form the basal core and bulk of East Maui. Overlying the Honomanu series, which consists of typically thin-bedded permeable basalts, are the younger, more massive, and less permeable andesitic and basaltic lava flows of the Kula volcanic series. The Kula period of volcanism was followed by a long period of volcanic quiescence during which time major erosion occurred and carved out the remarkably deep canyons of East Maui; namely, Keanae, Waihoi, Kipahulu, and Kaupo.

This long period of erosion ended with renewed volcanic activity along two of Haleakala's three rift zones; namely, the East and Southwest Rift Zones. This volcanic period produced the Hana series of basalts, andesitic basalts, and andesites, which partially filled East Maui's deep canyons and blanketed much of the eastern and southwestern slopes of East Maui.

The central Maui basin in which the groundwater resources of the project area occur, embraces the entire western slopes of Haleakala Volcano and has been identified by the State Commission on Water Resource Management as the Central Hydrologic Sector (see Figure 1). These slopes extend from Haleakala across the isthmus to the foot of the West Maui mountains and comprise an area of approximately 200 square miles. The eastern limit of the basin is geologically

delineated by Haleakala's North and Southwest Rift Zones which extend, respectively, from the northern shores at Haiku to Haleakala's summit and from there to La Perouse Bay on the southwest shore of East Maui (see Figure 1).

The western limit of the basin is geologically delineated by the subsurface contact between poorly permeable slope wash deposits of West Maui and the abutting Kula and Honomanu lavas that flowed westward from the summit of Haleakala and formed the flat lowlands of the central isthmus. Coastal and near-coastal deposits of alluvium and dune sand cover much of the Kula lavas in the isthmus. These deposits form coastal wetlands in the northern and southern parts of the isthmus at Kanaha Pond and Kealia Pond, respectively (see Figure 2).

The central basin surface is dominated by andesitic basalts of the Kula volcanic series, except in the Makena area where basaltic lava flows of the Hana volcanic series erupted from the lower section of the Southwest Rift Zone. However, the oldest rocks occurring in the basin comprise the Honomanu volcanic series of permeable basalts upon which the Kula and Hana formations rest. The Honomanu basalts are nowhere exposed in the basin, but they underlie most of the central Maui basin beneath a veneer of Kula lavas. The Honomanu basalts constitute the principal aquifer of central Maui.

REGIONAL HYDROLOGY

Central Hydrologic Sector and Aquifer Systems

The State Commission on Water Resource Management (CWRM, 1990) has identified the central Maui basin as the Central Hydrologic Sector and subdivided it into four aquifer systems; namely, Kahului, Paia, Makawao, and Kamaole (see Figure 1). The areal extent, groundwater recharge, and sustainable yield of each aquifer system have been estimated by the Commission on Water Resource Management (CWRM, 1990) and are summarized and presented below in rounded numbers:

Central Hydrologic Sector

Aquifer	Area (sq. mi.)	Recharge (mgd)	Sustainable Yield (mgd)
Kahului	9	2	1
Paia	61	17	8
Makawao	53	15	7
Kamaole	90	25	11
TOTAL	213	59	27

The amount of recharge for each of the four aquifer systems in the Central Hydrologic Sector shown in the table above, represents only natural recharge from rainfall and does not include large amounts of artificial recharge from deep percolation of excess sugarcane irrigation water applied to large acreages, particularly in the Paia Aquifer System of the Central Hydrologic Sector.

The Paia Aquifer System, in which the project site is located, covers an area of 61 square miles. However, the system has a sustainable yield of only 8 mgd, based upon an average rainfall of only 27 inches a year.

Groundwater Occurrence

All explored areas of the Central Hydrologic Sector consist of basal ground water. Except where diluted by large quantities of irrigation water, the basal aquifer is brackish (containing more than 250 mg/l of chlorides) throughout much of the sector: in the isthmus and all coastal areas from Paia to Kahului on the northern shores and from Maalaea to Makena on the southern shores. Where freshened by irrigation water, the basal aquifer may yield water having a salinity of less than 250 mg/l of chlorides, the limit for potable water. However, such artificially freshened basal water generally is considered nonpotable and unsuitable for municipal water use because irrigation recharge is undependable and subject to contamination. The Paia Aquifer System, in which the project site is located, is to a large extent recharged by surface water irrigation of sugarcane.

The Kahului Aquifer System, which lies west of the project site and adjoins the Paia Aquifer System, also is a brackish water aquifer that has been partly freshened by surface water recharge from sugarcane irrigation.

The Makawao Aquifer System, which lies southeast of the project site and continuous with the Paia Aquifer System, is unexplored except for a single well (Pukalani 5021-01) (Figure 2, Well I.D. #5). This well lies four miles inland of the project site, has a head of 8 feet, and produces brackish water containing 490 to 576 mg/l of chlorides (CWRM, 1996). The brackish water quality of this well is unexpected because the well lies six miles inland from the coast. It is hypothesized that this part of the basal aquifer receives little groundwater recharge too widely dispersed over a large area.

The Kamaole Aquifer System, which borders the southern boundaries of the Paia and Makawao Aquifer Systems, is located five miles south of the project site. The Kamaole Aquifer System lies hydrologically lateral to the Paia Aquifer System and, therefore, does not affect the hydrology of the project site. The Kamaole Aquifer System is largely unexplored, except along the Kihei-Makena coast, where most existing wells are brackish and located less than a mile inland

Groundwater Recharge

The Paia Aquifer System, in which the project site is located, receives a large, but undetermined amount of artificial recharge from drip irrigation of large acreages of sugarcane. The sugarcane lands are irrigated largely with surface waters collected from various streams on the windward slopes of East Maui by an elaborate irrigation ditch system and distributed throughout the Paia Aquifer System by the Haiku, Lowrie, Kauhikoa, and Hamakua Ditches (see Figure 2). These ditches and their approximate elevations are summarized below:

Ditch Name	Approximate Elev. (ft)
Haiku	450
Lowrie	650
Kauhikoa	1000
Hamakua	1100

As shown in Figure 2, these four main ditches, operated by Hawaiian Commercial and Sugar Co. (HC&S), distribute irrigation water throughout the area surrounding the project site. Overall, the ditch system distributes an average of 164 mgd of surface water (CWRM, 1990, pg. D7). Irrigated sugarcane lands surround the project site approximately four miles in all directions. Consequently, a significant but undetermined amount of fresh irrigation water recharges the basal aquifer underlying the project area.

Water Quality

The recharge from sugarcane irrigation has lowered the salinity of the basal aquifer to just under 250 mg/l chlorides (potable water limit) in the vicinity of the project site. This is based upon data from three monitor wells located a half mile north of the project site in the existing Central Maui Landfill (see Figure 2). Analyses of water samples from these monitor wells indicate ground water with a salinity of 132 to 216 mg/l chlorides (see Table 1). Supply wells drilled in the project site may yield ground water with similar chloride content, but as mentioned earlier the utility would be considered nonpotable. Exact groundwater makeup will not be known until a test well is developed on the project site.

All pumping wells within a four-mile radius of the project site produce brackish water with chloride contents ranging from 250 to 700 mg/l (see Table 2 and Figure 2).

Elsewhere in the Paia Aquifer System, wells with salinities of less than 250 mg/l chlorides have been found approximately 2.6 miles inland from the coast near Paia town and 4.1 miles inland from the coast at Kihei (see Figure 2, Well I.D. #16, #19, #21 and #3). Further inland, the basal aquifer normally has similar or lower chloride content. However, contrary to this belief, fresh water was not encountered in the Pukalani Well, located six miles inland of Paia and eight miles inland of Kihei. This finding supports the hypothesis that the chloride content of the basal aquifer underlying the project site has been lowered by irrigation water recharge.

Basal Groundwater Movement and Head

Since existing wells in the Central Hydrologic Sector are concentrated in the isthmus and coastal areas, groundwater occurrence and movement in the interior areas are mostly inferred from regional geology, rainfall distribution, and general knowledge and experience in Hawaiian hydrogeology. With average annual rainfall of less than 40 inches a year throughout most of the hydrologic sector, the

Commission on Water Resource Management (1990) estimates groundwater recharge for an area of 213 square miles at 59 mgd. With some 26 miles of coastline and little to no coastal caprock formation to impede groundwater flow, the estimated average natural groundwater discharge to the ocean is a very low 2.3 mgd/coastal mile.

Consequently, the basal aquifers which dominate the Central Hydrologic Sector are generally unconfined, thin, mostly brackish, and have a water table gradient of about one foot/mile. Although existing water level data in many instances cannot be reliably compared for lack of confirmed benchmarks, estimates of typical coastal water table gradients include:

Coastal Area	Water Table Gradient
Paia	1.0 ft./mile (assumes 1.0 ft. head at coast)
Kahului (Kanaha Pond)	0.7 ft./mile
Kihei	1.2± ft./mile

The basal heads listed for wells in the study area have been used together with the distribution of rainfall and irrigated areas to estimate the directions of groundwater movement shown in Figure 2.

The general direction of groundwater flow in the vicinity of the project site is estimated to be N70°W, with ultimate movement broadly divergent towards the isthmus and Kahului. Elsewhere in the Central Hydrologic Sector, groundwater movement is generally towards the coastlines.

EXISTING WELLS AND WATER USE

The wells nearest the project site are located a half mile north in the existing Central Maui Landfill. These wells are used for monitoring purposes only (Figure 2, Wells I.D. #7, #8, and #9). The nearest producing well (shaft) is HC&S' Puunene Pump 6 located 1.5 miles downslope of the project site (Figure 2, Well I.D. #14). Pump 6 has a pump capacity of 23.0 million gallons per day (mgd) and withdraws an average of 18.2 mgd for sugarcane irrigation (CWRM, 1996). Within a 3-mile radius of the project site, HC&S has four additional wells (shafts) which develop an additional 55.4 mgd (Figure 2, Wells I.D. #4, #11, #12, and #13). Other producing wells in the study area are listed in Table 1 and shown in Figure 2.

Groundwater development in the vicinity of the study area consists entirely of nonpotable water, the bulk of which is used for sugarcane irrigation. Minor amounts of ground water are used for landscape irrigation and for industrial purposes at sugar mill and pineapple canning operations. A large component of the ground water pumped by HC&S for sugarcane irrigation comes from the recycling of irrigation water return to the basal aquifer. Because the pumped ground water is supplemented by surface water diverted from streams in windward East Maui, the Paia basal aquifer has a lower chloride content than it otherwise would have and is capable of yielding large quantities of brackish ground water to HC&S' wells.

There are no existing municipal wells near the project site or elsewhere within the Central Hydrologic Sector. The Maui Department of Water Supply (DWS) at one time contemplated the use of an existing well located four miles northwest of the project site (Figure 2, Well I.D. #15). However, plans were abandoned in 1996 due to the well's high bacterial content (Herbert Kogasaka, DWS, personal communication, June 1997). The Maui County DWS has three other existing wells. These three wells are located 6.5 miles northeast of the project site at the eastern boundary of the Paia Aquifer System and are under consideration for use as sources of municipal water supply (Figure 2, Well I.D. #16, #19, and #21).

PROJECT WATER SUPPLY

Based upon data from nearby monitor wells 5125-01, 02, and 03, the basal aquifer underlying the project site has an estimated head of about 4.8 feet and chloride content of approximately 200 mg/l, which is slightly less than the potable water limit of 250 mg/l. However, because the salinity has been lowered by irrigation recharge, the ground water is considered nonpotable.

Four water supply wells are contemplated for the project. One well will be required for each of four DTCC units and each well must have an output of 220,000 gpd, for a total water requirement of 880,000 gpd. With an estimated basal head of 4.8 feet and a chloride content of approximately 200 mg/l chlorides, the projected total water requirement of 0.88 mgd can be met from wells drilled on the project

site. The units will be constructed in phases approximately four years apart, allowing timely confirmation of well performance and water quality.

PROJECT EFFLUENT DISPOSAL

The project's wastewater will be disposed of by means of injection wells. It is estimated that half of the water supply for each DTCC unit will be consumptively used; and, therefore, each DTCC unit will produce 110,000 gpd of wastewater effluent. Thus, the project's four DTCC units will produce an estimated total wastewater effluent of 440,000 gpd, or 0.44 mgd. The estimated quality of the wastewater is shown in Table 3 and is based upon a comparative analysis of the source/wastewater differences observed at the Maalaea generating station to the groundwater quality of the nearby monitor wells 5125-01, 02, and 03.

The maximum plume or zone of mixing in the basal aquifer resulting from disposal of 440,000 gpd of effluent was calculated, using an EPA-sponsored computer model (WHPA v2.2). Based upon existing well data, an aquifer transmissivity of 192,700 $ft.^2$/day, an aquifer thickness of 193 feet, and an aquifer porosity of 0.1 were assumed in the model. A hydraulic gradient of 0.45 ft./mile was also assumed, based upon the heads in monitor wells 5125-01 and 5125-02 located in the nearby Central Maui Landfill. A single injection well was reasonably assumed in the model to receive the estimated maximum effluent of 440,000 gpd, although there will be up to eight onsite injection wells with four in operation at any given time.

Based upon the above aquifer parameters, the results of the computer model indicate a zone of mixing, or plume of wastewater, as shown in Figure 2. The results assume an absolute worst-case scenario in which the full buildout rate of 0.44 mgd of wastewater would be injected from the start of plant operations and no dispersion would occur in the aquifer. The plume of wastewater would extend downgradient of the injection well a distance of 0.8 miles after 10 years, 1.5 miles after 20 years and 2.1 miles after 30 years of continuous injection. The maximum width of the plume would be 0.6 mile.

Based upon a different hydraulic gradient (0.7 ft./mile) determined from the heads in a well in Kanaha Pond (well not shown in Figure 2) and HC&S Pump 6 at Puunene, the zone of mixing would narrow to a width of 0.4 mile and extend 1.1

mile downgradient after 10 years, 2.0 miles after 20 years, and 3.0 miles after 30 years of steady injection at the rate of 0.44 mgd. The scenarios for a gradient of 0.45 ft./mile and 0.7 ft./mile are considered the best estimate of the maximum zone of mixing. Although the two scenarios assume no dispersion or mixing of the wastewater with the basal ground water, it is reasonable to assume that some mixing and dispersion will occur and cause the wastewater concentrations to dissipate and reach ambient groundwater quality within the extent of calculated zone of mixing.

The density of the wastewater, based upon salinity and total dissolved solids, will be equal to or slightly greater than the ambient ground water into which the wastewater will be injected. Consequently, the injection head, or rise in water level in each injection well above the ambient aquifer head should be very similar to the estimated drawdown of a well pumping at the injection rate, or about 0.5 feet. However in practice, injection wells have actual injection heads that exceed the theoretical injection head. This is due to the buoyancy of entrained air in the injected water column. Injection heads of several feet or more are anticipated for injection rates at 0.11 mgd per well. Such heads are confined to distances of several feet or tens of feet from the well and do not represent an overall rise in aquifer head.

POTENTIAL IMPACTS ON GROUND WATER

Groundwater Withdrawal

Changes in Water Levels. The project will require an estimated water supply of 220,000 gpd for each of four DTCC units which are planned for completion in four phases in the years 2006, 2010, 2014, and 2017 (or later). Thus, at full buildout of the project, an estimated 880,000 gpd (0.88 mgd) will be needed for the project. Using aquifer characteristics determined from pumping test data from Hamakuapoko Well 2 located in the eastern part of the Paia Aquifer System (Figure 2, Well I.D. #16), drawdown of groundwater levels in the aquifer due to the withdrawal of 0.88 mgd of brackish basal water for the project is estimated to be 0.6 feet in the project site and 0.07 feet at a distance of one mile after 365 days of pumping. HC&S Pump 6 (Figure 2, Well I.D. #14) is the nearest well to the project site. It is located 1.5 miles downgradient and has a pump capacity of 23.0 mgd. An

average of 18.2 mgd of brackish water is withdrawn for sugarcane irrigation (CWRM, 1996). This well has been in operation for many years since it was constructed in 1934 and, consequently, withdrawal of 18.2 mgd of ground water has not adversely affected the aquifer's 4.4 feet head. No adverse impact on groundwater levels is expected from the withdrawal of 0.88 mgd of brackish water for the project at full buildout and no mitigative measures are needed.

Changes in Water Quality. Pump 6, the nearest well to the project site, has a chloride range of 330 to 490 mg/l (potable water limit is 250 mg/l). The fact that well produces 18.2 mgd of water in such a narrow chloride range attests to the ability of the aquifer to sustain its water quality under heavy pumping conditions. The sustainable quality of the aquifer is further demonstrated by the fact that 1.3 mile further downgradient of Pump 6, HC&S develops from Pump 5 (Figure 2, Well I.D. #13) an additional 7.0 mgd of basal water having a chloride range of 430 to 700 mg/l. Pumps 5 and 6 lie between the project site and Kanaha Pond. Therefore the development of 0.88 mgd of brackish water for the project at full buildout is not expected to have any measurable or adverse impact on Kanaha Pond's water quality Consequently, no mitigative measures are anticipated or needed.

Effect on Existing Wells. The two nearest producing wells are HC&S' Pump 6 and Pump 9 (Figure 2, Well I.D. #14 and #12), located 1.5 and 1.8 miles from the project site. The nearest three other producing wells include HC&S' Upper Kihei Shaft, Pump 5, and Pump F (Figure 2, Well I.D. #4, #13, and #11) located 2.5, 2.8, and 3.3 miles, respectively, from the project site. As shown in Table 2, all five of these wells (shafts) develop a total of 80.6 mgd of ground water within a radius of approximately three miles of the project site. Thus, the withdrawal of 0.88 mgd, or 1.1% of 80.6 mgd of ground water for the project at full buildout is not expected to affect any existing wells. Actually, the project's net withdrawal from the basal aquifer will equal one-half of the 0.88 mgd because 0.44 mgd of wastewater will be re-injected into the basal aquifer with a quality similar to that of the existing downgradient wells. Therefore, no mitigative measures are needed.

Wastewater Disposal

The disposal of wastewater from the project by means of onsite injection wells is feasible because the project site lies makai of the Department of Health's

UIC line (see Figure 2) and is not expected to have any hydrologic impact on existing wells or the basal aquifer.

Each DTCC unit will produce an estimated 0.11 mgd of wastewater which will contain concentrations of chloride, nitrate, or other chemical constituents approximately double that of the supply water which is based on the monitor well data (see Tables 1 and 3). The wastewater will have a salinity of approximately 400 mg/l chlorides which is comparable to the salinity (330-490 mg/l chlorides) of HC&S Pump 6, the nearest existing well situated 1.5 miles downgradient of the project site. The density and temperature of the wastewater will be comparable to the ambient ground water and its overall quality will be suitable for irrigation purposes.

The zone of mixing, or plume of wastewater, as shown in Figure 2 will be an estimated 0.6 mile wide. Assuming the worst-case scenario of injecting the full buildout rate of 0.44 mgd from the beginning of plant operations with no dispersion, the plume of wastewater would extend downgradient of the project site a distance of 0.8 miles after 10 years, 1.5 miles after 20 years, and 2.1 miles after 30 years of continuous injection. However, this plume represents maximum dimensions because the full injection rate of 0.44 mgd will not be reached until at least 12 years and some dispersion will occur, causing the plume to decrease in size due to dilution to the ambient quality of the ground water. Injection heads of several feet or more are anticipated (due largely to air entrainment in the effluent) around the injection wells, but will not reflect an increase in aquifer head a short distance from the injection wells. As discussed earlier in this report, the planned wastewater disposal will not affect any existing wells.

Any potential impact from the use of injection wells will be mitigated by appropriate well design and testing to determine aquifer characteristics, such as hydraulic conductivity, salinity, temperature, and well performance. The injection wells will be constructed and operated in full compliance with Department of Health UIC Regulations.

Conclusions

The development of 0.88 mgd of nonpotable water required for the project at full buildout can be met by drilling and developing one or more wells onsite without

any adverse impact on the basal groundwater aquifer. Well drawdown is estimated to be less than a foot based upon pumping test data from Hamakuapoko Well 2 which presumably taps the same Honomanu basalts underlying the project site. No measurable effect or adverse impact is expected on existing wells or water quality from the withdrawal of 0.88 mgd, which represents only 1.1% of 80.6 mgd of ground water currently being withdrawn within a radius of 3.3 miles of the project site. Actually, the project's net withdrawal of ground water is half of the 0.88 mgd water supply needed for the project's DTCC units. This is because the resultant wastewater totals 0.44 mgd, which will be returned to the basal aquifer by means of injection wells. The existing wells within the 3.3 radius produce nonpotable ground water with chloride contents ranging from 430 to 700 mg/l and therefore no measurable effects on the water quality is expected.

The use of injection wells for the disposal of 0.44 mgd of wastewater will not impact the basal aquifer or any existing wells for several reasons. First, the rate of wastewater injection is extremely small when compared to the rate of groundwater movement which is indicated by the large withdrawals of ground water in the area. Secondly, the quality of the wastewater is estimated to be similar to the existing groundwater quality. Thirdly, the wastewater plume (Figure 2) will be diluted by mixing and diffusion and is not expected to be detectable at any existing well or coastal area as the plume becomes dispersed and diluted to ambient groundwater quality.

Because of the similarity between the quality of the wastewater and ground water, it may not be necessary or advisable to inject the wastewater in the saltwater zone below the basal brackish water lens.

Finally, because no site-specific data is available, a test well should be drilled as soon as possible to provide more detailed information on aquifer parameters and potential impacts.

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Table 1. GROUNDWATER QUALITY DATA (Landfill Monitor Wells, 5125-01, 02, 03)

ANALYTE		*Levels detected in monitoring wells:* lowest sample	highest sample	Hawaii Drinking Water Standards *
TOC	mg/l	ND'	17.00	--
Nitrate-N	mg/l	3.30	5.10	10.00
Chloride	mg/l	132.00	216.00	250.00
Sulfate	mg/l	29.00	71.00	250.00
Hardness	mg/l	172.00	202.00	--
Ammonia	mg/l	0.09	0.66	--
OH Alkalinity	mg/l	ND	ND	--
CO3 Alkalinity	mg/l	ND	ND	--
HCO3 Alkalinity	mg/l	239.00	395.00	--
Cyanide	mg/l	ND	0.04	--
TDS	mg/l	662.00	4,910.00	500.00
Antimony	mg/l	ND	0.02	--
Arsenic	mg/l	ND	0.03	0.05
Barium	mg/l	0.004	0.02	2.00
Beryllium	mg/l	ND	0.01	--
Cadmium	mg/l	ND	0.01	0.005
Calcium	mg/l	17.00	25.00	--
Chromium	mg/l	ND	0.01	0.10
Cobalt	mg/l	ND	0.004	--
Copper	mg/l	ND	0.03	1.00
Iron	mg/l	ND	0.27	0.30
Lead	mg/l	ND	0.01	0.05
Magnesium	mg/l	21.00	35.00	--
Manganese	mg/l	ND	0.15	0.05
Mercury	mg/l	ND	ND	0.002
Molybdenum	mg/l	ND	0.02	--
Nickel	mg/l	ND	0.03	--
Potassium	mg/l	9.50	24.00	--
Selenium	mg/l	ND	0.01	0.05
Silver	mg/l	ND	0.18	--
Sodium	mg/l	162.00	219.00	--
Thallium	mg/l	ND	ND	--
Vanadium	mg/l	0.01	0.03	--
Zinc	mg/l	ND	0.14	5.00

* Notes:
1. Drinking water standards based on Hawaii Dept. of Health, Safe Drinking Water Branch and EPA national secondary drinking water regulations.
2. "ND" indicates that the quantity of the analyte present in the sample was below detection limits.

Table 1. GROUNDWATER QUALITY DATA (cont'd)

ANALYTE		*Levels detected in monitoring wells:* lowest sample	highest sample	Hawaii Drinking Water Standards *
EPA Method 601/602, Purgable Halocarbons & Aromatics				
Benzene	µg/l	ND	ND	5.00
Carbon Tetrachloride	µg/l	ND	ND	5.00
Chlorobenzene	µg/l	ND	ND	100.00
o-Dichlorobenzene	µg/l	ND	ND	600.00
para-Dichlorobenzene	µg/l	ND	ND	75.00
1,2-Dichloroethane	µg/l	ND	ND	5.00
1,1-Dichloroethylene	µg/l	ND	ND	7.00
trans-1,2-Dichloroethylene	µg/l	ND	ND	100.00
DCP (1,2-Dichloropropane)	µg/l	ND	ND	5.00
Ethylbenzene	µg/l	ND	ND	700.00
Tetrachloroethylene	µg/l	ND	ND	5.00
Toluene	µg/l	ND	ND	1,000.00
1,1,1-Trichloroethane	µg/l	ND	ND	200.00
Trichloroethylene	µg/l	ND	ND	5.00
Vinyl Chloride	µg/l	ND	ND	2.00
Xylenes (total)	µg/l	ND	ND	10,000.00
All other analytes	µg/l	ND	ND	--
EPA Method 608, Organochloride Pesticides and PCBs				
Chlordane	µg/l	ND	ND	2.00
Endrin	µg/l	ND	ND	0.20
Heptachlor	µg/l	ND	ND	0.40
Heptachlor Epoxide	µg/l	ND	ND	0.20
Lindane (gamma-BHC)	µg/l	ND	ND	0.20
Methoxychlor	µg/l	ND	ND	40.00
PCB's	µg/l	ND	ND	0.50
Toxaphene	µg/l	ND	ND	3.00
All other analytes	µg/l	ND	ND	--
EPA Method 8260, Volatile Organics				
cis-1,2-Dichloroethylene	µg/l	ND	ND	70.00
Styrene	µg/l	ND	ND	100.00
TCP (1,2,3-Trichloropropane)	µg/l	ND	ND	0.80
All other analytes	µg/l	ND	ND	--
EPA Method 8150, Chlorinated Herbicides				
2,4-D	µg/l	ND	ND	70.00
2,4,5,-TP	µg/l	ND	ND	50.00
All other analytes	µg/l	ND	ND	--

Source of Data: FEIS for Expansion of Central Maui Sanitary Landfill Project (April 1996)

Table 2. RECORD OF SELECTED WELLS

ID No.	State Well No.	Well Name	Year Drilled	Owner/User	Csg. Dia. (in.)	Grnd Elev. (ft.)	Total Depth (ft.)	Csg. Depth (ft.)	Head (ft.)	Chloride (mg/l)	Pump Cap. (mgd)	Draft (mgd)	Use (type)
1	4626-01	Waiakoa Gulch	1949	Maui County	8	236	260	--	3.6	453	--	--	Unused
2	4727-01	Lower Kihei Shaft	1900	HC&S	--	26	23	--	3.5	455-644	4.77	3.5	Irrigation
3	4824-01	Kihei Expl.	1971	State DLNR	12	593	640	637	2.8	69	--	--	Unuused
4	4825-01	Upper Kihei Shaft	1900	HC&S	shaft	325	--	--	3.6	280-491	18.0	15.3	
5	5021-01	Pukalani	1972	Landco	16	1086	1130	1130	8.0 ?	490-576	--	--	Irrigation
6	5028-01	Waikapu Shaft TH	1926	HC&S	--	106	146	--	5.5	80-125	--	0.2	Lost
7	5125-01	MW-1	1995	Maui DPW	4.5	301.2	318	313	4.83	--	6	--	Monitor
8	5125-02	MW-2	1995	Maui DPW	4.5	221.3	1238	233	4.7	--	6	--	Monitor
9	5125-03	MW-3	1995	Maui DPW	4.5	241.2	258	253	4.7	--	6	--	Monitor
10	5128-01	Waikapu Shaft TH	1926	HC&S	6	145	185	--	5.0	270	--	--	Lost
11	5128-02	Waikapu SH-Pump F	1926	HC&S	--	126	129	--	5.7	250-620	36.0	28.9	Irrigation
12	5224-02	Puunene-Pump 9	1938	HC&S	--	207	202	--	4.3	275-425	15.14	11.2	Irrigation
13	5226-01	Puunene-Pump 5	1899	HC&S	--	40	48	--	4.6	430-700	9.14	7.0	Irrigation
14	5226-02	Puunene-Pump 6	1934	HC&S	--	182	176	--	4.4	330-490	23.0	18.2	Irrigation
15	5228-07	Reynolds 2	1959	Maui DWS	12	116	190	153	9.0; 3.9	115	--	--	Unused
16	5320-01	Hamakuapoko 2	1993	Maui DWS	12	780	812	810	4.66	49			Unused
17	5321-01	Kaheka-Pump 18	1938	HC&S	--	552	--	--	6.2	115-780	29.71	21.5	Irrigation

Table 2. RECORD OF SELECTED WELLS (Cont'd)

ID No.	State Well No.	Well Name	Year Drilled	Owner/User	Csg. Dia. (in.)	Grnd Elev. (ft.)	Total Depth (ft.)	Csg. Depth (ft.)	Head (ft.)	Chloride (mg/l)	Pump Cap. (mgd)	Draft (mgd)	Use (type)
18	5323-01	Paia-Pump 2	1929	HC&S	--	125	--	--	3.9	300-491	18.39	13.8	Irrigation
19	5419.01	Haiku	1979	State DOWALD	12	828	869	859	4.3	58-96	.50	--	Unused
20	5420-01	Maui High School	1964	Maui DWS	8	349	371	370	4.0; 3.4	94	.29	--	Unused
21	5420-02	Hamakuapoko 1	1992	Maui DWS	12	702	765	732	4.27	52	--	--	Unused
22	5422-01	Paia Mill-Pum 13	1923	HC&S	--	155	150	--	3.8; 5.2	166-453;335	13.29	10.7	
23	5422-02	Paia-Pump 17	1932	HC&S	--	295	--	--	4.0	185-343	11.51	8.7	
24	5423-02	Low Paia-Pump 16	1899	HC&S	--	25	--	--	--	335-1499	27.14	17.0	
25	5424-01	Sprecklsvl Pump 4	1911	HC&S	--	40	--	--	3.5	400-630	8.83	6.7	Irrigation
26	5425-01	Sprecklsvl	1895	HC&S	--	35	--	--	3.3	850	--	5.0	Sealed

Explanation:
HC&S - Hawaiian Commercial & Sugar
DLNR - Department of Land & Natural Resources
DPW - Department of Public Works
DWS - Department of Water Supply
DOWALD - Division of Water & Land Development

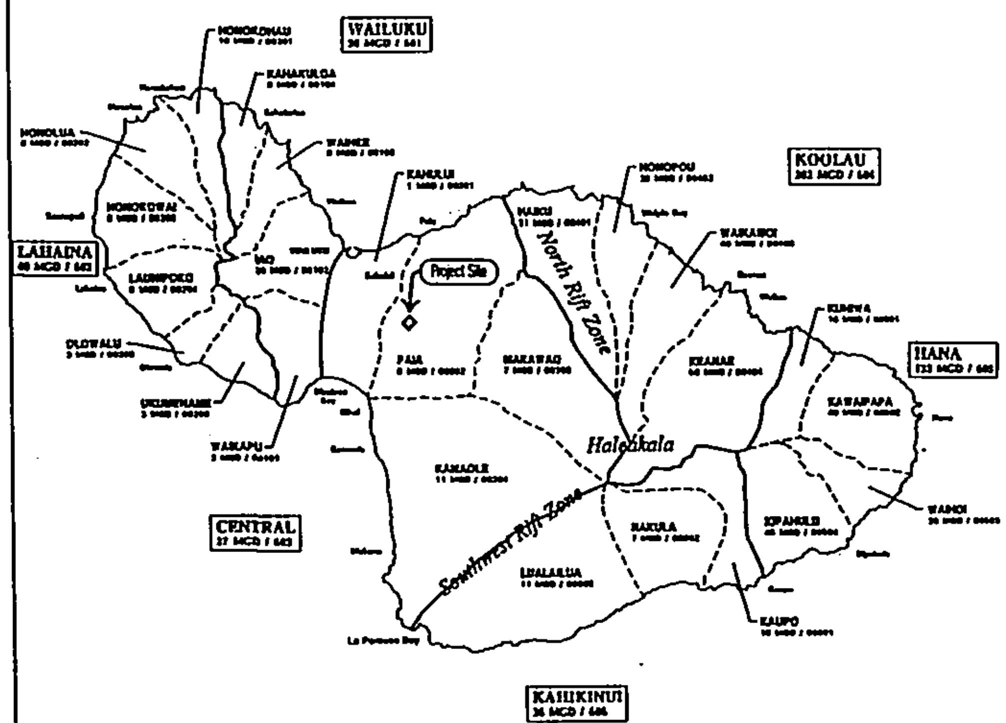
Waena

Table 3. ESTIMATED WASTEWATER QUALITY

Parameter	mg/l
Ammonia (NH3)*	0.76
Bicarbonate (as HCO3)*	634
BOD	1.62
Carbon Dioxide	90
Chloride*	400
Conductivity, umhos	1500
Fluoride	0.31
Hardness*	374
Nitrate*	8.4
Nitrite	1.93
Nitrogen	0.34
Oil & grease	<5
pH	6.91
Phosphorus	0.33
Silica	56
Sulfate*	100
Total Organic Carbon*	17
Total Suspended Solids	<1
Total Alkalinity*	634
Total Dissolved Solids*	5572
Turbidity	0.65
Calcium*	42.0
Chromium*	0.02
Magnesium*	56
Potassium*	34
Sodium*	381

*Based on data from Landfill Monitor Wells 5125-01, 02, 03; otherwise from Maui Electric Company, Limited's Maalaea Injection Well.

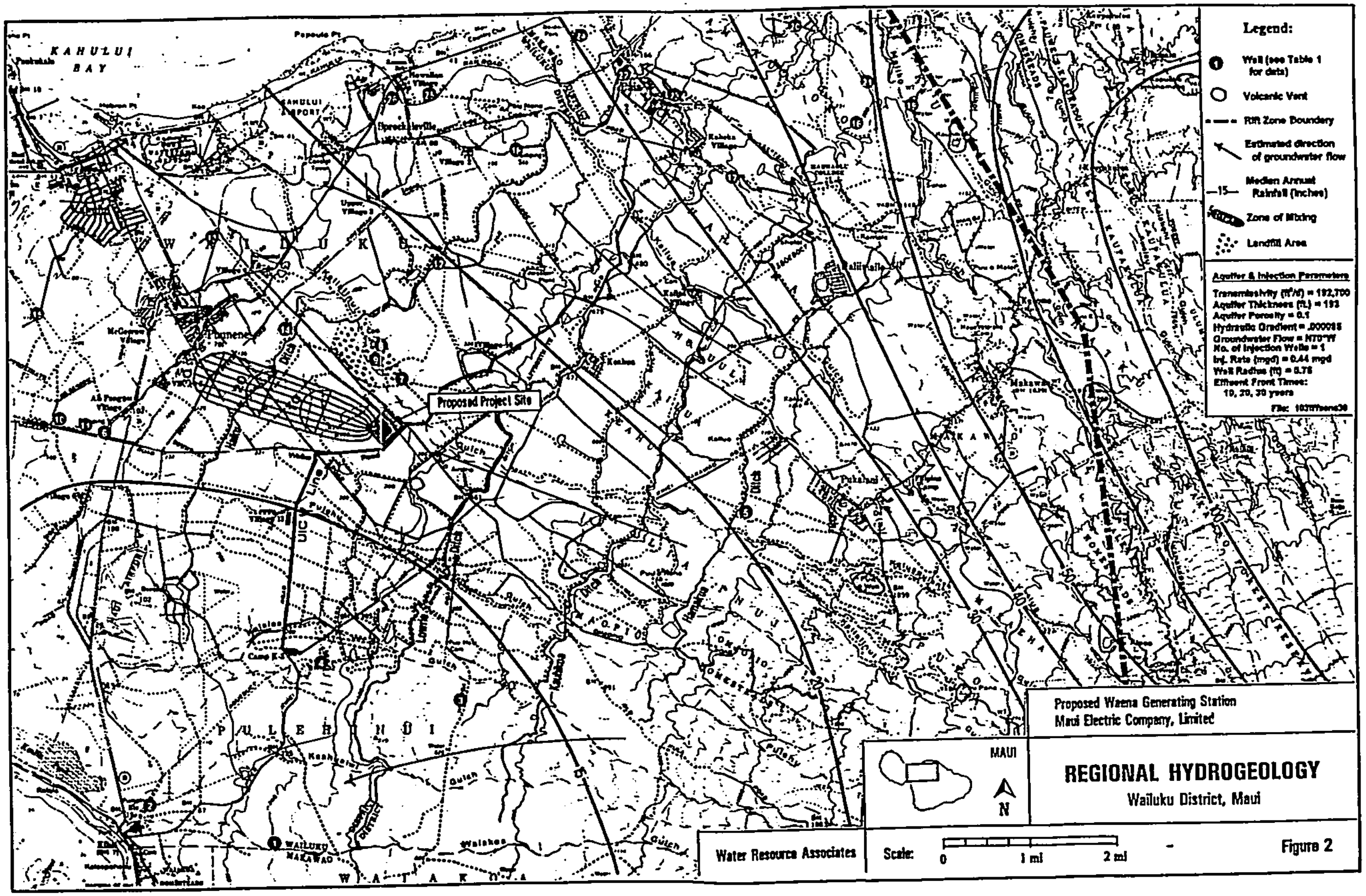
ISLAND OF MAUI
TOTAL = 476 MGD
HYDROLOGIC UNITS
Sustainable Yield / Aquifer Code



Proposed Waena Generating Station
Maui Electric Company, Limited

AQUIFER SYSTEMS OF MAUI

Water Resource Associates | Source: Commission on Water Resource Management, 1995 | Figure 1



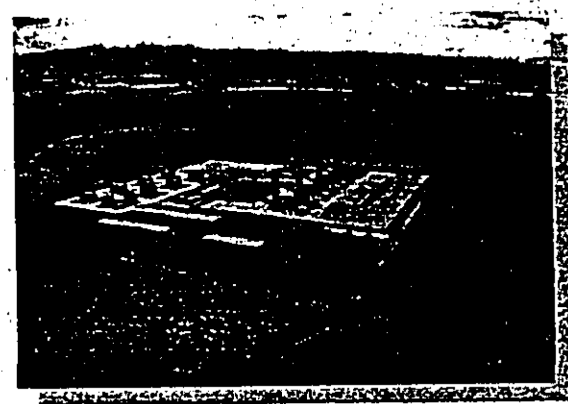
Proposed Waena Generating Station
Maui Electric Company, Limited

REGIONAL HYDROGEOLOGY

Wailuku District, Maui

Figure 2

DOCUMENTS CAPTURED AS RECEIVED



APPENDIX F

BIOLOGICAL RESOURCES SURVEY

BIOLOGICAL RESOURCES SURVEY REPORT FOR MAUI ELECTRIC COMPANY, LIMITED'S PROPOSED WAENA GENERATING STATION AND EASEMENTS FOR TRANSMISSION LINES, CENTRAL MAUI, HAWAII

FOR
CH2M HILL
1585 KAPIOLANI BOULEVARD, SUITE 1420
HONOLULU, HAWAII 96814

BY
EVANGELINE J. FUNK, PH.D.
BOTANICAL CONSULTANTS
HONOLULU, HAWAII
MARCH 1997

INTRODUCTION

The approximately sixty-seven acre site for the proposed Waena Generating Station is located on the northwestern corner of Pulehu and Waiko Roads. The easements for the proposed transmission lines proceed from the northeastern corner of the proposed Waena Generating Station site in a northwesterly direction along Pulehu Road for approximately two miles to Firebreak Road. There are two proposed routes westward from Pulehu Road to the aqueduct, then northwesterly to an established water pump near the junction of Central Power Plant Road and Pulehu Road. At the water pump the proposed transmission line easement makes a 90 degree turn to the southwest for about one half mile to its terminus at the Puunene Sugar Mill.

The second leg of the proposed transmission line easement leaves Pulehu Road and travels in a northeasterly direction for approximately two miles along North Firebreak Road where it turns in a more northerly direction to follow Makapit Road until it merges with Sunny Side Road. It follows Sunny Side Road for approximately four miles to the Paia Sugar Mill.

The proposed Waena Generating Station site is presently under cultivation. The crop is sugarcane (*Saccharum officinarum* L.). The proposed transmission line easements either follow paved roads (Pulehu Road), gravel roads (North Firebreak Road), or aqueduct routes. A botanical survey of all of these areas was carried out in March 1997.

BIOLOGICAL HISTORY

Several biological surveys have been done in the general area of these proposed projects. A 1993 botanical survey for a proposed East Maui Water Development Plan covered part of the same route from Paia, Maui along Sunny Side Road to Makapit Road (Funk 1993). In 1995 both flora and fauna surveys were carried out for the proposed Kahului Airport Improvements (Noda 1996). These surveys covered all of the area northwest of Hana Highway eastward to Spreckelsville, Maui. An addendum to the proposed Kahului Airport Improvements EIS surveyed the area from Hana Highway to Pulehu and Hansen Roads (Funk 1996). The 1995 report listed the largest number of native Hawaiian plants, probably because large portions of the coastal lands it covered have not been completely domesticated.

BOTANICAL SURVEY REPORT

METHODS

The sixty-seven acres for the proposed Waena Generating Station site are presently a dense monoculture of sugar cane. Only brief forays into this area were made. The three accessible edges of this site i.e. a cane haul road along the southwestern boundary, the edge along Waiko Road, and the Pulehu Road edge were sampled by way of a walk through survey.

All of the proposed transmission line easements were also surveyed by way of walk through surveys and both sides of all transmission line routes were covered.

RESULTS

Two vegetation types were found, Sugarcane Fields and Ruderal Vegetation. There was some variation in the shrub and tree distribution along the roadways where Ruderal Vegetation was most commonly found.

Sugarcane Fields

As mentioned earlier, this vegetation type is found on the Proposed Waena Generating Station site and consists of a densely growing, large grass, *Saccharum officinarum*. Individual plants can attain a height of from 8 to 12 feet. Some were flowering. This vegetation type grows so densely that

other plants cannot penetrate into the fields.

Ruderal Vegetation

Ruderal or weedy vegetation is found around the proposed Waena Generating Station site and along most of the proposed transmission line easements. The Ruderal fringe around the generating plant site is very mixed. There are mixed grasses such as buffel grass (*Cenchrus ciliaris* L.), sour grass (*Digitaria insularis* (L.) Mez ex Ekman), star grass (*Chloris divaricata* R. Br.) and wiregrass (*Eleusine indica* (L.) Gaertn.) mixed in with many species of seed bearing, thorny weeds. Most prominent among these are spiny amaranth (*Amaranthus spinosus* L.), *Bidens cynapiifolia* Kunth, sow thistle (*Sonchus oleraceus* L.), cheese weed (*Malva parviflora* L.) rattle box (*Crotalaria berteroana* DC), and apple of Peru (*Nicandra physalodes* (L.) Gaertn.).

Along the proposed transmission line easement on both sides of Pulehu Road from the corner of the proposed Waena Generating Station site to North Firebreak Road, the common vegetation is mixed grasses, mainly buffel grass and Guinea grass (*Panicum maximum* Jacq.) with a great variety of weedy herbs mixed in. There are also some woody plants to be found along this part of the easement, notably near the old cistren. Scattered koa haole shrubs (*Leucaena leucocephala* (Lam.) deWit), and java plum trees (*Syzygium cumini* (L.) Skeels), as well as some huge, planted ear pod trees (*Enterolobium cyclocarpum* Jacq.) Griseb.) and monkey pod trees (*Samanea saman* (Jacq.) Merr.) along the road where it crosses the Haiku Ditch. From the Haiku Ditch to the Puunene Sugar Mill the route of the easement passes through an area of fallow fields, young sugar fields, or segments where the wayside vegetation has been removed. Only near the pump and at the approach to the Puunene Sugar Mill

SPECIES LIST

In the following species list the plant families have been arranged alphabetically within three groups, Monocotyledons, and Dicotyledons. The genera and species have been arranged alphabetically within the families. The taxonomy and nomenclature follow that of Wagner, Herbst, and Sohmer (1990), St.John (1973), and Neal (1965). For each taxon the following information is provided:

1. An asterisk before the plant name indicates a plant introduced to the Hawaiian Islands since Captain Cook or by the aborigines.

2. The scientific name.

3. The Hawaiian name or the mostly widely used common name.

4. Species abundance. <u>Abundance ratings are for this site only</u> and they have the following meanings:

Uncommon = a plant that was found less than five times.

Occasional = a plant that was found between five to ten times.

Common = a plant considered an important part of the vegetation.

Locally abundant = plants found in large numbers over a limited area. For example the plants found in grassy patches.

This species list is the result of an extensive survey of this site completed at the end of the rainy season (March 1997) and it reflects the vegetative composition of the flora during a single season. Changes in the vegetation will occur due to introductions and losses and a slightly different species list would result from a survey conducted during a different growing season. In addition there may be environmental factors such as fire which will lead to species composition alteration.

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
MONOCOTYLEDONS		
ARECACEAE - Palm Family		
*Phoenix sylvestris Roxb.	Date palm	Uncommon
CYPERACEAE - Sedge Family		
**Cyperus rotundus* L.	Nut grass	Locally abundant
POACEAE - Grass Family		
**Bothriochloa pertusa* (L.) A. Camus	Pitted beardgrass	Locally abundant
**Cenchrus ciliaris* L.	Buffelgrass	Common
**Cenchrus echinatus* L.	Common sandbur	Occasional
**Chloris barbata* (L.) Sw	Swollen fingergrass	Common
**Chloris divaricata* R. Br.	Stargrass	Locally abundant
**Chloris virgata* Sw.	Feather fingergrass	Occasional
**Cynodon dactylon* (L.) Pers.	Bermuda grass	Locally abundant
**Digitaria ciliaris* (Retz.) Koeler	Henry's crabgrass	Occasional
**Digitaria insularis* (L.) Mez ex Ekman	Sourgrass	Locally abundant
**Echinochloa colona* (L.) Link	Jungle-rice	Locally abundant
**Eleusine indica* (L.) Gaertn.	Wiregrass	Occasional
**Eragrostis cilianensis* (All.) Link	Stinkgrass	Locally abundant
**Eragrostis tenella* (L.) P. Beauv. ex Roem. & Schult.		Occasional
**Leptochloa uninervia* (K. Presl) Hitchc. & Chase		Locally abundant
**Panicum maximum* Jacq.	Guinea grass	Abundant
**Pennisetum purpureum* Schumach.	Elephant grass	Occasional
**Rhynchelytrum repens* (Willd.) Hubb.	Natal redtop	Uncommon
**Saccharum officinarum* L.	Sugar	Common
**Sacciolepis indica* (L.) Chase	Glenwood grass	Uncommon
DICOTYLEDONES		
ACANTHACEAE - Acanthus Family		
**Asystasia gangetica* (L.) T. Anderson	Chinese violet	Uncommon
AMARANTHACEAE - Amaranth Family		
**Amaranthus spinosus* L.	Spiny amaranth	Locally abundant
**Amaranthus viridis* L.	Slender amaranth	Occasional
APIACEAE -Parsley Family		
**Ciclopermum leptophyllum* (Pers.) Sprague	Fir-leaved celery	Locally abundant
**Daucus pusillua* Michx.	American carrot	Occasional

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
ASTERACEAE - Sunflower Family		
Bidens alba (L.) DC		Occasional
Bidens cynapiifolia Kunth		Common
Calyptocarpus vialis Less.		Locally abundant
**Emilia coccinea* (Sims) G. Don	Flora's paintbrush	Common
**Emilia sonchifolia* (L.) DC	Flora's paintbrush	Common
**Erechtites hieracifolia* (L.) Raf. ex DC		Occasional
**Galinsoga parviflora* Cav.		Locally abundant
**Parthenium hysterophrus* L.	False ragweed	Occasional
**Pluchea symphytifolia* (Mill.) Gillis	Sourbush	Uncommon
**Sonchus oleraceus* L.	Sow thistle	Common
**Synedrella nodiflora* (L.) Gaertn	Nodeweed	Locally abundant
**Tagetes minuta* L.	Marigold	Uncommon
**Tridax procumbens* L.	Coat buttons	Uncommon
**Verbesina encelioides* (Cav.) Benth & Hook.	Golden crown beard	Occasional
**Xanthium strumarium* L.	Cockle bur	Locally abundant
BIGNONIACEAE - Bignonia Family		
**Spathodea campanulata* P. Beauv.	African tulip	Uncommon
BORAGINACEAE - Borage Family		
**Heliotropium amplexicaule* Vahl.		Uncommon
BRASSICACEAE - Mustard Family		
**Brassica nigra* (L.) W. Koch	Black mustard	Common
**Capsella rubella* Reut.	Shepard's purse	Occasional
**Lepidium virginicum* L.		Locally abundant
**Lobularia maritima* (L.) Desv.	Sweet alyssum	Occasional
CAPPARACEAE - Caper Family		
**Cleome gynandra* L.	Wild Spider Flower	Common
CARYOPHYLLACEAE - Pink Family		
**Silene gallica* L.	Small-flowered catch fly	Occasional
CHENOPODIACEAE - Goosefoot Family		
**Atriplex semibacata* R. Br.	Australian saltbush	Uncommon
**Chenopodium murale* L.	Aheahea	Uncommon

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
CONVOLVULACEAE - Morningglory Family		
**Ipomoea indica* (J. Burm.) Merr.	Koali	Uncommon
**Ipomoea triloba* L.	Little bell	Locally abundant
Jacquemontia ovalifolia (Choisy) H. Hallier	Pa'uohi'iaka	Occasional
**Merremia aegyptia* (L.) Urb.	Hairy merremia	Occasional
CUCURBITACEAE - Gourd Family		
**Momordica charantia* L.	Balsam pear	Occasional
EUPHORBIACEAE - Spurge Family		
**Chamaesyce hirta* (L.) Millsp.	Hairy spurge	Common
**Chamaesyce hypericifolia* (L.) Millsp.	Graceful spurge	Common
**Chamaesyce prostrata* (Aiton) Small	Prostrate spurge	Occasional
**Euphorbia cyathophora* J. A. Murry	Mexican fire plant	Occasional
**Ricinus cummunis* L.	Castor bean	Occasional
FABACEAE - Bean Family		
**Chamaecrista nictitans* L.	Partridge pea	Occasional
**Crotalaria pallida* Aiton	Smooth rattlepod	Common
**Crotalaria berteroana* DC		Occasional
**Desmanthus virgatus* (L.)	Slender mimosa	Locally abundant
**Desmodium triflorum* (L.) DC		Occasional
**Enterolobium cyclocarpum* (Jacq.) Griseb.	Earpod	Uncommon
**Glycine wightii* (Wight & Arnott) Verdc.		Uncommon
**Indigo spicata* Frossk.	Creeping indigo	Occasional
**Indigo suffruticosa* Mill	Indigo	Occasional
**Leucaena leucocephala* (Lam). deWit	Koa haole	Common
**Macroptilium atropurpureum* (DC) Urb.		Locally abundant
**Medicago polymorpha* L.	Bur clover	Occasional
**Melilotus indica* (L.) All.		Occasional
**Pithecellobium dulce* (Roxb.) Benth	Opiuma	Locally abundant
**Prosopis pallida* Kunth	Kiawe	Occasional
**Samanea saman* (Jacq.) Merr.	Monkey pod	Common
**Senna occidentalis* (L.) Link	Coffee senna	Occasional
GERANIACEAE - Geranium Family		
**Erodium cicutarium* (L.) L'Her.	Pin clover	Uncommon
LAMIACEAE - Mint Family		
**Leonotis nepetfolia* (L.)		Occasional

is any vegetation to be found; sugarcane and koa haole near the pump, and Guinea grass and koa haole near the mill.

The only native Hawaiian plants found during the survey, 'ilima (*Sida fallax* Walp) and pa'uohi'iaka (*Jacquemontia ovalifolia* Hallier) were found along Pulehu Road near the landfill road.

Along North Firebreak Road eastward from Pulehu Road for about one eighth of a mile, there can be found some very mixed, weedy vegetation. Guinea grass, swollen finger grass (*Chloris barbata* (L.) Shaw), feather fingergrass (*Chloris virgata* Sw.), and bristly foxtail grass (*Setaria verticillata* (L.) P. Beauv.) are mixed with castor bean (*Ricinus communis* L.), hairy merremia (*Merremia aegyptia* (L. Urb.), Mexican poppy (*Argemone mexicana* L.), *Erechtites hieracifolia* (L.) Raf. ex DC, cheese weed, and many others. From this point eastward to Sunny Side Road, there are small, scattered patches of Bermuda grass (*Cynodon dactylon* (L.) Pers.), Mexican poppy, wild spider flower (*Cleome gynandra* L.), and other weed species.

For a short distance along both sides of Sunny Side Road can be found woody koa haole and castor bean shrubs, as well as, mixed grasses and forbs. However, along most of Sunny Side Road, past Puunene Cinder cone to Paia Mill, the ground layer vegetation on both sides of the easement has been removed. Only in one big bend in the road does the easement go through a swale where fairly dense ruderal vegetation occurs. Here can be found some elephant grass (*Pennisetum purpureum* Schumach.), koa hole, castor bean, lion's ear (*Leonotis nepetaefolia* (L.) R. Br.), and a China berry tree (*Melia azedarach* L.) or two. Beyond this swale there are only intermittent koa hole shrubs, some monkey pod, earpod, 'opiuma (*Pithecellobium dulce* (Roxb.) Benth.), and banyan trees (*Ficus microcarpa* L. fil.). The ground layer has been sprayed.

CONCLUSIONS

The two plant species mentioned earlier, 'ilima and pa'uohi'iaka are the only native Hawaiian taxa found either on the sixty-seven acre proposed Waena Generating Station site or along the approximately ten miles of proposed transmission line easements. 'Ilima and pa'uohi'iaka are common to the lowlands of all the major Hawaiian Islands and not considered to be rare or threatened in anyway. The remainder of the flora consists of alien species. This project will have very little impact on the flora of the area.

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
MALVACEAE - Hibiscus Family		
**Abutilon grandifolium* (Willd.) Sweet	Hairy abutilon	Occasional
**Malva parviflora* L.	Cheese weed	Locally abundant
**Malvastrum coromandelianum* (L.) Garcke	False mallow	Occasional
Sida fallax Walp.	'Ilima	Occasional
**Sida rhombifolia* L.		Occasional
**Sida spinosa* L.	Prickly sida	Occasional
MELIACEAE - Mahogany Family		
**Melia azedarach* L.	Chinaberry	Occasional
MORACEAE - Mulberry Family		
**Ficus microcarpa* L. fil	Banyan	Occasional
MYRTACEAE - Myrtle Family		
**Syzygium cumini* (L.) Skeels	Java plum	Occasional
NYCTAGINACEAE - Four-o'clock Family		
**Bougainvillea spectabilis* Willd.	Bougainvillea	Occasional
**Boerhavia coccinia* Mill.		Occasional
**Boerhavia repens* L.	Occasional	
**Mirabilis jalapa* L.	Four-o'clock	Uncommon
PAVPAVERACEAE - Poppy Family		
**Argemone mexicana* L.	Mexican poppy	Common
POLYGONACEAE - Buckwheat Family		
**Antigonon leptopus* Hool. & Arnott	Mexican creeper	Occasional
**Emex spinosa* (L.) Campd.	Emex	Uncommon
PORTULACACEAE - Purslane Family		
**Portulaca oleracea* L.	Pig weed	Occasional
PROTEACEAE - Protea Family		
**Grevillea robusta* A. Cunn. ex R. Br.	Silk oak	Uncommon

SCIENTIFIC NAME	COMMON NAME	ABUNDANCE
SOLANACEAE - Nightshade Family		
**Datura stramonium* L.	Jimson weed	Occasional
**Lycopersion pimpinellifolium* (Jusl.) Mill.	Currant tomato	Occasional
**Nicandra physalodes* L. Gaertn.	Apple of Peru	Common
**Solanum americanum* Mill.	Popolo berry	Occasional
**Solanum linnaeanum* Hepper & Jarger	Apple of Sodom	Common
**Solanum seaforthianum* Andr.		Occasional
STERCULIACEAE - Cacao Family		
Waltheria indica L.	'Uhaloa	Common
VERBENACEAE - Verbena Family		
**Stachytarpheta dichotoma* (Ruiz & Pav.) Vahl		Common

FAUNA SURVEY REPORT FOR THE PROPOSED WAENA GENERATING STATION AND EASMENTS FOR TRANSMISSION LINES SITE

INTRODUCTION AND METHODS

This report summarizes the results of a fauna survey of the proposed Waena Generating Station site and easements for transmission lines which was conducted in March, 1997. Two recent studies carried out in the same general area contain reports on flora and fauna found in the vicinity of the proposed Waena Generating Station and proposed transmission lines easments. The most thorough is found in the Environmental Impact Statement for the Kahului Airport Improvements (Noda 1996). The second, a review of several possible sites for a power plant in Central Maui (Dames & Moore 1995) covered several sites, none in depth. However, virtually nothing has been published on either the birds or the mammals of the region, probably because this area has been under cultivation for more than a century. The standard references for birds of Hawaii (Munro 1944, Berger 1981, Hawaii Audubon Society 1984) do not specify the area in their distribution of species.

Three fixed station observation points (20 minutes at each station), one along the cane haul road and two along Waiko Road were carried out for the proposed Waena Generating Station site and five fixed station observation points of twenty minutes each were conducted along the transmission easements. Observations were made during early daylight hours in order to take advantage of the higher activity levels of both birds and mammals during cooler parts of the day. In addition, forty-five minute observation periods were conducted from twilight to early darkness on two consecutive evenings to determine if the Hawaiian hoary bat or Hawaiian owl are present in this area. Only the nonmigratory barn owl (*Tyto alba*) was found.

RESULTS

Mammals - Only one species of mammal was found during the survey. Individual Mongooses (*Herpestes auropunctatus*) were seen along the cane haul road, Waiko Road, and North Firebreak Road. The mongoose is a mammal which was introduced into Hawaii and is not considered to be endangered or threatened in any way.

Past and present use of these sites; i.e., the growing of sugarcane and the nearby landfill, may have encouraged the development of rodent populations. However, at the time of the survey no other mammals except the mongooses were seen, but it must be assumed that the ubiquitous house mouse (*Mus musculus*) and at least one species of rat, most likely the black rat (also known as the roof, house, or ship rat) (*Rattus rattus*), both known to feed on sugarcane nodes, are both present on the site.

Birds - Because the entire site has been extensively modified from its original state, it has almost no value as native bird habitat. However, it does support a variety of non-native species. Most of the bird observation stations were in areas where trees or large shrubs were present and the understory had not been sprayed. The weedy vegetation of the site provides a rich source of food for many species of small, seed eating birds. Fourteen species of introduced birds were found during the survey and all are listed below. No threatened or endangered species were found. The annotated checklist follows the nomenclature of Pratt, Bruner and Berrett (1987).

SPECIES LIST

Family Passeridae: Old World Sparrows

Passer domesticus (House sparrow)

House sparrows are sometimes called feathered mice. These streaky brown and gray birds are a familiar commensal species and were seen on powerlines, in the big trees near the old reservoir, and in the koa haole near the Paia Sugar Mill.

Family Ardeidae: Herons, Egrets and Bitterns

Bubulcus ibis (Cattle egret)

Several of these large, white birds were seen flying above the cane fields and along the roads especially near the landfill.

Introduced in 1957 to help control cattle insect pests, cattle egrets have proliferated and are now pests themselves.

Family Fringillidae: Carduline Finches

Carpodacus mexicanus (House finch)

The house finch is a small, sparrowlike bird with a streaked appearance. The head, throat and breast of male birds may vary from dull yellow to bright red. The females and the bodies of males are similar with gray to black streaks of color.

Introduced into Hawaii during the last century, the house finch has adapted and is now widespread throughout the islands. Many pairs of birds were seen around the old reservoir and near the road to the landfill.

Family Emberizidae: Emberizine Finches

Cardinalis cardinalis (Northern cardinal)

Northern cardinals, both males and females were seen in trees and shrubs in all parts of the study area in low numbers. The bright red coloring of the

male bird make him easily recognizable. The call of these birds is very distinctive.

Family Columbidae: Pigeons and Doves

Streptopelia chinensis (Spotted Dove)

The spotted dove is a large bird which is grayish brown with rosy blushed breast feathers. At the sides and back of the neck is a patch of black with white spots. The spotted dove is one of the most commonly found birds along the cane haul roads, especially where grass seed is plentiful. Other individuals were seen on the power lines and in flight.

Columba livia (Rock Dove)

Rock doves are known as pigeons and are often seen in parks. They are plump birds, often with mixed plumage. A large flock of mixed plumage rock doves flew over the proposed generating plant site near Pulehu Road.

Geopelia striata (Zebra Dove)

This ground dwelling, seed eating dove is smaller and often more abundant than the spotted dove. Zebra doves were one of the most commonly found birds on this site. They appear to favor the open weedy places, cane haul roads, powerlines and trees.

Family Sturnidae: Starlings and Mynas

Acridotheres tristis (Common Myna)

The ubiquitous myna is a plump, brown bird with a black head and tail. It has a white belly, tail tip and wing patches, and bright yellow legs, feet, bill, and eye liners. Mynas are present in all parts of the areas in the trees, along roads, in abandoned cane fields, and along the landfill road.

Family Phasianidae: Gallinaceous Birds

Francolinus pondicerianus (Gray Francolin)

Two nondescript female gray francolins were seen in a fallow field near the water pump. These plump, sandy colored birds seldom fly, but run very fast and are often hard to see.

Family Estrildidae: Waxbills, Mannikins, and Parrotfinches

Lonchura punctulata (Nutmeg Mannikin)

Many of these tiny, dark brown finches with grey appearing breasts were seen in the abandoned sugar fields where large colonies of weedy plants had gone to seed. They were also found in the dense Guinea grass stands near the houses in Paia. Nutmeg mannikins form large flocks and are often seen perched on waving grass heads.

Lonchura malabarica (Warbling Silverbill)

This finch is tiny, sand colored, and hard to see. They are more likely to be heard in the kiawe or koa haole trees. Silverbills were seen in the kiawe trees near the old reservoir.

Family Alaudidae: Larks

Alauda arvensis (Eurasian Skylark)

A single skylark was seen in an open field along Sunny Side Road. It appeared brown because of it light and dark brown streaks. Some white appeared in its tail feathers.

Family Tytonidae: Barn-owls

Tyto alba (Common barn-owl)

Barn-owls were seen and are reported to be very common near the sugar fields of central Maui where they probably feed on the rodents that infest these sites. These are large, light colored birds that are often perch on powerlines just after sunset.

ENDANGERED SPECIES

No candidate, proposed, or listed threatened or endangered species as set forth in the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543), were found on the proposed Waena Generating Station Site or along the transmission line easements.

No hoary bats (*Lasiurus cinereus semotus*) were seen during this survey. These mammals are rare on Maui and generally roost at higher elevations, although they have been recorded at elevations as low as four hundred feet (Kramer 1971). The proposed project area is not hoary bat habitat and it contains no known bat roosting sites nor is it a suitable area for foraging. This project will not result in the removal of habitat necessary for bat survival and would have no impact upon this endangered species.

RECOMMENDATIONS

Some sea birds such as petrels and shearwaters are known to nest in high, craggy places such as the rim of Haleakala Crater. Although none were seen during the survey, they are known to leave their burrows at night and on some islands they are known to be confused by bright lights. Although this has not been known to be a problem on Maui and very likely will not be a problem at this site, it is highly recommended that all outside night lights be hooded to protect the night fliers.

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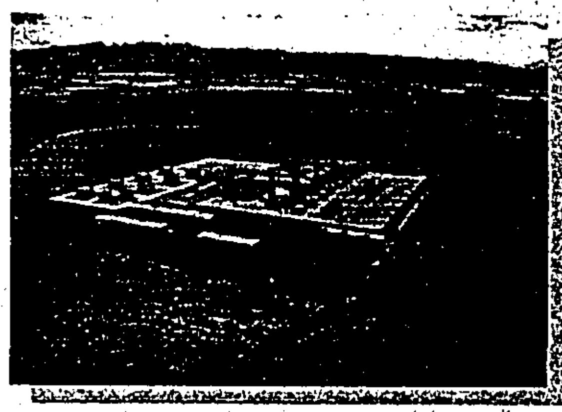

APPENDIX G

ARCHAEOLOGICAL INVENTORY SURVEY

SCS Project Number 102-1

AN ARCHAEOLOGICAL INVENTORY SURVEY OF THE PROPOSED MAUI ELECTRIC COMPANY, LIMITED'S WAENA GENERATING STATION AND TRANSMISSION LINE CORRIDORS, WAILUKU AND MAKAWAO DISTRICTS, ISLAND OF MAUI, HAWAI'I (TMK: 2-5, 3-8)

By:
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April 1997

Prepared for:

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ABSTRACT

At the request of CH2M Hill, Scientific Consultant Services, Inc. (SCS) conducted an archaeological inventory survey of Maui Electric Company, Limited's proposed 67 acre Waena Generating Station site and c. 10 miles of proposed and alternative transmission line routes in Wailuku and Makawao Districts, [TMK:2-5 and 3-8]. The purpose of the survey was to identify any archaeological remains within the area. Field work was conducted on March 13, 1997 by Project Directors Berdena Burgett and Amy Dunn. Dr. Robert L. Spear provided overall direction for the project. No archaeological remains were identified in the survey area and no further archaeological work is recommended.

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FIGURES

INTRODUCTION

At the request of CH2M Hill, Scientific Consultant Services (SCS) conducted archaeological studies at Maui Electric Company, Limited's proposed Waena Generating Station location and associated transmission line corridors in Wailuku and Makawao Districts, Island of Maui [TMK: 2-5,3-8] (Figure 1). The purpose of the current study was to locate and document any archaeological resources within the proposed project areas.

Field work was conducted on March 13, 1997 by Project Directors Berdena Burgett and Amy Dunn.

The current study area is located on the dry central plain of Maui. The area ranges in elevation from 60 ft. above mean sea level (AMSL) at the Puunene end to 360 feet AMSL at the generating station plant site and from 100 to 200 feet AMSL along the proposed upper powerline corridor to Paia.

The survey area includes a c.67.0 acre electric generating station site located at the junction of Waiko and Pulelu Roads and c.10.0 miles of proposed and alternative transmission line routes. The proposed routes extend northwest from the generating station site; a lower route continues c.2.5 miles to a small pump station, then turns southwest to Puunene. At the junction of Pulehu and North Firebreak Road a second route leads generally northeast to the mill at Paia (Figures 2 and 3). Figures 4 and 5 show additional views of the project area including the aquaduct channel.

Average monthly rainfall within the project area measures 5 inches or less and monthly daytime temperatures range between 79 and 89 degrees Fahrenheit (Armstrong 1983: 63,64). Soils in the area are described as moderately deep to deep silty clay loams, (Molokai, Eva, Waiakoa, and Paia Series) on nearly level to moderately steep slopes (0-3% to 7-15%). These well-drained soils have moderately fine textured subsoils and are found on low uplands (Foote *et al.* 1972). With the exception of existing powerline corridors and leveled clearings containing piled rocks, the entire study area is currently under sugarcane cultivation (*Saccharum officinarum L.* hybrid).

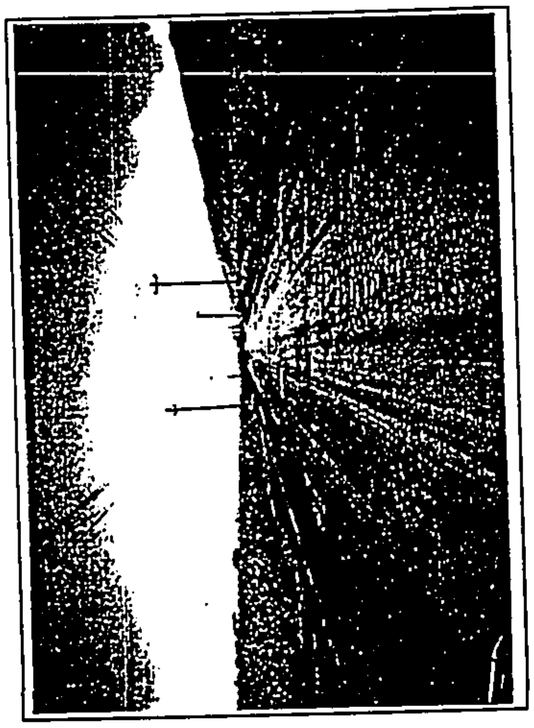

FIGURE 2: GENERAL PROJECT AREA VIEW, NORTH FIREBREAK ROAD VIEW TO SOUTH.

FIGURE 3: GENERAL PROJECT AREA VIEW, NORTH FIREBREAK ROAD VIEW TO NORTH.

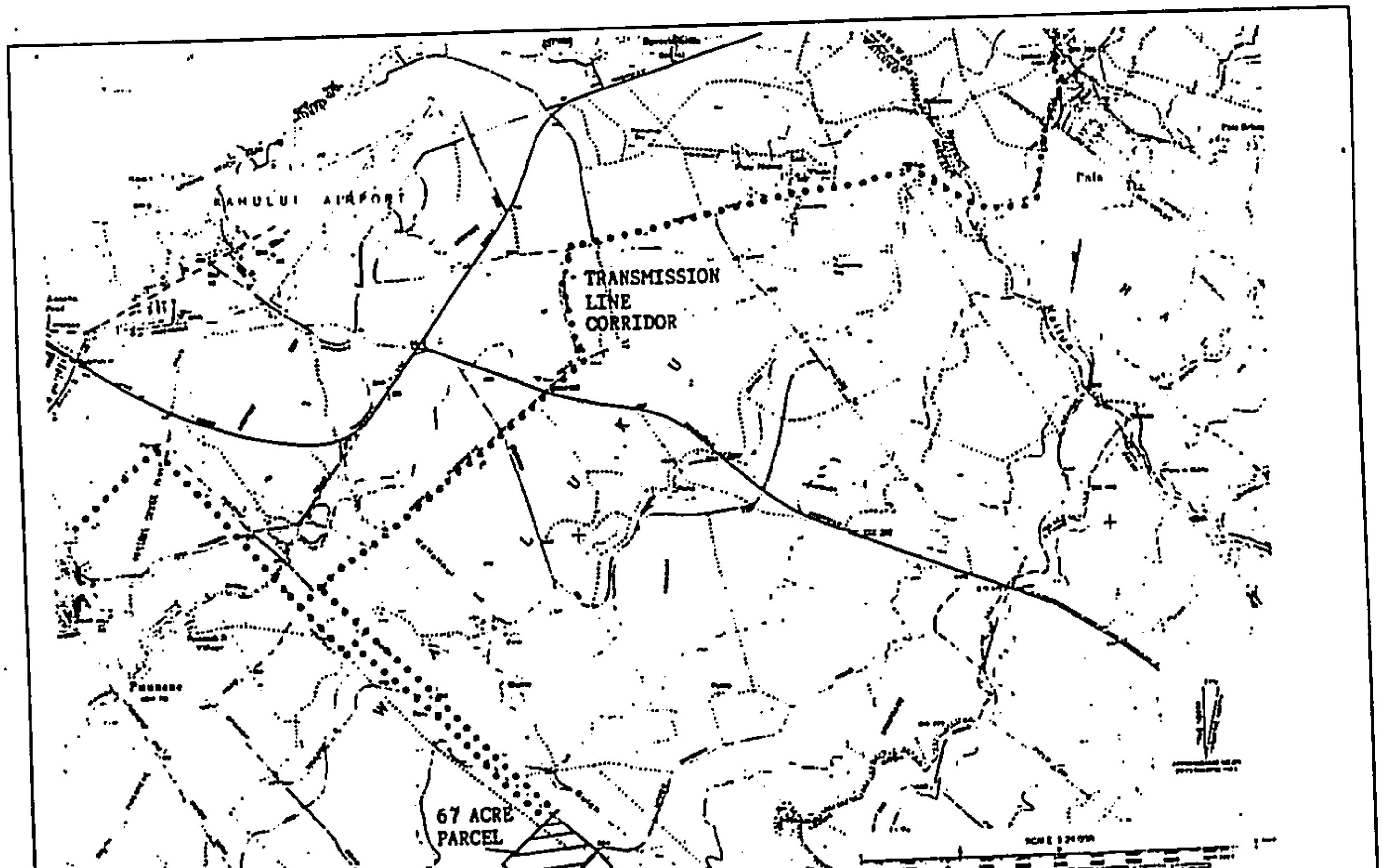

FIGURE 1: USGS PAIA QUADRANGLE SHOWING GENERATING STATION PROJECT AREA AND TRANSMISSION LINE CORRIDORS.

FIGURE 4: NORTHEAST END OF THE 67 ACRE PARCEL FROM PULEHU AND WAIKO RDS. VIEW TO NORTHWEST.

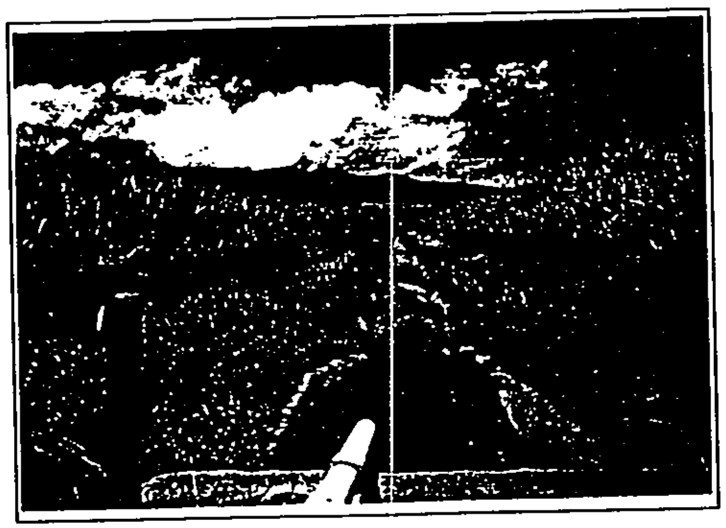

FIGURE 5: AQUADUCT IN 67 ACRE PARCEL. VIEW FROM WAIKO ROAD TO THE NORTHWEST.

DOCUMENTARY RESEARCH AND LAND USE

A search of historic writings produced only scant reference to prehistoric use of the current study area. Kamakau (1992:74) briefly mentions Puunene as the site of the hardest fought battle between Alapa`i of Hawaii and Pele`iohalani, Chief of Oahu, who was aiding Kekaulike's son Kauhi in his rebellion against Maui Chief Kamehameha-nui.

The present project area is situated in Wailuku *ahupua`a*, Wailuku District, Maui. The *ahupua`a* includes the coastal area of Kahului Bay from Kapukaula to Paukukalo and the northern half of the isthmus between Haleakala and the West Maui Mountains.

The central plain of Maui was an arid region, evidently little used until the advent of extensive plantation agriculture during the late nineteenth century.

Prior to the Mahele of 1848-53, nearly all lands in Hawai`i had been held by the king and chiefs. The events of the Mahele land redistribution program, which gave both natives and aliens the opportunity to acquire and own lands, led to foreign acquisition and development of large areas of the state (Kuykendall 1961: 287-298).

During the Mahele the dry central plain of Maui was designated as Crown Lands, to be managed by the government, and later came to be called "Government Lands" (Kuykendall 1938:288). Newspaper articles during 1875 urged the government to irrigate the plains to increase sugar production and enhance the value of government lands. The newspaper editor believed that private enterprise could not handle the enterprise. The government thought the cost too high (at least $200,000) and engineering difficulties too great (Adler 1966:34).

Private enterprise did undertake the first irrigation project: H.P. Baldwin and S.T. Alexander obtained a government lease in 1876 and started construction of the Hamakua Ditch to transport water to their Haiku plantation. After reading about the planned Alexander and Baldwin ditch, Claus Spreckels arrived on Maui to explore the water resources and undeveloped land in the central plain. In 1878 Spreckels returned to Maui with irrigation engineer Hermann Schussler to survey a route for a proposed waterway to transport water from the northern slopes of Haleakala to the plains of the Wailuku and Waikapu Commons. The course of the waterway, the water carrying capacity of the soil, the type and strength of piping needed, and the cost of the enterprise were calculated. Spreckels then had a plan for a sugar growing project on the plains, but owned no land and no water rights (Adler 1966:35,36).

Spreckels solved the first problem by leasing twenty-four thousand acres of crown lands on the Wailuku Commons from the government for $1,000 a year. He also bought one-half interest in an adjoining sixteen thousand acres on the Waikapu Commons. Then he petitioned the king and ministry for water rights at $500 a year. After some behind the scenes maneuver-ing, and a little pressure on the ministry from his friend King Kalakaua, Spreckels was granted a government lease for water rights to his properties in July 1878 (ibid: 37-39). The Hawaiian Commercial Company was organized in September 1878 to carry on the activities of the properties (Kuykendall 1967:66).

Spreckels had obtained a thirty year lease on water rights and was given six years to complete construction of the ditch. Construction of the thirty mile long water course, that carried sixty million gallons of water a day from the northern slope of Haleakala to the Spreckelsville Plantation, was completed in September 1879. The fields were plowed and two thousand acres planted in cane. The first irrigated crop was harvested in 1880 (Daws 1968:227; Adler 1966:48).

Spreckels had invested $500,000 on irrigation alone, and changed the dry plains into productive cane growing lands. He recognized that the proper development of the estate would entail the outlay of millions of dollars and probably couldn't be completed by the end of his thirty year lease. In that case he might lose all of the expensive improvements to the lease held lands. What he needed was a fee simple title to the lands.

In 1880 Spreckels approached high chiefess Princess Ruth Ke`elikolani and offered to buy her claim to part interest in the crown lands of the kingdom, some half-million acres. The high chiefess sold her cloudy claim to part interest in the crown lands to Spreckels for ten thousand dollars and made her a loan of sixty thousand dollars at 6 per cent to enable her to pay off 12 percent notes for the same amount (Daws 1968:228; Adler 1966: 54).

In 1882 Spreckels offered a trade to the legislature: in return for fee simple title for his twenty-four thousand acres of lease land on Maui he would not press his claim to the crown lands purchased from Princess Ke`elikolani. A bill was drawn up, and though its passage was opposed by legislators independent of the king's party, the bill was passed and signed by the king. Spreckels signed a quit claim relinquishing his interest in the crown lands, and received a royal patent in fee simple for his lease lands on Maui (Daws 1968: 228, 229; Speakman 1978:122-124).

The Hawaiian Commercial and Sugar Company was organized as a district plantation company in 1882 and took over management of the Spreckelsville plantation lands that had been managed by the Hawaiian Commercial Company. In 1898 S.T.Alexander, H.P. Bald-win, and J.B. Castle and Associates took control of Hawaiian Commercial and Sugar Compa-ny (Kuykendall 1967:66; Speakman 1978:125).

PREVIOUS ARCHAEOLOGY

Only one previous archaeological investigation has been conducted within the areas of the current investigation. Hammatt (1995) inspected three potential locations for a proposed power plant. No archaeological sites were identified at any of the three locations. Hammatt's Site A2 corresponds to the location of the c.67 acre generating station location investigated during the current project.

Fredericksen, W. H.and D.L. Fredericksen (1988a) conducted an inventory survey of 223 acres on the south side of Dairy Road c.1500 feet northwest of the current project area. The survey included excavation of seven backhoe trenches. No sites or features were identi-fied.

Fredericksen, W.H., D.L. Fredericksen, and E.M. Fredericksen (1988b) surveyed a 34 acre parcel near the ocean in Spreckelsville, c. 3/4 mile north of the proposed transmission line corridor along Sunny Side Road. The surface survey and backhoe trenching identified no sites or cultural deposits.

ANTICIPATED RESULTS

Documentary research provided no evidence of prehistoric sites or utilization of the area; and because the entire survey area had been under sugar cane cultivation for more than 100 years it was expected that archaeological sites or features would be not be present in the area.

METHODOLOGY

FIELD METHODS

Proposed transmission line routes on either side of existing, all weather roadways were surveyed. Those portions away from main roadways were surveyed from cane haul roads, and on foot when the roads were impassable or did not follow the proposed routes. The north and east sides of the generating station site were examined and the central portion was inspected from the cane haul road that bisects the site northwest-southeast. Pedestrian sweeps were not made through the site because of the dense cane growth.

FIELDWORK RESULTS

No archaeological resources were identified in any of the proposed transmission line routes or the generating station site. Where the transmission line routes follow existing roads, dozed berms and/or cultivated cane fields adjoin the road right of ways. Approximately 3/4 mile of transmission line route follows the path of an underground aqueduct through the cane fields between Hansen Road and the Haiku Ditch. The aqueduct continues southeast and crosses the generating station site. The project site lies within an existing cane field and, although the entire site was not surveyed on foot, it would seem unlikely that any sites would be present, since cane field cultivation often creates plow zones to four feet below the surface.

RECOMMENDATIONS

Based on the lack of documentary evidence of prehistoric occupation or other utilization of the project area, and the negative results of the field investigations, further archaeological work is not recommended for the generating station site or any of the transmission line routes. The construction work will not impact any cultural resources.

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DEPARTMENT OF LAND AND NATURAL RESOURCES

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

August 29, 1997

David Blane, Director
Planning Department, County of Maui
250 S. High St.
Wailuku, HI 96793

LOG NO: 20038 ✓
DOC NO: 9708BD08

Dear Mr. Blane:

SUBJECT: **Chapter 6E-42 Historic Preservation Review of Archaeological Inventory Survey Report - Power Plant and Transmission Line Corridors Multiple, Wailuku and Makawao Districts, Island of Maui**
<u>TMK 2-5, 3-8</u>

This letter reviews the survey report *An Inventory Survey of Proposed Power Plant and Transmission Line Corridors, Wailuku and Makawao Districts, Island of Maui, Hawai'i TMK:2-5, 3-8* (Burgett and Spear, SCS 1997), submitted by Scientific Consultant Services Inc. on August 8, 1997.

We concur with the findings that no significant historic sites are located on the subject property. Historic to modern sugarcane production and access road construction have destroyed all previous vestiges of the landscape, making it unlikely that significant historic sites survive.

We therefore find the proposed construction of the power line to have "no effect" on known historic resources. However, in the event that unrecorded historic remains (i.e. subsurface pavings, artifacts, human skeletal remains) are inadvertently uncovered during construction, all work should cease in the vicinity and the contractor should immediately contact our Maui Archaeologist, Dr. Boyd Dixon, at the State Historic Preservation Division office in Wailuku (243-5169).

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

BD:jen

DOCUMENTS CAPTURED AS RECEIVED

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

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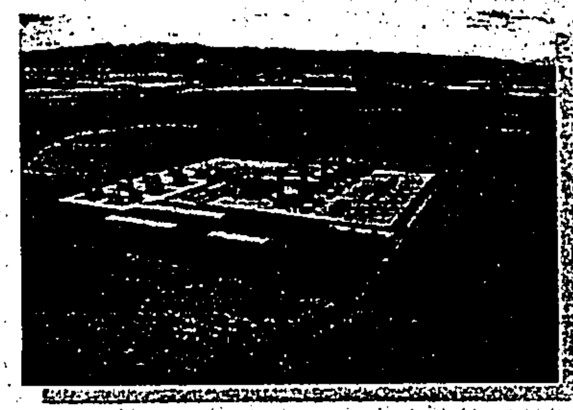
State Historic Preservation Division

BD:jen



APPENDIX H

ACOUSTIC STUDY

ACOUSTIC STUDY OF POTENTIAL NOISE IMPACTS ASSOCIATED WITH MAUI ELECTRIC COMPANY, LIMITED'S PROPOSED WAENA GENERATING STATION WAILUKU, MAUI

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CHAPTER I. SUMMARY

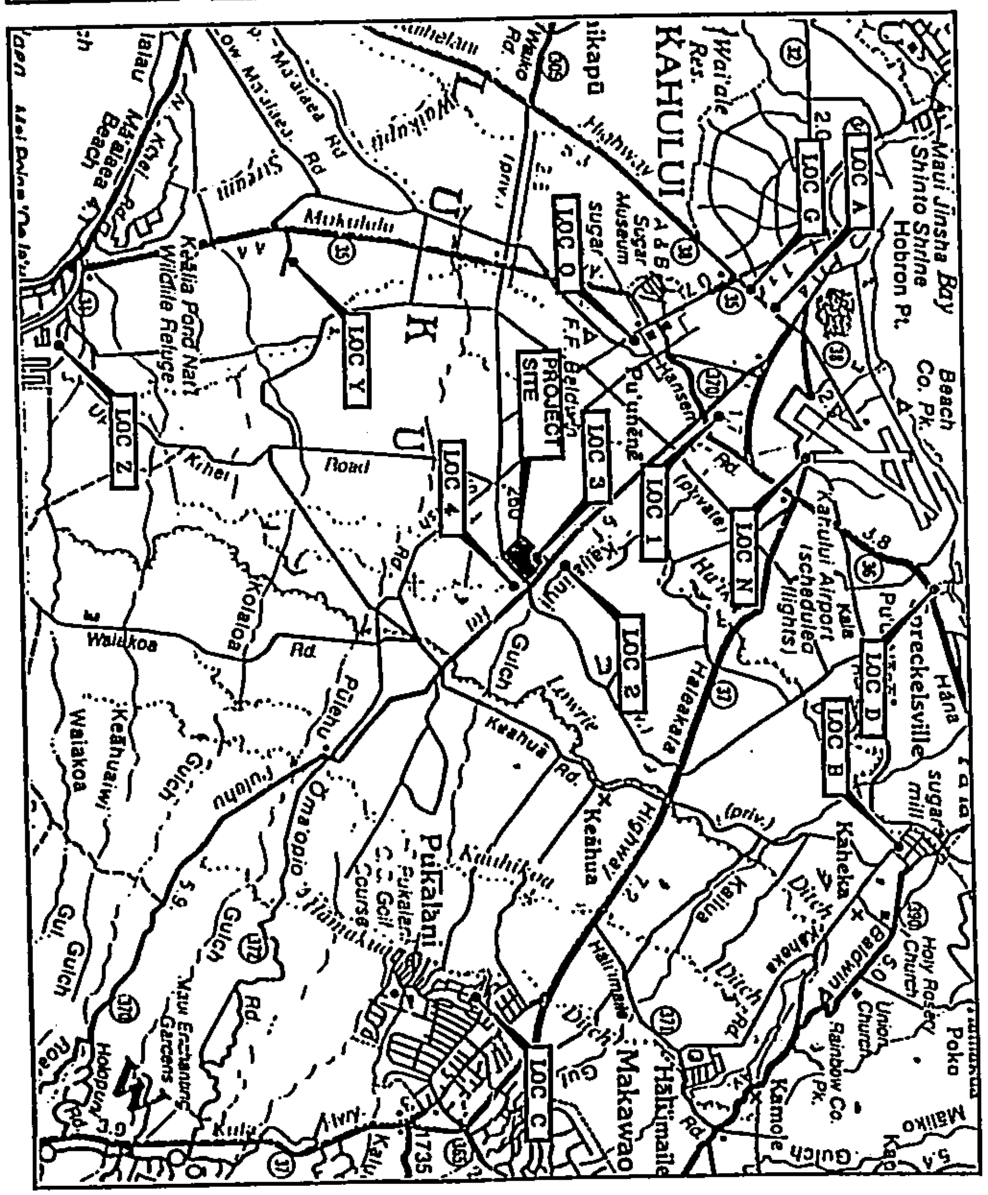
The findings from the sound measurement efforts which were performed and the noise contours which were developed indicate that there will be low risk of adverse noise impacts as a result of the proposed Phase I thru Phase IV improvements at the Maui Electric Company, Limited (MECO) Waena Generating Station. Additionally, compliance with the 70 dBA property line noise standard of the State Department of Health should be possible following the proposed Phase I thru Phase IV improvements. Similar conclusions were also made regarding the low risk of adverse noise impacts during construction activities at the project site.

Mitigation measures are recommended to minimize potential risk of noise impacts associated with work place noise exposure, and to minimize risks of complaints from intense but short duration noise events (such as steam venting). In addition, preventative measures are recommended to minimize risks of adversely impacting noise sensitive receptors at future developments at locations near the generating station. These mitigation measures may include: incorporating special acoustical interior finishes in the Steam Turbine Buildings; minimizing noise disturbances during the nighttime and early morning hours; providing prior notification to nearby residents if unavoidable loud noise events are anticipated; and/or implementing land use controls and providing disclosures of the noise from the generating station to future tenants of the lands within 1 mile of the proposed facility.

CHAPTER II. PURPOSE

The purpose of this study was to evaluate the possible adverse noise impacts associated with the proposed Waena Generating Station facility on the Island of Maui. The site of the proposed generating station is located in the Central Maui Isthmus area and southeast of Puunene where shown in Figure 1.

The noise emission levels from the generating station were evaluated for four phases of possible station expansion. In each of the four phases, a dual train combined cycle (DTCC) unit would be added to the station. Each DTCC unit would consist of two 20 MW combustion turbine (CT) generators fitted with two heat recovery steam generators (HRSGs) and one 18 MW steam turbine (ST) generator. The potential noise impacts associated with the addition of each of the four DTCC units at the generating station were to be evaluated using the predicted noise levels from the station at the closest noise sensitive communities to the generating station. The relationship of these noise levels to current federal and state noise criteria and standards were also to be evaluated.



PROJECT AND NOISE MEASUREMENT SITE LOCATION MAP

FIGURE 1

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIPS TO LAND USE COMPATIBILITY

Department of Health Noise Regulations. On the island of Maui, the State Department of Health (DOH) regulates noise from on-site activities. State DOH noise regulations are expressed in maximum allowable property line noise limits (see Reference 1). Although they are not directly comparable to noise criteria expressed in Ldn, State DOH noise limits for preservation/residential, apartment/commercial, and agricultural/industrial lands equate to approximately 55, 60, and 76 Ldn, respectively. Because the project site and surrounding areas are located on lands zoned for Agricultural use, DOH noise limits for agricultural lands apply along the proposed generating station's property boundary lines. These property line limits are 70 dBA for both the daytime and nighttime periods. The daytime and nighttime periods are from 7:00 AM to 10:00 PM and from 10:00 PM to 7:00 AM, respectively. On lands zoned for multifamily use, the State DOH limits are 60 dBA and 50 dBA during the daytime and nighttime periods, respectively. On lands zoned for single-family residential use, the State DOH limits are 55 dBA and 45 dBA during the daytime and nighttime periods, respectively. These noise limits cannot be exceeded for more than 2 minutes in any 20-minute time period under the State DOH noise regulations.

Other Noise Descriptors. A general consensus has developed for use of the Day-Night Sound Level (Ldn) in describing environmental noise in general, and for relating the acceptability of the noise environment for various land uses. The Day-Night Sound Level represents the 24-hour average sound level for a typical day, with nighttime noise levels (from 10:00 PM to 7:00 AM) increased by 10 decibels prior to computation of the 24-hour average.

The Ldn descriptor employs a process of averaging instantaneous A-Weighted sound levels as read on a standard Sound Level Meter, which are normally referred to as meter readings in dBA. A brief description of the acoustic terminology and symbols used is provided in APPENDIX B. The average noise level during a one hour period is called the hourly equivalent sound level, and is designated as Leq(h) or Leq. The maximum A-Weighted sound level occurring during an intermittent event (or single event) is referred to as the Lmax value. The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the Sound Exposure Level, or Lse, and is analogous to the energy of the time varying sound levels associated with the intermittent noise event. Current noise standards and criteria which associate land use compatibility or adverse health and welfare effects with various levels of environmental noise are normally described in terms of Ldn rather than the single event (Lmax or Lse) noise descriptors. The reasons for this are based on the relatively good correlation between the cumulative Ldn descriptor and annoyance reactions of the exposed population. However, at very low levels of environmental noise (55 Ldn or less), other attitudinal variables and biases (besides noise) of the exposed population tend to influence annoyance reactions, and the correlation between annoyance reactions and Ldn levels deteriorates.

Table 1, extracted from Reference 2, categorizes the various Ldn levels of outdoor noise exposure with severity classifications. Table 2, also extracted from Reference 2, presents the general effects of noise on people in residential use situations. Figure 2, extracted from Reference 3, presents suggested land use compatibility guidelines for residential and nonresidential land uses. A general consensus among federal agencies has developed whereby residential housing development is considered acceptable in areas where exterior noise does not exceed 65 Ldn. This value of 65 Ldn is used as a federal regulatory threshold for determining the necessity for special noise abatement measures when applications for federal funding assistance are made.

Federal agencies (HUD and EPA) recognize 55 Ldn as a desirable goal for exterior noise in residential areas for protecting the public health and welfare with an adequate margin of safety (References 4 and 5). Although 55 Ldn is significantly quieter than 65 Ldn, the lower level has not been adopted for regulatory purposes by federal agencies due to economic and technical feasibility considerations.

In Hawaii, where open living conditions prevail throughout the year, and where natural ventilation is a prevalent characteristic of residential housing, the more conservative level of 55 Ldn should be used to evaluate potential noise impacts. This is particularly true whenever relatively quiet areas are under evaluation. Also, at an exterior noise level of 55 Ldn, the noise attenuation characteristics of typical naturally ventilated dwellings produce acceptable noise levels within the dwelling (approximately 45 Ldn). Naturally ventilated residential units which are located outside the 55 Ldn contour are considered to be "Unconditionally Acceptable" in respect to adverse health and welfare effects.

For commercial, agricultural, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 Ldn are generally considered acceptable. Exceptions to this occur when naturally ventilated dwellings, office, and other commercial establishments are exposed to exterior levels which exceed 65 Ldn.

TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION
(RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 Ldn	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 Ldn But Not Above 65 Ldn	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 Ldn But Not Above 75 Ldn	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 Ldn	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.

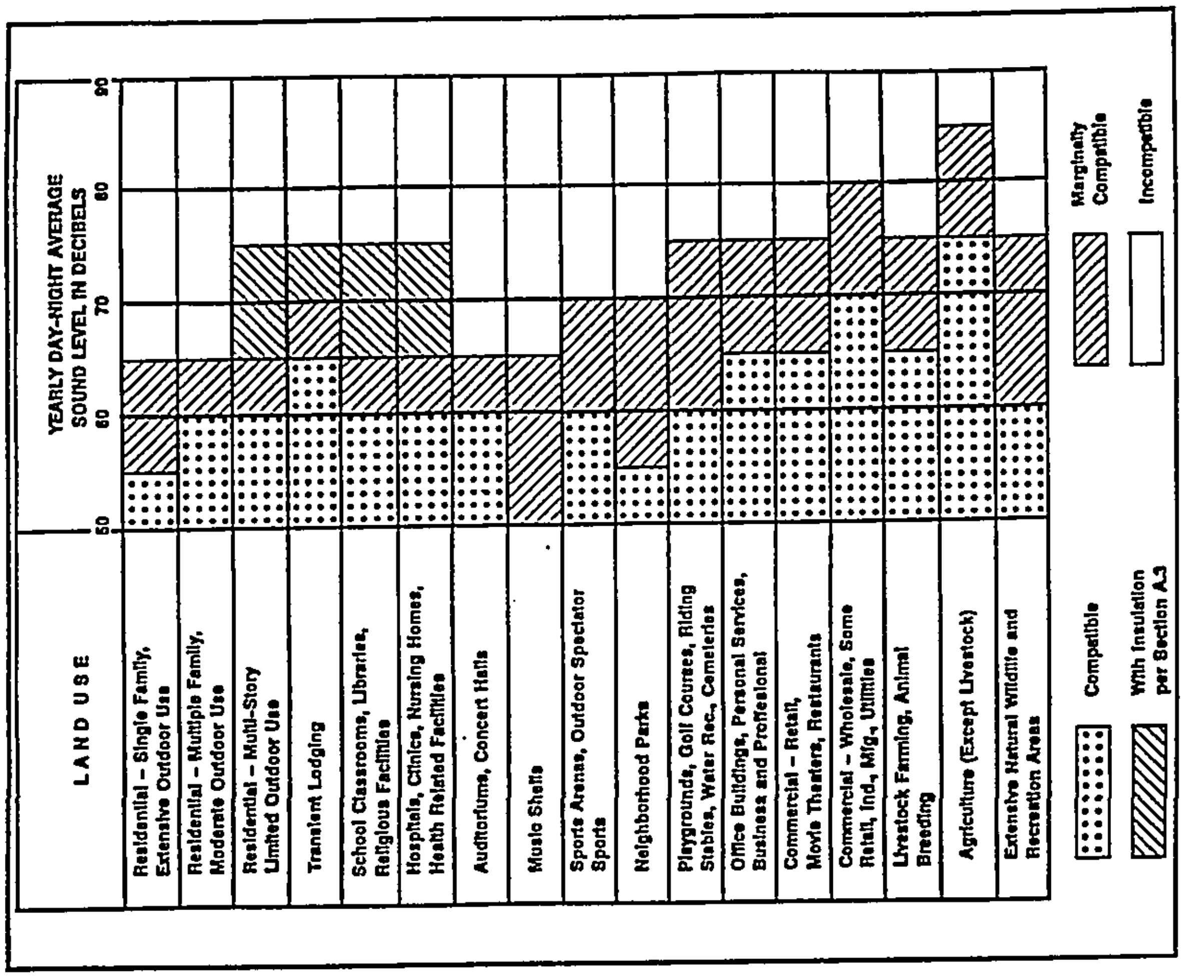


FIGURE 2

LAND USE COMPATIBILITY
WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVEL
AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED
(Source: American National Standards Institute S12.40-1990)

TABLE 2

EFFECTS OF NOISE ON PEOPLE
(Residential Land Uses Only)

EFFECTS[1] / DAY-NIGHT AVERAGE SOUND LEVEL IN DECIBELS	Hearing Loss	Speech Interference		Annoyance[2]	Average Community Reaction[4]	General Community Attitude Towards Area
		Indoor	Outdoor			
	Qualitative Description	%Sentence Intelligibility	Distance in Meters for 95% Sentence Intelligibility	% of Population Highly Annoyed[3]		
75 and above	May Begin to Occur	98%	0.5	37%	Very Severe	Noise is likely to be the most important of all adverse aspects of the community environment.
70	Will Not Likely Occur	99%	0.9	25%	Severe	Noise is one of the most important adverse aspects of the community environment.
65	Will Not Occur	100%	1.5	15%	Significant	Noise is one of the important adverse aspects of the community environment.
60	Will Not Occur	100%	2.0	9%	Moderate to Slight	Noise may be considered an adverse aspect of the community environment.
55 and below	Will Not Occur	100%	3.5	4%		Noise considered no more important than various other environmental factors.

1. "Speech Interference" data are drawn from the following tables in EPA's "Levels Document": Table 3, Fig. D-1, Fig. D-2, Fig. D-3. All other data from National Academy of Science 1977 report "Guidelines for Preparing Environmental Impact Statements on Noise, Report of Working Group 69 on Evaluation of Environmental Impact of Noise."

2. Depends on attitudes and other factors.

3. The percentages of people reporting annoyance to lesser extents are higher in each case. An unknown small percentage of people will report being "highly annoyed" even in the quietest surroundings. One reason is the difficulty all people have in integrating annoyance over a very long time.

4. Attitudes or other non-acoustic factors can modify this. Noise at low levels can still be an important problem, particularly when it intrudes into a quiet environment.

NOTE: Research implicates noise as a factor producing stress-related health effects such as heart disease, high-blood pressure and stroke, ulcers and other digestive disorders. The relationships between noise and these effects, however, have not as yet been quantified.

CHAPTER IV. GENERAL STUDY METHODOLOGY

The hourly average [Leq(h)] and Day-Night Sound Level (Ldn) noise descriptors were both used to describe the future noise levels in the environs of the Maui Electric Company, Limited's (MECO) Waena Generating Station. Computer generated noise contours of 55 to 70 Leq at 5 Leq intervals were developed for conditions following each of the four facility improvement phases (Phase I thru IV). These Leq noise contours were developed to represent the expected average noise levels during the nighttime peak operating period, when the station loads and meteorological conditions are expected to coincide to produce the highest average noise levels in the communities closest to the station. These noise contours were also useful for comparing the predicted noise levels with the 70 dBA DOH noise standard which are applicable along the station's property boundaries. The Ldn descriptor was useful for comparing predicted noise exposure levels with federal noise impact criteria and standards which are expressed as Ldn values.

Figure 1 depicts the location of the proposed MECO Waena Generating Station in relationship to existing communities in the surrounding area. Also shown in Figure 1 are the various noise measurement locations which were used in prior studies as well as in the current study effort to describe the existing and future noise levels at the generating station. The prior measurements of background ambient noise levels were originally obtained in conjunction with efforts related to the site selection studies for the generating station (see Reference 6). Additional background ambient noise measurements and long range sound propagation loss measurements were also performed in conjunction with the current study. The background ambient noise measurements were obtained primarily during the quietest early morning periods to determine the possible audibility of the power plant at the closest but distant communities. The long range sound propagation loss measurements were obtained to determine the likelihood of reduced sound attenuation due to sound ducting effects during the early morning periods at the closest communities.

The generating station is expected to operate 24-hours per day on a regular basis. Under these conditions, the relationship between the PM peak hour Leq and the Ldn was computed to be as follows: Ldn = Leq(PM Peak Hour) + 6. For each generating station improvement phase (or addition of a DTCC unit), the PM peak hour Leq and the Ldn noise contours were developed. The noise contours did not account for noise shielding effects from station (buildings, tanks, etc.) and terrain features, and therefore, they tend to overstate the station noise levels for ground level receptors whenever these shielding effects are present. The noise contours do not overstate

the predicted station noise levels for elevated receptors (such as at Pukalani), since shielding effects from natural terrain and man-made features would tend to be less effective for these elevated receptors.

The Leq and Ldn noise contours were compared to existing land use compatibility criteria and background ambient noise levels to evaluate the potential noise impacts and complaint risks from noise associated with operations of the proposed facility. The Leq contours were used to evaluate risks of exceeding the 70 dBA State Department of Health noise limit along the property boundary lines of the facility. Using the Ldn noise contour results and the results of the background noise measurements, evaluations were made of potential noise impacts in the health and welfare category, and of potential annoyance responses from the nearest communities. Based on the above evaluations, recommendations for mitigation measures which would minimize risks of health and welfare impacts and risks of annoyance responses from nearby residences were provided. Recommendations associated with minimizing potential noise impacts and complaint risks during the construction period, and particularly during the well drilling phase of the construction were also provided.

CHAPTER V. EXISTING BACKGROUND AMBIENT NOISE LEVELS

Short–term daytime background ambient noise levels in the vicinity of the proposed Waena Generating Station were measured by Dames and Moore (Reference 7), with average values ranging from 54 to 60 dB. The locations of the Dames and Moore monitoring sites are shown in Figure 1 as Sites 1 thru 4. Dominant noise sources reported were intermittent dump trucks, a distant helicopter, local vehicular traffic, and sugar cane leaves rustling in the wind. The measured levels were well below the 70 dBA DOH property line noise limit for agricultural and industrial uses, which apply in the project area.

Additional traffic and background ambient noise level measurements were obtained in 1992 by Y. Ebisu and Associates and reported in Reference 6. The locations of these measurement sites ("G", "Y", and "Z") are shown in Figure 1, and the results of these measurements are summarized in Table 3A and Figures 3 thru 9. Location "G" was selected to measure daytime and nighttime traffic noise levels at 50 feet from Dairy Road. Location "Y" was selected to measure background noise levels in areas removed from existing developments. Location "Z" was selected to measure background ambient noise levels at the closest community (Walakoa) south and normally downwind of the proposed generating station. In Table 3A, the Leq (or Equivalent Sound Level) values shown represent the average noise levels (in decibels) measured during the indicated noise measurement periods. In Figures 3 thru 9, the maximum (Lmax), minimum (Lmin), and median (L50) sound levels (in decibels) recorded are also indicated for each measurement period. The L10 values shown represent the levels exceeded ten percent of the time.

The traffic noise measurement results at Location "G" indicated that average traffic noise levels at 50 feet from the centerline ranged from 56 dBA during the quietest early morning hours to 70 dBA during the noisier daytime period. Average daily traffic noise level was estimated to be 68 Ldn at 50 feet from the roadway centerline, and is considered to be typical for the major roadways in the area such as Hana Highway and Haleakala Highway.

The measurement results at Locations "Y" and "Z" indicated that existing background ambient noise levels in the areas removed from the major roadways are very low, and range from 35 to 44 Leq. This is typical of rural areas, where background ambient noise levels are controlled by distant roadway traffic or aircraft, and the natural sounds of foliage and birds. Existing background ambient noise levels in the communities closest to the project site are believed to be very low and similar to those

TRAFFIC AND BACKGROUND NOISE MEASUREMENTS

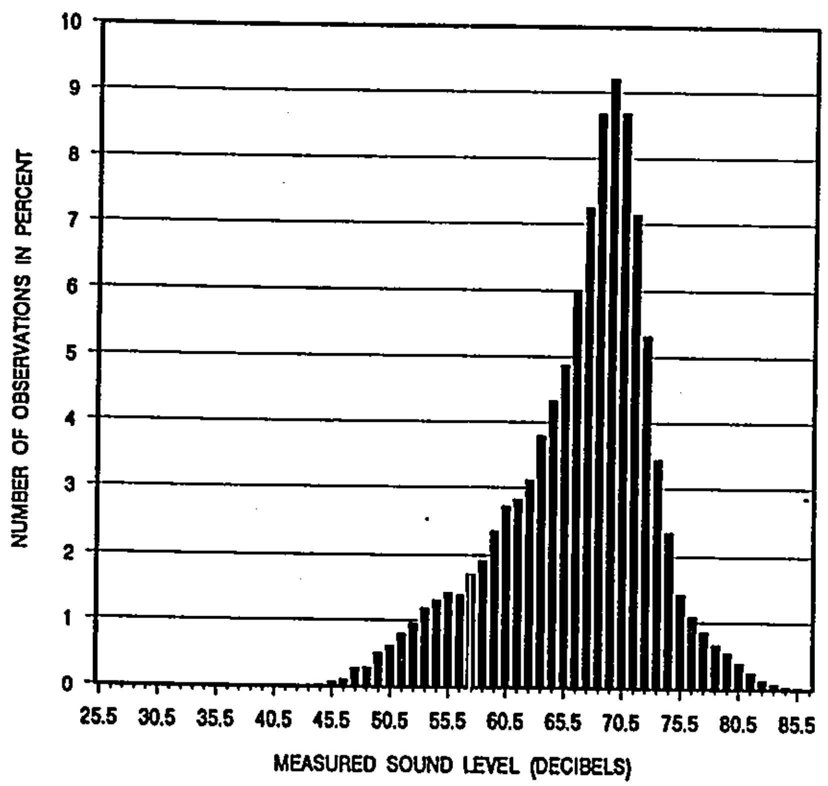
LOCATION	Time of Day (HRS)	Ave. Speed (MPH)	--Hourly Traffic Volume-- AUTO	M.TRUCK	H.TRUCK	Measured Leq (dB)	Predicted Leq (dB)
G. 50 FT from the center–line of Dairy Road. (10/8/92)	1000 TO 1100	41	1,227	52	50	70.0	69.6
G. 50 FT from the center–line of Dairy Road. (10/8/92)	1625 TO 1655	41	789	25	11	68.5*	68.5
G. 50 FT from the center–line of Dairy Road. (10/9/92)	0200 TO 0300	41	30	12	0	55.7	56.2
Y. Near Maui Race Track, west of project site. (10/8/92)	1420 TO 1520	N/A	N/A	N/A	N/A	41.8	N/A
Y. Near Maui Race Track, west of project site. (10/9/92)	0445 TO 0515	N/A	N/A	N/A	N/A	36.5	N/A
Z. Walakoa residental area, south of project site. (10/8/92)	1245 TO 1345	N/A	N/A	N/A	N/A	44.2	N/A
Z. Walakoa residental area, south of project site. (10/9/92)	0325 TO 0425	N/A	N/A	N/A	N/A	34.9	N/A

NOTE: * Excludes aircraft noise.

FIGURE 3

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION 'G' (1000 TO 1100 HOURS)

DATE: OCTOBER 8, 1992 METER RESPONSE: FAST

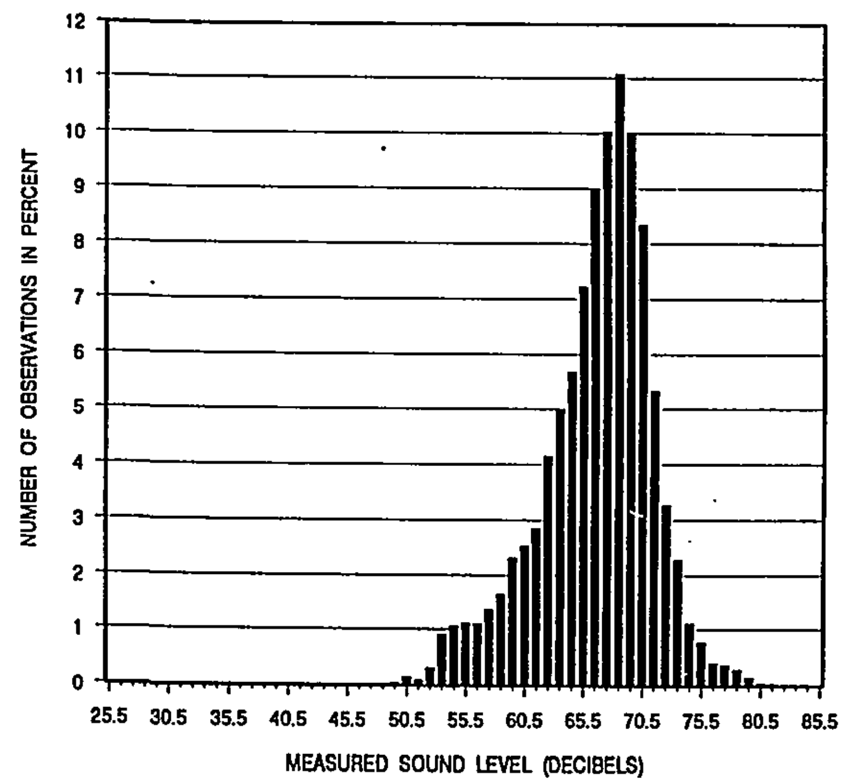


Lmax: 86.1 dBA
L10: 73.0 dBA
L50: 68.0 dBA
Leq: 70.0 dBA
Lmin: 44.2 dBA

FIGURE 4

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION 'G' (1625 TO 1655 HOURS)

DATE: OCTOBER 8, 1992 METER RESPONSE: FAST

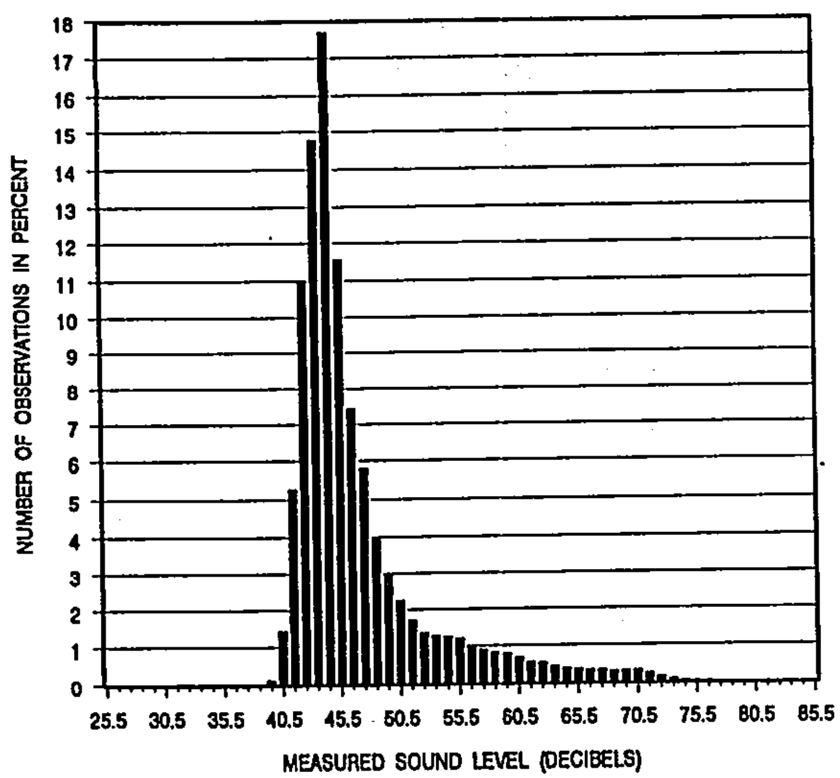


Lmax: 81.5 dBA
L10: 71.5 dBA
L50: 67.0 dBA
Leq: 68.5 dBA
Lmin: 49.1 dBA

FIGURE 5

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION 'G' (0200 TO 0300 HOURS)

DATE: OCTOBER 9, 1992 METER RESPONSE: FAST

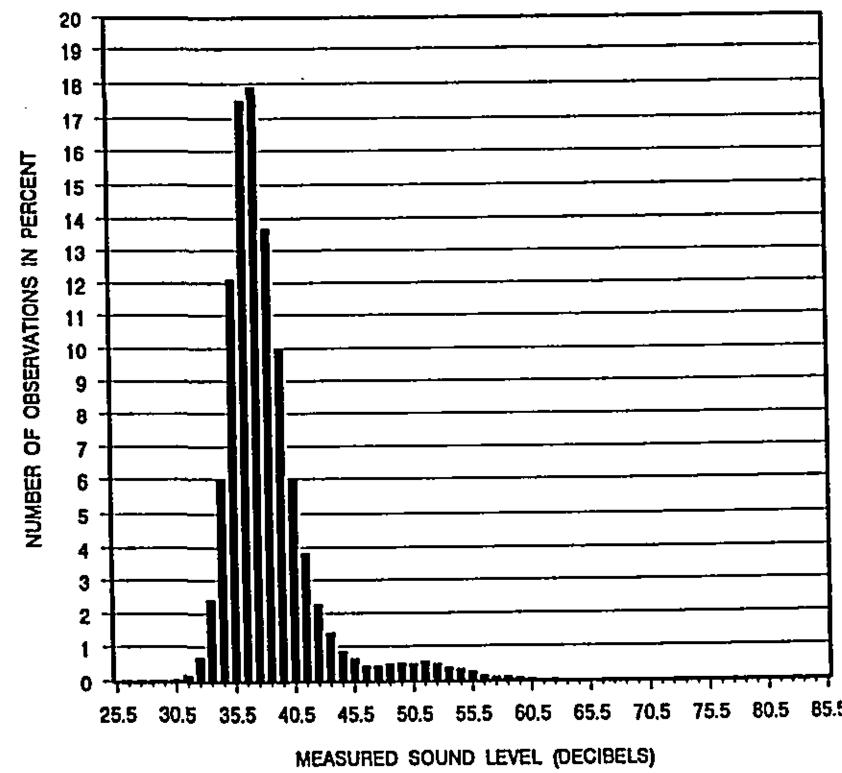


Lmax: 77.7 dBA
L10: 55.0 dBA
L50: 44.5 dBA
Leq: 55.7 dBA
Lmin: 38.8 dBA

FIGURE 6

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION 'Y' (1420 TO 1520 HOURS)

DATE: OCTOBER 8, 1992 METER RESPONSE: FAST

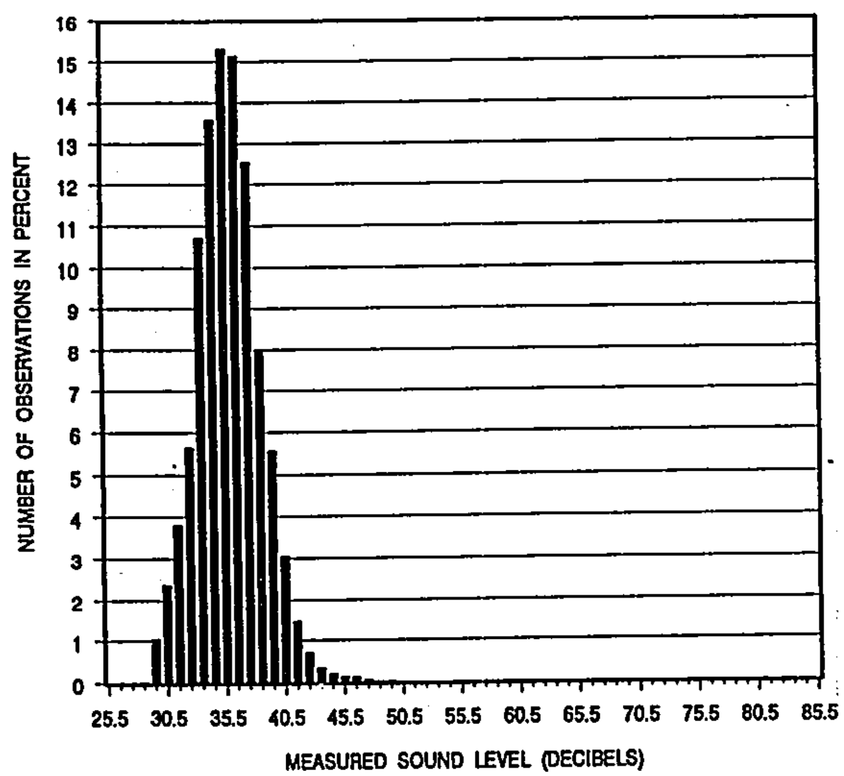


Lmax: 64.0 dBA
L10: 41.5 dBA
L50: 37.5 dBA
Leq: 41.8 dBA
Lmin: 30.4 dBA

FIGURE 7

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION 'Y' (0445 TO 0515 HOURS)

DATE: OCTOBER 9, 1992 METER RESPONSE: FAST

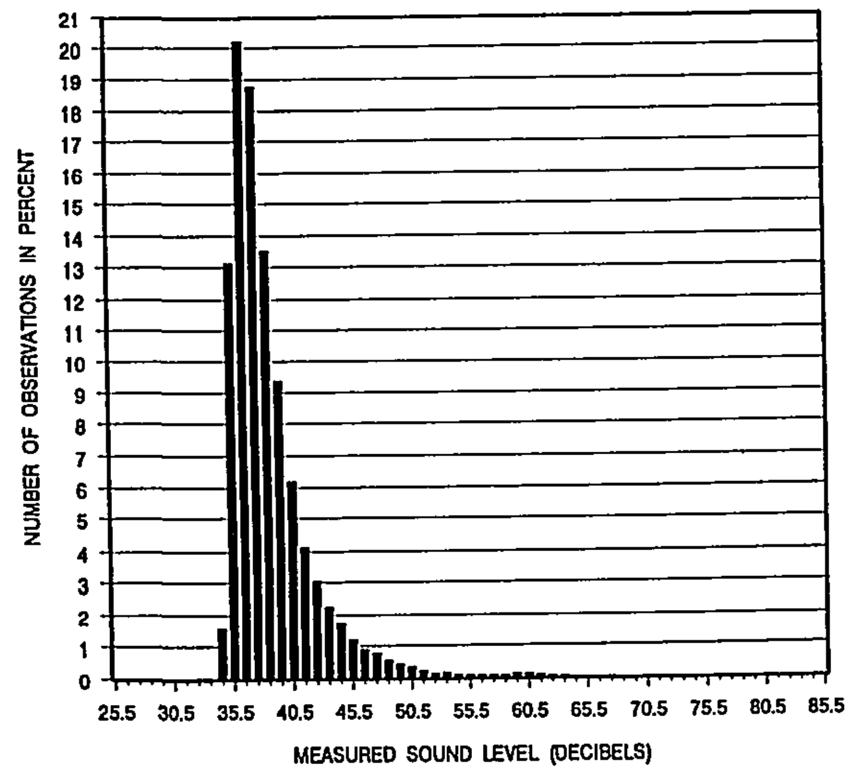


Lmax: 52.0 dBA
L10: 39.0 dBA
L50: 35.5 dBA
Leq: 36.5 dBA
Lmin: 28.4 dBA

FIGURE 8

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION 'Z' (1245 TO 1345 HOURS)

DATE: OCTOBER 8, 1992 METER RESPONSE: FAST

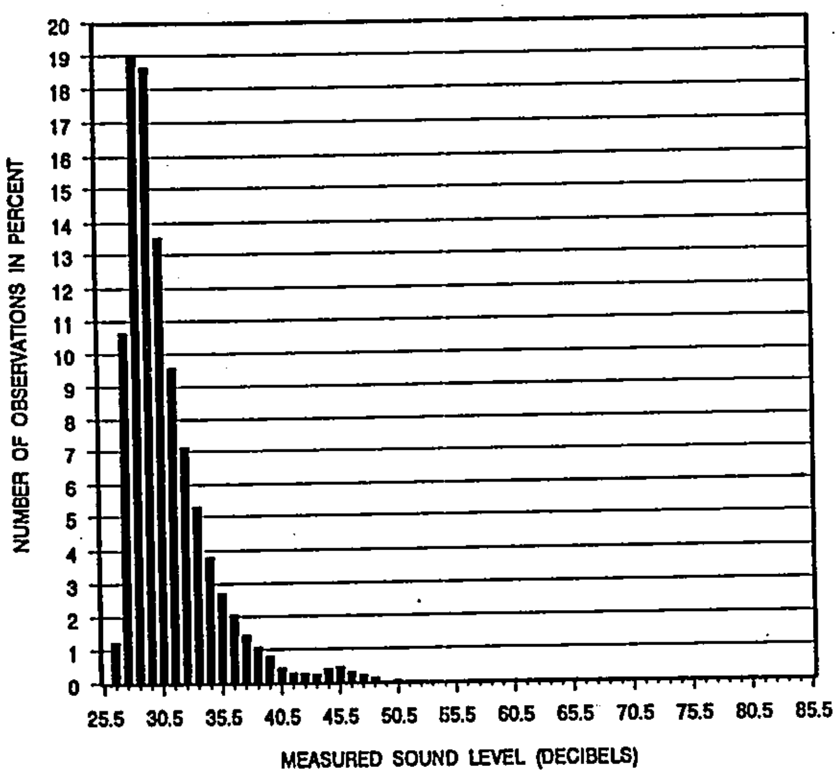


Lmax: 71.7 dBA
L10: 43.0 dBA
L50: 37.5 dBA
Leq: 44.2 dBA
Lmin: 33.8 dBA

FIGURE 9

HISTOGRAM OF MEASURED SOUND LEVELS AT LOCATION 'Z' (0325 TO 0425 HOURS)

DATE: OCTOBER 9, 1992 METER RESPONSE: FAST



Lmax: 63.7 dBA
L10: 35.0 dBA
L50: 30.0 dBA
Leq: 34.9 dBA
Lmin: 25.4 dBA

measured at Locations "Y" and "Z", particularly if they are removed from major roadways and particularly during the nighttime and early morning hours.

In order to obtain additional estimates of background ambient noise levels in the communities closest to the proposed generating station site, A–Weighted and Linear background ambient noise measurements were obtained on April 26 and 27, 1997. The communities surveyed included Kahului (Location "A"), Spreckelsville (Location "D"), Paia (Location "B"), Pukalani (Location "C"), and Puunene (Location "O"), which are shown in Figure 1. The results of these noise measurements are shown in Table 3B, and were structured to document the lower background noise levels during the quieter early morning period. Noise levels during the quiet early morning period was controlled by distant traffic and wind at all locations. At Location "O", the sugar mill controlled the measured background ambient noise levels.

TABLE 3B

LINEAR AND A-WEIGHTED BACKGROUND NOISE MEASUREMENTS AT VARIOUS LOCATIONS

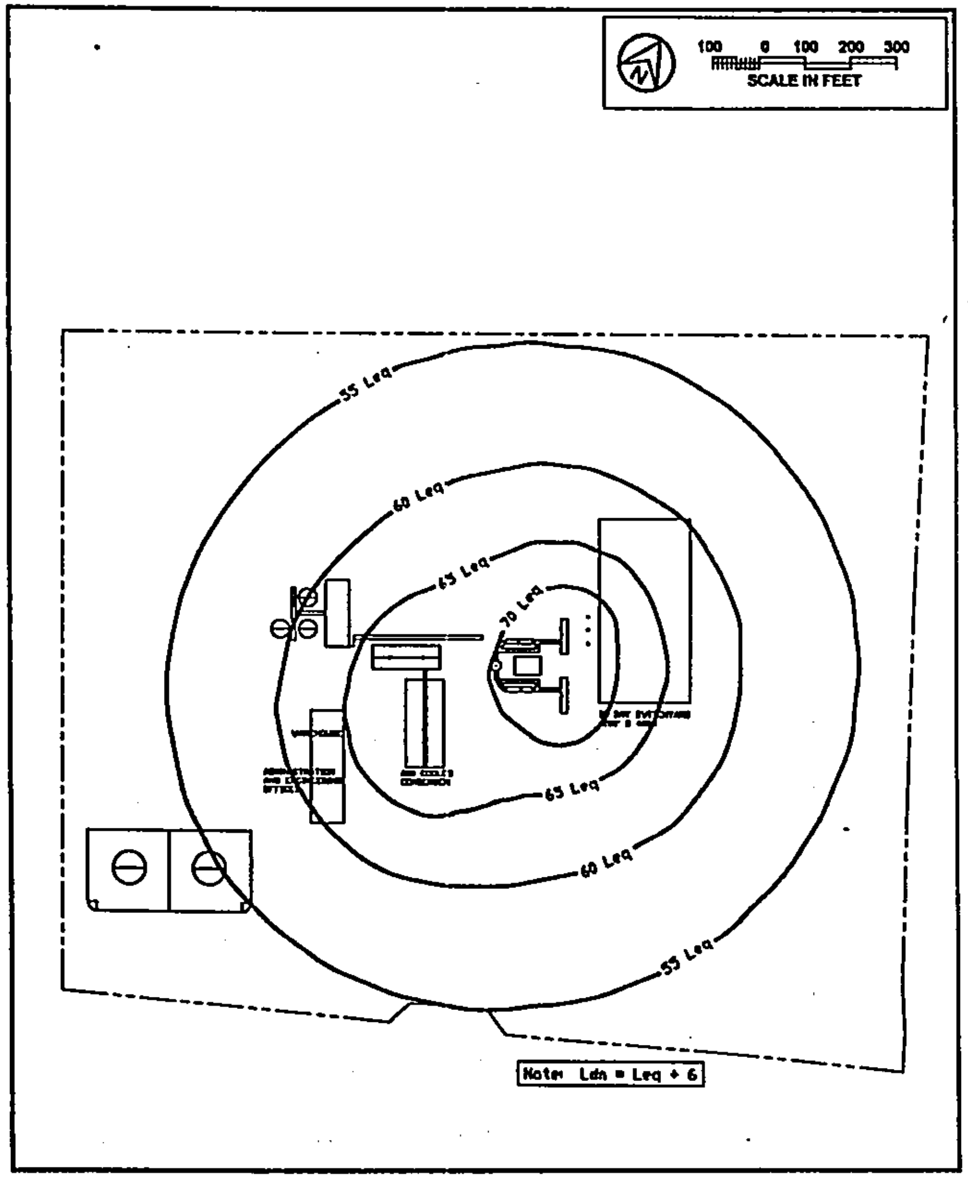
LOCATION	TIME OF DAY (HRS)	LINEAR SOUND LEVEL			A-WEIGHTED SOUND LEVEL		
		Lmax	Leq	Lmin	Lmax	Leq	Lmin
A. Off Dairy Road, Kahului (4/27/97)	0247-0255	>56	>56	56	58.7	44.0	41.3
B. Pii Loko Street, Pala (4/26/97)	1006-1012	>52	>52	52	52.3	47.0	42.9
B. Pii Loko Street, Pala (4/27/97)	0313-0325	66	50	39	49.7	34.0	28.4
C. Keikilani Street, Pukalani (4/26/97)	1045-1052	>56	>56	56	59.9	47.6	42.5
C. Keikilani Street, Pukalani (4/27/97)	0358-0410	>61	61	46	55.7	44.0	38.6
D. Kaunoa Senior Center, Spreckelsville (4/27/97)	0100-0110	>57	57	51	57.5	48.7	44.4
O. East of Sugar Mill, Puunene (4/27/97)	0126-0140	>55	>55	55	53.0	47.7	43.1

CHAPTER VI. FUTURE GENERATING STATION NOISE LEVELS

In CY 2004, the first of two 20 MW combustion turbine (CT) generators is planned to be installed at the Waena Generating Station. Each of the CT's will be outfitted with heat recovery steam generators (HRSG). By CY 2006, the second CT unit plus an 18 MW steam turbine (ST) generator will be added to the station to complete the first of three DTCC units. Additional DTCC units, each comprised of similar CT, HRSG, and ST modules, are planned to be added to the station by CY 2010 and 2016, and beyond 2020. The three stages of improvements to the generating station between CY 2004 and CY 2015 have been designated as Phases I, II, and III. The condition following addition of the fourth DTCC unit after CY 2020 has been designated as Phase IV.

Phase I Noise Levels. Figure 10 depicts the hourly equivalent (or Leq) noise contours for the generating station with the first DTCC unit on-line during a PM peak hour. The equivalent Ldn contours can be estimated from Figure 10 by adding 6 units to the 55 thru 70 Leq contours shown, which are equivalent to the 61 thru 76 Ldn contours, at 5 Ldn intervals. The noise levels for CT-1, CT-2, and the air-cooled condenser were assumed to be 60 dB (A-Weighted) at 300 FT distance. The noise levels of the heat recovery steam generators (HRSG) were assumed to be insignificant when compared to CT-1 and CT-2. The condenser noise level was assumed to be 60 dB at 300 FT. The steam turbine (ST-3) was assumed to be 90 dB at 3 FT and located within a naturally ventilated turbine building with louvered ventilation openings. The beneficial noise shielding effects from the large tanks, buildings, and other structures on the site were not included in Figure 10. These station noise contours are expected to represent the worst case noise levels during a PM peak hour following the Phase I improvements. As indicated in Figure 10, the 70 Leq noise contour should be contained within the station's property boundaries, and the State DOH's 70 dBA limit for agricultural and industrial lots will be met following the Phase I improvements.

The closest noise sensitive properties to the proposed MECO Waena Generating Station are day-care and social services facilities located in Puunene, beyond 2.0 miles from the station. Residences in the other closest communities of Kahului, Pukalani, Pala, and Walakoa are located beyond 3 miles from the station. The predicted station noise levels, using a Linear-Weighting filter (instead of the A-Weighting filter) at these distant communities are shown in Table 4. Due to the large separation distances between the generating station site and the nearest communities, the predicted noise levels from the generation station are very low, and should not be audible at the levels shown in the table. The A-Weighted Sound Levels



HOURLY EQUIVALENT (LEQ) NOISE CONTOURS FOR WAENA GENERATING STATION (PHASE I)

FIGURE 10

TABLE 4

ANTICIPATED GENERATING STATION NOISE LEVELS AT COMMUNITIES IN SURROUNDING AREAS

		-- PREDICTED NOISE LEVEL (dBL) --			
COMMUNITY	DISTANCE	PHASE I	PHASE II	PHASE III	PHASE IV
Puunene	12,000'	36.2	39.2	41.0	42.2
Kahului	18,000'	28.3	31.3	33.1	34.3
Pukalani	21,000'	25.0	28.0	29.8	31.0
Spreckelsville	22,000'	23.9	26.9	28.7	29.9
Paia	24,000'	21.8	24.8	26.6	27.8
Waiakoa	26,000'	19.7	22.7	24.5	25.7

Note:
The predicted A-Weighted Sound Levels (dBA) are approximately 28 dB units less than the dBL values shown in the table.

(in dBA units) are approximately 28 dB units less than the Linear-Weighted values (in dBL units) shown in the table. Included in a separate table (Table 5) are the predicted station's noise levels at these distant communities with 12 dB of reduced attenuation due to sound ducting. Appendix C presents the rationale for predictions of reduced attenuation due to ducting and the use of dBL units, and describes the long range sound propagation measurement results which formed the basis for these predictions.

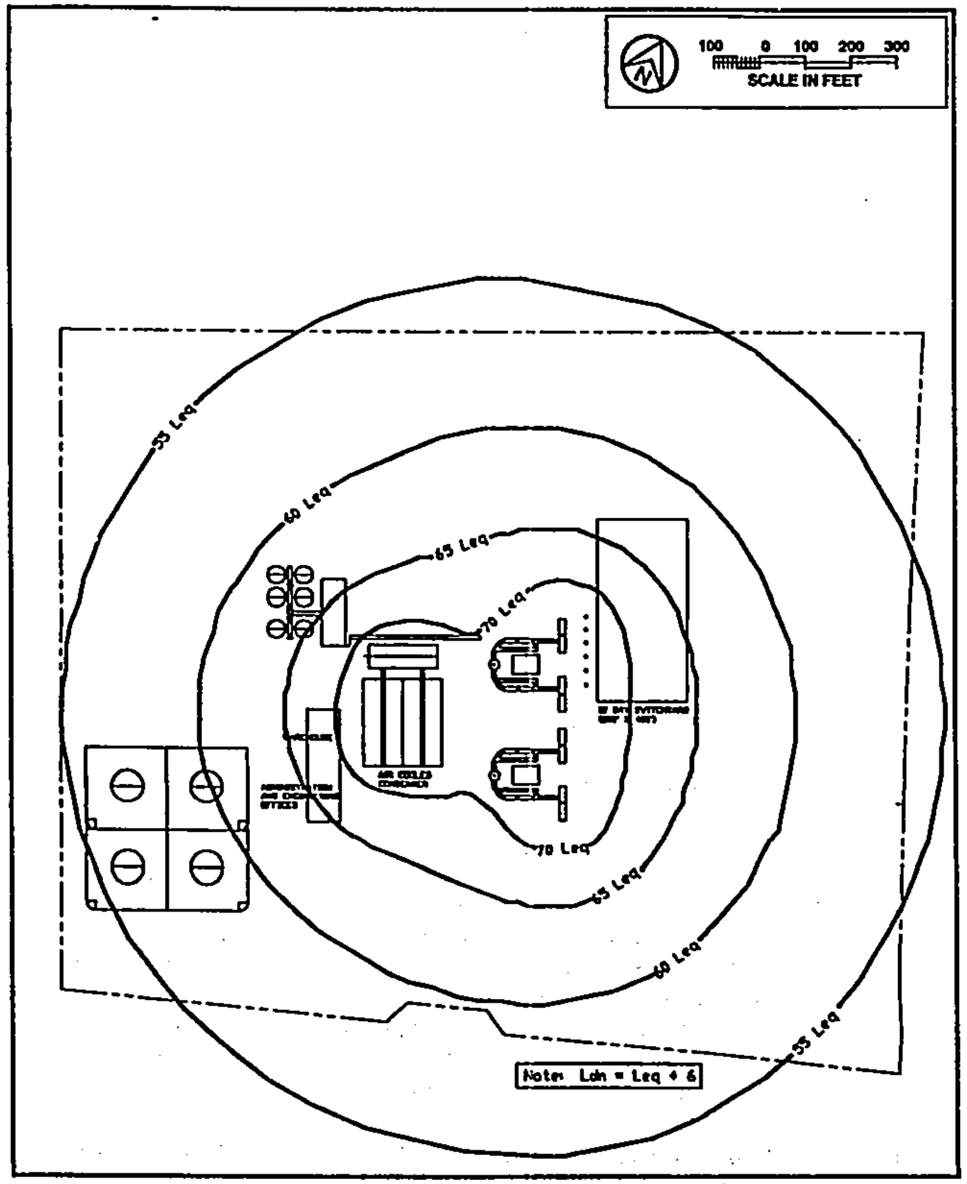
Phase II, III, and IV Noise Levels. Figures 11 thru 13 depict the hourly equivalent (or Leq) noise contours for the generating station with the second thru fourth DTCC units included and on-line during a PM peak hour. As was the case in Figure 10, the Ldn contour levels are 6 units greater than the Leq contour values shown in the figures. The noise levels and other modeling assumptions for the second thru fourth DTCC units were identical to those assumed under Phase I. As indicated in Figures 11 thru 13, the 70 Leq noise contour should be contained within the station's property boundaries, and the State DOH's 70 dBA limit for agricultural and industrial lots will be met following the station improvements thru Phase IV. Tables 4 and 5 present the predicted noise levels associated with Phase II thru IV additions to the generating station at the closest communities to the station. As was the case with Phase I noise levels, the predicted generating station noise levels are very low for Phases II thru IV, and should not be audible with or without the 12 dB of reduced attenuation due to sound ducting.

TABLE 5

WORST CASE GENERATING STATION NOISE LEVELS AT COMMUNITIES WITH 12 DB OF DUCTING EFFECTS

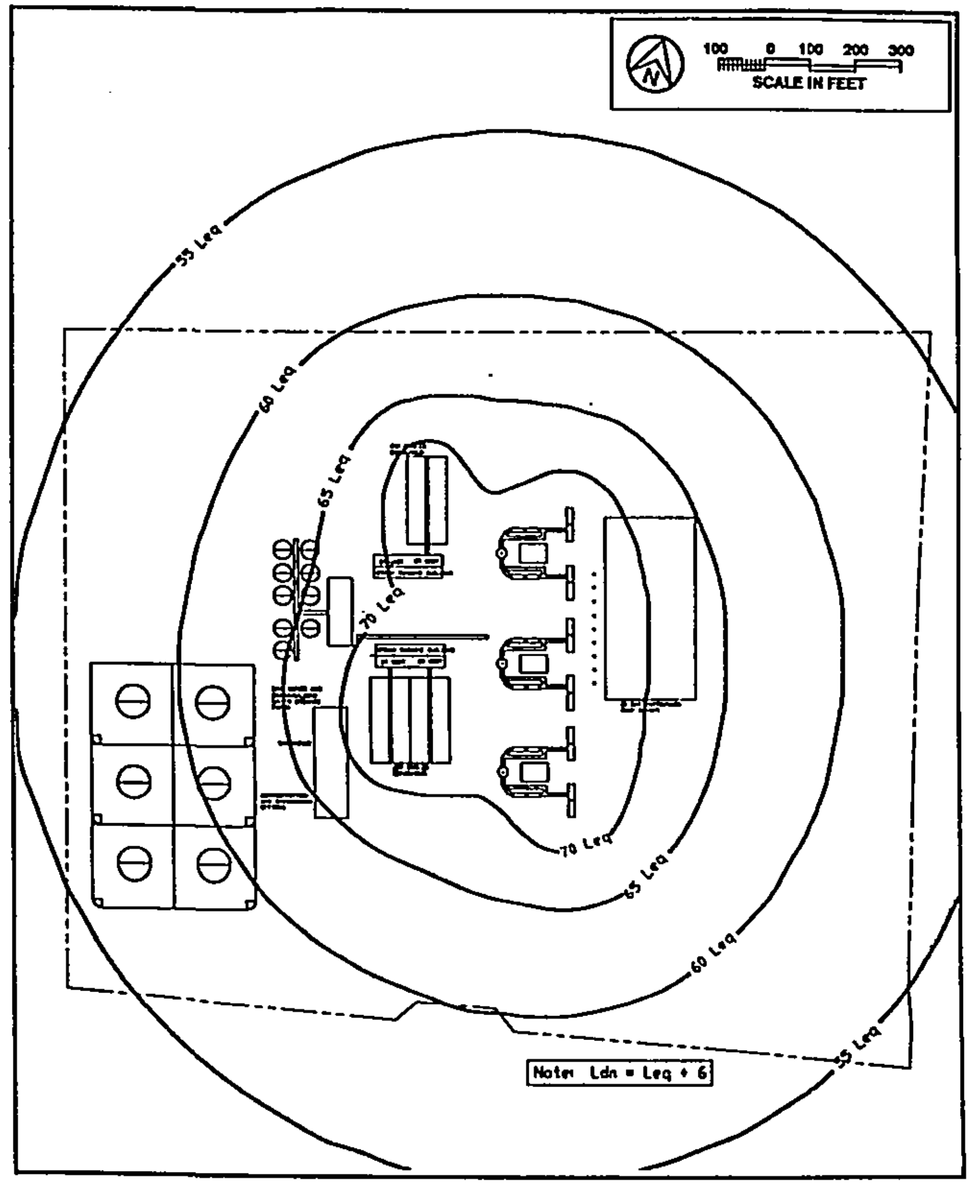
		-- PREDICTED NOISE LEVEL (dBL) --			
COMMUNITY	DISTANCE	PHASE I	PHASE II	PHASE III	PHASE IV
Puunene	12,000'	48.2	51.2	53.0	54.2
Kahului	18,000'	40.3	43.3	45.1	46.3
Pukalani	21,000'	37.0	40.0	41.8	43.0
Spreckelsville	22,000'	35.9	38.9	40.7	41.9
Pala	24,000'	33.8	36.8	38.6	39.8
Walakoa	26,000'	31.7	34.7	36.5	37.7

Note:
The predicted A-Weighted Sound Levels (dBA) are approximately 28 dB units less than the dBL values shown in the table.



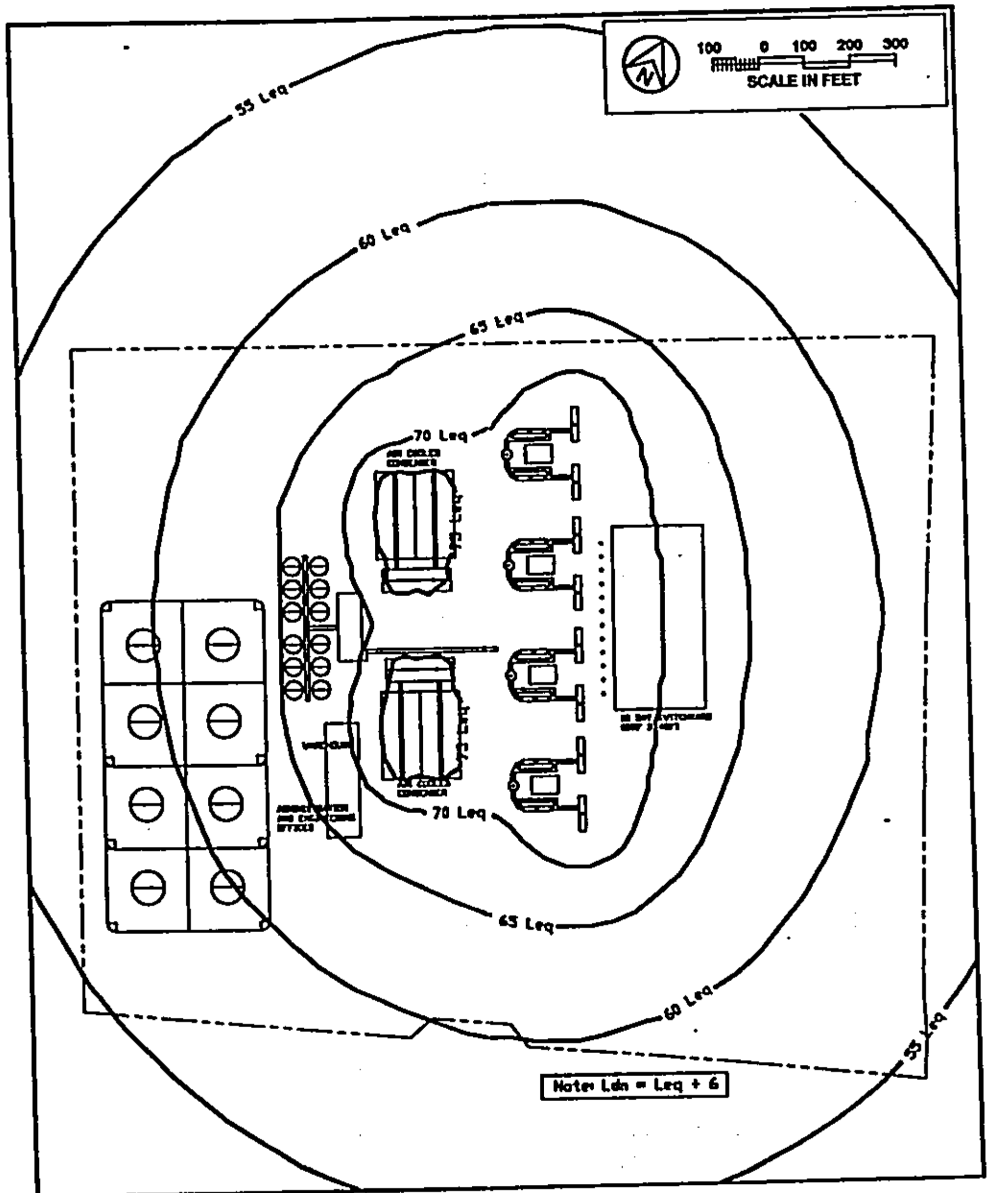
HOURLY EQUIVALENT (LEQ) NOISE CONTOURS FOR WAENA GENERATING STATION (PHASE II)

FIGURE 11



HOURLY EQUIVALENT (LEQ) NOISE CONTOURS FOR WAENA GENERATING STATION (PHASE III)

FIGURE 12



HOURLY EQUIVALENT (LEQ) NOISE CONTOURS FOR WAENA GENERATING STATION (PHASE IV)

FIGURE 13

CHAPTER VII. POTENTIAL NOISE IMPACTS ASSOCIATED WITH THE WAENA GENERATING STATION EQUIPMENT AND RECOMMENDED NOISE MITIGATION MEASURES

Phase I (58 MW). Adverse noise impacts are not expected to result from the proposed Phase I improvements at the MECO Waena Generating Station. Compliance with the State DOH 70 dBA standard along the station property lines should be possible with a complete DTCC unit and auxiliary equipment on-line. Tables 4 and 5 summarize the predicted hourly Leq sound levels at the nearest communities under worst case conditions with and without sound ducting. The sound level predictions will typically be lower than those shown in the tables due to local shielding effects from terrain or man-made structures located on the generating station site and/or at the receptor locations in the surrounding communities. During the daytime hours, when ground temperatures are typically higher than that of the atmosphere, sound attenuation due to upward bending of the sound will also result in lower predicted sound levels than those shown in Tables 4 and 5. In addition, measured background ambient noise levels at the surrounding communities also indicate that predicted sound levels from the generating station will probably be inaudible during the nighttime and early morning hours when worst case sound propagation and background ambient noise conditions occur. For these reasons, special noise mitigation measures should not be required for the implementation of the proposed Phase I improvements.

Phases II thru IV (116 thru 232 MW). Adverse noise impacts are also not expected to occur following the planned improvements from Phase II thru Phase IV. The future average daytime and nighttime noise levels from the station should not exceed the DOH 70 dBA standard at all station property lines. The FHA/HUD 65 Ldn standard for dwelling units should not be exceeded at locations which are beyond 500 feet from the station boundaries. Under worst case sound propagation conditions, and without local shielding effects, the 45 dBA DOH nighttime noise limit for single family residences should not be exceeded at locations beyond 4,600 feet from the station boundaries. At the present time, no noise sensitive land uses are located within 2 miles of the proposed station boundaries. Risks of generating station noise levels being audible at the closest communities are considered to be very low based on measured background ambient noise levels and the worst case sound level predictions shown in Tables 4 and 5. For these reasons, special noise mitigation measures should not be required for the implementation of the proposed Phase II thru Phase IV improvements.

Potential Mitigation Measures. Risks of potential noise impacts on existing dwelling units or other noise sensitive land uses from normal station operations are considered to be near zero. The following noise mitigation measures are available in conjunction with the proposed Phase I thru Phase IV improvements at the MECO Waena Generating Station primarily as preventative measures should lands be developed around the station, and as measures to minimize costs associated with administering hearing conservation programs within the generating station.

a. Incorporate absorptive interior finishes in the Steam Turbine Buildings to minimize sound build-up above Occupational Safety and Health Administration (OSHA) noise standards.

b. Include provisions in the new equipment procurement specifications which require that low and high frequency tonal sources be attenuated or masked. This is particularly important for the heat recovery steam generators which may have a tendency to develop discrete tonal flow noise components.

c. Noise disturbances (steam venting) from the generating station should be minimized during the nighttime hours. In addition, plant noise levels should be minimized during the early morning hours of probable thermal inversion. Prior notice to nearby residents of anticipated but unavoidable loud noise events should be provided.

d. It is unlikely that the generating station could comply with the most stringent DOH noise limit associated with single-family residential use, which is 45 dBA at any adjacent lot which is zoned for single-family residential use. In addition, under the Phase IV improvement scenario, the 45 dBA nighttime limit for single-family residences may be exceeded at locations which are as far as 4,600 feet from the station boundaries. Therefore, future development of lands for residential or other noise sensitive uses within 4,600 feet of the station boundaries should be discouraged unless it can be demonstrated that local shielding effects from buildings, tanks, etc. on the station allow for shorter buffer distances from the station for single-family residential use.

e. Additional sound attenuation measures may be required in the future if the generating station must comply with the more stringent DOH noise regulations associated with commercial or multi-family residential uses, which is 50 dBA at any adjacent lot which is zoned for these uses. In addition, under the Phase IV improvement scenario, the 50 dBA nighttime limit for multi-family family residences may

be exceeded at locations which are as far as 2,500 feet from the station boundaries Therefore, future development of lands for commercial or multi-family residential uses within 2,500 feet of the station boundaries should be discouraged unless it can be demonstrated that local shielding effects from buildings, tanks, etc. on the station allow for shorter buffer distances from the station for these uses.

f. Future development for industrial and agricultural uses on neighboring lands surrounding the generating station should be encouraged. Residential units on these adjacent lands should be disallowed due to potential adverse noise impacts. Adequate disclosure of the expected noise levels from the MECO Waena Generating Station should be provided in all real estate transactions, rental, or lease agreements involving the lands within 1 mile of the center of the station.

Construction Phase. Due to the very large buffer distances between the generating station site and the nearest noise sensitive receptors, construction noise should not cause adverse noise impacts. This conclusion also applies to any noise from well drilling activities at the project site.

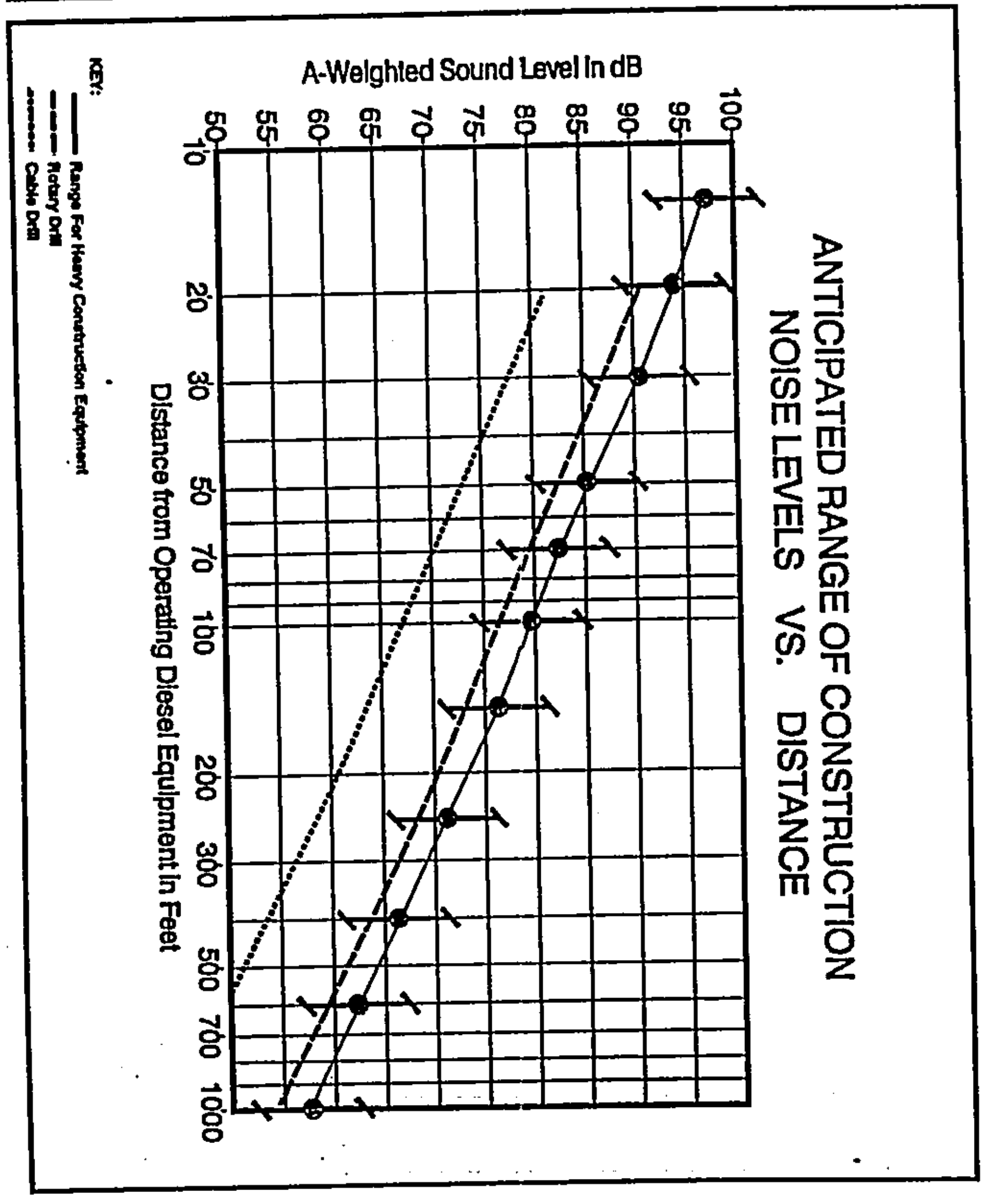
Typical levels of noise from construction activity (excluding pile driving activity) are shown in Figure 14. The noise levels of rotary drills, are approximately 3 dB lower than the central values of heavy construction equipment shown in Figure 14. The major noise sources of rotary well drilling equipment are the air compressor and its diesel engine, the hydraulic pump and its diesel engine, the hydraulic motor on the drill rig, and the air hammer within the drill bit. The noise levels of cable drilling equipment are approximately 10 dB less than those of rotary drilling equipment as indicated in Figure 14. The primary noise sources from the cable drilling equipment are the diesel engine and the impact noise from the drill bit.

At the noise sensitive properties in Puunene, which are at least 2 miles from the project site, predicted noise levels during construction and well drilling activities on the project site are expected to not exceed 12 dBA and 24 dBA without and with sound ducting effects, respectively. Adverse impacts from construction noise are not expected due to the very low noise levels anticipated, due to the temporary nature of the work, and due to the administrative controls available for its regulation.

Compliance with the 70 dBA DOH noise limit for agricultural and industrial parcels is possible during rotary drilling operations which are located at least 200 FT from the property line. For cable drilling operations, the setback distance from the property line can be reduced to a range of 70 to 100 FT, depending on the quieting package for

CONSTRUCTION NOISE LEVELS VS. DISTANCE

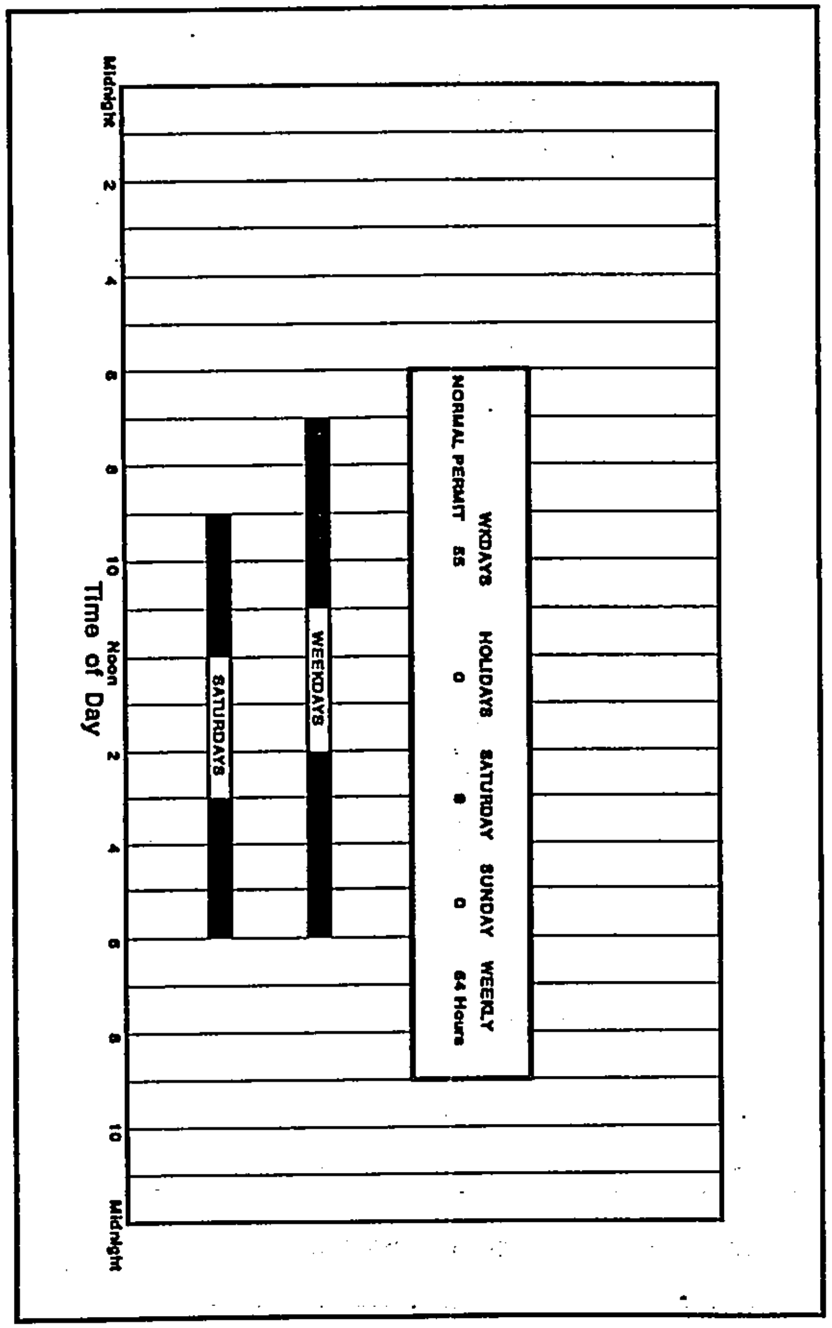
FIGURE 14



the diesel engine. However, because of the absence of any nearby noise sensitive receptors within 2 miles of the project site, 24-hour well drilling operations should be possible without causing adverse noise impacts.

Mitigation of construction noise to levels less than 70 dBA along the station property lines will not be practical in all cases due to the intensity of the louder construction noise sources (80 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (rock breaking, grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site. The incorporation of State Department of Health construction noise limits and curfew times, which are applicable on the island of Maui (Reference 5), is another noise mitigation measure which can be applied to this project. Table 6 depicts the hours of construction which would be allowed under the DOH permit procedures for construction noise which exceeds 70 dBA at the project's property lines. Noisy construction activities are not allowed on holidays under the DOH permit procedures.

If 24-hour well drilling or construction operations are required during the construction period, it is suggested that a variance from the rules of Reference 5 be requested. Because of the very low noise levels anticipated from construction activities during the day or night at the nearest noise sensitive receptors, an application to the DOH for a construction noise variance would not be unreasonable.



AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

TABLE 6

APPENDIX A. REFERENCES

(1) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 12, 1996.

(2) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(3) American National Standard, "Sound Level Descriptors for Determination of Compatible Land Use," ANSI S12.40-1990; Acoustical Society of America.

(4) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; April 1, 1995.

(5) "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety;" U.S. Environmental Protection Agency; EPA 550/9-74-004; March 1974.

(6) Y. Ebisu & Associates letter to Belt Collins & Associates dated December 3, 1992.

(7) Dames and Moore memo #22941-007-001 dated February 27, 1995.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78, NOISE REGULATION REPORTER.

APPENDIX B (CONTINUED)

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE(1) A-WEIGHTING	OTHER(2) WEIGHTING	UNWEIGHTED
1. Sound (Pressure) (3) Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level (4) Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average value over (non-time domain) set of observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level exceeded x% of the total set of (non-time domain) observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1)). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX C. RESULTS OF SOUND PROPAGATION MEASUREMENTS

Meteorological conditions (ground temperature, air temperature, humidity, and wind direction and speed) can affect the propagation of sound from one location to another, or more specifically, these meteorological conditions can affect how much or how little sound is attenuated from one location to another. The variations in sound attenuation due to meteorological conditions tend to increase in magnitude with increasing separation distances between the noise source and receptor. During the daytime, and particularly near midday, when ground temperatures tend to be highest, sound attenuation also tends to be at its peak. In addition, background ambient noise levels also tend to be highest during the daytime hours. This favorable combination of high sound attenuation (due to meteorological factors) and high background ambient noise levels tends to make distant noise sources less intrusive (or more difficult to hear) during the midday period.

Both the meteorological conditions and background ambient noise levels generally become less favorable during the night and early morning hours, when distant noise sources may become more audible due to reduced sound attenuation and lower background ambient noise levels. Wind direction and speed do affect sound propagation, but the more predominant and regular effects are the daily occurrences of less favorable thermal and background ambient noise conditions during the nighttime and early morning hours. Air temperature and humidity changes have some effect on sound propagation, but their primary net result on sound propagation is that distant noise sources tend to have more bass (or low frequency) content and little treble (or high frequency) content. This is because the air through which the sound travels absorbs (or attenuates) the high frequency sounds at a higher rate than low frequency sounds.

Reduced sound attenuation (similar to sound propagation in a tunnel) can occur due to a meteorological condition called air temperature inversion. These thermal inversions, which have been confirmed by nightly soundings of the atmosphere, are caused by nighttime radiational cooling of the ground, which can be reinforced by the cool drainage wind flow from a high mountain, such as Haleakala. Average strength of the inversions is probably in the order or 2 to 3 degrees F., with a range of 0 to 6 degrees F. Average height of the inversion layer is 300 FT, with a range of 200 to 450 FT. These thermal inversion layers tend to support sound ducting, which allows low frequency sound to travel for longer distances at reduced attenuation. High frequency sound is absorbed at a greater rate than low frequency sound, and propagate at shorter distances than low frequency sound, with or without sound ducting.

Empirical evidence of the presence of low frequency sound ducting is available from records of low frequency, noise events from distant jet aircraft which appear to be significantly louder than normal. These louder events tend to occur during the nighttime or early morning hours (between 6:00 pm and 8:00 am) when the strength of the ground radiational air temperature inversion is greatest. During the summer months, the possibility of thermal inversion is reduced during the nighttime and early morning hours. This is due to the generally warmer ground temperatures and the stronger nighttime trade winds, which tend to negate the effects of the cool drainage winds from a high mountain such as Haleakala.

An attempt was made to measure the possible magnitude of the reduced sound attenuation associated with low frequency sound ducting during the early morning hours on March 21 and 22, 1997. Measurements of jet aircraft noise were obtained at Locations "N" and "O" where shown in Figure 1. Location "N" was approximately 2,000 feet from the main runway at Kahului Airport, and Location "O" was approximately 11,000 feet south and downwind of the main runway. Winds were relatively light during the measurement periods. The noise measurements included jet engine thrust reversal noise following touchdown events and start-to-roll noise during takeoff. The results of the noise measurements are shown in Tables C-1 and C-2. Tables C-1 and C-2 contain the measurements of audible noise events while the aircraft (or noise source) was on the ground.

Under standard propagation conditions and for jet aircraft noise events, the measured differences in sound attenuation from Location "N" to Location "O" was predicted to be 20 dBL (Linear Scale). In evaluating the sound measurement data, probable sound ducting was considered to exist whenever the measured sound level difference between measured values at Location "N" vs. Location "O" was less than 20 dBL. In Tables C-1 and C-2, which recorded ground-to-ground propagation conditions (similar to propagation conditions for the MECO Waena Generating Station), 13 of 36 (or 36 percent) of the measured sound levels displayed evidence of probable sound ducting, with the majority of these events occurring on March 21, 1997. The primary difference in observed meteorological conditions between the 21st and 22nd of March 1997 was the overcast sky on the 21st vs. the very clear (cloudless) sky on the 22nd. For the 13 ground-to-ground propagation noise events which displayed evidence of sound ducting, the average amount of increased sound level due to ducting was calculated to be 5 dBL, with a standard deviation of 3.8 dBL. The maximum amount of increased sound level attributable to ducting was 12 dBL during a thrust reversal event at 0811 hours on March 21, 1997 (see Table C-1).

TABLE C-1

LOCATIONS: KAHULUI AIRPORT (LOC N) AND PUUNENE (LOC O), MAUI

DATE: MARCH 21, 1997

TIME	Loc N	Loc O	Atten.	Ducting?	AIRCRAFT	NOISE EVENT ON GROUND
0543	77	< 56	> 21	NO	B-737(200)	THRUST REVERSAL, LANDING RWY 02
0557	75	< 56	>19	NO	B-737(200)	THRUST REVERSAL, LANDING RWY 02
0603	72	< 56	>16	NO	B-737(200)	THRUST REVERSAL, LANDING RWY 02
0612		75			B-737(200)	START TAKEOFF ROLL, RWY 02
0614	92	73	19	YES	B-737(200)	START TAKEOFF ROLL, RWY 02
0627	74	60	>14	NO	DC-9(50)	THRUST REVERSAL, LANDING RWY 02
0637	100	79	21	NO	DC-9(50)	START TAKEOFF ROLL, RWY 02
0639	98	81	17	YES	B-737(200)	START TAKEOFF ROLL, RWY 02
0704	93	73	20	NO	DC-9(50)	START TAKEOFF ROLL, RWY 02
0706	87	72	15	YES	B-737(200)	START TAKEOFF ROLL, RWY 02
0727		<63			DC-9(50)	THRUST REVERSAL, LANDING RWY 02
0737	75	<63	>12		B-737(200)	THRUST REVERSAL, LANDING RWY 02
0749	76	<63	>13		DC-9(50)	THRUST REVERSAL, LANDING RWY 02
0801	75	<63	>12		B-737(200)	THRUST REVERSAL, LANDING RWY 02
0811	88	79	9	YES	DC-9(50)	START TAKEOFF ROLL, RWY 02
0811	77	69	8	YES	B-737(200)	THRUST REVERSAL, LANDING RWY 02
0813	85	75	10	YES	B-737(200)	START TAKEOFF ROLL, RWY 02
0820	90	77	13	YES	DC-9(50)	START TAKEOFF ROLL, RWY 02
0836	89	72	17	YES	B-737(200)	START TAKEOFF ROLL, RWY 02
0850	86	70	16	YES	B-737(200)	START TAKEOFF ROLL, RWY 02
0900	90	73	17	YES	DC-9(50)	START TAKEOFF ROLL, RWY 02

Notes:

1. All times are in hours.
2. Measured values shown for Loc N, Loc O, and Attenuation are in decibels using the Linear (or Unweighted) Filter.
3. Ducting assumed present when measured Attenuation < 20 dB.

TABLE C-2

LOCATIONS: KAHULUI AIRPORT (LOC N) AND PUUNENE (LOC O), MAUI

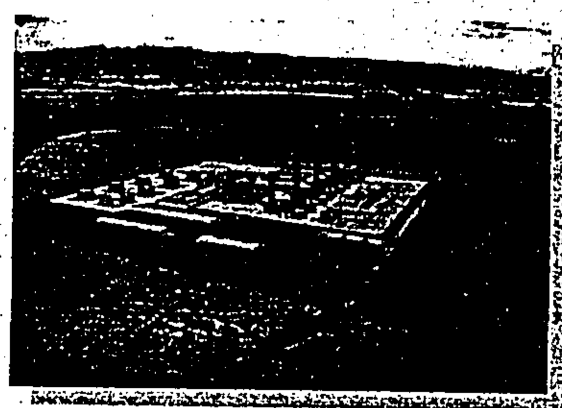
DATE: MARCH 22, 1997

TIME	Loc N	Loc O	Atten.	Ducting?	AIRCRAFT	NOISE EVENT ON GROUND
0541	81	< 57	> 24	NO	B-737(200)	THRUST REVERSAL, LANDING RWY 02
0604	74	< 57	> 17	NO	DC-9(50)	THRUST REVERSAL, LANDING RWY 02
0607	75	< 57	> 18	NO	B-737(200)	THRUST REVERSAL, LANDING RWY 02
0635	94	< 57	> 37	NO	DC-9(50)	START TAKEOFF ROLL, RWY 02
0703	96	< 57	> 38	NO	DC-9(50)	START TAKEOFF ROLL, RWY 20
0725	88	58	30	NO	DC-9(50)	THRUST REVERSAL, LANDING RWY 20
0737	83	< 57	> 26	NO	B-737(200)	THRUST REVERSAL, LANDING RWY 20
0751	86	68	18	YES	DC-9(50)	THRUST REVERSAL, LANDING RWY 20
0759	79	62	17	YES	DC-9(50)	THRUST REVERSAL, LANDING RWY 20
0805	91	64	27	NO	DC-9(50)	START TAKEOFF ROLL, RWY 02
0811	81	57	24	NO	B-737(200)	START TAKEOFF ROLL, RWY 02
0828	77	< 57	> 20	NO	B-737(200)	THRUST REVERSAL, LANDING RWY 02
0829	78	< 57	> 21	NO	DC-9(50)	THRUST REVERSAL, LANDING RWY 02
0832	87	< 57	> 30	NO	DC-9(50)	START TAKEOFF ROLL, RWY 02
0837	88	59	29	NO	B-737(200)	START TAKEOFF ROLL, RWY 02
0847	89	61	28	NO	B-737(200)	START TAKEOFF ROLL, RWY 02
0900	89	61	28	NO	B-737(200)	START TAKEOFF ROLL, RWY 02
0908	92	61	31	NO	DC-9(50)	START TAKEOFF ROLL, RWY 02
0932	91	66	25	NO	DC-9(50)	START TAKEOFF ROLL, RWY 02
0938	79	60	19	YES	B-737(200)	THRUST REVERSAL, LANDING RWY 02

Notes:

1. All times are in hours.
2. Measured values shown for Loc N, Loc O, and Attenuation are in decibels using the Linear (or Unweighted) Filter.
3. Ducting assumed present when measured Attenuation < 20 dB.

Based on these measurement results, it was concluded that low frequency sound ducting is possible in the project area, and that reduced sound attenuation of 5 to 12 dBL can be expected during the nighttime and early morning hours. These results, coincidentally, are very similar to data collected at other state airports. Based on these measurements, predictions of generating station noise levels at the distant communities from the station were made after adding 12 dBL to the station noise level predictions using standard propagation conditions to describe the potential effects of sound ducting.



APPENDIX I

TRAFFIC STUDY

MAUI ELECTRIC COMPANY, LIMITED'S
PROPOSED
WAENA GENERATION STATION
TRAFFIC STUDY

FINAL

Prepared for
CH2M Hill, Inc.

Prepared by
Austin, Tsutsumi & Associates, Inc.
Engineers • Surveyors
Honolulu, Hawaii

July 1997

ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS

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ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS

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AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

TED S. KAWAHIGASHI, P.E.
KENNETH K. KUROKAWA, P.E.
IVAN K. NAKATSUKA, P.E.
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MAUI ELECTRIC COMPANY, LIMITED'S

PROPOSED WAENA GENERATING STATION

TRAFFIC STUDY

I. INTRODUCTION

This report documents the findings of the traffic study conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to evaluate the potential traffic impacts of Maui Electric Company, Limited's (MECO) development of the proposed Waena Generating Station in central Maui. Land use and zoning changes at the State and County levels would be needed to develop the project.

A. Project Description

MECO proposes to develop and operate an electrical generation facility in central Maui. The facility would contain four diesel oil-fired 58-MW dual-train combined cycle (DTCC) units consisting of eight combustion turbines, eight heat recovery steam generators, four steam turbines, four steam condensers, four motor control houses, a control room, fire protection system supply wells, water treatment facility, wastewater treatment facility, injection wells, water and air laboratory, maintenance shop, warehouse and storage areas, relay building, switch yard, fuel storage tanks, fuel storage tank berms, fuel unloading area, administrative building and related 69-kilovolt transmission lines.

In the future, there is a possibility of relocating baseyard facilities from the existing Kamehameha Avenue site in Kahului to the project site. If the baseyard relocation occurs, then the project site would also contain transmission and distribution warehouse/offices, storage and parking area, and a gasoline storage area.

The project will be developed in phases, with the first 58-MW being completed in the Year 2006. According to current projections, which are

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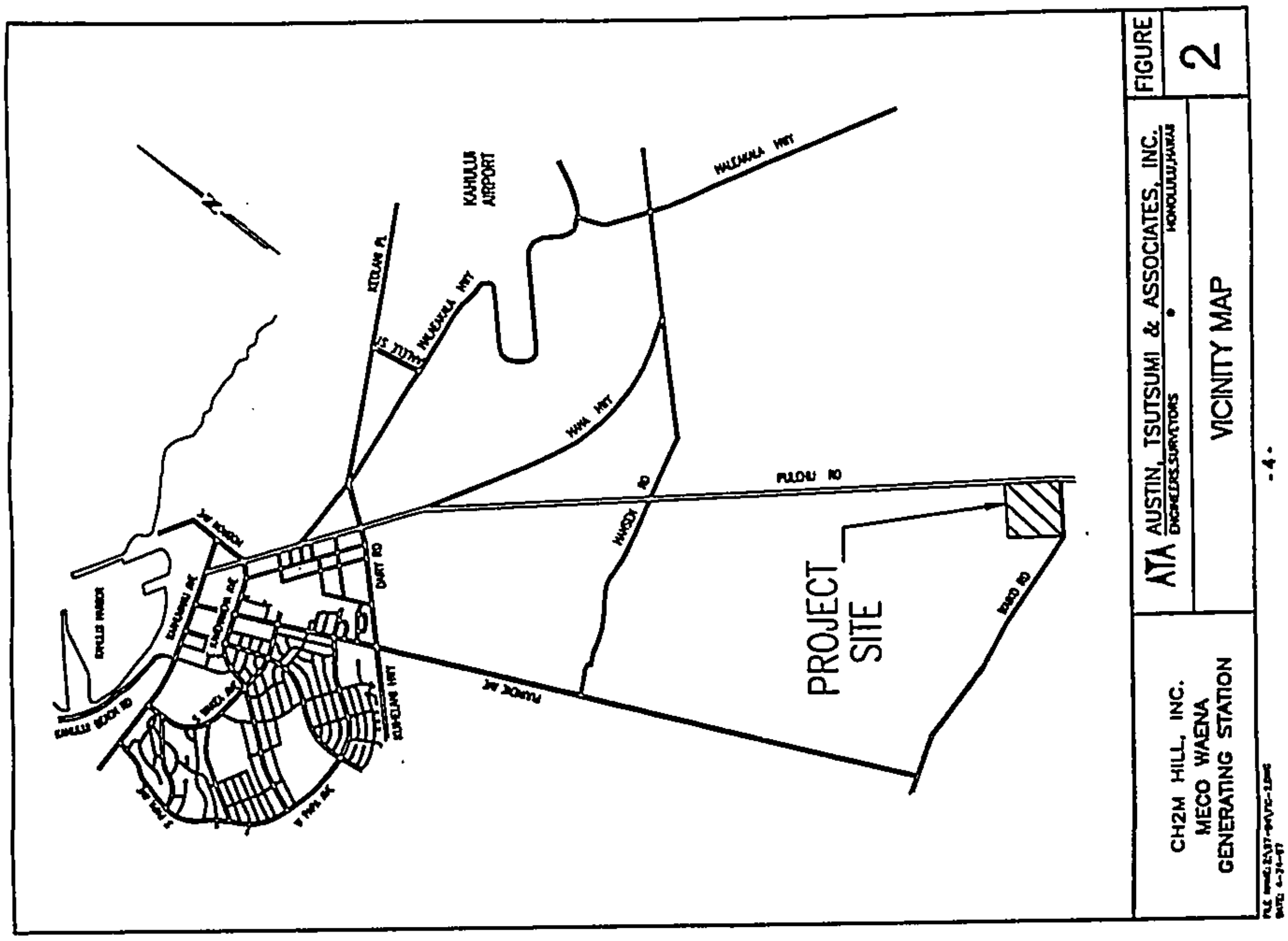
dependent on the demand for electrical power on Maui, the second and third phases of 58-MW each are planned for implementation during the next 10 years or by Year 2016. The fourth phase is expected beyond Year 2016; however, by the third phase the project would be considered fully operational and the level of employment at the Waena Generating Station would remain relatively stable from the third to the fourth phase. Thus, for this study, Year 2016 is utilized in the assessment of future conditions.

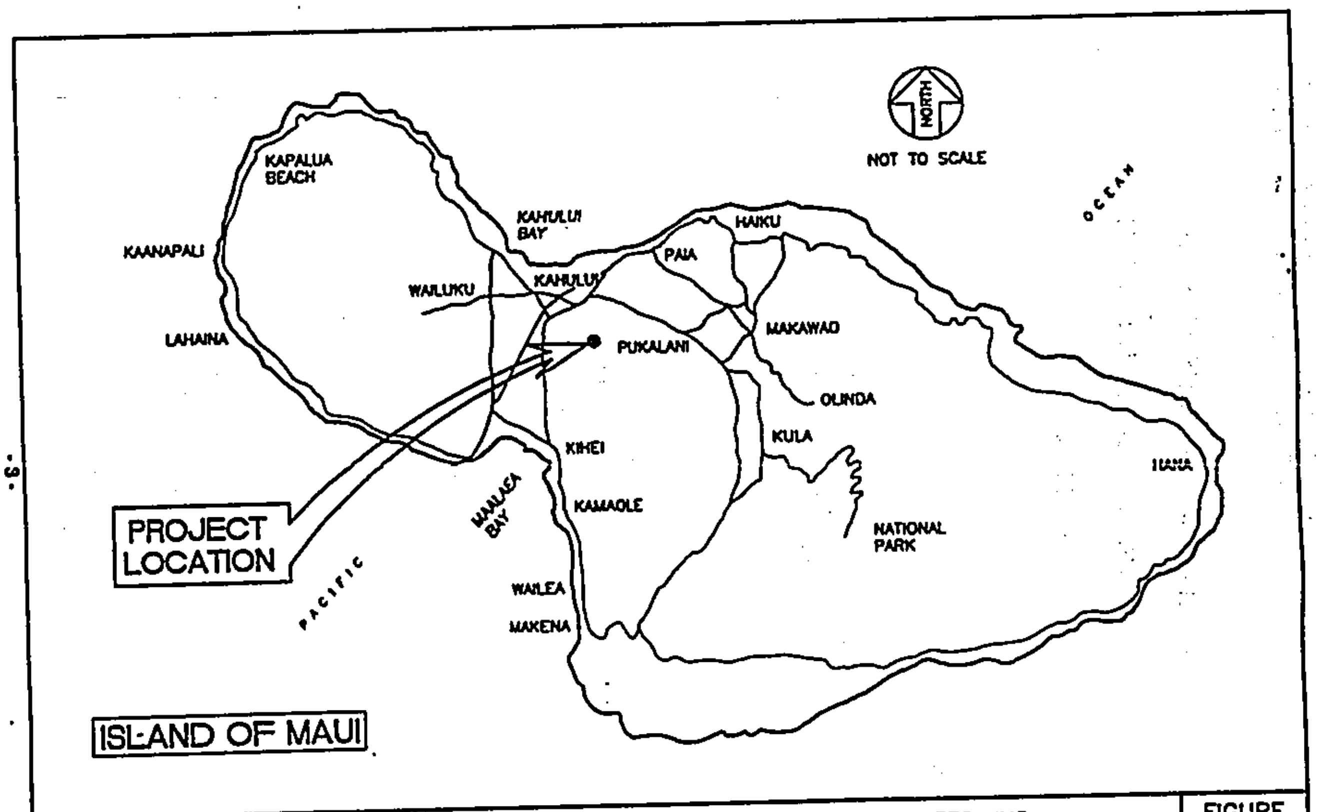
The general location of the proposed Waena Generating Station is shown in Figure 1. The project is situated east of Kahului as depicted in the vicinity map in Figure 2. A preliminary layout of the project site is provided in Figure 3. The site is specifically identified as TMK: 3-8-03: portion of 01. The site, which is owned by MECO, is currently utilized by Hawaiian Commercial & Sugar Company for the cultivation of sugar cane and accessible via Pulehu Road and private cane haul roads.

Access to the Waena Generating Station would be provided via Pulehu Road at two driveway locations, at the makai and mauka borders of the property. Although these two driveways would be connected by an internal circulation road, the makai driveway is designated for fuel trucks and the mauka driveway, the main access, is for employees and visitors. The primary parking area is located at the mauka driveway.

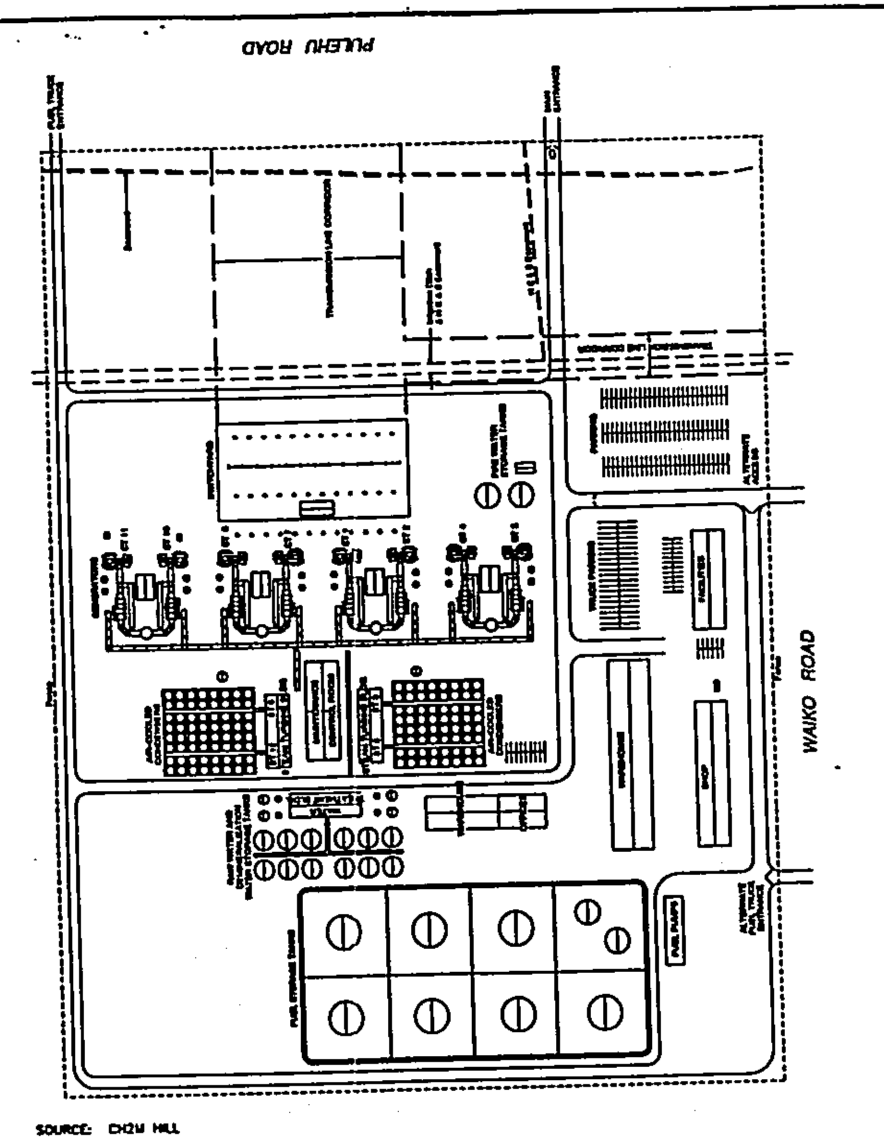
B. Study Methodology

The purpose of the study is to analyze the potential project traffic impacts on the roadway system within the study area. Proposed roadway improvements, which are required to allow the street system to accommodate the future traffic volumes without, as well as with the power generation station, are identified in this study, as needed.





CH2M HILL, INC. MECO WAENA GENERATING STATION	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII PROJECT LOCATION	FIGURE 1



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Traffic volume counts and observations were conducted at key intersections to identify existing traffic conditions. Four existing intersections along the major roadways and the two future driveway locations in the study area, which are listed below, were analyzed during the morning, mid-day, and afternoon peak hours of traffic.

1. Hana Highway, Kamehameha Avenue, and Hobron Avenue
2. Hana Highway and Dairy Road
3. Hana Highway and Pulehu Road
4. Hansen Road and Pulehu Road
5. Pulehu Road and Project Driveway A (Future Fuel Truck Access)
6. Pulehu Road and Project Driveway B (Future Main Access)

In order to assess the traffic impacts of the proposed Waena Generating Station in context with other growth expected to occur in the region, future Year 2016 traffic assignment was developed to establish future baseline conditions without the proposed project. The traffic volumes generated by the proposed Waena Generating Station were added to the future Year 2016 baseline conditions. A comparison of the traffic analysis results of the future Year 2016 baseline conditions with and without the proposed project is utilized to determine the expected traffic impacts of the proposed Waena Generating Station.

II. EXISTING CONDITIONS

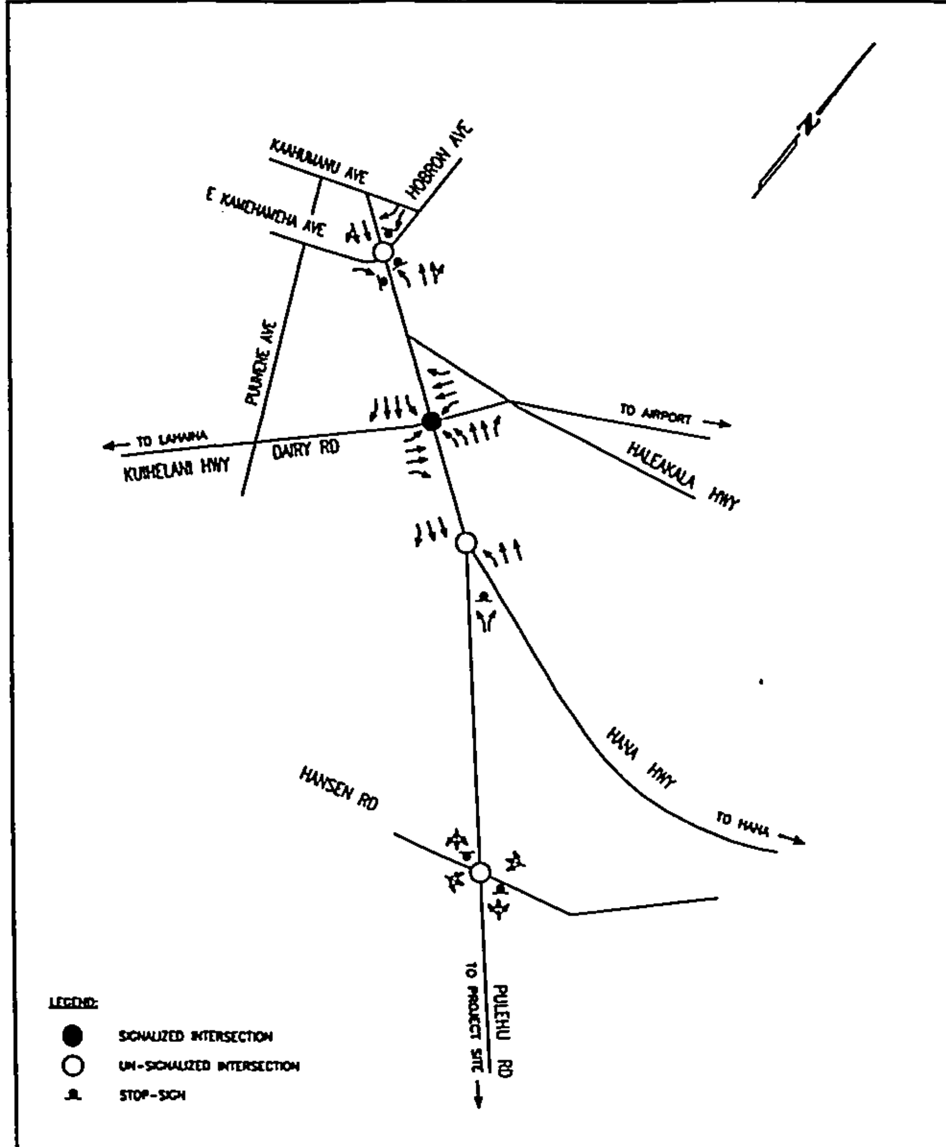
A field investigation was undertaken to develop a description of existing conditions and infrastructure at the study intersections. Information relevant to the study includes land use, an inventory of streets, traffic volumes, and the current operating conditions of traffic on the roadway system.

A. Existing Roadway System

This section describes the existing circulation system serving the area, including the number of travel lanes, street classifications, and traffic control devices. Brief descriptions of the roadway facilities in the study area follow:

- Hana Highway is a major State four-lane divided highway linking Kahului and Hana. North of the Haleakala Highway intersection, Hana Highway is a two-lane highway. Major intersections along this highway are channelized and controlled by traffic signals.
- Kamehameha Avenue is a four-lane local collector roadway, serving the industrial/commercial area of Kahului. Kamehameha Avenue and Hobron Avenue connect to Hana Highway in an unsignalized intersection with restrictions on certain movements. At the approach to Hana Highway, a landscaped median on Kamehameha Avenue separates the northbound and southbound traffic, permitting only right-turn movements into and out of Kamehameha Avenue.
- Hobron Avenue is a local two-lane collector road, providing access to the industrial area in the vicinity of Kahului Harbor. At its unsignalized intersection with Hana Highway and Kamehameha Avenue, left- and right-turn movements are allowed, but through movements between Hobron Avenue and Kamehameha Avenue are restricted by the Hana Highway median.
- Dairy Road is a County four-lane collector. West of Puunene Avenue, Dairy Road becomes Kuihelani Highway and connects Kahului with the Maalaea area.
- Pulehu Road is a two-lane County collector roadway connecting the Upcountry area to Kahului. Pulehu Road is a rural, circuitous road and provides an alternative route to Haleakala Highway, but most of the traffic to the Upcountry area travels on Haleakala Highway. The County landfill is located on Pulehu Road.
- Hansen Road is a two-lane rural roadway connecting the Puunene area to Hana Highway in the Airport area.

The existing laneage configurations at the study intersections are illustrated in Figure 4. The types of traffic control devices at each study intersection, including



CH2M HILL, INC. MECO WAENA GENERATING STATION	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS,SURVEYORS • HONOLULU,HAWAII EXISTING INTERSECTION CONFIGURATIONS	FIGURE 4

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signalization or stop controlled approaches at unsignalized intersections, are also identified in Figure 4.

B. Existing Traffic Operations

The following sections present the existing intersection peak hour traffic volumes and a description of the methodology utilized to analyze the intersection operating conditions at each of the four existing study intersections.

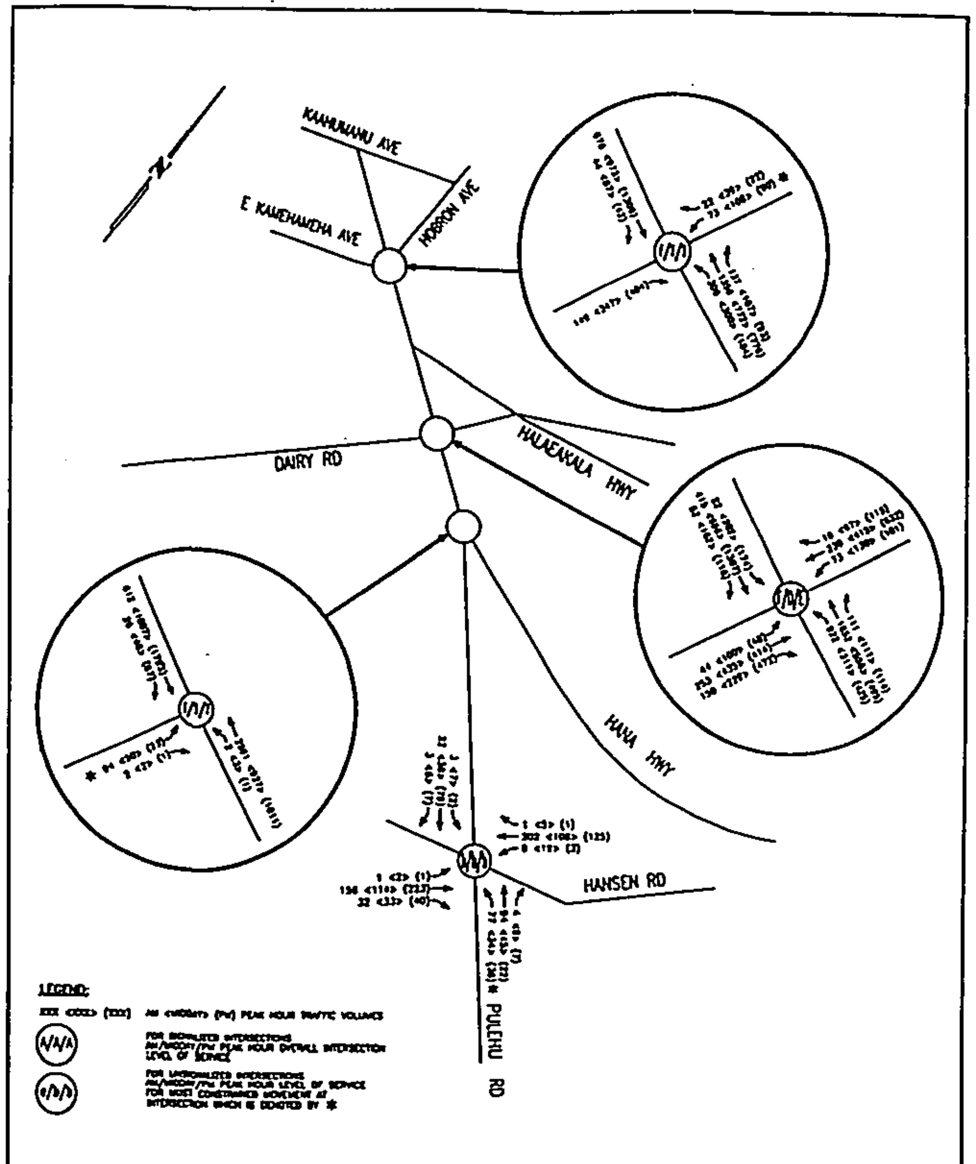
1. Existing Traffic Volumes

Manual turning movement counts at the study intersections were conducted by ATA during the weekday morning (AM), mid-day (MD) and afternoon (PM) peak periods of traffic on April 1, 2 and 10, 1997. The count data are provided in Appendix A and the peak hour volumes are presented in Figure 5.

Generally, traffic on Hana Highway flows fairly well through the study intersections. Hana Highway traffic has the right-of-way and, therefore, does not stop at the unsignalized intersections with Kamehameha Avenue/Hobron Avenue and with Pulehu Road. Also, the traffic signal at the Dairy Road intersection is designed to provide the higher volume Hana Highway traffic with more green time than Dairy Road. Traffic volumes at the intersection of Hansen Road and Pulehu Road are relatively low in comparison to Hana Highway traffic. The commuter traffic on Hana Highway is apparent; the Upcountry residents utilize Hana Highway to travel to work in the morning peak period and return home during the afternoon peak hour.

2. Technical Analysis

The technical analysis of traffic conditions is described in this section for signalized and unsignalized intersections. Level of service (LOS) is a qualitative measure used to describe the condition of traffic flow, ranging from free flow conditions at LOS A to congested conditions at LOS F.



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The 1994 Highway Capacity Manual, Special Report 209, "Operational Method for Signalized Intersections" was utilized to analyze the signalized intersections in this study. This method provides results in terms of stopped delay per vehicle, LOS and the volume-to-capacity (v/c) ratio. The stopped delay per vehicle and LOS reflect the delay and discomfort to motorists. The capacity of a signalized intersection is calculated, based upon laneage configuration and the traffic signal operations (in terms of phasing and timing) of the intersection. The v/c ratio quantifies the utilization of capacity; a v/c ratio greater than 1.00 indicates that traffic volumes exceed the calculated capacity of the signalized intersection.

Unsignalized intersections are controlled by Stop signs or Yield signs on minor street approaches. The "Two-Way Stop Control" method described in the 1994 Highway Capacity Manual (Transportation Research Board, 1994) was employed to determine the available reserve capacity and corresponding level of service for each of the constrained movements (approaches from minor streets and left-turn movements from the major highway) at the unsignalized intersections.

Level of service definitions for both signalized and unsignalized intersections are included in Table 1 and Table 2, respectively.

3. Analysis Results

This section describes the current levels of service at the four existing intersections. Three of the study intersections are unsignalized, including the intersections of Hana Highway with Kamehameha Avenue and Hobron Avenue, Hana Highway with Pulehu Road, and Hansen Road with Pulehu Road; the stop or yield controls at these intersections are on the minor streets of Kamehameha Avenue, Hobron Avenue and Pulehu Road. The remaining study intersection of Hana Highway with Dairy Road is signalized. Figure 5 and Table 3 present the existing level of service at each of the four existing study intersections.

TABLE 1

LEVEL OF SERVICE DEFINITIONS FOR SIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	DELAY (SECONDS/VEHICLE)	DESCRIPTION
A	.0 - 5.0	Little or no delay
B	5.1 - 15.0	Short traffic delay
C	15.1 - 25.0	Moderate traffic delay
D	25.1 - 40.0	Long traffic delay
E	40.1 - 60.0	Very long traffic delay
F	> 60.0	Failure - extreme congestion

SOURCE: "Highway Capacity Manual", Transportation Research Board, 1994.

TABLE 2

LEVEL OF SERVICE DEFINITIONS FOR UNSIGNALIZED INTERSECTIONS

LEVEL OF SERVICE	DELAY (SECONDS/VEHICLE)	DESCRIPTION
A	0.0 - 5.0	Little or no delay
B	5.1 - 10.0	Short traffic delay
C	10.1 - 20.0	Moderate traffic delay
D	20.1 - 30.0	Long traffic delay
E	30.1 - 45.0	Very long traffic delay
F	> 45.0	Failure - extreme congestion

SOURCE: "Highway Capacity Manual", Transportation Research Board, 1994.

Table 3
EXISTING YEAR 1997 TRAFFIC CONDITIONS

Intersection	Type of Intersection	AM Peak Hour v/c Ratio	AM Peak Hour Delay (Seconds)	AM Peak Hour Level of Service	Mid-Day Peak Hour v/c Ratio	Mid-Day Peak Hour Delay (Seconds)	Mid-Day Peak Hour Level of Service	PM Peak Hour v/c Ratio	PM Peak Hour Delay (Seconds)	PM Peak Hour Level of Service
Hana Highway, Kamehameha Avenue and Hobron Avenue	Unsignalized									
Hana Highway Westbound Left Turn		--	9.7	B	--	24.9	D	--	28.1	D
Kamehameha Avenue Northbound Right Turn		--	7.7	B	--	12.4	C	--	23.6	D
Hobron Avenue Southbound Approach										
Left Turn		--	>45.0	F	--	>45.0	F	--	>45.0	F
Right Turn		--	6.5	B	--	4.6	A	--	4.4	A
Overall Intersection		--	>45.0	F	--	>45.0	F	--	>45.0	F
Hana Highway and Dairy Road	Signalized									
Dairy Road Northbound Approach		--	53.3	E	--	38.8	D	--	79.0	F
Dairy Road Southbound Approach		--	65.2	F	--	39.3	D	--	54.6	E
Hana Highway Eastbound Approach		--	32.9	D	--	23.1	C	--	47.5	E
Hana Highway Westbound Approach		--	65.4	F	--	24.2	C	--	61.7	E
Overall Intersection		0.80	60.6	F	0.51	29.8	D	0.71	66.4	E
Hana Highway and Pulehu Road	Unsignalized									
Hana Highway Southbound Left Turn		--	4.5	A	--	7.3	B	--	19.4	C
Pulehu Road Westbound Approach										
Left Turn		--	>45.0	F	--	>45.0	F	--	>45.0	F
Right Turn		--	5.3	A	--	8.5	B	--	21.2	D
Overall Intersection		--	>45.0	F	--	5.3	B	--	6.2	B
Hansen Road and Pulehu Road	Unsignalized									
Hansen Road Northbound Left Turn		--	2.6	A	--	2.4	A	--	2.4	A
Hansen Road Southbound Left Turn		--	2.6	A	--	2.5	A	--	2.8	A
Pulehu Road Eastbound Approach		--	5.6	B	--	4.9	A	--	6.0	B
Pulehu Road Westbound Approach		--	7.9	B	--	5.4	B	--	6.6	B
Overall Intersection		--	2.8	A	--	2.1	A	--	1.9	A

- Hana Highway with Kamehameha Avenue and Hobron Avenue - During the morning, mid-day, and afternoon peak hours at this unsignalized intersection, the Hobron southbound left-turn movement experiences very long delays or Level of Service F. Normally, about 2 vehicles on this approach were observed waiting for gaps in the Hana Highway traffic; however, during the afternoon peak hour, the queue extended to 6 vehicles. The Hana Highway median serves as a waiting area and allows the Hobron Avenue left-turn movement to be undertaken in two steps; motorists first cross Hana Highway Wailuku (west) bound traffic then wait in the median to merge into Hana (east) bound traffic. The Hana Highway westbound left-turn movement is controlled by a stop sign and must yield to the Hobron Avenue traffic waiting in the median to merge with eastbound Hana Highway traffic.

  The Kamehameha Avenue northbound right-turn movement and the Hana Highway westbound left-turn movement operate with short delays (Level of Service B) during the morning peak hour and some delay (Levels of Service C and D) during the mid-day and afternoon peak hours. Queues were not noticeable during the morning peak hour, but during the afternoon peak hour, average queues were about 3-4 vehicles for these two movements. In addition, during short periods within the afternoon peak hour, the Hana Highway westbound left-turn queue was observed to extend to 11 vehicles and the Kamehameha Avenue right-turn movement had 13 vehicles queued on this approach. The traffic signal at the nearby intersection of Hana Highway and Wharf Street has a metering effect which creates gaps in the Hana Highway traffic and permits these extended queues to clear the Kamehameha Avenue/ Hobron Avenue intersection.

- Hana Highway with Dairy Road - During the morning peak hour, the Hana Highway westbound left and through movements dominate this signalized intersection. In order to accommodate this heavy traffic demand during the morning peak period, the traffic signal allows a long cycle length with leading and lagging left-turn phases for the Hana Highway left-turn movement. The analysis results show Level of Service C for the eastbound approach and Level of Service F on the remaining three approaches; however, the traffic volumes on all approaches are able to clear the intersection within a single traffic signal cycle. During the morning peak hour, this intersection is operating below capacity with an overall volume-to-capacity (v/c) ratio of 0.80 and Level of Service F conditions.

During the mid-day peak hour, overall conditions at the intersection of Hana Highway with Dairy Road are at Level of Service D and the v/c ratio is at 0.51. In the afternoon peak hour, the Dairy Road northbound approach is at Level of Service F, but the overall intersection is at Level of Service E with a v/c ratio of 0.71.

- Hana Highway with Pulehu Road - During the morning, mid-day and afternoon peak hours at this unsignalized intersection, the analysis results indicate the Pulehu Road westbound left-turn movement is at Level of Service F. The Hana Highway median permits motorists to execute this Pulehu Road left-turn movement in two steps, first crossing Hana Highway northbound traffic, then waiting in the median to merge with Hana Highway southbound traffic. The traffic signals at the neighboring intersections of Hana Highway/Dairy Road and Hana Highway/Haleakala Highway produce gaps in the Hana Highway traffic flows which are utilized by the motorists turning into and out of Pulehu Road.
- Hansen Road with Pulehu Road - The low volumes of traffic are dispersed quickly through this unsignalized intersection, as indicated by Level of Service A and B conditions during the morning, mid-day, and afternoon peak hours.

III. FUTURE BASE PROJECTIONS AND ANALYSIS

In order to properly evaluate the potential impact of the project on the local traffic conditions, forecasts of two future traffic conditions were developed. Future traffic volumes at the study intersections were projected for future conditions without and with

the traffic generated by the proposed Waena Generating Station. The methodologies and key assumptions used to develop these forecasts are described in this section.

The future base traffic forecasts for Year 2016 without the proposed Waena Generating Station generated traffic are based on the background traffic growth of existing traffic volumes which reflect a combination of regional growth and nearby development projects as well as expected changes in the existing roadway system.

A. Near-Term Roadway Improvements

Several modifications in the existing roadway system are planned in the next few years, including the construction of new roadways and installation of new traffic signals, which would affect the four existing study intersections. These roadway improvements are currently undergoing environmental processing or design and implementation is expected prior to the opening of the proposed Waena Generating Station.

The State Department of Transportation, Highways Division, is planning to implement traffic signals at the intersection of Hana Highway, Kamehameha Avenue and Hobron Avenue. The laneage configuration at this intersection will be revised to permit left turn and through movements on the Kamehameha Highway approach and through movements on the Hobron Avenue approach. In addition, the Hana Highway westbound right-turn lane at this intersection will be extended.

As part of the Kahului Airport Master Plan, the State Department of Transportation, Airports Division will construct a new four-lane Airport Access Road. This new road will cross Hana Highway with a partial clover leaf interchange and require the closure of the section of Pulehu Road between Hana Highway and Hansen Road. In addition, Hansen Road will be closed between Pulehu Road and Hana Highway and realigned to meet Hana Highway in a signalized cross-intersection with a new Airport Spine Road. With these changes, regional and airport traffic are expected to divert from Dairy Road to the Airport Access Road and Dairy Road would remain to primarily serve local traffic. The closure of a section of Pulehu Road requires Pulehu Road traffic to utilize the realigned Hansen Road to access Hana Highway.

The proposed modifications are highlighted in Figure 6 and the revisions to the study intersection configurations are identified in Figure 7. If the environmental processing and design of these projects are concluded by the end of Year 1997, then the construction of these roadway improvements are expected to be completed by Year 1999.

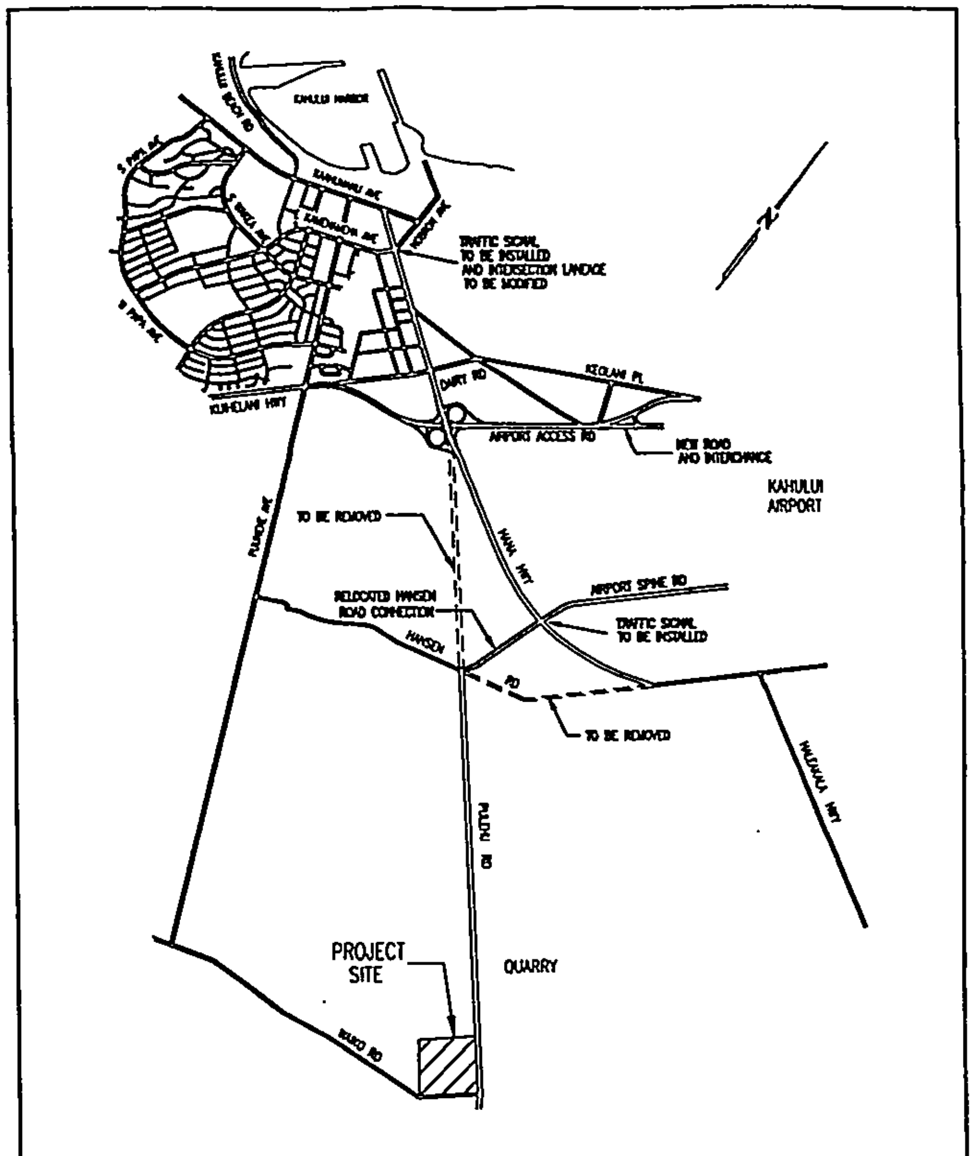
B. Background Traffic Growth

The background growth rate, which was applied to existing traffic volumes to estimate Year 2016, is based on the projections from the Maui Long-Range Land Transportation Plan by Kaku Associates (Final Report, February 1997), Year 2020 Traffic Assessment of Kahului Airport Access Road by Wilbur Smith Associates (December 1995), and historical counts obtained from the State Department of Transportation.

The average annual growth rate applied to each intersection varied for the morning, mid-day and afternoon peak hours as well as by location, as the study intersections serve different land uses and functions within the regional roadway system. The growth rates ranged from 1.0% - 2.8% in the peak direction and from 1.2% - 4.4% in the off-peak direction. In addition, some of the traffic volumes were manually adjusted to reflect the changes due to the planned near-term roadway improvements, described above.

C. Future Base Volumes and Level of Service Analysis

The future Year 2016 base traffic volumes for the four study intersections are presented in Figure 8. For the future base traffic volumes, the traffic assignments assume the implementation of the planned roadway improvements, which include the signalization of the Hana Highway/Kamehameha Avenue/Hobron Avenue intersection, the construction of the Airport Access Road and related closure of Pulehu Road and realignment of Hansen Road. The results of the overall intersection Level of Service are summarized in Figure 8 and detailed results are given in Table 4. For long-term transportation planning, Level of Service D or better is desirable for developed areas, such as the Wailuku-Kahului areas.



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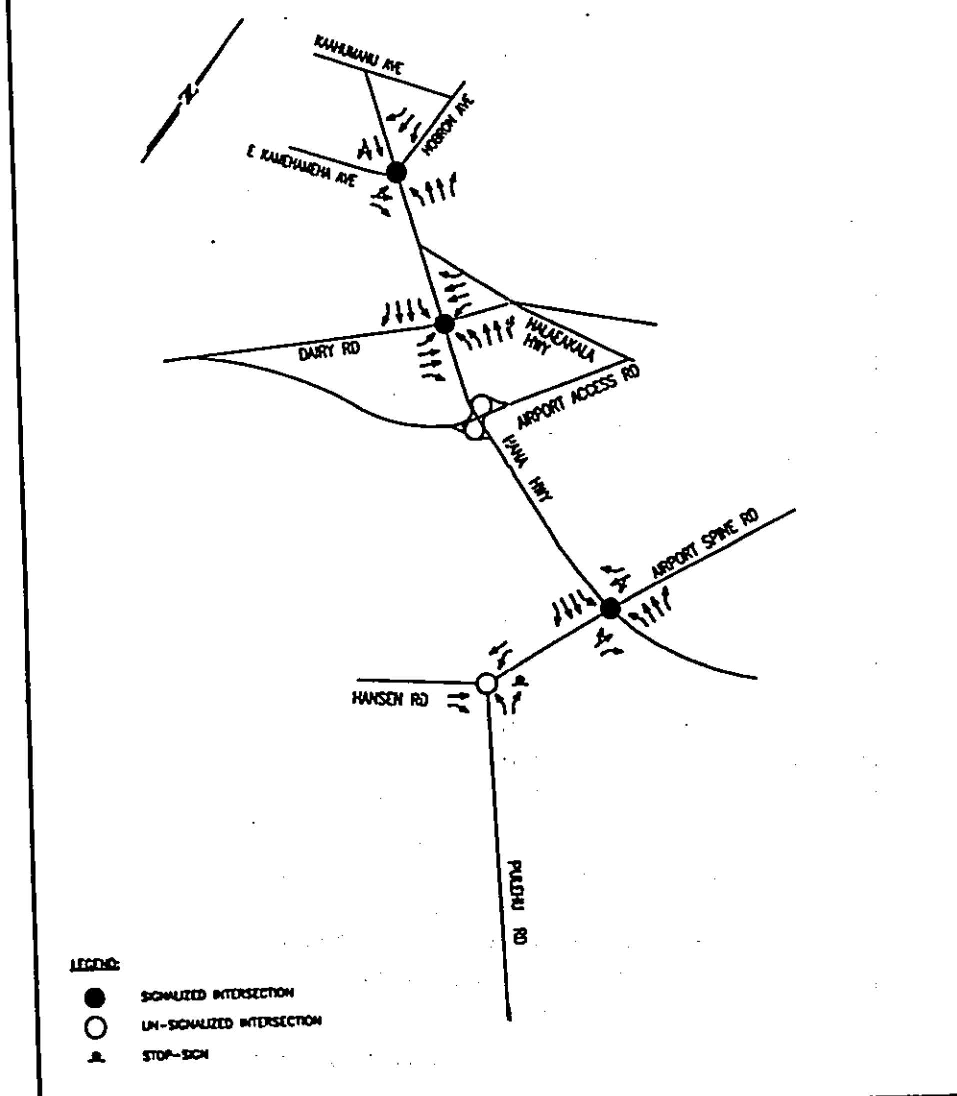

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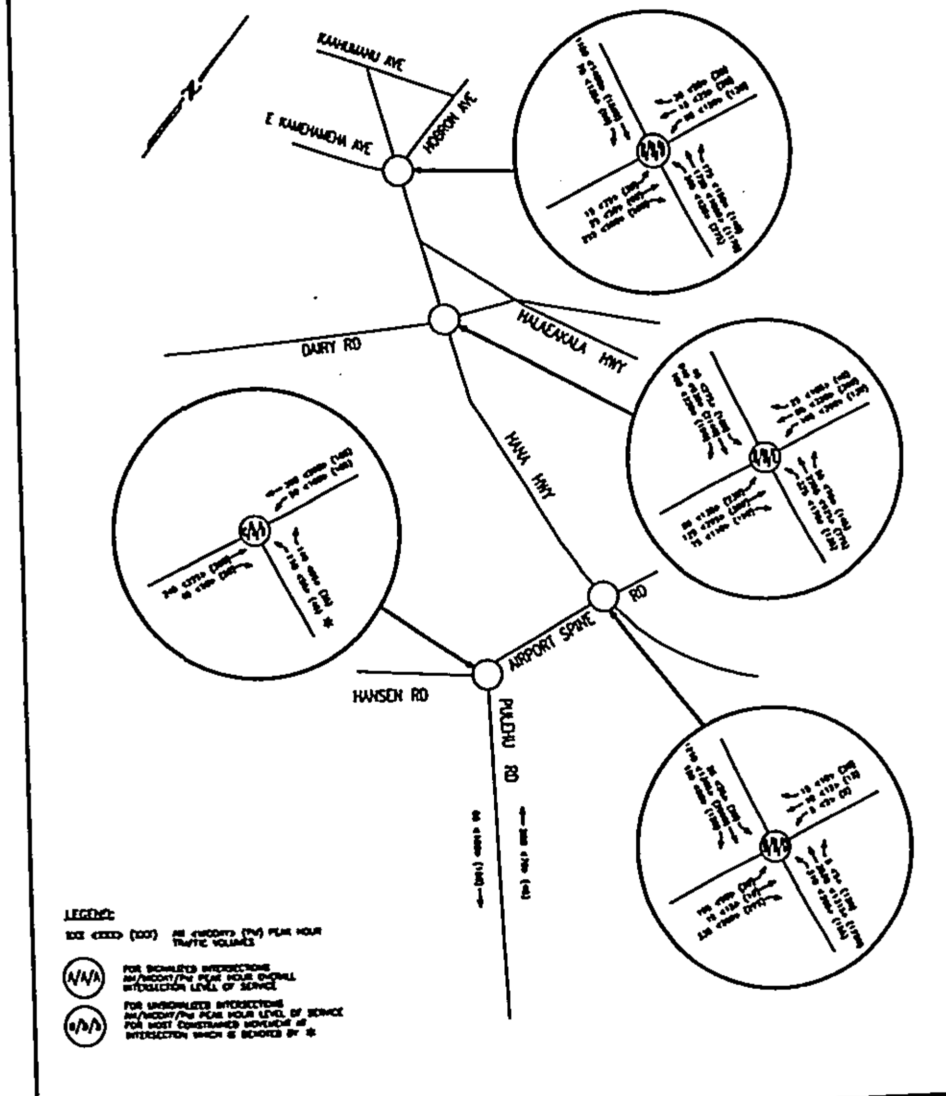
BASE INTERSECTION CONFIGURATIONS

FIGURE 7



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FUTURE TRAFFIC CONDITIONS WITHOUT PROJECT

FIGURE 8

Table 4
FUTURE YEAR 2016 TRAFFIC CONDITIONS WITHOUT THE PROJECT

Intersection	Type of Intersection	AM Peak Hour v/c Ratio	AM Peak Hour Delay (Seconds)	AM Peak Hour Level of Service	Mid-day Peak Hour v/c Ratio	Mid-day Peak Hour Delay (Seconds)	Mid-day Peak Hour Level of Service	PM Peak Hour v/c Ratio	PM Peak Hour Delay (Seconds)	PM Peak Hour Level of Service
Hana Highway, Kamehameha Avenue and Hobron Avenue	Signalized									
Kamehameha Avenue Northbound Approach		--	10.1	B	--	15.6	C	--	55.3	E
Hobron Avenue Southbound Approach		--	17.7	C	--	20.2	C	--	60.1	E
Hana Highway Eastbound Approach		--	10.0	B	--	16.4	C	--	54.4	E
Hana Highway Westbound Approach		--	4.2	A	--	8.8	B	--	13.0	B
Overall Intersection		0.63	6.9	B	0.70	12.4	B	0.78	39.3	D
Hana Highway and Dairy Road	Signalized									
Dairy Road Northbound Approach		--	15.6	C	--	14.9	B	--	53.8	E
Dairy Road Southbound Approach		--	18.5	C	--	15.4	C	--	52.5	E
Hana Highway Eastbound Approach		--	8.3	B	--	11.2	B	--	50.5	E
Hana Highway Westbound Approach		--	7.5	B	--	12.7	B	--	19.3	C
Overall Intersection		0.67	8.0	B	0.58	12.9	B	0.78	44.4	E
Hana Highway, Realigned Hansen Road and Airport Spine Road	Signalized									
Hansen Road Northbound Approach		--	41.2	E	--	13.4	B	--	69.3	E
Airport Spine Road Southbound Approach		--	44.5	E	--	12.1	B	--	45.1	E
Hana Highway Eastbound Approach		--	14.2	B	--	7.3	B	--	42.9	E
Hana Highway Westbound Approach		--	35.0	D	--	7.3	B	--	10.8	B
Overall Intersection		1.00	30.8	D	0.63	7.9	B	0.89	34.3	D
Realigned Hansen Road and Pulehu Road	Unsignalized									
Hansen Road Southbound Left Turn		--	2.9	A	--	2.9	A	--	3.2	A
Pulehu Road Westbound Approach										
Left Turn		--	10.5	C	--	8.5	B	--	9.3	B
Right Turn		--	4.0	A	--	3.7	A	--	3.9	A
Overall Intersection		--	2.2	A	--	1.6	A	--	1.4	A

- Hana Highway with Kamehameha Avenue and Hobron Avenue – For this intersection, installation of traffic signals helps to decrease delays to Kamehameha Avenue and Hobron Avenue traffic and results in improvement to overall intersection conditions to Level of Service B during the morning and mid-day peak hour and Level of Service D during the mid-day peak hour. However, Level of Service E conditions would be expected during the afternoon peak hour for the Kamehameha Avenue (northbound) approach, the Hobron Avenue (southbound) approach and the Hana Highway eastbound approach.

- Hana Highway with Dairy Road – The construction of the Airport Access Road and its interchange with Hana Highway results in decreased regional traffic volumes at the intersection of Hana Highway and Dairy Road, improving overall intersection operations to Level of Service B during the morning and mid-day peak hours and Level of Service E during the afternoon peak hour. The northbound, southbound and eastbound approaches at this intersection would also experience Level of Service E conditions during the afternoon peak hour.

- Hana Highway with Realigned Hansen Road and New Airport Spine Road – At this intersection, the overall intersection traffic conditions would be expected to operate at Level of Service D during the morning and afternoon peak hours and at Level of Service B during the mid-day peak hour. In addition, the v/c ratio for the morning peak hour would be at capacity, or 1.00. The results show Level of Service E conditions for the northbound, southbound and eastbound approaches during the morning and afternoon peak hours.

- Hansen Road with Pulehu Road – At the unsignalized intersection of the realigned Hansen Road and Pulehu Road, the stop-controlled Pulehu Road left-turn movement would be at Level of Service C or better.

D. **Long-Term Roadway Improvements**

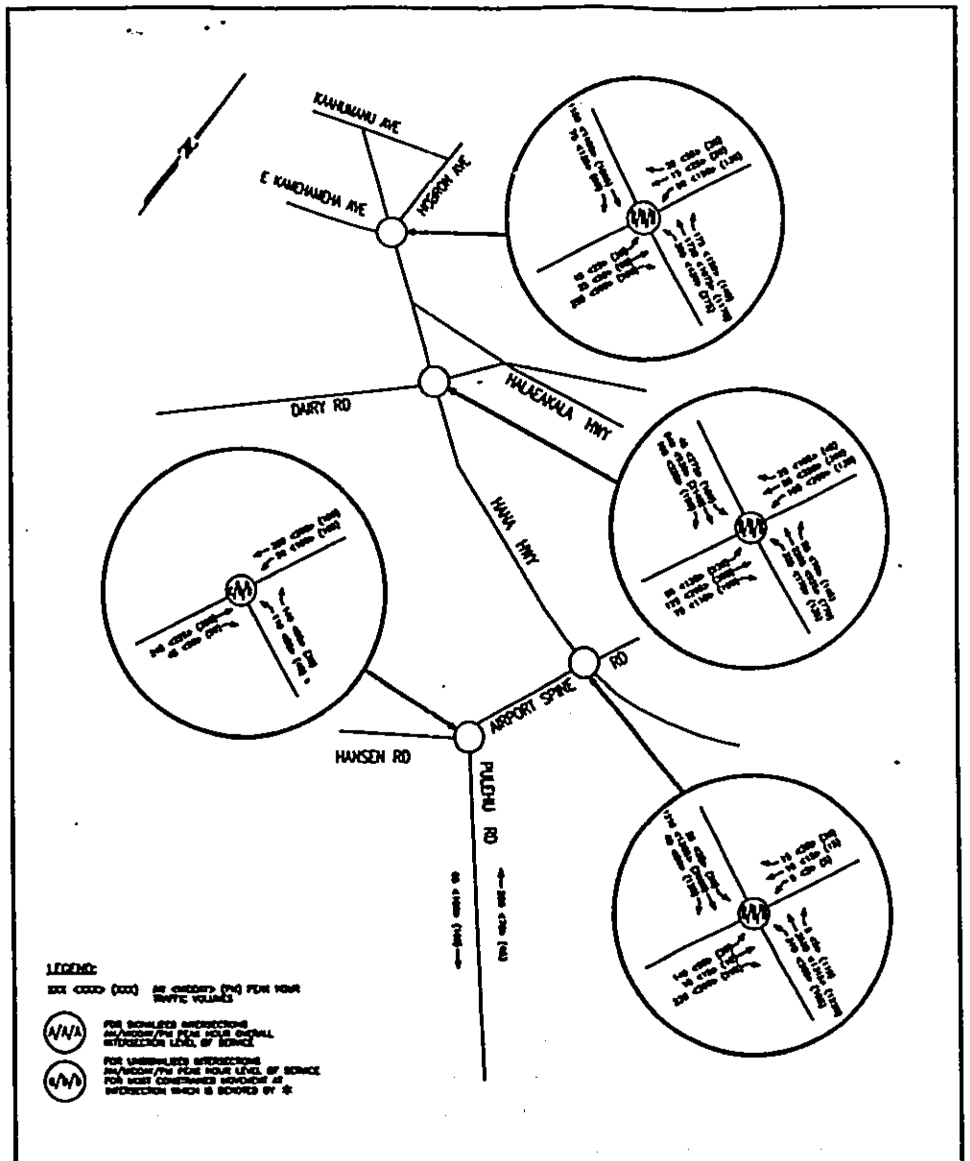
In general, the near-term planned roadway improvements (Airport Access Road, traffic signals and reconfigured intersections) assist in improving overall intersection operations; however, the Level of Service E results indicate additional roadway improvements would be needed to accommodate long-term increases in future traffic volumes.

The future traffic conditions at the Hana Highway intersections could be improved by the widening of Hana Highway to six travel lanes or the construction of the Kula-to-Kihei roadway. The analysis results for a widened Hana Highway are presented in Table 5 and Figure 9 and show traffic conditions at Level of Service C or better and v/c ratios of less than 1.00. Alternatively, the construction of the Kula-to-Kihei roadway would provide another route to divert Upcountry traffic and alleviate the traffic demand on Hana Highway.

The future long-term deficiency of Hana Highway was studied in the 1997 Maui Long-Range Land Transportation Plan in context to islandwide transportation needs. The alternatives of widening of Hana Highway to six lanes and the construction of the Kula-to-Kihei Road were analyzed as part of the islandwide study. The Kula-to-Kihei roadway is recommended in the Maui Long-Range Land Transportation Plan and alternative routes are currently being studied by the State Department of Transportation.

Table 5
FUTURE YEAR 2016 TRAFFIC CONDITIONS WITHOUT THE PROJECT AND WITH LONG-TERM IMPROVEMENTS

Intersection	Type of Intersection	AM Peak Hour			Mid-Day Peak Hour			PM Peak Hour		
		v/c Ratio	Delay (Seconds)	Level of Service	v/c Ratio	Delay (Seconds)	Level of Service	v/c Ratio	Delay (Seconds)	Level of Service
Hana Highway, Kamehameha Avenue and Hobron Avenue	Signalized									
Kamehameha Avenue Northbound Approach		--	8.0	B	--	10.7	B	--	15.8	C
Hobron Avenue Southbound Approach		--	16.2	C	--	16.9	C	--	14.4	B
Hana Highway Eastbound Approach		--	10.4	B	--	12.0	B	--	14.5	B
Hana Highway Westbound Approach		--	3.3	A	--	4.7	A	--	4.2	A
Overall Intersection		0.50	8.3	B	0.57	9.1	B	0.66	10.9	B
Hana Highway and Dairy Road	Signalized									
Dairy Road Northbound Approach		--	13.2	B	--	13.4	B	--	17.4	C
Dairy Road Southbound Approach		--	15.4	C	--	13.7	B	--	19.5	C
Hana Highway Eastbound Approach		--	7.4	B	--	11.5	B	--	14.6	B
Hana Highway Westbound Approach		--	5.0	B	--	13.2	B	--	8.3	B
Overall Intersection		0.52	8.6	B	0.50	12.7	B	0.67	14.2	B
Hana Highway, Realigned Hansen Road and Airport Spine Road	Signalized									
Hansen Road Northbound Approach		--	18.2	C	--	11.2	B	--	17.7	C
Airport Spine Road Southbound Approach		--	16.6	C	--	10.3	B	--	14.2	B
Hana Highway Eastbound Approach		--	4.8	A	--	7.8	B	--	10.6	B
Hana Highway Westbound Approach		--	8.1	B	--	7.5	B	--	4.5	A
Overall Intersection		0.77	7.9	B	0.51	8.0	B	0.72	9.2	B
Realigned Hansen Road and Pulehu Road	Unsignalized									
Hansen Road Southbound Left Turn		--	2.9	A	--	2.9	A	--	3.2	A
Pulehu Road Westbound Approach										
Left Turn		--	10.5	C	--	8.5	B	--	9.3	B
Right Turn		--	4.0	A	--	3.7	A	--	3.9	A
Overall Intersection		--	2.2	A	--	1.6	A	--	1.4	A



CH2M HILL, INC. MECO WAENA GENERATING STATION	ATA AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII	FIGURE
	FUTURE TRAFFIC CONDITIONS WITHOUT PROJECT WITH LONG-TERM IMPROVEMENTS	9

IV. PROJECT-GENERATED TRAFFIC VOLUMES

The development of traffic projections for the proposed project involves trip generation, trip distribution, and traffic assignment. A description of each of these steps follows:

A. Trip Generation

The traffic expected to be generated by the proposed Waena Generating Station was estimated based on information provided by MECO concerning the number of employees, shifts, and proposed operations at the project site. The employees at the proposed Waena Generating Station are classified into three categories: 1) generation production operations, 2) generation non-operation production, and 3) transmission and distribution.

The first category of generation production operations represents the employees who run the generating station 24 hours a day by working in three shifts, 6:00 AM - 2:00 PM, 2:00 PM - 10:00 PM, and 10:00 PM - 6:00 AM. Due to the scheduling of the shift hours, these employees do not commute during the regular morning, mid-day or afternoon peak hours.

The second category of generation non-operation production is the administrative and technical staff at the proposed Waena Generating Station. These employees work one daytime shift, 7:00 AM - 3:30 PM. The starting time of the daytime shift is slightly earlier than the typical commuter starting time (8:00 AM); however, the MECO employee traffic was not discounted for this difference in shift time in order to assess the cumulative peak volumes of highway traffic and employee traffic.

The third category of transmission and distribution are the employees related to the baseyard operations which potentially could be relocated from the Kahului baseyard to the Waena site. These employees normally work 7:00 AM - 3:30 PM, except for six dispatchers who work in three shifts (6:00 AM - 2:00 PM, 2:00 PM - 10:00 PM, and 10:00 PM - 6:00 AM). The commuting trips between home and work of the transmission and distribution employees are separated from their work-day trips in MECO vehicles to various sites on the island to repair or maintain MECO facilities.

Service and delivery trips include visitors to the project for meetings or supplies and other incidental trips during the work day. The estimated number of service and delivery trips is based on the operations at other MECO generating stations.

Fuel for the proposed Waena Generating Station will be delivered daily by truck. The fuel supply is located at Kahului Harbor. When the proposed Waena Generating Station is fully operational, approximately 11 fuel trucks will be needed to transport 44 daily truckloads of fuel to the Waena site.

The estimated project-related traffic for the proposed Waena Generating Station is provided in Table 6. Although the decision to relocate the Kahului baseyard to the Waena site is still under consideration, the traffic related to this relocation is included in the project traffic to identify the potential traffic impact of the project.

B. Trip Distribution

The project distribution was divided into two parts, fuel truck and non-fuel truck distribution. All fuel trucks are expected to haul fuel from the fuel supply depot located at Kahului Harbor to the project site. Although there are various ways to travel between Kahului Harbor and the project site, fuel truck drivers are expected to use the most direct and accessible route along Hobron Avenue, Hana Highway, realigned Hansen Road and Pulehu Road, as depicted in Figure 10. The non-fuel truck distribution includes employees commuting between home and work, as well as baseyard field crews traveling to repair/maintenance job sites in different areas of the island, which vary daily. The directional distribution developed for the Waena project was based on existing and projected population and employment data, as identified in the Maui Long Range Land Transportation Plan, Final Report, February 1997 (Kaku Associates). The project traffic distribution, exclusive of fuel trucks, is presented in Figure 11.

C. Traffic Assignment

The traffic assignment identifies the specific streets and intersections utilized by the project traffic and is based on the proposed access into and out the project site as well as the availability of local routes to the regional highway

Table 6
PROJECT TRIP GENERATION

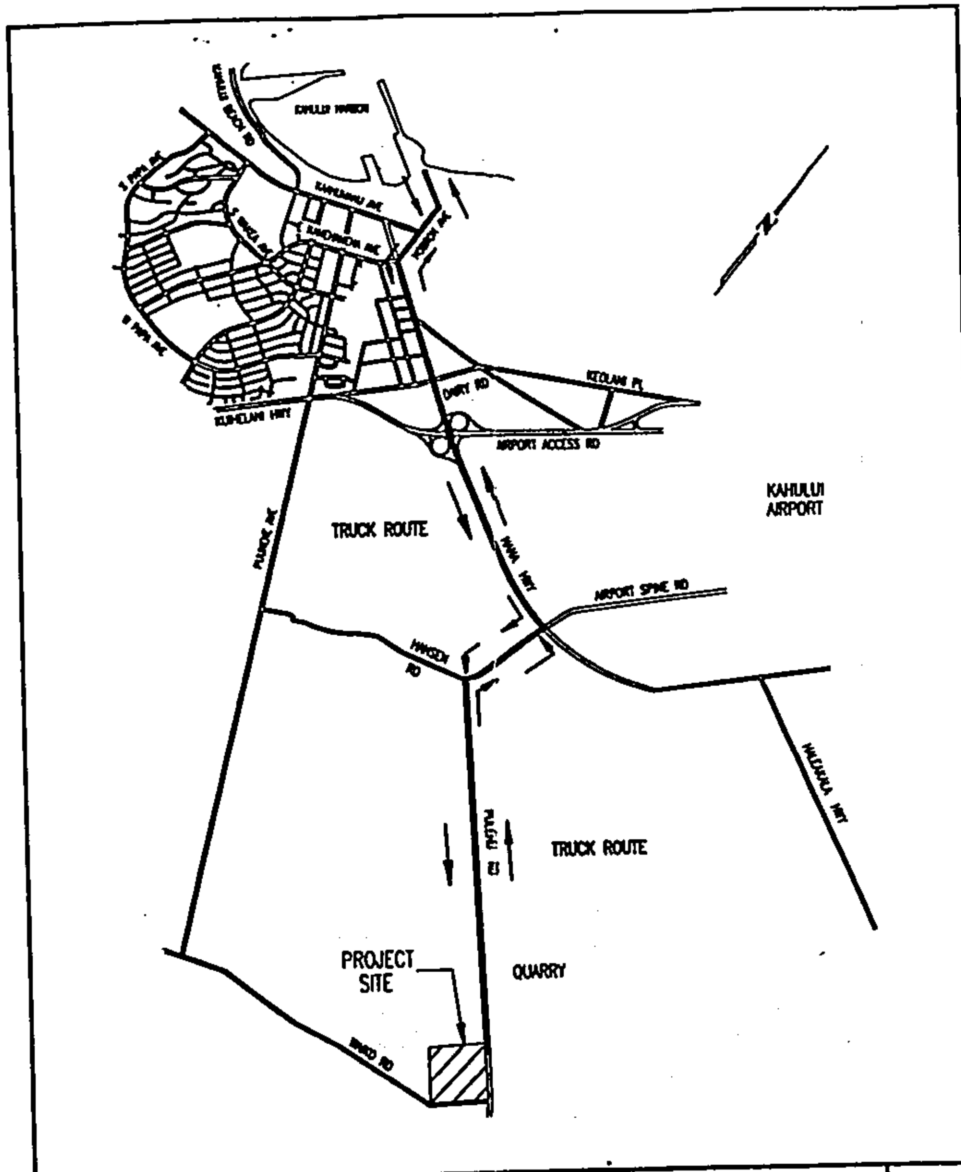
Type of Trip	Quantity	Parameter	Daily Trips	AM Peak Hour Enter	AM Peak Hour Exit	Mid-Day Peak Hour Enter	Mid-Day Peak Hour Exit	PM Peak Hour Enter	PM Peak Hour Exit
Generation Production Operations [a]	20	Employees	40	0	0	0	0	0	0
Generation Non-Operation Production [b]	26	Employees	52	26	0	2	2	0	26
Transmission and Distribution [c]	110	Employees	220	104	0	10	10	0	104
Transmission and Distribution [c]	85	Field Crews/Vehicles	170	0	50	0	0	50	0
Service and Delivery	40	Visitors/Meetings/Supplies	80	9	9	0	0	0	0
Fuel Haul	11	Trucks	88	6	6	4	4	6	6
Total			650	145	65	16	16	56	136

Notes:

[a] These employees work in three shifts (6:00 am - 2:00 pm, 2:00 pm - 10:00 pm, 10:00 pm - 6:00 am) and do not commute during the peak hours.

[b] The administrative and technical staff work one daytime shift (7:00 am - 3:30 pm).

[c] Potential employee relocation from the Kahului Baseyard; these employees normally work one shift (7:00 am - 3:30 pm), except for six dispatchers who work in three shifts (6 am / 2 pm / 10 pm). Individual employee commute trips to/from the Waena project site are shown separately from the field crews travelling in MECO vehicles between the project site and repair/maintenance locations, which vary daily.



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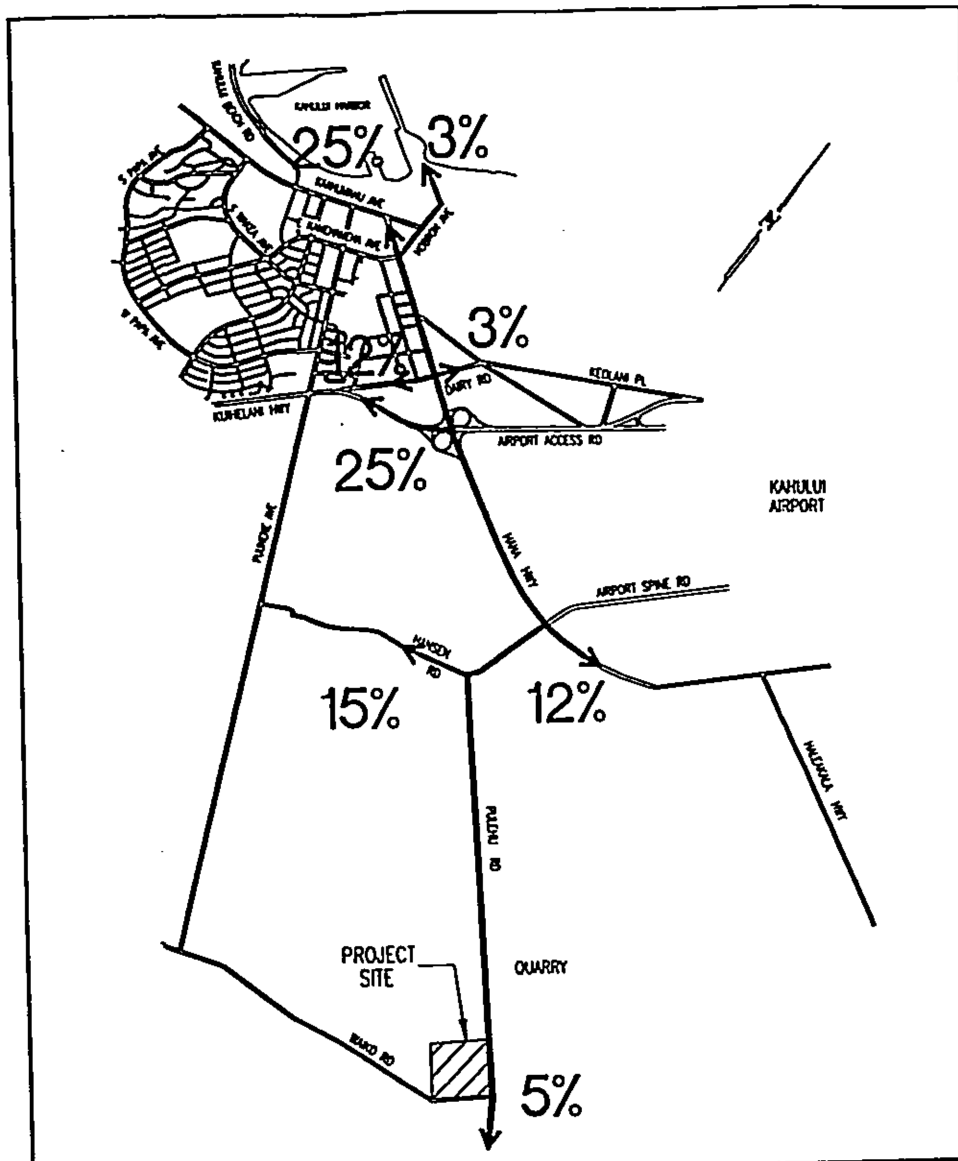
FUEL TRUCK ROUTE

FIGURE 10



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PROJECT TRAFFIC DISTRIBUTION
(EXCEPT FUEL TRUCKS)

FIGURE 11

system. The resulting estimated project-generated peak hour volumes at each of the study intersections are provided in Figure 12.

V. FUTURE CONDITIONS WITH THE PROJECT

This section discusses the traffic operating conditions when the project-generated traffic volumes are added to the future base traffic volumes.

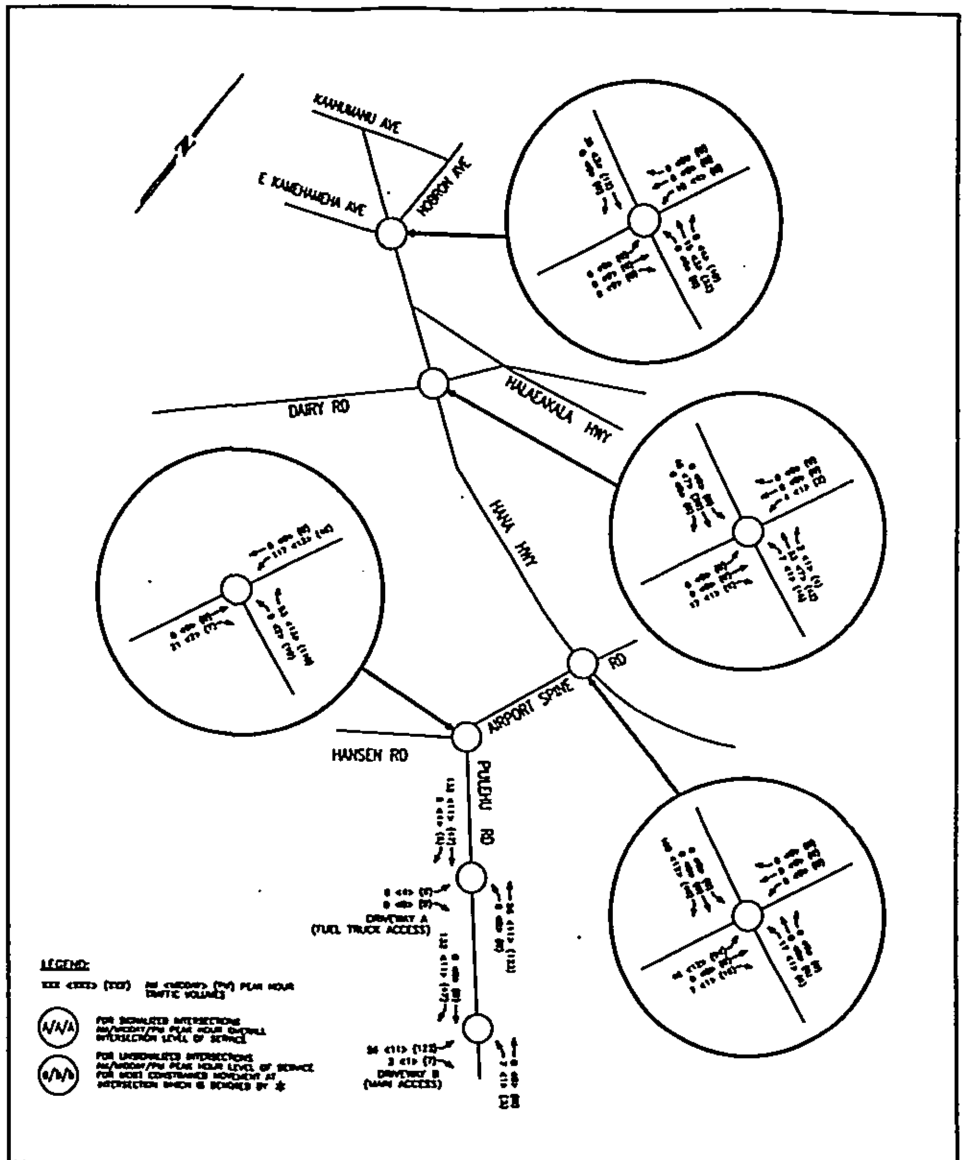
A. Future Traffic Volumes with Project-Generated Traffic

The future Year 2018 traffic volumes with the project generated traffic volumes are shown in Figure 13. The base roadway improvements, which are described in detail in the previous Section III.A are primarily related to the construction of the Kahului Airport Access Road, a new interchange with Hana Highway, the closure of a portion of Pulehu Road, the relocation of Hansen Road, and the signalization of the intersection of Hana Highway with Kamehameha Avenue/Hobron Avenue.

B. Level of Service Analysis

The results of the analysis of the future traffic volumes with the project-generated traffic are given in Table 7 and in Figure 13. The analysis results in Table 7 show that one or more of the approaches at the three signalized Hana Highway intersections with Kamehameha Avenue/Hobron Avenue, Dairy Road, and relocated Hansen Road/Airport Spine Road is expected to operate at Level of Service E.

- <u>Hana Highway with Kamehameha Avenue and Hobron Avenue</u> – The overall intersection conditions during the morning (Level of Service B) and afternoon (Level of Service D) peak hour conditions would remain the same as the future conditions without the project (without the long-term roadway improvements (Table 4)). During the afternoon peak hour, the northbound, southbound and eastbound approaches would be at Level of Service E conditions, also showing no change with the project. For the mid-day peak hour, the northbound approach improves from Level of



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PROJECT TRAFFIC VOLUMES

FIGURE 12

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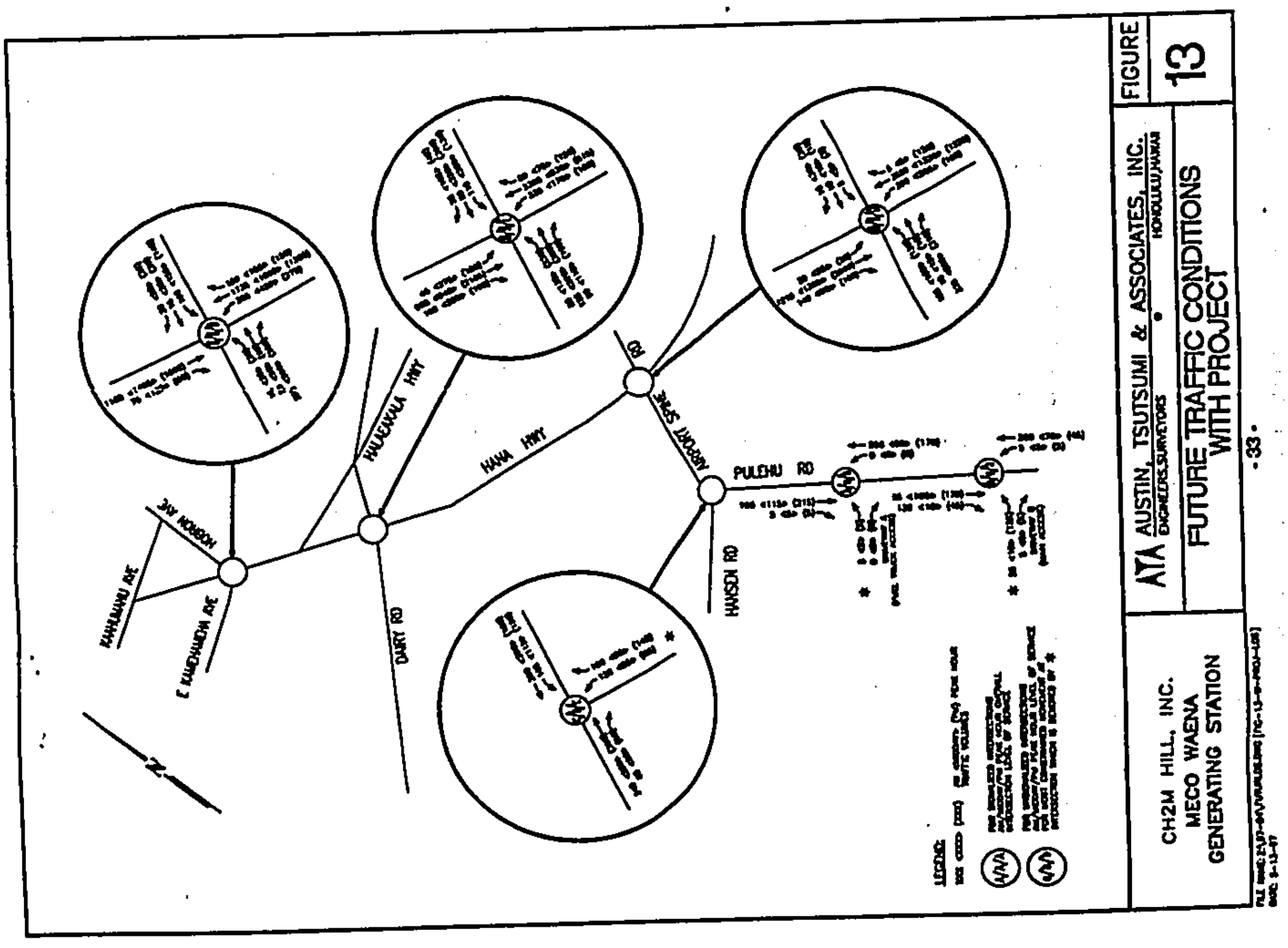
Table 7
FUTURE YEAR 2018 TRAFFIC CONDITIONS WITH THE PROJECT

Intersection	Type of Intersection	AM Peak Hour v/c Ratio	AM Peak Hour Delay (Seconds)	AM Peak Hour Level of Service	Mid-Day Peak Hour v/c Ratio	Mid-Day Peak Hour Delay (Seconds)	Mid-Day Peak Hour Level of Service	PM Peak Hour v/c Ratio	PM Peak Hour Delay (Seconds)	PM Peak Hour Level of Service
Hana Highway, Kamehameha Avenue and Hobron Avenue	Signalized									
Kamehameha Avenue Northbound Approach		--	10.3	B	--	10.6	B	--	55.9	E
Hobron Avenue Southbound Approach		--	18.1	C	--	16.8	C	--	60.5	E
Hana Highway Eastbound Approach		--	10.1	B	--	45.5	E	--	53.8	E
Hana Highway Westbound Approach		--	4.2	A	--	5.3	B	--	13.1	B
Overall Intersection		0.84	7.0	B	0.74	22.4	B	0.79	39.9	D
Hana Highway and Dairy Road	Signalized									
Dairy Road Northbound Approach		--	15.2	C	--	14.9	B	--	64.0	E
Dairy Road Southbound Approach		--	18.5	C	--	15.4	C	--	62.8	E
Hana Highway Eastbound Approach		--	8.5	B	--	11.2	B	--	50.9	E
Hana Highway Westbound Approach		--	6.0	B	--	12.7	B	--	20.1	C
Overall Intersection		0.68	8.4	B	0.58	12.9	B	0.77	44.5	E
Hana Highway, Realigned Hansen Road and Airport Spine Road	Signalized									
Hansen Road Northbound Approach		--	41.4	E	--	13.9	B	--	56.6	E
Airport Spine Road Southbound Approach		--	41.6	E	--	12.1	B	--	41.9	E
Hana Highway Eastbound Approach		--	18.4	C	--	7.3	B	--	43.1	E
Hana Highway Westbound Approach		--	36.9	D	--	7.3	B	--	13.8	B
Overall Intersection		1.01	32.3	D	0.83	8.0	B	0.90	35.8	D
Realigned Hansen Road and Pulehu Road	Unsignalized									
Hansen Road Southbound Left Turn		--	3.2	A	--	3.0	A	--	3.4	A
Pulehu Road Westbound Approach										
Left Turn		--	15.9	C	--	8.9	B	--	11.2	C
Right Turn		--	4.3	A	--	3.8	A	--	4.4	A
Overall Intersection		--	3.1	A	--	1.7	A	--	2.2	A
Pulehu Road and Driveway A (Fuel Truck Access)	Unsignalized									
Pulehu Road Westbound Left Turn		--	2.8	A	--	2.4	A	--	2.7	A
Driveway A Approach		--	6.1	B	--	4.3	A	--	5.6	B
Overall Intersection		--	0.1	A	--	0.1	A	--	0.1	A
Pulehu Road and Driveway B (Main Access)	Unsignalized									
Pulehu Road Westbound Left Turn		--	2.8	A	--	2.4	A	--	2.7	A
Driveway A Approach		--	5.8	B	--	4.2	A	--	5.7	B
Overall Intersection		--	0.8	A	--	0.4	A	--	2.0	A



C to Level of Service B and the eastbound approach drops from Level of Service C to Level of Service E.

- Hana Highway with Dairy Road – The analysis indicates the overall operating conditions and the individual approaches are the same as the future condition without the project.

- Hana Highway with Relocated Hansen Road and New Spine Road – Except for the morning peak hour eastbound approach which drops from Level of Service B (without the project) to Level of Service C (with the project), the Level of Service condition for the other approaches and the overall intersection remain the same as the future condition without the project.

- Realigned Hansen Road with Pulehu Road – The analysis results for this unsignalized intersection are the same as the future condition without the project, except for the afternoon peak hour westbound left turn which lowers from Level of Service B to Level of Service C.

- Pulehu Road with Driveway A (Fuel Truck Access) – The methodology for unsignalized intersections was utilized to analyze traffic volumes at Driveway A. Project traffic exiting Driveway A would encounter short or little delay during the morning (Level of Service B), mid-day (Level of Service A) and afternoon (Level of Service B) peak hours. The traffic entering the project at Driveway A would be at Level of Service A during the three study peak hours.

- Pulehu Road with Driveway B (Main Access) – The traffic volumes at Driveway B were analyzed with the unsignalized intersection methodology. The results show Level of Service B (morning and afternoon peak hours) and Level of Service A (mid-day peak hour) for exiting project traffic. Exiting traffic would be at Level of Service A.

C. Long-Term Roadway Improvements

The growth in future traffic volumes would result in the need for regional improvements, such as the construction of the Kula-to-Kihei Road or the widening of Hana Highway to six lanes. If Hana Highway were widened to six lanes, operating conditions would improve to Level of Service C or better, as shown in Table 8 and Figure 14. Alternatively, the Kula-to-Kihei Road being studied by the State Department of Transportation would offer a diversionary route for Upcountry traffic. The Kula-to-Kihei Road would reduce the heavy traffic demand on Hana Highway, eliminating the need to widen, while improving the traffic operations on Hana Highway.

D. Project-Related Access Improvements

The project will provide two driveways to access the site. Adequate turning areas at the driveways should be provided to permit the large fuel trucks a smooth transition when entering or exiting the project driveways on Pulehu Road. The project landscaping along Puhelu Road should be designed and maintained to minimize obstructions that could impede the sight distance of motorists on Pulehu Road or at the project driveways. In addition, since the Waena generating station would operate 24 hours a day and have shift changes during the night and early morning hours, lighting of the driveways at night would be beneficial for Pulehu Road motorists and the project-generated traffic.

VI. SUMMARY OF FINDINGS AND RECOMMENDATIONS

This section summarizes the findings and recommendations of this traffic impact assessment report for the proposed Waena Generating Station.

A. Findings

1. Existing Conditions

Generally, traffic flows fairly well on Hana Highway; however, cross street traffic experiences long delays (Level of Service F).

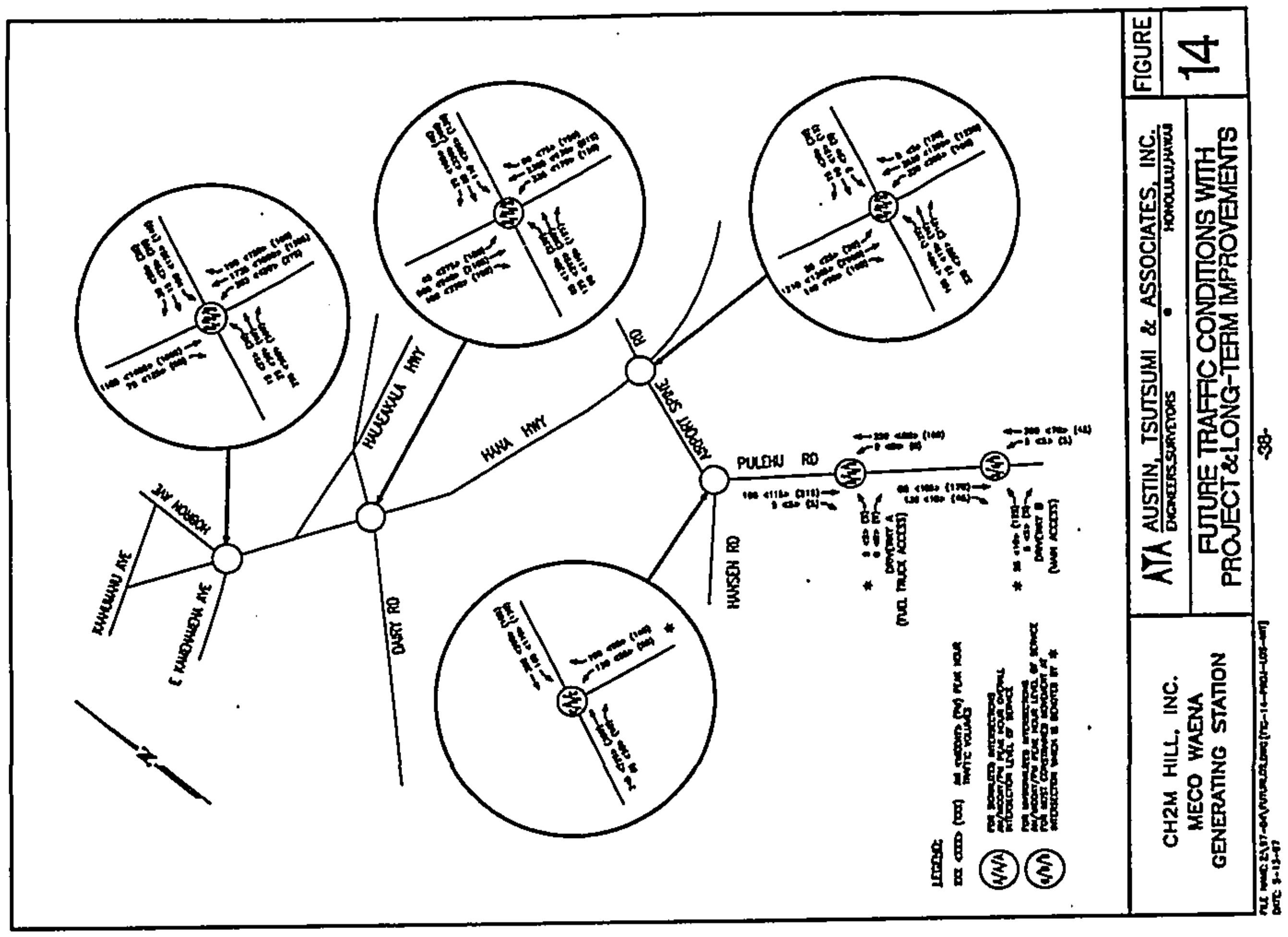


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Table 8
FUTURE YEAR 2016 TRAFFIC CONDITIONS WITH THE PROJECT AND LONG-TERM IMPROVEMENTS

Intersection	Type of Intersection	AM Peak Hour v/c Ratio	AM Peak Hour Delay (Seconds)	AM Peak Hour Level of Service	Mid-Day Peak Hour v/c Ratio	Mid-Day Peak Hour Delay (Seconds)	Mid-Day Peak Hour Level of Service	PM Peak Hour v/c Ratio	PM Peak Hour Delay (Seconds)	PM Peak Hour Level of Service
Hana Highway, Kamehameha Avenue and Hobron Avenue	Signalized									
Kamehameha Avenue Northbound Approach		--	8.1	B	--	10.6	B	--	15.9	C
Hobron Avenue Southbound Approach		--	16.5	C	--	16.8	C	--	14.4	B
Hana Highway Eastbound Approach		--	10.3	B	--	12.1	B	--	14.5	B
Hana Highway Westbound Approach		--	3.3	A	--	4.7	A	--	4.4	A
Overall Intersection		0.61	8.3	B	0.67	9.1	B	0.67	11.0	B
Hana Highway and Dairy Road	Signalized									
Dairy Road Northbound Approach		--	12.7	B	--	13.5	B	--	17.5	C
Dairy Road Southbound Approach		--	18.3	C	--	13.7	B	--	19.5	C
Hana Highway Eastbound Approach		--	7.6	B	--	11.5	B	--	15.1	C
Hana Highway Westbound Approach		--	8.2	B	--	13.2	B	--	8.5	B
Overall Intersection		0.63	8.8	B	0.61	12.7	B	0.68	14.4	B
Hana Highway, Realigned Hansen Road and Airport Spine Road	Signalized									
Hansen Road Northbound Approach		--	18.3	C	--	11.6	B	--	19.2	C
Airport Spine Road Southbound Approach		--	15.5	C	--	10.3	B	--	13.6	B
Hana Highway Eastbound Approach		--	8.6	B	--	7.6	B	--	12.0	B
Hana Highway Westbound Approach		--	11.6	B	--	7.5	B	--	4.7	A
Overall Intersection		0.78	10.5	B	0.61	8.0	B	0.73	10.8	B
Realigned Hansen Road and Pulehu Road	Unsignalized									
Hansen Road Southbound Left Turn		--	3.2	A	--	3.0	A	--	3.4	A
Pulehu Road Westbound Approach										
Left Turn		--	15.9	C	--	6.9	B	--	11.2	C
Right Turn		--	4.3	A	--	3.6	A	--	4.4	A
Overall Intersection		--	3.1	A	--	1.7	A	--	2.2	A
Pulehu Road and Driveway A (Fuel Truck Access)	Unsignalized									
Pulehu Road Westbound Left Turn		--	2.6	A	--	2.4	A	--	2.7	A
Driveway A Approach		--	6.1	B	--	4.3	A	--	6.6	B
Overall Intersection		--	0.1	A	--	0.1	A	--	0.1	A
Pulehu Road and Driveway B (Main Access)	Unsignalized									
Pulehu Road Westbound Left Turn		--	2.6	A	--	2.4	A	--	2.7	A
Driveway A Approach		--	6.6	B	--	4.2	A	--	6.7	B
Overall Intersection		--	0.5	A	--	0.4	A	--	2.0	A

a. At the unsignalized intersection of Hana Highway, Kamehameha Avenue, and Hobron Avenue, the southbound Hobron Avenue operates at Level of Service F during the morning, mid-day and afternoon peak hours.

b. At the signalized intersection of Hana Highway and Dairy Road, the northbound, southbound and westbound approaches at this intersection operate at Level of Service F during the morning and/or afternoon peak hours.

c. At the unsignalized intersection of Hana Highway and Pulehu Road, the Pulehu Road left turn experiences Level of Service F during the morning, mid-day and afternoon peak hours.

2. **Future Base Year 2016 Traffic**

Roadway improvements are planned to be implemented within the next two or three years; however, the growth in traffic demand due to regional population and employment will further aggravate traffic operations at the existing locations where long delays are currently experienced, as listed in Section IV.A.1.

With the future Year 2016 traffic conditions without or with the proposed project, the intersections listed below would operate at Levels of Service E or F and/or volume-to-capacity ratios greater than 1.00.

- Hana Highway with Kamehameha Avenue/Hobron Avenue,
- Hana Highway with Dairy Road, and
- Hana Highway with realigned Hansen Road/Airport Spine Road.

3. **Near-Term Base Roadway Improvements**

The base roadway improvements, described below, are expected to be implemented by Year 1999. The modifications to the roadway network are shown in Figure 6 and the changes to the study intersections with these improvements are identified in Figure 7. Several roadway

improvements are planned in the near-term which would affect three of the study intersections:

a. Signalization of the intersection of Hana Highway, Kamehameha Avenue and Hobron Avenue and modification of this intersection laneage configuration to allow left turns and through movements on the Kamehameha Avenue approach and through movements on the Hobron Avenue approach.

b. Construction of the Kahului Airport Access Road and a partial-cloverleaf interchange with Hana Highway.

c. Relocation of Hansen Road intersection with Hana Highway across the proposed Airport Spine Road and signalization of this intersection.

d. Closure of Pulehu Road between Hana Highway and Hansen Road and the reconfiguration of the intersection of Pulehu Road and Hansen Road into an unsignalized T-intersection.

4. **Long-Term Roadway Improvements**

Additional improvements beyond the near-term base improvements would be needed to accommodate the future traffic demands with or without the proposed project. Possible measures to improve the future base conditions include the widening of Hana Highway to six lanes or the construction of alternative roadways, such as the proposed Kula-Kihei Road to divert traffic away from Hana Highway. These alternatives to improve Hana Highway were considered in the development of the 1997 Maui Long-Range Land Transportation Plan which recommended the construction of the Kula-Kihei Road. With the long-term roadway improvements, traffic operating conditions would be expected to improve to Level of Service C or better.

5. **Proposed Waena Generating Station**

a. The proposed Waena Generating Station will generate 210 morning peak hour trips, 32 mid-day peak hour trips, and 192 afternoon peak hour trips.

b. The analysis indicates the future Year 2016 traffic conditions with the proposed Waena Generation Station are similar to the future traffic conditions without the project. If future traffic volumes grow as projected, the near-term base and long-term roadway improvements would improve the future traffic conditions to Level of Service C or better, regardless of the traffic generated by the proposed Waena Generation Station.

B. Recommendations

The project will provide two driveways to access the site. Adequate turning areas at the driveways should be provided to permit the large fuel trucks a smooth transition when entering or exiting the project driveways on Pulehu Road. The project landscaping along Pulehu Road should be designed and maintained to minimize obstructions that could impede the sight distance of motorists on Pulehu Road or at the project driveways. In addition, since the Waena Generating Station would operate 24 hours a day and have shift changes during the night and early morning hours, lighting of the driveways at night would be beneficial for Pulehu Road motorists as well as the project-generated traffic.

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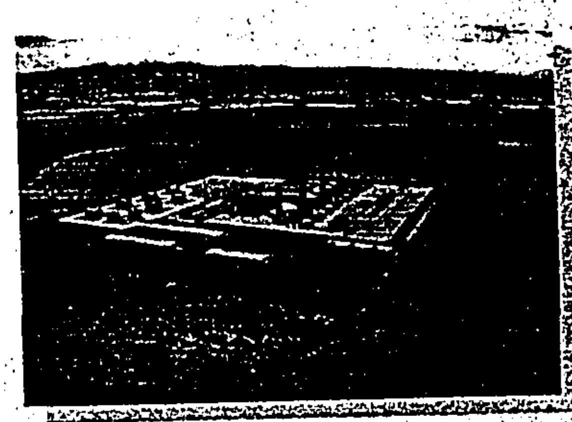

APPENDIX J

ELECTRIC AND MAGNETIC FIELD CALCULATIONS

TECHNICAL MEMO

Electric and Magnetic Field Level Calculations for Maui Electric Company, Limited's Proposed Waena Generating Station

Prepared by:

Enertech Consultants
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Prepared for:

CH2M HILL, INC.

and

Maui Electric Company, Limited

June 18, 1997

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TECHNICAL MEMO

Electric and Magnetic Field Level Calculations for Maui Electric Company, Limited's Proposed Waena Generating Station

June 18, 1997

INTRODUCTION

Electric and magnetic field levels were calculated for a series of conceptual overhead powerline configurations and for the conceptual generating station switchyard design related to the proposed Waena Generating Station project. The scope of this effort included computer modeling of EMF field levels for five different powerline configurations (with different loading conditions) and for the main electrical equipment and buswork associated with the generating station and switchyard. The purpose of this technical memo is to document the results of these electric and magnetic field computer calculations.

SOFTWARE

For the five transmission line configurations, the computer modeling/calculations were performed using the computer program ENVIRO, which is a component of the EMFWorkstation developed by Enertech Consultants for the Electric Power Research Institute (EPRI). ENVIRO produces environmental field calculations (including conductor surface gradients, electric field, magnetic field, audible noise, radio noise, and television interference) based upon user-specified transmission/distribution line configurations and conductor information. The software has the unique capability to calculate induced currents on shield wires, both for grounded and insulated cases.

ENVIRO accepts user-specified data on both transmission and distribution line configuration parameters, including phasing arrangement, phase spacing, voltage, and current (or load). Other parameters, such as earth resistivity, altitude and sensor location are also defined. Subconductor specifications, such as name, quantity, spacing, diameter, resistance and reactance, are entered into the model. Up to 50 different conductor bundles can be described and modeled using ENVIRO. Finally, weather data and profile specifications are provided to complete the model.

Based upon these parameters, ENVIRO produces environmental field calculations as lateral profile values based upon the profile specifications. Four types of calculations result : 1) conductor surface gradients, 2) electric field profiles, 3) magnetic field profiles, and 4) audible noise profiles using six types of calculation methods. Included in the audible noise calculations are radio noise and television interference values. Graphical representations of the lateral profile data are also a feature of ENVIRO.

For the generating station and switchyard, the computer modeling/calculations were performed using the computer program SUBCALC, which is also a component of the EMFWorkstation developed by Enertech Consultants for EPRI. SUBCALC produces magnetic field calculations based upon user-specified transmission/distribution line configurations and substation equipment information.

SUBCALC accepts user-specified data on both transmission and distribution line configuration parameters, including phasing arrangement, phase spacing, voltage, and current (or load). Other equipment, such as power transformers, circuit breakers, air core reactors and capacitor banks, can also be defined and entered into the model. Results which are produced from the SUBCALC program include two-dimensional magnetic field contour maps, three-dimensional magnetic field plots, and the calculated magnetic field along any user-defined path.

LINE GEOMETRY INFORMATION

Five different overhead powerline configurations were modeled in this preliminary evaluation. Two of the lines are existing 69 kV transmission lines, two of the lines are proposed lines, and one is a combination of both existing and proposed lines. The two existing lines are identified as the Kanaha - Pukalani 69 kV line and the Maalaea - Kealahou 69 kV line. Both of these lines are single circuit 69 kV powerlines.

The first proposed line is identified in this report as the Pulehu Road - North Firebreak Road 69/12 kV line. This proposed line is a double circuit 69 kV line with a double circuit 12 kV underbuild. This line originates at the proposed Waena Generating Station, exits onto Pulehu Road, and proceeds northwest along Pulehu Road until it reaches North Firebreak Road. When the proposed line reaches North Firebreak Road, one of the 69 kV circuits separates from the other three circuits and proceeds north along North Firebreak Road towards Paia. This proposed single circuit 69 kV transmission line is identified in this report as the North Firebreak Road - Paia 69 kV line and has the same conceptual line configuration as the existing Maalaea - Kealahou 69 kV line. The existing Kanaha - Pukalani 69 kV transmission line will join together with the remaining three proposed as the North Firebreak Road - Paia 69 kV line and has the same conceptual line configuration as the existing Maalaea - Kealahou 69 kV line. The existing Kanaha - Pukalani 69 kV transmission line will join together with the remaining three proposed circuits (replacing the North Firebreak Road - Paia 69 kV line) and continue northwest toward Puunene. This combination of existing and proposed circuits is identified as the North Firebreak Road - Puunene 69/12 kV double circuit line.

Figure 1 and Table 1 present a summary of the different line configurations used for the computer modeling calculations. For the two existing transmission lines, calculations were performed for two different loading conditions, one loading condition as the line approaches the station and the other loading condition as the line leaves the station. All loading values used in this report are projected loads for calendar year (CY) 2020. Table 2 presents the loading values for each line type.

The transmission and distribution line geometry describing the three different configurations, as well as future loading information, were supplied through CH2M-HILL by Maui Electric Company, Limited (MECO).

Table 1.
Summary of Transmission/Distribution Line Configurations

Configuration Type	Powerline Name	69 kV	Underbuild 12 kV
Existing	Kanaha - Pukalani	Single Circuit Delta	None
Existing	Maalaea - Kealahou	Single Circuit Delta	None
Proposed	Pulehu Road- North Firebreak Road	Double Circuit Vertical	Double Circuit Vertical
Proposed	North Firebreak Road - Paia	Single Circuit Delta	None
Proposed	North Firebreak Road - Puunene	Double Circuit Vertical	Double Circuit Vertical

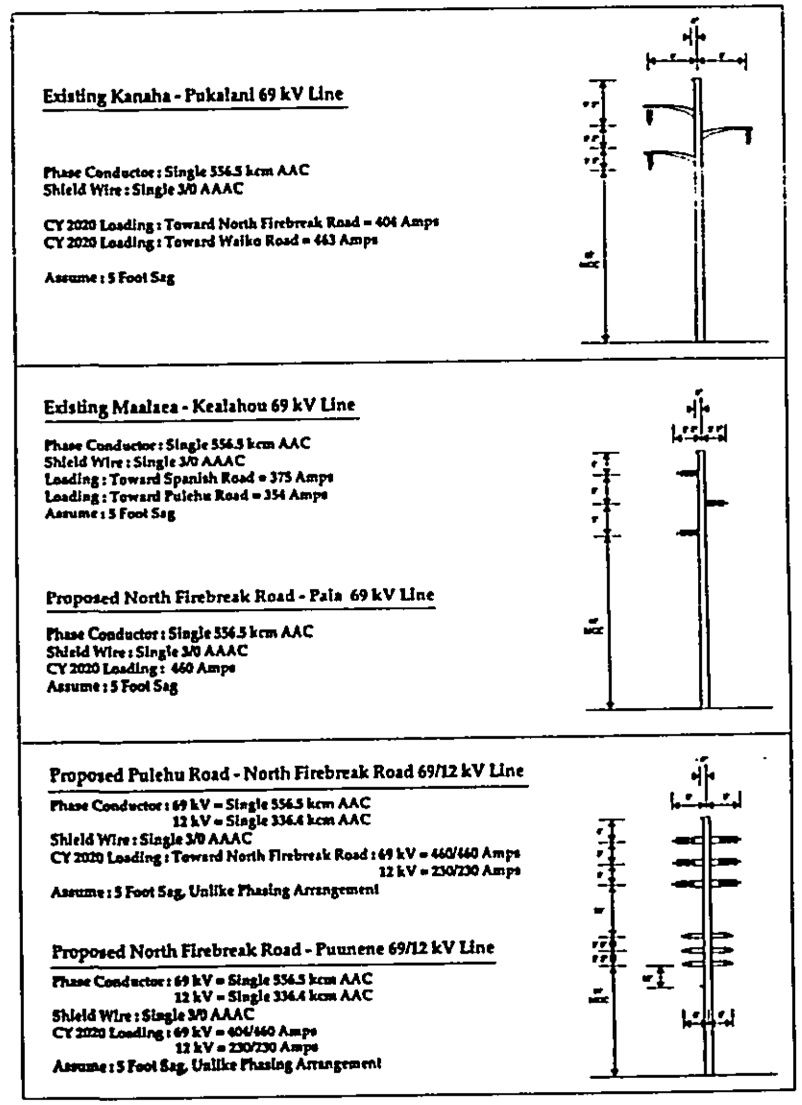


Figure 1. Diagram of Transmission Line Configurations

Table 2.

Summary of Transmission/Distribution Line Projected 2020 Loading Conditions

Line Name	Direction	69 kV Load*	12 kV Load*
Kanaha - Pukalani	Toward North Firebreak Road	404 A	N/A
	Toward Waiko Road	463 A	N/A
Maalaea - Kealahou	Toward Spanish Road	375 A	N/A
	Toward Pulehu Road	354 A	N/A
Pulehu Road - North Firebreak Road	Toward North Firebreak Road	460/460 A	230/230 A
North Firebreak Road - Pala	Toward Pala	460 A	N/A
North Firebreak Road - Puunene	Toward Puunene	404/460 A	230/230 A

* - Note: The direction of current flow for each powerline was assumed for planning purposes to always be in the same direction.

MODELING ASSUMPTIONS

Certain assumptions were made in performing these computer calculations. The purpose of these calculations was to determine preliminary electric and magnetic fields under assumed normal operating conditions. For the transmission lines, electric and magnetic fields were calculated for locations directly underneath the transmission lines at midspan and extending away from the transmission line center as lateral profiles. Field levels at other locations (such as at the tower/pole locations) would be lower than those calculated at midspan. For the generating station equipment and switchyard, magnetic fields were calculated for the entire generating station area and the immediate surrounding area where the associated transmission lines are located.

Both computer programs ENVIRO and SUBCALC assume a flat terrain and do <u>not</u> take into account variations in topography.

For the transmission line electric field calculations, a 5 percent overvoltage condition was assumed for each line type. The electric field shielding reduction that may exist at the project site due to the presence of buildings, light poles, trees, shrubs, and other objects was not included in these calculations. The effect of not including these objects, along with the worst case 5 percent overvoltage, is to produce electric field results that are higher than those that would actually exist next to an object at the project site.

The phasing arrangement for the single 69 kV circuits was assumed to be A-B-C top to bottom. The phasing arrangement for the double circuit 69 kV and 12 kV circuits was assumed to be "unlike" phasing to maximize the magnetic field cancellation. For the double circuit configurations, the direction of current flow for each circuit was assumed to always be in the same direction. The loading values used for this modeling were provided by MECO and projected for the year 2020. The shield wires were assumed to be grounded at each pole. The sag for the shield wires, as well as the 69 kV and 12 kV lines, was assumed to be 5 feet at midspan.

Details regarding the specific locations of some of the generating station electrical equipment, switchyard components, buswork, and powerline support structures were not provided. General diagrams provided approximate locations of some equipment (such as tower locations and span lengths), while other locations were assumed based upon general operating principals (such as buswork routing). It was assumed that the output of the twelve generators within the station were equally providing the total power necessary to produce the loading on each 69 kV and 12 kV powerline associated with the station. Each individual generator was assumed to be producing a 69 kV bus load of about 250 Amps (A).

Magnetic field modeling of the generators was based upon field measurements conducted at another operating generating station and were adjusted proportionately to attempt to reflect the difference in size and output differences. The twelve main transformers which step up the voltage level from 13.8 kV to 69 kV, were included in the model. The twelve auxiliary transformers which step down the voltage level from 13.8 kV to 480V were also included in the model.

The 69 kV buswork was assumed to be routed from each transformer to the switchyard area. A simple ring-bus arrangement was assumed within the switchyard. Each 69 kV buswork segment was assumed to have 250 A of load per generator, with the loads combining at the buswork entering the switchyard. The buswork and other equipment associated with the 480V system which feeds the switchgear plant auxiliary loads were not included in the model. Also, the 69 kV disconnect switches, breakers, and other associated equipment were not included in the model.

General diagrams provided approximate locations of the transmission line routes but did not specify exact pole locations. Pole locations and spacings were assumed based upon reasonable operating assumptions. The span lengths associated with each powerline were assumed to be approximately 200 feet.

CALCULATION RESULTS

The results of the transmission line and generating station computer calculations are presented in both graphical and tabular formats. Graphical plots of the electric and magnetic field calculations are provided in Appendix A. Electric field plots are presented in units of kiloVolts per meter (kV/m), while magnetic field plots are presented in milliGauss (mG). For each field plot, the calculated values represent the maximum field which would actually be present at a given location. To measure the maximum magnetic field, a magnetic field meter utilizing a single axis sensor coil would be used, with the sensor coil rotated in space until the maximum field orientation (major field ellipse) is found and a maximum field value is measured.

TRANSMISSION LINES

Table 3 presents the electric field calculations for the five transmission line configurations. As shown, electric field calculations were performed for distances ranging from -250 feet from centerline out to +250 feet (center of pole/tower = 0 ft). Differences in transmission line loading values do not influence the calculated electric field values. Since the proposed North Firebreak Road - Paia 69 kV line is the same configuration as the existing Maalaea - Kealahou 69 kV line, calculated electric field values are the same for both lines. Similarly, since the proposed Pulehu Road - North Firebreak Road 69/12 kV double circuit line and the North Firebreak Road - Puunene 69/12 kV double circuit line share the same configuration, calculated electric field values for both of these lines are also the same.

Table 3.
Calculated CY 2020 Transmission Line Electric Field Profiles

Distance from Centerline (Feet)	Calculated Electric Field - kV/m				
	Existing Kanaha - Pukalani 69 kV Line (All Loads)	Existing Maalaea - Kealahou 69 kV Line (All Loads)	Proposed Pulehu Rd - Firebreak Rd 69/12 kV Line (All Loads)	Proposed Firebreak Rd - Paia 69 kV Line (All Loads)	Proposed Firebreak Rd - Puunene 69/12 kV Line (All Loads)
-250	0.003	0.003	0.004	0.003	0.004
-240	0.003	0.003	0.004	0.003	0.004
-230	0.003	0.003	0.004	0.003	0.004
-220	0.004	0.004	0.005	0.004	0.005
-210	0.004	0.004	0.005	0.004	0.005
-200	0.005	0.004	0.005	0.004	0.005
-190	0.005	0.005	0.006	0.005	0.006
-180	0.006	0.005	0.006	0.005	0.006
-170	0.007	0.006	0.007	0.006	0.007
-160	0.008	0.007	0.008	0.007	0.008
-150	0.010	0.008	0.008	0.008	0.008
-140	0.012	0.009	0.009	0.009	0.009
-130	0.014	0.010	0.010	0.010	0.010
-120	0.017	0.012	0.011	0.012	0.011
-110	0.021	0.014	0.013	0.014	0.013
-100	0.026	0.017	0.014	0.017	0.014
-95	0.029	0.019	0.015	0.019	0.015
-90	0.033	0.021	0.016	0.021	0.016
-85	0.037	0.024	0.017	0.024	0.017
-80	0.042	0.027	0.018	0.027	0.018
-75	0.048	0.031	0.020	0.031	0.020
-70	0.054	0.035	0.021	0.035	0.021
-65	0.062	0.041	0.023	0.041	0.023
-60	0.071	0.048	0.025	0.048	0.025
-55	0.081	0.057	0.027	0.057	0.027
-50	0.092	0.067	0.029	0.067	0.029
-45	0.105	0.080	0.031	0.080	0.031
-40	0.119	0.094	0.033	0.094	0.033
-35	0.133	0.111	0.034	0.111	0.034
-30	0.146	0.130	0.035	0.130	0.035
-25	0.157	0.150	0.035	0.150	0.035
-20	0.165	0.169	0.035	0.169	0.035
-15	0.167	0.186	0.033	0.186	0.033
-10	0.165	0.198	0.031	0.198	0.031
-5	0.161	0.204	0.029	0.204	0.029
0	0.161	0.202	0.028	0.202	0.028

Table 3.
Calculated CY 2020 Transmission Line Electric Field Profiles (Continued)

Distance from Centerline (Feet)	Calculated Electric Field - kV/m Existing Kanaha - Pukalani 69 kV Line (All Loads)	Existing Maalaea - Kealahou 69 kV Line (All Loads)	Proposed Pulehu Rd - Firebreak Rd 69/12 kV Line (All Loads)	Proposed Firebreak Rd - Pala 69 kV Line (All Loads)	Proposed Firebreak Rd - Puunene 69/12 kV Line (All Loads)
0	0.161	0.202	0.028	0.202	0.028
5	0.168	0.193	0.029	0.193	0.029
10	0.179	0.179	0.031	0.179	0.031
15	0.190	0.161	0.033	0.161	0.033
20	0.196	0.141	0.035	0.141	0.035
25	0.195	0.121	0.035	0.121	0.035
30	0.189	0.103	0.035	0.103	0.035
35	0.178	0.087	0.034	0.087	0.034
40	0.164	0.073	0.032	0.073	0.032
45	0.149	0.062	0.031	0.062	0.031
50	0.134	0.052	0.029	0.052	0.029
55	0.120	0.044	0.027	0.044	0.027
60	0.107	0.037	0.025	0.037	0.025
65	0.095	0.031	0.023	0.031	0.023
70	0.084	0.027	0.021	0.027	0.021
75	0.075	0.023	0.020	0.023	0.020
80	0.067	0.020	0.018	0.020	0.018
85	0.060	0.018	0.017	0.018	0.017
90	0.053	0.015	0.016	0.015	0.016
95	0.048	0.014	0.015	0.014	0.015
100	0.043	0.012	0.014	0.012	0.014
110	0.035	0.010	0.013	0.010	0.013
120	0.029	0.008	0.011	0.008	0.011
130	0.024	0.007	0.010	0.007	0.010
140	0.020	0.006	0.009	0.006	0.009
150	0.017	0.005	0.008	0.005	0.008
160	0.015	0.005	0.008	0.005	0.008
170	0.013	0.004	0.007	0.004	0.007
180	0.011	0.004	0.006	0.004	0.006
190	0.010	0.003	0.006	0.003	0.006
200	0.009	0.003	0.006	0.003	0.006
210	0.008	0.003	0.005	0.003	0.005
220	0.007	0.003	0.005	0.003	0.005
230	0.006	0.002	0.004	0.002	0.004
240	0.006	0.002	0.004	0.002	0.004
250	0.005	0.002	0.004	0.002	0.004

Table 4 presents the transmission line magnetic field calculations, expressed in milliGauss (mG), for each of the five different line configurations. For each existing transmission line, two loading cases are presented for CY 2020 (one loading condition as the line approaches the station and the other loading condition as the line leaves the station). As shown, magnetic field calculations were performed for distances ranging from -250 feet from centerline out to +250 feet, where levels of about 1 mG or less were calculated.

Table 4.
Calculated CY 2020 Transmission Line Magnetic Field Profiles

Distance from Centerline (Feet)	Calculated Magnetic Field - mG Existing Kanaha - Pukalani 69 kV Line (Toward North Firebreak Rd - 404 Amps)	Existing Kanaha - Pukalani 69 kV Line (Toward Waiko Road - 463 Amps)
-250	0.45	0.52
-240	0.48	0.55
-230	0.52	0.60
-220	0.56	0.65
-210	0.61	0.70
-200	0.67	0.77
-190	0.74	0.84
-180	0.81	0.93
-170	0.90	1.03
-160	1.01	1.16
-150	1.14	1.30
-140	1.29	1.48
-130	1.48	1.70
-120	1.71	1.96
-110	2.00	2.30
-100	2.37	2.71
-95	2.59	2.96
-90	2.83	3.25
-85	3.12	3.57
-80	3.44	3.94
-75	3.80	4.36
-70	4.22	4.84
-65	4.71	5.39
-60	5.26	6.03
-55	5.89	6.75
-50	6.62	7.58
-45	7.44	8.52
-40	8.36	9.58
-35	9.39	10.76
-30	10.50	12.03
-25	11.66	13.36

Table 4.
Calculated CY 2020 Transmission Line Magnetic Field Profiles (Continued)

Calculated Magnetic Field - mG

Distance from Centerline (Feet)	Existing Kanaha - Pukalani 69 kV Line (Toward North Firebreak Rd - 404 Amps)	Existing Kanaha - Pukalani 69 kV Line (Toward Waiko Road - 463 Amps)
-20	12.82	14.69
-15	13.89	15.92
-10	14.79	16.95
-5	15.41	17.67
0	15.70	17.99
5	15.61	17.88
10	15.16	17.38
15	14.43	16.54
20	13.50	15.47
25	12.46	14.28
30	11.38	13.05
35	10.33	11.84
40	9.34	10.70
45	8.42	9.66
50	7.60	8.71
55	6.86	7.86
60	6.21	7.11
65	5.63	6.45
70	5.12	5.87
75	4.67	5.35
80	4.27	4.90
85	3.92	4.49
90	3.61	4.13
95	3.33	3.82
100	3.08	3.53
110	2.66	3.05
120	2.33	2.66
130	2.05	2.35
140	1.82	2.08
150	1.63	1.86
160	1.47	1.68
170	1.33	1.52
180	1.21	1.39
190	1.11	1.27
200	1.02	1.17
210	0.94	1.08
220	0.87	1.00
230	0.81	0.93
240	0.76	0.87
250	0.71	0.81

Table 4.
Calculated CY 2020 Transmission Line Magnetic Field Profiles (Continued)

Calculated Magnetic Field - mG

Distance from Centerline (Feet)	Existing Maalaea - Kealahou 69 kV Line (Toward Spanish Rd -375 Amps)	Existing Maalaea - Kealahou 69 kV Line (Toward Pulehu Rd - 354 Amps)
-250	0.77	0.73
-240	0.81	0.76
-230	0.85	0.80
-220	0.90	0.85
-210	0.95	0.90
-200	1.01	0.95
-190	1.08	1.02
-180	1.16	1.09
-170	1.25	1.18
-160	1.35	1.28
-150	1.48	1.40
-140	1.63	1.53
-130	1.80	1.70
-120	2.01	1.90
-110	2.27	2.15
-100	2.59	2.45
-95	2.78	2.63
-90	2.99	2.82
-85	3.23	3.05
-80	3.49	3.30
-75	3.79	3.58
-70	4.12	3.89
-65	4.50	4.25
-60	4.92	4.64
-55	5.39	5.09
-50	5.91	5.58
-45	6.48	6.12
-40	7.11	6.71
-35	7.77	7.33
-30	8.45	7.97
-25	9.12	8.61
-20	9.76	9.21
-15	10.30	9.73
-10	10.71	10.11
-5	10.94	10.33
0	10.97	10.36

Table 4.
Calculated CY 2020 Transmission Line Magnetic Field Profiles (Continued)

Distance from Centerline (Feet)	Calculated Magnetic Field - mG: Existing Maalaea - Kealahou 69 kV Line (Toward Spanish Rd -375 Amps)	Calculated Magnetic Field - mG: Existing Maalaea - Kealahou 69 kV Line (Toward Pulehu Rd - 354 Amps)
0	10.97	10.36
5	10.80	10.20
10	10.45	9.86
15	9.95	9.39
20	9.36	8.84
25	8.72	8.23
30	8.07	7.62
35	7.44	7.02
40	6.83	6.45
45	6.28	5.92
50	5.76	5.44
55	5.30	5.00
60	4.88	4.61
65	4.51	4.26
70	4.17	3.94
75	3.87	3.66
80	3.60	3.40
85	3.36	3.18
90	3.15	2.97
95	2.95	2.79
100	2.78	2.62
110	2.47	2.33
120	2.22	2.10
130	2.01	1.90
140	1.83	1.73
150	1.68	1.59
160	1.55	1.47
170	1.44	1.36
180	1.34	1.27
190	1.26	1.19
200	1.18	1.11
210	1.11	1.05
220	1.05	0.99
230	1.00	0.94
240	0.95	0.89
250	0.90	0.85

Table 4.
Calculated CY 2020 Transmission Line Magnetic Field Profiles (Continued)

Distance from Centerline (Feet)	Calculated Magnetic Field - mG: Proposed Pulehu Road - North Firebreak 69/12 kV Line (460/460/230/230 Amps)	Calculated Magnetic Field - mG: Proposed North Firebreak Road - Puunene 69/12 kV Line (404/460/230/230 Amps)
-250	0.09	0.01
-240	0.10	0.02
-230	0.11	0.02
-220	0.12	0.02
-210	0.13	0.03
-200	0.15	0.03
-190	0.16	0.04
-180	0.18	0.05
-170	0.21	0.07
-160	0.24	0.08
-150	0.28	0.10
-140	0.32	0.13
-130	0.37	0.17
-120	0.44	0.21
-110	0.52	0.27
-100	0.62	0.34
-95	0.68	0.39
-90	0.75	0.44
-85	0.83	0.50
-80	0.91	0.57
-75	1.01	0.64
-70	1.12	0.73
-65	1.24	0.84
-60	1.37	0.96
-55	1.53	1.09
-50	1.69	1.25
-45	1.88	1.43
-40	2.09	1.63
-35	2.31	1.86
-30	2.54	2.11
-25	2.78	2.38
-20	3.02	2.65
-15	3.22	2.91
-10	3.38	3.14
-5	3.48	3.32
0	3.50	3.43

Table 4.
Calculated CY 2020 Transmission Line Magnetic Field Profiles (Continued)

Distance from Centerline (Feet)	Calculated Magnetic Field - mG Proposed Pulehu Road - North Firebreak 69/12 kV Line (460/460/230/230 Amps)	Proposed North Firebreak Road - Puunene 69/12 kV Line (404/460/230/230 Amps)
0	3.50	3.43
5	3.43	3.45
10	3.29	3.40
15	3.09	3.27
20	2.85	3.10
25	2.60	2.89
30	2.34	2.67
35	2.10	2.44
40	1.87	2.22
45	1.66	2.02
50	1.47	1.83
55	1.31	1.66
60	1.16	1.51
65	1.03	1.37
70	0.92	1.24
75	0.82	1.13
80	0.73	1.03
85	0.65	0.93
90	0.59	0.85
95	0.53	0.78
100	0.47	0.71
110	0.38	0.60
120	0.31	0.51
130	0.26	0.44
140	0.22	0.38
150	0.18	0.33
160	0.15	0.28
170	0.13	0.25
180	0.11	0.22
190	0.10	0.19
200	0.09	0.17
210	0.08	0.15
220	0.07	0.14
230	0.07	0.13
240	0.06	0.11
250	0.06	0.10

Table 4.
Calculated CY 2020 Transmission Line Magnetic Field Profiles (Continued)

Distance from Centerline (Feet)	Calculated Magnetic Field - mG Proposed North Firebreak Road - Paia 69 kV Line (460 Amps)
-250	0.94
-240	0.99
-230	1.04
-220	1.10
-210	1.17
-200	1.24
-190	1.32
-180	1.42
-170	1.53
-160	1.66
-150	1.81
-140	1.99
-130	2.21
-120	2.47
-110	2.79
-100	3.18
-95	3.41
-90	3.67
-85	3.96
-80	4.28
-75	4.65
-70	5.06
-65	5.52
-60	6.04
-55	6.61
-50	7.25
-45	7.95
-40	8.72
-35	9.53
-30	10.36
-25	11.19
-20	11.97
-15	12.64
-10	13.14
-5	13.42
0	13.46

Table 4.
Calculated CY 2020 Transmission Line Magnetic Field Profiles (Continued)

Distance from Centerline (Feet)	Calculated Magnetic Field - mG: Proposed North Firebreak Road - Pala 69 kV Line (460 Amps)
0	13.46
5	13.25
10	12.81
15	12.21
20	11.48
25	10.70
30	9.90
35	9.12
40	8.38
45	7.70
50	7.07
55	6.50
60	5.99
65	5.53
70	5.12
75	4.75
80	4.42
85	4.13
90	3.86
95	3.62
100	3.41
110	3.03
120	2.72
130	2.47
140	2.25
150	2.06
160	1.90
170	1.77
180	1.65
190	1.54
200	1.45
210	1.36
220	1.29
230	1.22
240	1.16
250	1.11

GENERATING STATION

The results of the generating station computer modeling are presented in both graphical and tabular formats. Figure 2 presents a diagram of the generating station model. A graphical plot of the magnetic field calculations are provided as a contour map in Figure 3. For each magnetic field plot, the calculated values represent the maximum magnetic field which would actually be present at a given location.

Calculations were also performed to determine magnetic field levels along the perimeter of the generating station. A graph of the perimeter path locations and calculated field values are included in Appendix A. Table 5 presents a summary of the calculated magnetic field values along the perimeter of the generating station. As shown, the perimeter field values range from about 0.1 mG along the western side of the station to about 20.3 mG underneath the overhead transmission lines on Pulehu Road.

Table 5. Summary of Proposed Generating Station Perimeter Calculations

Segment #	Segment Location	Calculated Magnetic Field - mG: Minimum	Calculated Magnetic Field - mG: Maximum
1	Southeastern Side	1.1	10.0
2	Northeastern Side	7.5	20.4
3	Northwestern Side	0.1	9.6
4	Southwestern Side	0.2	1.4

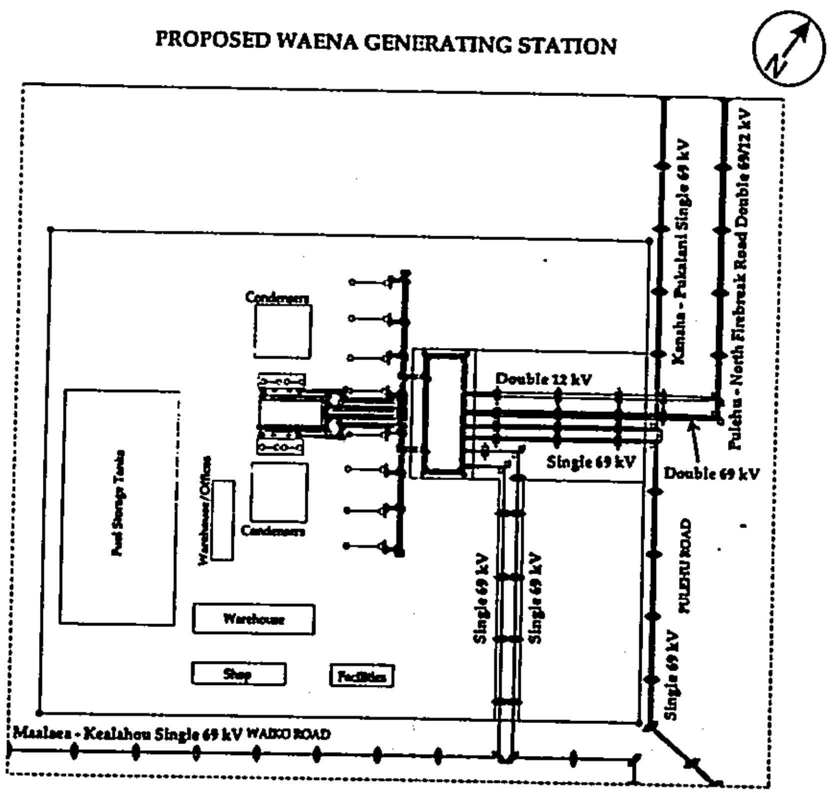


Figure 2. Computer Site Model of Proposed Waena Generating Station

-19-

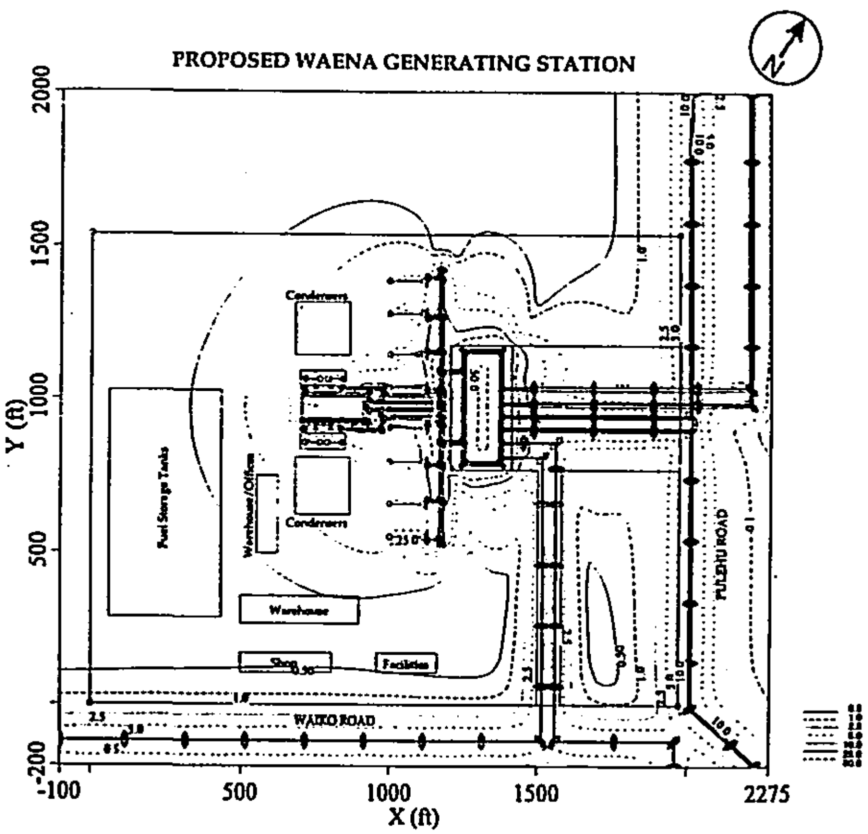


Figure 3. Calculated Magnetic Field Contour Map of Proposed Waena Generating Station

-20-

ANALYSIS

For the Kanaha - Pukalani single circuit 69 kV transmission line, the CY 2020 preliminary calculated electric field ranges from about 3 volts per meter (0.003 kV/m) at 250 feet away from centerline to a maximum of about 196 volts per meter (0.196 kV/m) near centerline at midspan. Calculated electric field values for the Maalaea - Kealahou single circuit 69 kV transmission line and the proposed North Firebreak Road - Paia single circuit 69 kV transmission line ranges from about 2 volts per meter (0.002 kV/m) at a distance of 250 feet away from centerline to a maximum of about 204 volts per meter (0.204 kV/m) near centerline at midspan. Calculated electric field values for the proposed Pulehu Road - North Firebreak Road double circuit 69 kV transmission line with a double circuit 12 kV underbuild, as well as the proposed North Firebreak Road - Puunene double circuit 69 kV transmission line with a double circuit 12 kV underbuild, ranges from about 4 volts per meter (0.004 kV/m) at a distance of 250 feet away from centerline to a maximum of about 35 volts per meter (0.035 kV/m) near centerline at midspan. The proposed double circuit transmission lines produce less electric field than the existing or proposed single circuit transmission lines due to the line geometry configuration, which will provide some measure of electric field cancellation.

A summary of the CY 2020 preliminary calculated magnetic field values associated with the three transmission lines is presented in Table 6. As shown, the Kanaha - Pukalani single circuit 69 kV transmission line exhibits the largest calculated magnetic fields near centerline at midspan, due to the wider conductor spacing configuration and loading conditions. The proposed Pulehu Road - North Firebreak Road double circuit 69 kV transmission line (with a double circuit 12 kV underbuild) and the proposed North Firebreak Road - Puunene double circuit 69 kV transmission line (with a double circuit 12 kV underbuild) produces the least calculated magnetic field near centerline at midspan, due to the double circuit arrangement with "unlike" phasing (which optimizes the field cancellation). The proposed North Firebreak Road - Paia 69 kV line produces calculated magnetic field levels in between the levels produced by the two existing single circuit 69 kV lines.

Table 6. Summary of Transmission Line Magnetic Field Calculations

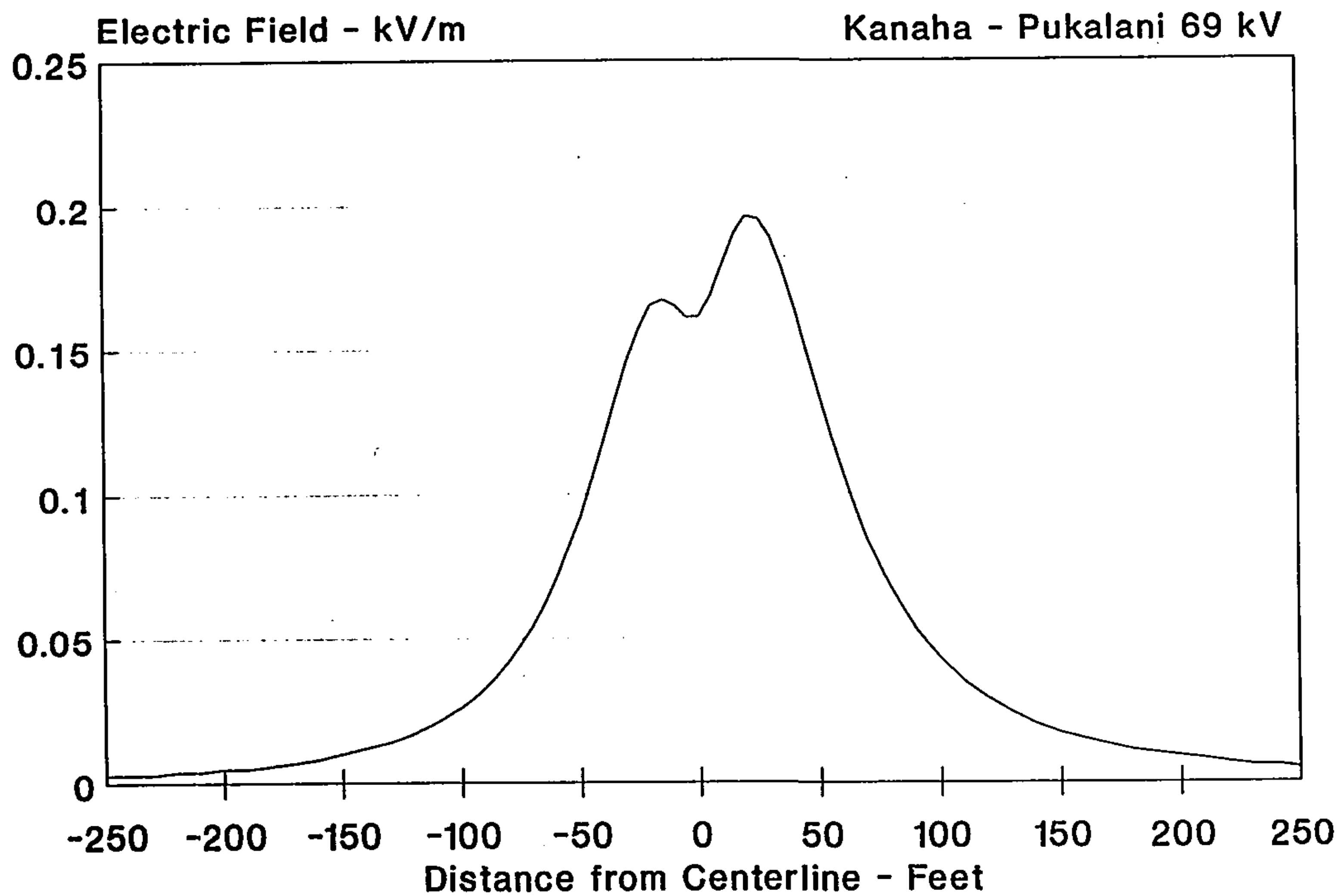
Transmission Line Name	Load (Amps)	Calculated Magnetic Field - mG	
		Minimum	Maximum
Kanaha - Pukalani 69 kV Line	404 463	0.5 0.5	15.7 18.0
Maalaea - Kealahou 69 kV Line	375 354	0.8 0.7	11.0 10.4
Proposed Pulehu Road - North Firebreak Road 69/12 kV Line	460/460/230/230	0.1	3.5
Proposed North Firebreak Road - Paia 69 kV Line	460	0.9	13.5
Proposed North Firebreak Road - Puunene 69/12 kV Line	404/460/230/230	0.0	3.5

The preliminary calculation results of the generating station computer modeling indicate that the generating station equipment, due to its location near the center of the station, does not contribute significantly to the magnetic field levels at the perimeter of the station (the highest calculated fields from the station equipment is found along the northwestern perimeter of the station and is less than 1.0 mG). The 69 kV buswork and switchyard, using the conceptual arrangement and loading conditions, also does not contribute significantly to the magnetic field levels at the perimeter of the station. The dominant source of magnetic fields at the proposed station perimeter and beyond is due primarily to the 69 kV and 12 kV overhead transmission lines, which enter and leave the station along Pulehu Road and Waiko Road. The highest calculated magnetic fields were found underneath the overhead transmission lines along Pulehu Road.

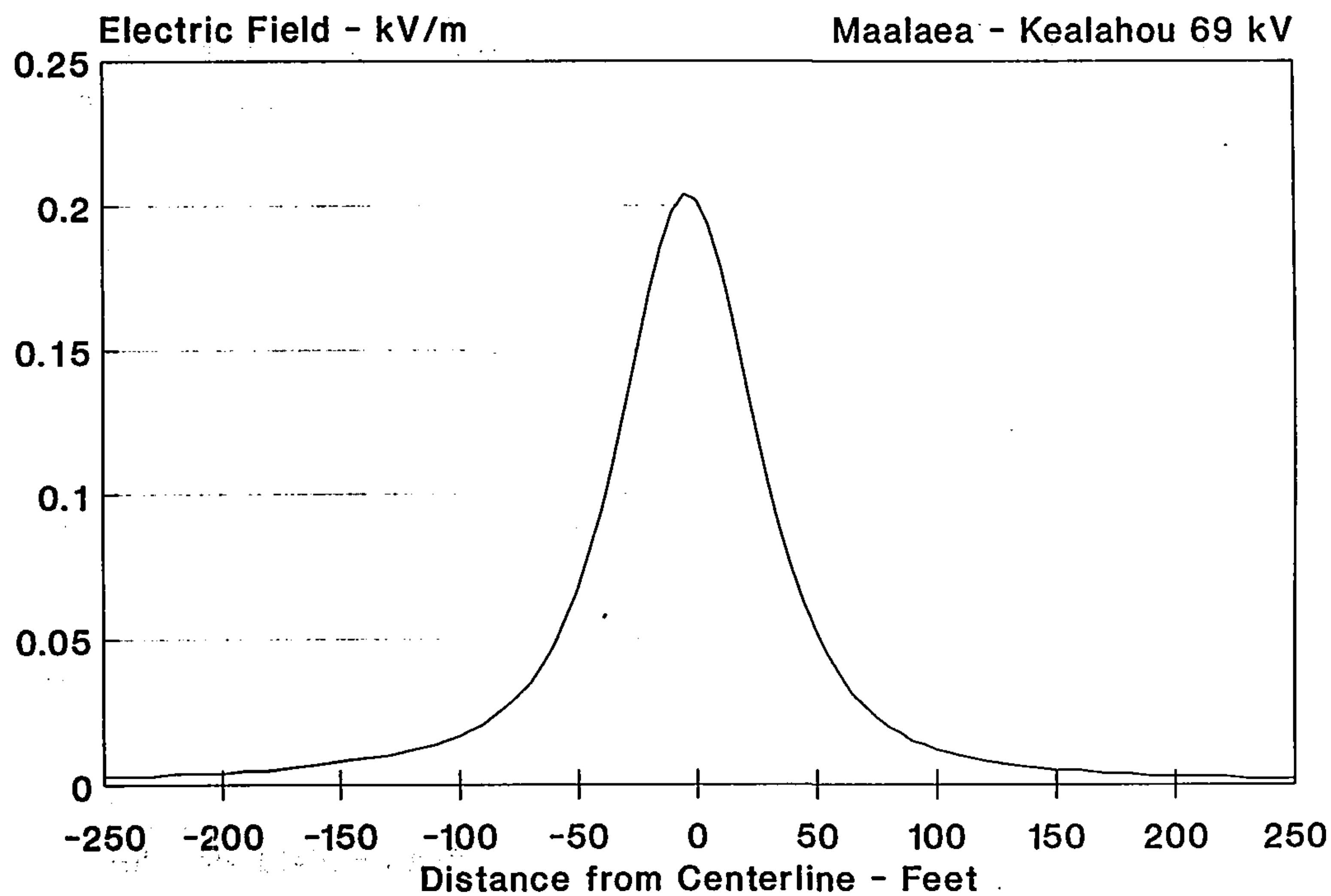
APPENDIX A

ELECTRIC AND MAGNETIC FIELD CALCULATION RESULTS

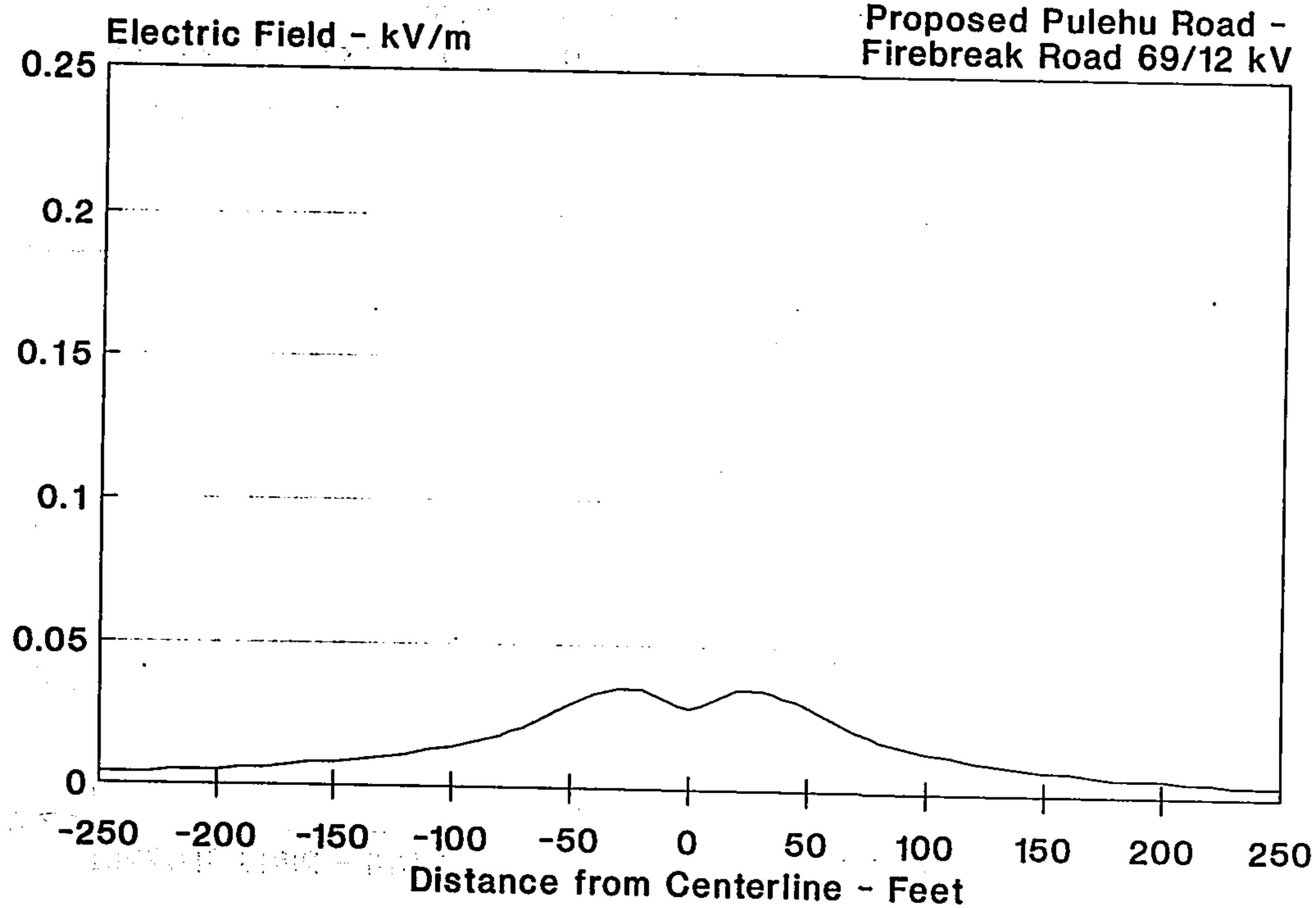
Proposed Waena Generating Station
Powerline Electric Field Calculations



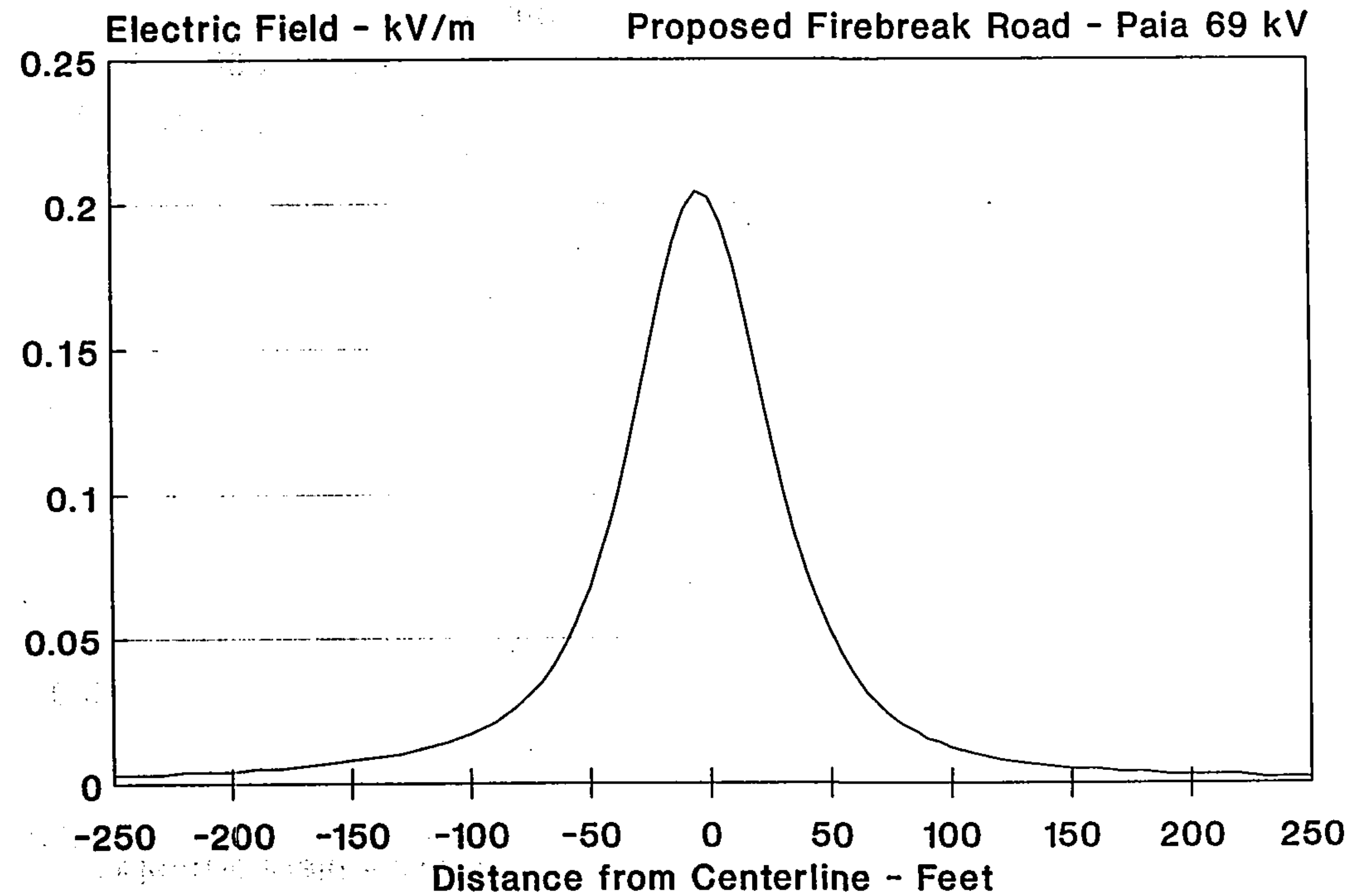
Proposed Waena Generating Station
Powerline Electric Field Calculations



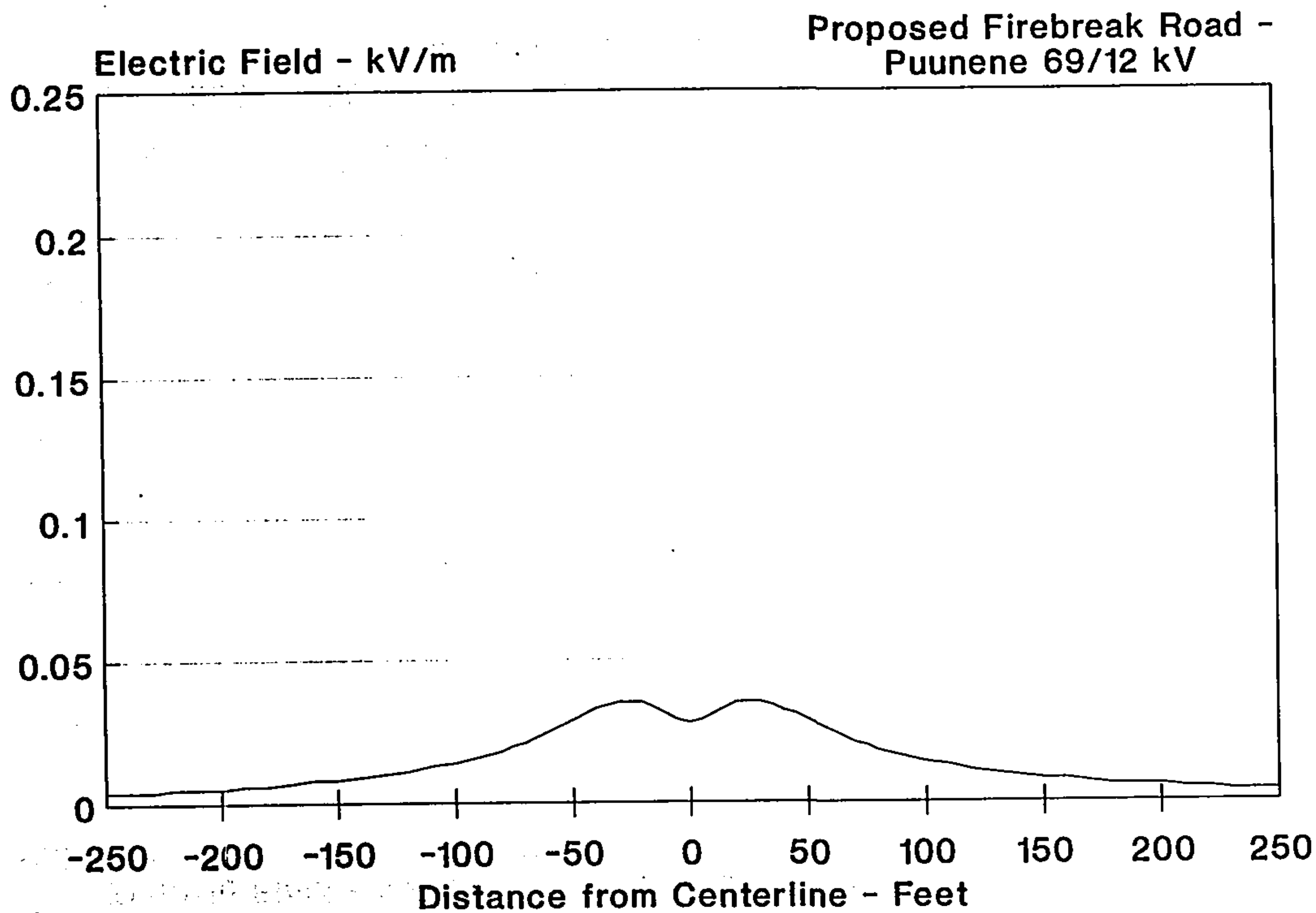
Proposed Waena Generating Station
Powerline Electric Field Calculations



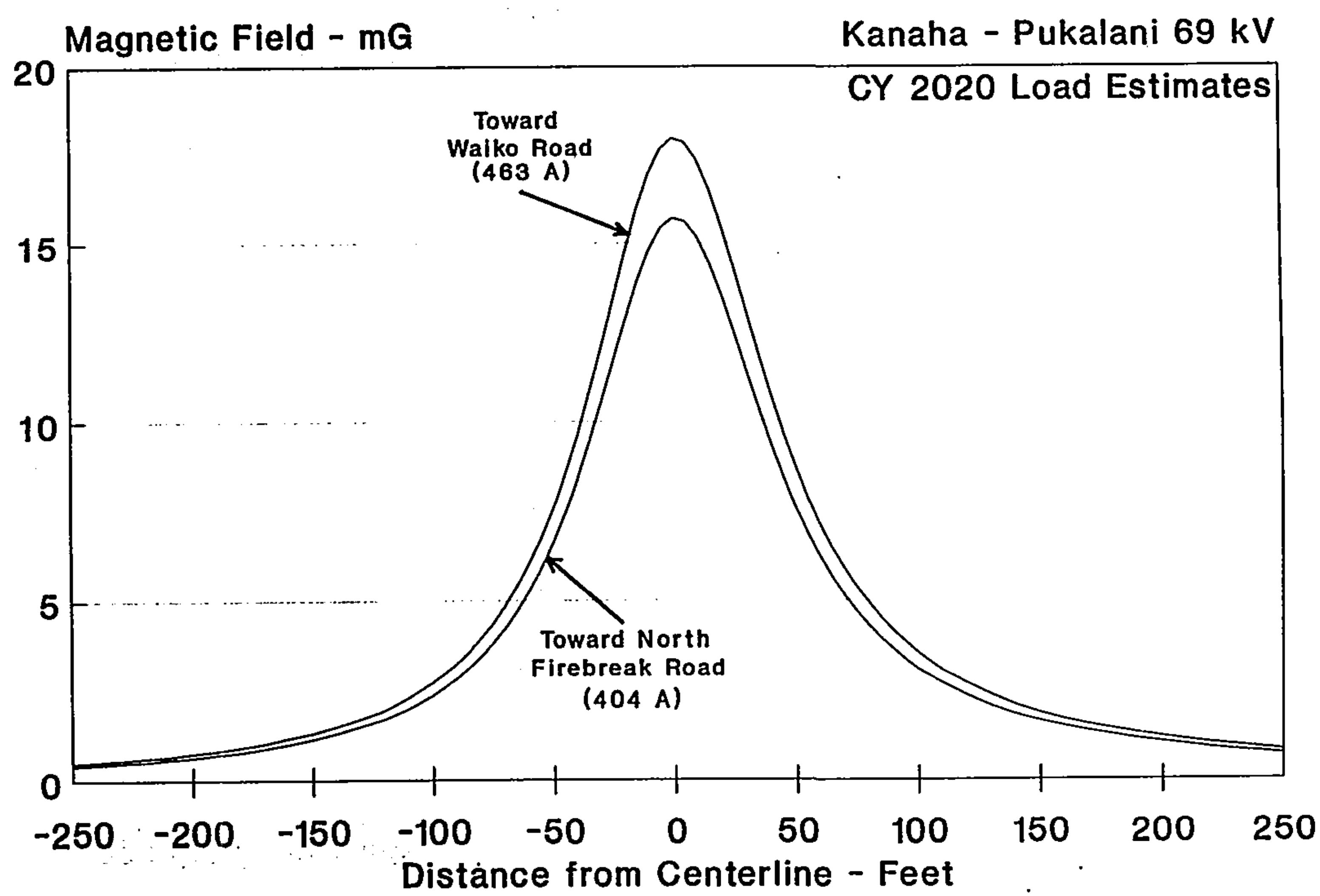
Proposed Waena Generating Station
Powerline Electric Field Calculations



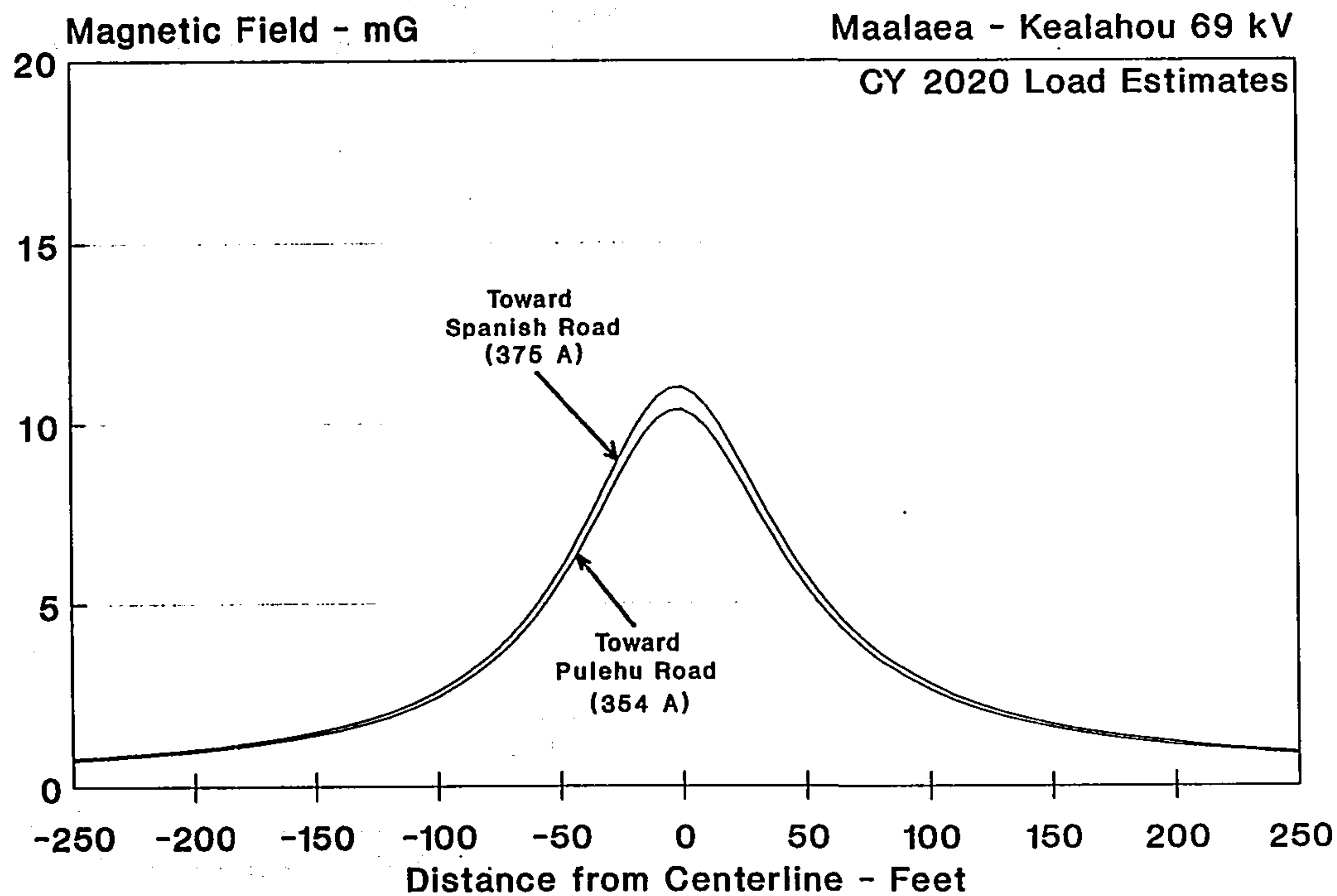
Proposed Waena Generating Station
Powerline Electric Field Calculations



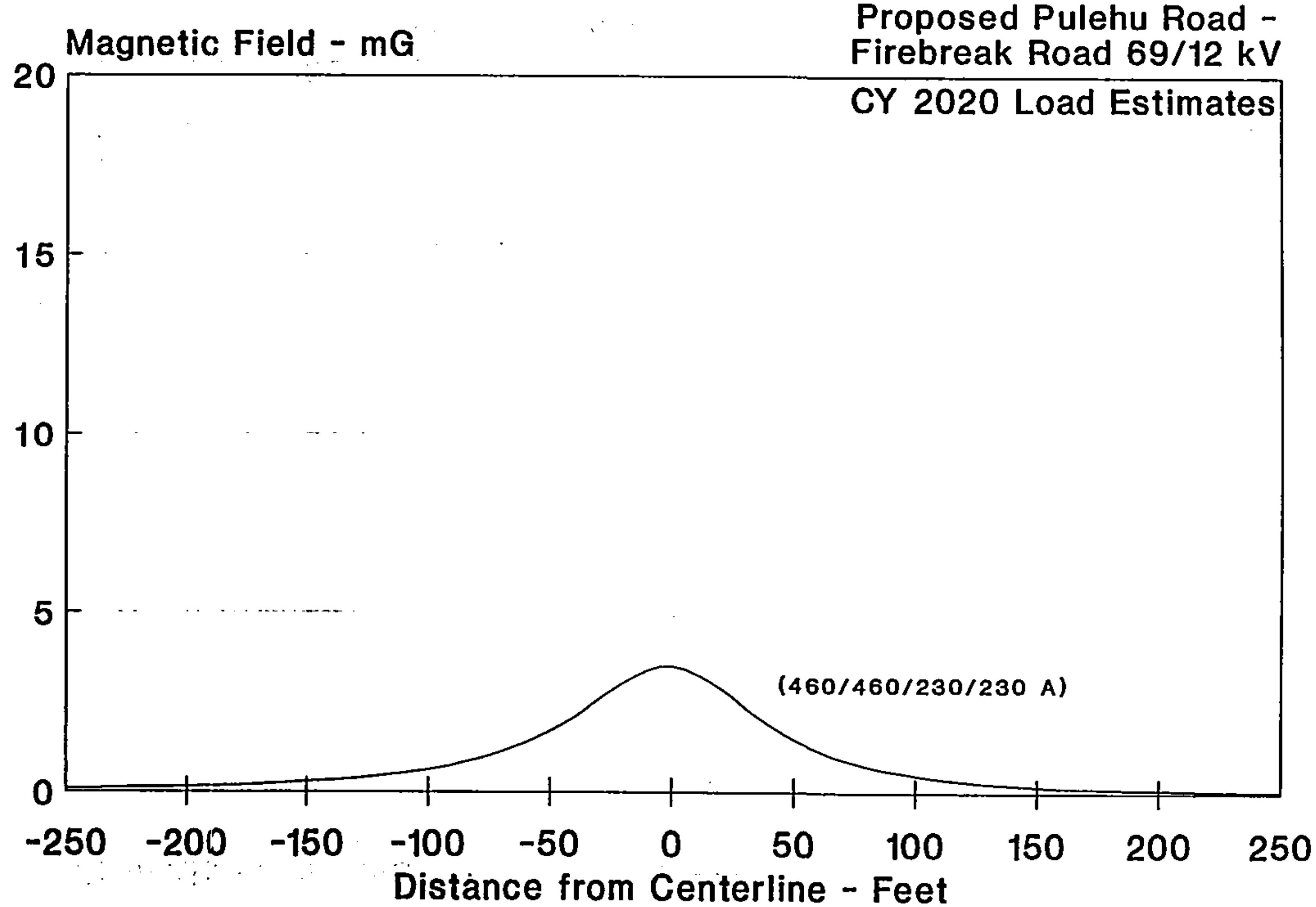
Proposed Waena Generating Station
Powerline Magnetic Field Calculations



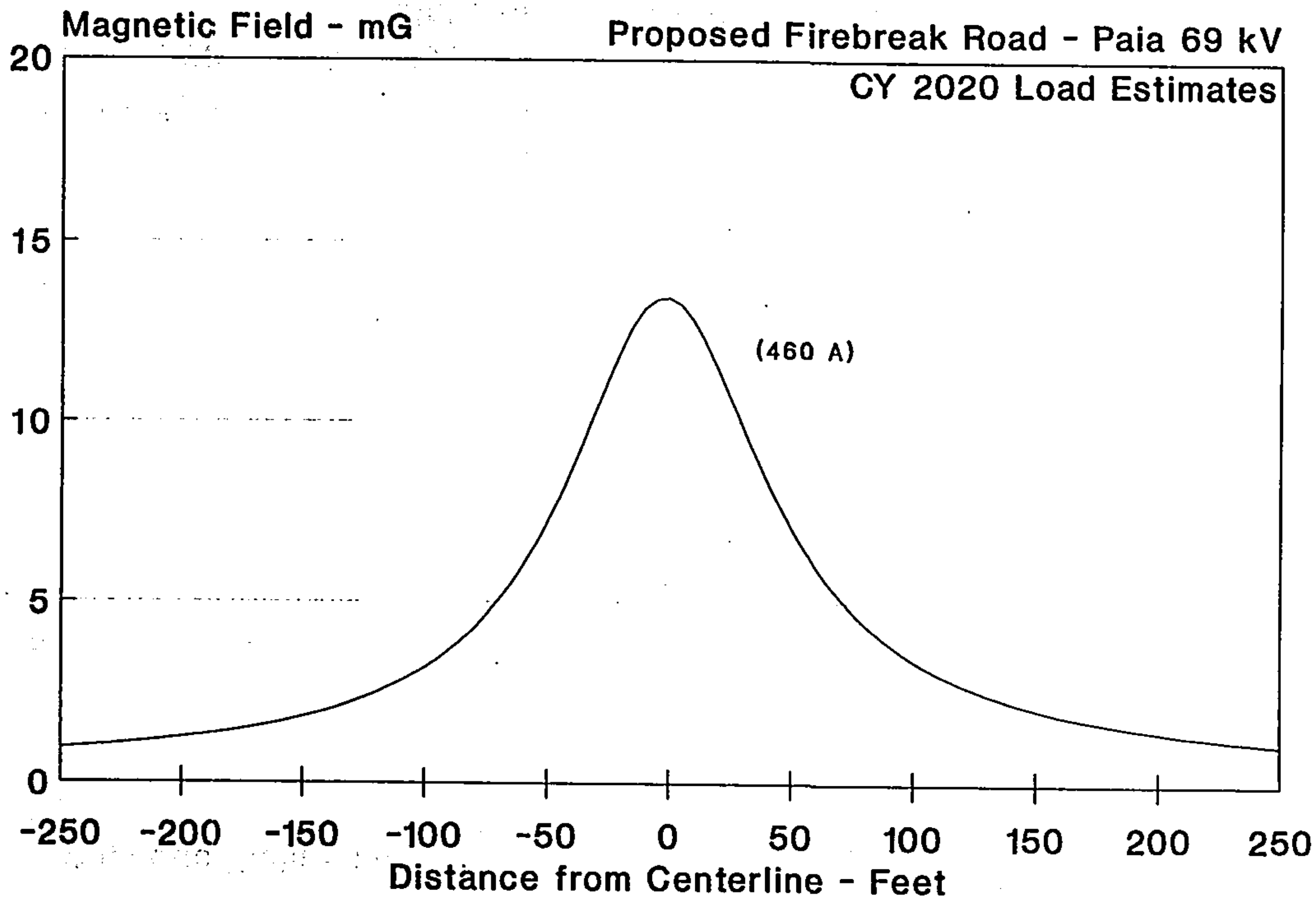
Proposed Waena Generating Station
Powerline Magnetic Field Calculations



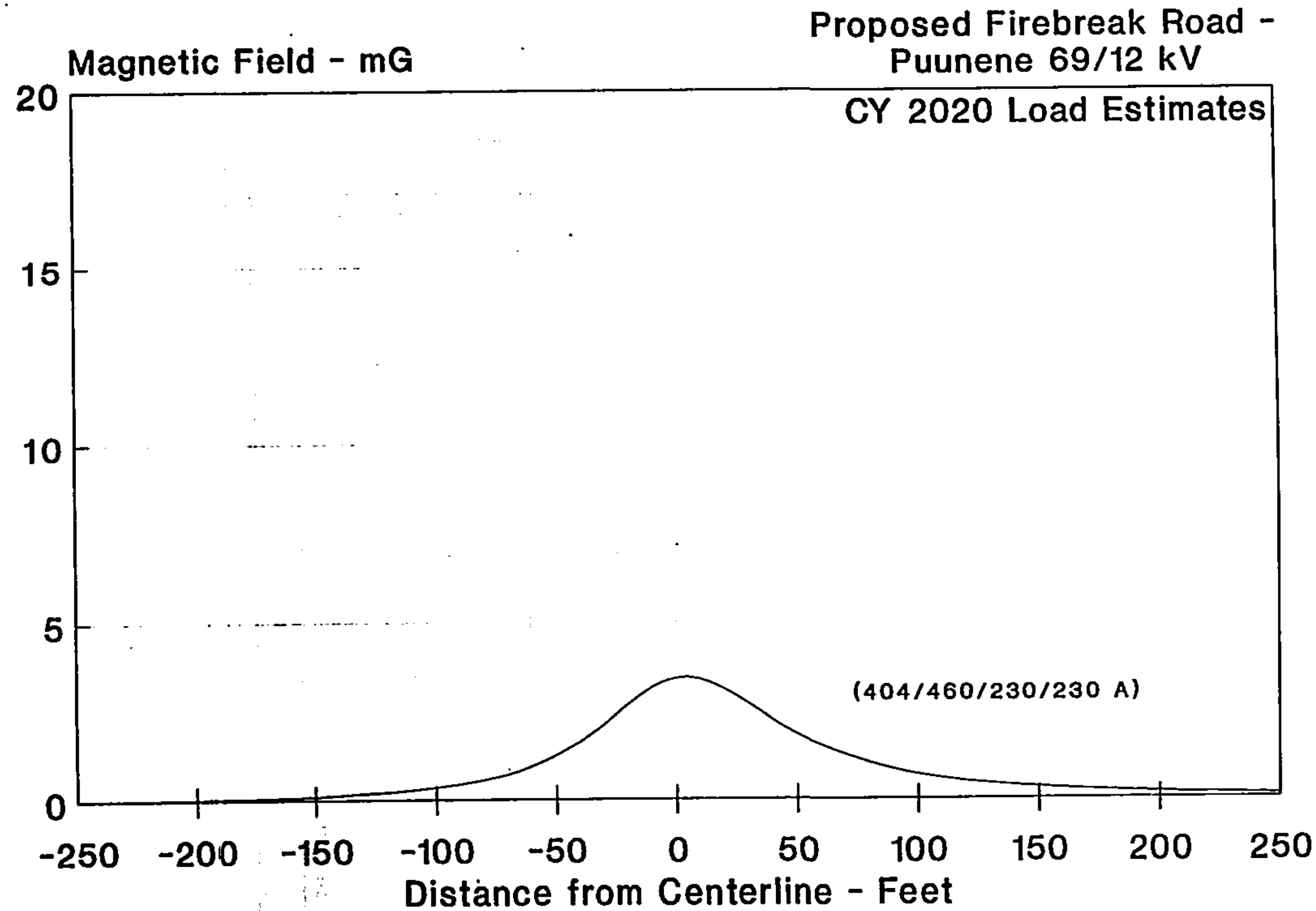
Proposed Waena Generating Station
Powerline Magnetic Field Calculations



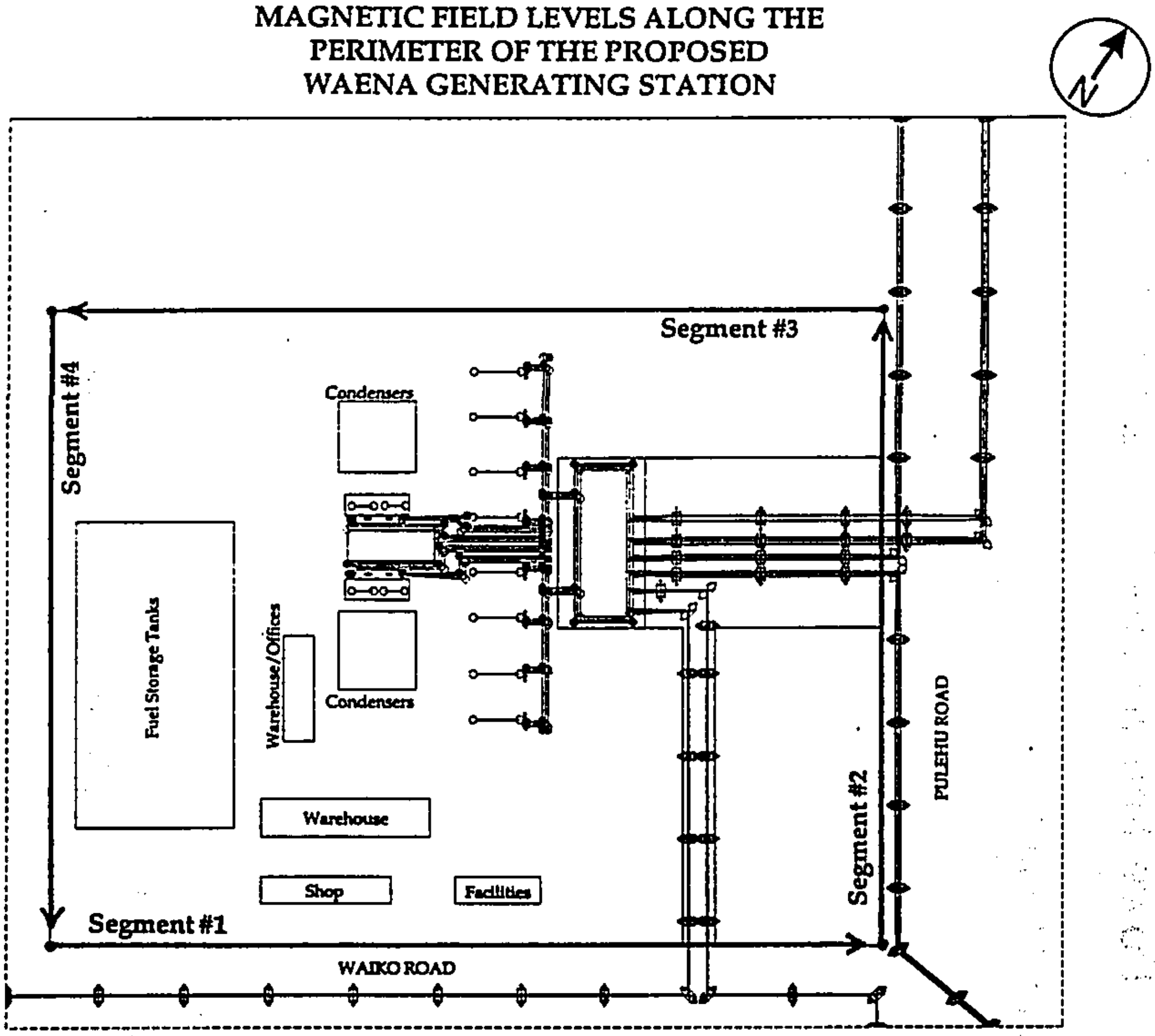
Proposed Waena Generating Station
Powerline Magnetic Field Calculations

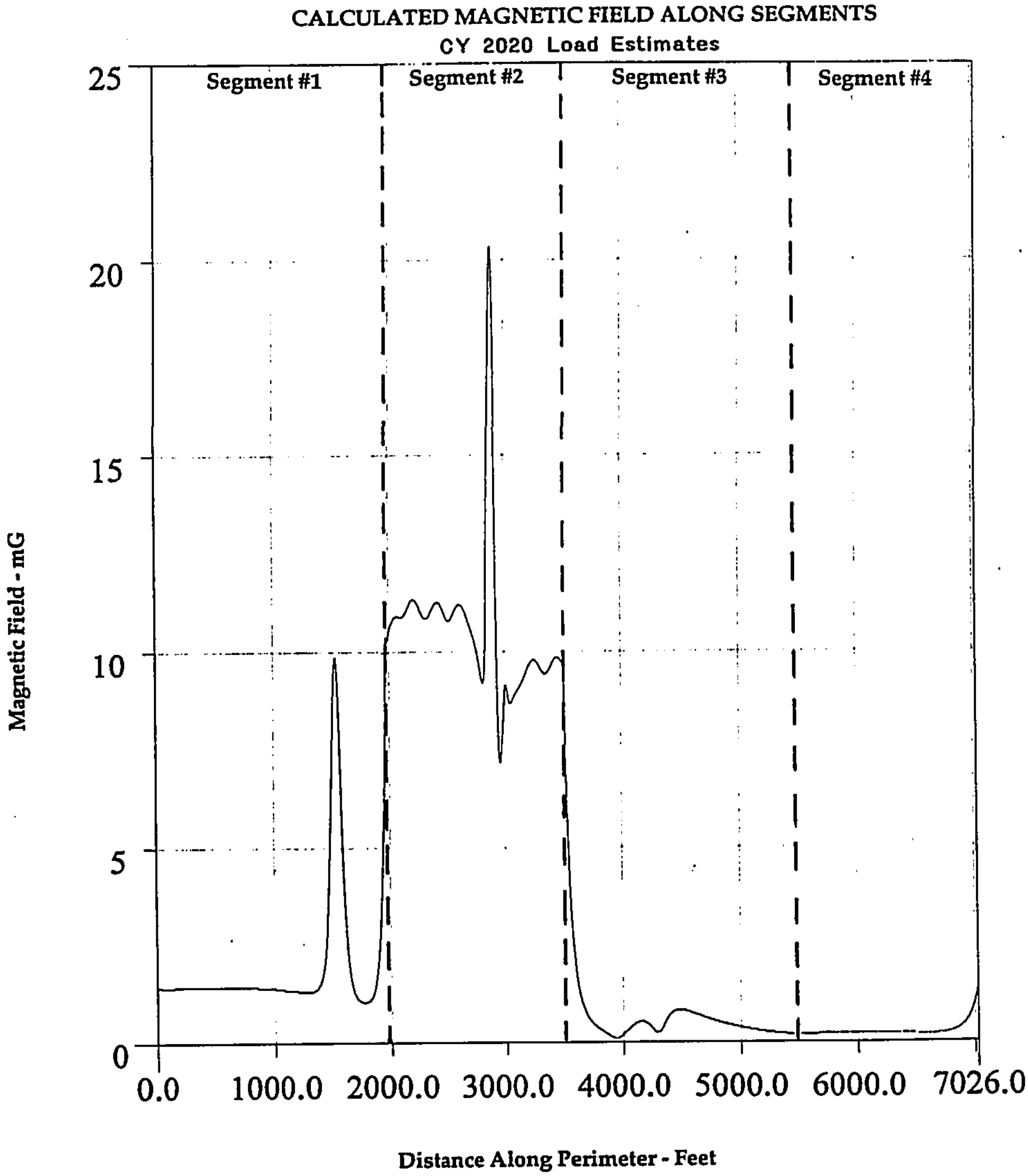


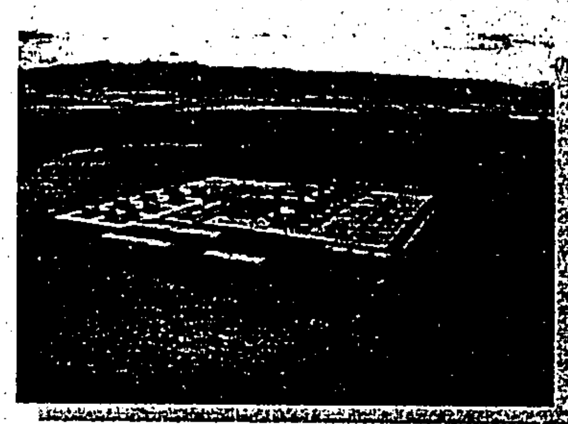
Proposed Waena Generating Station
Powerline Magnetic Field Calculations



SEGMENT LOCATIONS FOR CALCULATED MAGNETIC FIELD LEVELS ALONG THE PERIMETER OF THE PROPOSED WAENA GENERATING STATION

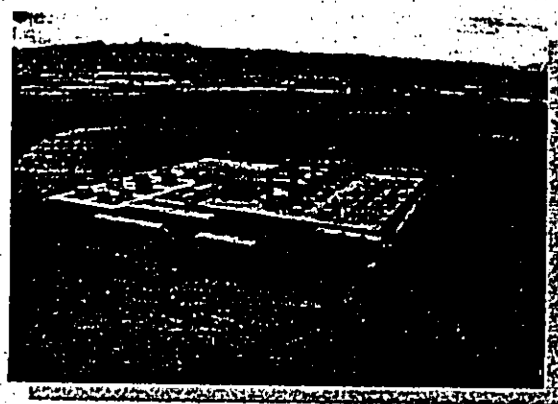



CALCULATED MAGNETIC FIELD ALONG SEGMENTS
CY 2020 Load Estimates
Segment #1
Segment #2
Segment #3
Segment #4
Magnetic Field - mG
25
20
15
10
5
0
0.0
1000.0
2000.0
3000.0
4000.0
5000.0
6000.0
7026.0
Distance Along Perimeter - Feet



APPENDIX K

EIS PUBLIC MEETING MATERIALS



APPENDIX K1

PUBLIC SCOPING MEETING

WAENA GENERATING STATION PROJECT

MAUI ELECTRIC COMPANY, LIMITED

PUBLIC SCOPING MEETING

March 18, 1997

Upcountry Aquatic Center

♦

AGENDA

OPEN HOUSE	6:30 - 7:00 P.M.
PUBLIC MEETING	7:00 - 9:00 P.M.

- Welcome
- Presentation
- Public Comments
- Questions and Answers
- Closing Remarks

WAENA GENERATING STATION PROJECT

MAUI ELECTRIC COMPANY, LIMITED

PUBLIC SCOPING MEETING

March 19, 1997

Kihei Elementary School Cafeteria

♦

AGENDA

OPEN HOUSE	6:30 - 7:00 P.M.
PUBLIC MEETING	7:00 - 9:00 P.M.

- Welcome
- Presentation
- Public Comments
- Questions and Answers
- Closing Remarks

WAENA GENERATING STATION PROJECT

MAUI ELECTRIC COMPANY, LIMITED

PUBLIC SCOPING MEETING

March 20, 1997

Maui Arts & Cultural Center, HEI Meeting Room

♦

AGENDA

OPEN HOUSE	6:30 - 7:00 P.M.
PUBLIC MEETING	7:00 - 9:00 P.M.

- Welcome
- Presentation
- Public Comments
- Questions and Answers
- Closing Remarks

MECO'S WAENA GENERATING STATION SCOPING MEETING FACT SHEET

WHAT:
MECO needs to establish a new power plant site for generating unit additions in 2004 and beyond.

WHY:
After the next Maalaea generation addition, Units M17-19 (1997 - 2000), the Maalaea Plant property will not be expanded. Expansion of MECO's Kahului Plant is unlikely due to property limitations, tsunami zone restrictions, etc.

TO BE INSTALLED:
- On approximately 67 Acres.
- Generation Capacity: Approximately 232 MW over 20 - 30 years.
- Type of Equipment and Structures Proposed:
  - Four (4) Dual Train Combined Cycle Units @ 58 MW each (Combustion turbines, steam turbines, heat recovery steam generators, stacks, steam condensers.) (Combustion turbines are fuel flexible; combined cycle units are the most efficient Utility owned generators in the State of Hawaii.) and supporting facilities.
  - Related Facility: T&D Baseyard (Potential)
  - 69 KV Transmission Lines.

WHERE:
- The Waena Generating Station is located ¼ mile mauka of the County Central Maui Landfill entrance, at the intersection of Waiko and Pulehu Roads. (This site was referred to as Site A-2 in MECO's Siting Study.)
- The nearest community to the Waena Generating Station is Puunene, located approximately 2.1 miles away.

WHEN:
- Forecasted Operation Date of the first combustion turbine unit on this site is early 2004.

HOW:
- Over 20 Federal, State and County permits required to permit the land and install the generating unit.
- Requires an Environmental Assessment or Environmental Impact Statement
- County Plan Re-designation (Parallel Path):
  - Through the Wailuku Kahului Community Plan 10 year update
  - Through an individual Community Plan Amendment (This process will ensure adequate community input).

PUBLIC SCOPING MEETINGS TO BE HELD:
- March 18 @ 7:00 PM: Upcountry Swimming Complex Multi-Purpose Room (Pukalani)
- March 19:@ 7:00 PM: Kihei Elementary School Cafeteria
- March 20:@ 7:00 PM: Maui Arts and Cultural Center HEI Meeting Room

CONTACT:
To answer any questions, please contact Neal Shinyama, MECO's Project Coordinator at 871-2341, or Mark Willey, MECO's Consultant, at 943-1133 (Oahu).

File:scopefac.doc
03/18/97

New Power Station on Maui

Maui Electric Company plans to build a 232 megawatt electrical generation facility on approximately 67 acres of land located in central Maui. In addition, the electric company may locate its existing transmission and distribution base yard from its location in Kahului to the new facility.

The site is located north of Waiko Road at its intersection with Pulehu Road. The site is owned by Maui Electric Company and is currently leased to Hawaiian Commercial & Sugar for sugarcane cultivation. Surrounding land uses include quarrying activities, a county landfill and sugar cultivation. The electric company will be requesting land use changes from agriculture to urban/heavy industrial to allow for the power generation project on the site.

The power generation station will include four diesel oil fired 58 megawatt power generation units, four steam turbines, water and wastewater facilities, injection wells, fuel storage tanks, related 69 kilovolt transmission lines, and other accessory facilities.

Maui Electric Company will be preparing an environmental impact statement to evaluate the project. Some of the impacts associated with the project that will be covered by the environmental impact statement include: air quality, land use, noise, visual, biological, and cultural resources.

The air quality study will analyze the dispersion patterns of particulates, sulfur dioxide, carbon monoxide, and nitrogen oxides from the power station to determine potential effects on ambient air quality. Visual simulations will be prepared to depict the project during its initial phase and after it is fully developed. For more information, please see page 8.

Environmental Impact Statement Preparation Notices

(6) Waena Power Generating Station

District: Wailuku
TMK: 3-8-03:por. 01
Applicant: Maui Electric Company, Ltd.
P.O. Box 398
Kahului, Hawaii 96732
Contact: Ed Reinhardt (871-8461)

Accepting Authority: County of Maui
Planning Department
250 South High Street
Wailuku, Hawaii 96793
Contact: David Blane (243-7735)

Consultant: CH2M Hill
1585 Kapiolani Boulevard, Suite 1420
Honolulu, Hawaii 96814-4530
Contact: Mark Willey (943-1133)

Public Comment Deadline: April 7, 1997
Status: EISPN First Notice, pending public comment. Address comments to the applicant with copies to the accepting authority, the consultant and OEQC.

Maui Electric Company, Limited (MECO) is proposing to construct and operate a 232-MW power generation station on approximately 67 acres adjacent to Pulehu Road in central Maui. The Waena Power Generation Station would consist of four 58-MW dual-train combined cycle units which would be installed in phases, with the first phase scheduled for operation in the year 2004. The site of the project is owned in fee by MECO. The site is currently under sugarcane cultivation. The purpose of the project is to increase MECO's capacity to meet future energy demands on the island of Maui.

The power station will include a generating plant area, switching yard, administration buildings, fuel storage tanks, warehouses, and possible transmission and distribution facilities. Portions of the site have the potential to be made available for private sector-sponsored small-scale energy-related projects on an interim or long-term basis.

MECO will be requesting a change in the Maui County Community Plan and Zoning designations for the site to allow for heavy industrial use. In addition, a request will be made to the State Land Use Commission to redesignate the parcel from the Agriculture District to the Urban District. In preparation of these applications, MECO will be preparing an environmental impact statement. Some of the impacts associated with the project that the EIS will cover include: air quality, traffic, noise, land use, biological resources, cultural resources, visual resources, water resources, and geophysical resources.

Waena Power Generating Station
EIS Public Scoping Meetings
March 18, 19 & 20, 1997

MEETING SUMMARIES

The following summarizes the Environmental Impact Statement (EIS) public scoping meetings for the Waena Power Generating Station held at the following locations:

March 18 - Upcountry Swimming Complex Multi-Purpose Room (Pukalani)
March 19 - Kihei Elementary School Cafeteria
March 20 - Maui Arts and Cultural Center McCoy Theater

PURPOSE

To solicit the public's comments regarding issues and concerns that should be addressed in the EIS for Maui Electric Company's (MECO's) proposed Waena Power Generating Station.

AGENDA

6:30 to 7:00 PM - Open House
7:00 to 9:00 PM - Public Comments
Presentation
Public Comments
Questions & Answers

ATTENDANCE

See attached list.

PRESENTATION

The following is a summary of the presentation at all three meetings.

William Bonnet, President, MECO, began by stating the purpose of the meeting (see above). Mr. Bonnet stressed the importance of keeping the public informed of the project's status and of the need for the public to keep MECO aware of any concerns. In this way, there will be "no surprises" for either MECO or the public.

After a comprehensive site selection process, MECO selected the subject 67-acre site and purchased it in fee from Alexander & Baldwin - Hawaii, Inc. These scoping meetings are the first of a series of meetings to gather public input on the proposed project and to focus on the potential impacts of the project at this site.

Mark Willey, Project Manager for the EIS and Land Use Entitlement process, CH2M HILL, began by stating the agenda for the meeting. Mr. Willey described the various handouts that were available and explained that written comments regarding what should be addressed in the EIS should be sent to MECO and must be postmarked by April 7, 1997.

Mr. Ed Reinhardt, Manager of Engineering, MECO, explained the site selection process, which started off by examining potential locations throughout the island of Maui. Subsequent studies narrowed the alternative sites down to twelve and then down to three. The final three sites consisted of two in the Pulehu area: "A-2", the subject site, located on Pulehu Road approximately 1/4 mile mauka of the Central Maui Landfill, and "D-1", located approximately 1 1/2 mile mauka (east) of Site "A-2" along Pulehu Road. The third site, "C-3" was located near the old Puunene Airstrip. The two Pulehu sites were given higher ratings based primarily on their relation to existing infrastructure and distance from residential areas. The air quality modeling study indicated that "A-2" was the only site where a 232-megawatt (MW) generation station would comply with air quality standards given existing emission sources. Air quality was one of the most critical environmental screening factors in the site selection process.

At the end of this extensive site selection process, "A-2", the subject site, was identified as the preferred alternative.

Mr. Reinhardt then briefly explained the project components. When complete, the 67-acre site will contain four 58-MW dual-train combined cycle (DTCC) units for a total capacity of 232-MW. Each of the DTCC units will consist of two 20-MW combustion turbines and an 18-MW steam turbine. Full build-out of all four DTCC units is estimated to take approximately 30 years. To accomplish the 2004 commercial operation date for the first 20-MW combustion turbine, the engineering effort will need to commence by late 2000 with construction to start around 2002.

Mr. Bonnet noted that the largest development increment is 20-MW and that this provides flexibility over the long term to incorporate any possible changes in generating technologies which may occur in the future.

Mr. Willey explained that MECO is presenting a request for a Community Plan Map Amendment from "Agricultural" to "Heavy Industrial" for the site to the County Council as part of the Wailuku-Kahului Community Plan Ten-Year Update process in order to allow for a careful consideration of community-wide planning issues. MECO has also filed a separate application with the Maui County Planning Department in order to allow for a detailed review of the request on an individual basis. The filing of a separate Community Plan Amendment has triggered the preparation of an Environmental Assessment (EA) which is currently available for public review. The EA concludes that the scope and magnitude of the project are such that preparation of an EIS, pursuant to Chapter 343, Hawaii Revised Statutes is warranted. The EA also outlines the areas, which along with the items brought up during these scoping meetings and subsequent scoping letters, will be addressed in the EIS. The Environmental Impact Statement Preparation Notice

(EISPN) was published in the March 8, 1997, issue of The Environmental Notice, published by the Office of Environmental Quality Control. The Public Scoping Period for the Draft EIS ends April 7, 1997. The EIS will provide full disclosure and review of anticipated environmental impacts and proposed mitigation measures. Public meetings will be held to review comments on the Draft EIS; these meetings are expected to occur in August.

Other required approvals include a State Land Use District Boundary Amendment from "Agricultural" to "Urban" from the State Land Use Commission and a Change in Zoning from "Interim" to "Heavy Industrial" from the Maui County Council. The project will also be required to meet air quality standards for emissions pursuant to requirements established by the Federal Environmental Protection Agency and the State Department of Health.

PUBLIC COMMENTS

Concerns to be addressed in the EIS which were provided by the individuals attending the meetings are summarized below.

March 18, 1997 (Pukalani)

Ken Okamura, Maui County Farm Bureau. Mr. Okamura raised the following concerns:

- Impacts of air emissions on upcountry agricultural crops
- Types of emissions and concentration levels
- Rates of emissions
- Effect of Maui Vortex
- Impacts of emissions on specific crop

Takeo Miyaguchi, Maui Farmers Exchange. Mr. Miyaguchi raised the following concern:

- Impacts of sulfur dioxide (SO_2) on sensitive agricultural crops

Harry Eager, The Maui News. Mr. Eager raised the following concerns:

- Monitoring air quality after completion of project
- Frequency of air quality monitoring
- Worst-case scenario after completion of project (cumulative air quality impacts)
- Impacts of noise
- Buffer zone around plant
- Examples of comparable noise levels

March 19, 1997 (Kihei Elementary School)

Jim Williamson. Mr. Williamson raised the following concerns:

- Alternative forms of energy (Economies of Scale)
- Dependence upon fossil fuel
- Growth rate of the island compared to the size of the power station
- Reliability/redundancy of proposed transmission lines
- Water sources for new station
- Impacts of nitrogen oxide and sulfur dioxide (EPA's standards and scrubbers)
- Accuracy of EPA's model for air circulation and the effect of Maui Vortex
- Future plans for MECO's existing power plants after completion of proposed Waena Generating Station

Hana Steel, County of Maui. Ms. Steel raised the following concerns:

- Recycling program for the proposed project
- Community education plan for the new power station
- Future of undeveloped land fronting the project site

March 20, 1997 (Kahului)

Glenn Shepherd. Mr. Shepherd raised the following concerns:

- Future plans for the undeveloped portion of land fronting Pulehu Road
- Land use issues
- Soil classifications for all of the alternative sites
- Soil productivity for the chosen project site
- Potential to use the quarry or a site near the quarry
- Amount of time required to compete project
- Site selection process
- Potential to expand existing Maalaea Plant
- Type of fuel to be used for new station
- Proposed plans for MECO's existing Kahului Power plant and Maalaea Power Plant after completion of Waena Plant
- Utilizing fossil fuel
- Alternative sources of fuel (e.g.: Bio-mass)
- Fuel flexibility; use of low-sulfur coal
- Energy conservation programs

Mary Evanson. Ms. Evanson raised the following concerns:

- Drilling of wells for water
- Projected water demand after completion
- Re-use of water
- Water quality tests at or near the site

Jerry Sessums. Mr. Sessums raised the following concerns:

- Proposed plans for stormwater and wastewater
- Alternate ways to access the site
- Widening of Pulehu Road to accommodate large fuel trucks
- Fuel flexibility; utilizing methane as source of fuel from the nearby landfill

Steven Moser, MD. Dr. Moser raised the following concerns:

- Impact of the project on air quality of central and upcountry Maui, especially if acceptable levels of nitrogen oxides, sulfur dioxides, carbon monoxides, particulates, and ozone will be exceeded
- Impact of the project on haze and if increased haze would have a negative economic cost on isle tourism
- Impact of the project on isle crops and economic costs of any crop losses
- Ability of the State Department of Health to adequately monitor the project for air quality maintenance
- Viability of existing sustainable yield of the aquifer given this and other projects in the area and if increased pumping will increase aquifer salinity
- Impacts of the injection wells on the aquifer water quality, specifically the types of pollutants and their possible migration pattern.
- If MECO had adequately considered all other reasonable alternatives, such as renewable resources, and if MECO had factored into the overall cost of the project any future increases in fuel costs
- If MECO isn't oversupplying the island with power given the island's projected growth rate
- If the project wouldn't actually stimulate additional growth by making more energy available
- Overall cost of the project to the ratepayer
- If it is appropriate to remove prime agricultural lands from production for this project
- If the project will produce any hazard to air navigation for Kahului Airport
- If the project will stimulate additional industrial growth in adjacent properties
- If the project will cause visual pollution at night due to bright lights

CLOSING REMARKS

Mr. Willey reminded everyone to sign in on the sign-in sheets. All names on the lists will be added to the project mailing list. The mailing list will be used to inform interested parties of availability of the Draft EIS for review, upcoming meetings, and to send out notices and project information. Those who indicated so on the sign-in sheet will receive a copy of the Draft EIS for review.

Maui Electric Company, Limited
Waena Generating Station
EIS Public Scoping Meeting
Date: March 18, 1997 – Pukalani

no EIS

Check if you plan to speak ☑

Please print legibly

Name: TAKEO MIYAGUCHI
Organization: MAUI FARMERS EXCHANGE
Address: P.O. BOX 296
City/Zip: MAKAWAO, 96768
Phone: ( ) 572-8439

Add to EIS
Consulted parties

Check if you plan to speak ☑

Please print legibly

Name: Kenneth Okimura
Organization: Maui County Farm Bureau ~~[illegible]~~ Gov't Affairs
Address: RR-2 Box 91
City/Zip: Kula, HI 96790
Phone: (808) 878-1769

no EIS

Check if you plan to speak ☐

Please print legibly

Name: Harry Eagar
Organization: The Maui News
Address: PO Box 550
City/Zip: Wailuku HI 96793
Phone: (808) 242-6392

Check if you plan to speak ☐

Please print legibly

Name:
Organization:
Address:
City/Zip:
Phone: ( )

Check if you plan to speak ☐

Please print legibly

Name:
Organization:
Address:
City/Zip:
Phone: ( )

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Maui Electric Company, Limited
Waena Generating Station
EIS Public Scoping Meeting
Date: 3-19-97

SEND EIS ✓

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Please print legibly

Name: JIM WILLIAMSON
Organization:
Address: 672 KUMULANI DRIVE
City/Zip: KIHEI, 96753
Phone: (808) 874-6151

SEND EIS ✓

Check if you plan to speak ☐

Please print legibly

Name: Hana Steel PhD
Organization: County of Maui
Address: ~~[illegible] KIHEI RD #~~ 200 SOUTH HIGH ST.
City/Zip: WAILUKU HI 96793
Phone: (808) 243-7874

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Name:
Organization:
Address:
City/Zip:
Phone: ( )

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Organization:
Address:
City/Zip:
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City/Zip:
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Maui Electric Company, Limited
Waena Generating Station
EIS Public Scoping Meeting
Date: March 20, 1997

Please print legibly

DEIS Please

Check if you plan to speak: [✓]
Name: Mary Evanson
Organization: Self
Address: PO Box 694
City/Zip: Makawao 96768
Phone: ( ) 572-9724

EIS

Check if you plan to speak: [ ]
Name: Glenn Shepherd
Organization:
Address: 477 S. Alu Rd
City/Zip: Wailuku 96793
Phone: ( ) 244-7224

EIS

Check if you plan to speak: [ ]
Name: Jerry + Sandy Sessums
Organization:
Address: 210 Kaupea St.
City/Zip: Makawao, Hi. 96768
Phone: (808) 573-2196

No EIS

Check if you plan to speak: [ ]
Name: Mike Tanji
Organization: MECO
Address: PO Box 330285
City/Zip: Kahului HI 96733
Phone: ( ) 8775940

DEIS

Check if you plan to speak: [✓]
Name: Steven Moser
Organization: Hawaii Medical Association
Address: 1883 Mill St.
City/Zip: Wailuku HI
Phone: 808 244 2748

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CH2MHILL
Celebrating 50 Years

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

April 8, 1997

139792.EL01

«Title» «FirstName» «LastName»
«JobTitle»
«Company»
«Address1»
«Address2»
«City», «State» «PostalCode»

Dear «Title» «LastName»:

Subject: Waena Generating Station EIS Public Scoping Meetings

Thank you for taking time to attend our public scoping meetings to solicit comments on items to address in the environmental impact statement (EIS) being prepared for the Waena Power Generating Station. Enclosed you will find a summary of the three meetings held, listing who from the public attended and what comments were made. In addition, the individual comments have been combined by topic areas so that you can see who else shares your particular concerns.

During the preparation of the Draft EIS, Maui Electric Company, Limited and CH2M HILL will be performing the necessary studies and analyses to address the concerns raised in these public scoping meetings. Following publication of the Draft EIS, those of you who indicated that you wished to receive a copy will receive one for review. Should you have further comments on the project to make following review of the Draft EIS, we invite you to do so.

Again, thank you for your interest and participation in the project. Should you have any further questions concerning the project, please feel to contact me at (808) 943-7135, ext. 203.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

HNL/SPLTRRPS.DOC
Enclosure
c: David Blane, Maui County Planning Department
Ed Reinhardt, MECO
Neal Shinyama, MECO
Mike Yuen, HECO

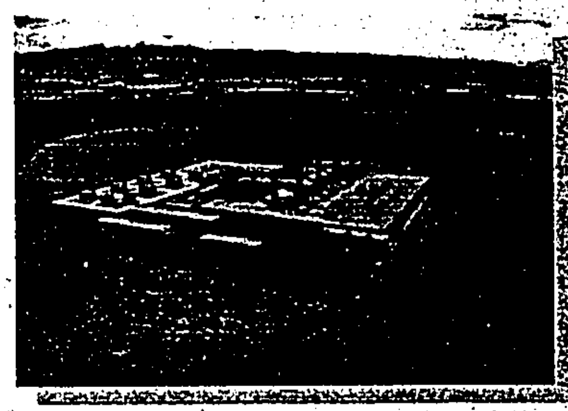
Maui Electric Company, Ltd.
Proposed Waena Power Generating Station
Public Scoping Meetings
March 18, 19, & 20, 1997

Public Comments/Concerns received at the meeting:

CONCERNS	SPEAKER	ISSUES RAISED
AIR NAVIGATION	Steven Moser	• Hazards to air navigation for Kahului Airport
AIR QUALITY	Ken Okamura, Maui Farm Bureau; Takeo Miyaguchi, Maui Farmers Exchange; Harry Eager, Maui News; Jim Williamson; and Steven Moser	• Impacts of air emissions on upcountry agricultural crops • Types of emissions and concentration levels • Rates of emissions • Impacts of "Maui Vortex" • Impacts on specific and sensitive crops • Monitoring air quality after completion of project • Frequency of air quality monitoring • Worst-case scenario after completion of project (cumulative air quality impacts) • Impacts of NOx and sulfur dioxide (EPA's standards and scrubbers) • Accuracy of EPA's model for air circulation and the effect of "Maui Vortex" • Impact on central and upcountry Maui, esp. if acceptable levels of NOx, sulfur dioxides, carbon monoxides, particulates, and ozone will be exceeded • Impact of haze and possible negative economic cost on isle tourism • Impact on isle crops; economic costs of crop losses • Ability of State DOH to adequately monitor project for air qual. maintenance
ALTERNATIVE FORMS OF ENERGY/CONSERVATION	Glenn Shepherd, Jim Williamson, Jerry Sessums, and Steven Moser	• Dependence upon fossil fuel • Alternative sources of fuel (Economies of Scale) • Ongoing research for alternative fuel sources • Fuel flexibility. Use of low-sulfur coal or methane from the nearby landfill • Energy conservation programs • Consideration of renewable resources as alternative • Effect of future increases in fuel costs

CONCERNS	SPEAKER	ISSUES RAISED
ALTERNATIVE SITES	Glenn Shepherd	• Potential to use the quarry or a site near the quarry
COST	Steven Moser	• Overall cost to the ratepayer
EDUCATION	Hana Steel	• Community education plan for the new power station
ENERGY SOURCE	Glenn Shepherd	• Type of fuel to be used for new station
FUTURE OF MECO'S OTHER POWER PLANT FACILITIES	Jim Williamson and Hana Steel	• Future plans for MECO's existing power plants after completion of proposed Waena plant
GROWTH ISSUES	Jim Williamson and Steven Moser	• Growth rate of the island compared to the size of the power station; will there be an oversupply of power • Increased available energy might stimulate additional growth • Stimulation of industrial growth in adjacent properties
LAND USE	Steven Moser and Glenn Sheperd	• Appropriateness of removing prime agricultural lands from production for project
NOISE	Harry Eager, Maui News	• Impacts of noise • Buffer zone around plant • Comparable levels of noise
OTHER MECO POWER PLANT FACILITIES	Glenn Shepherd	• Future plans for MECO's existing Kahului and Maalaea Power plants after completion of proposed Waena plant
PROCESS	Glenn Shepherd	• Amount of time required to complete the project
SITE ACCESS	Jerry Sessums	• Alternative ways to access the site • Widening of Pulehu Road to accommodate large fuel trucks
SITE SELECTION	Glenn Shepherd	• Site selection process • Potential to expand the Maalaea Plant
SOILS	Glenn Shepherd	• Soil Classifications for all of the alternative sites • Soils productivity for the chosen for the project site
SOLID WASTE	Hana Steel	• Recycling program for the proposed plant
STORMWATER & WASTEWATER	Jerry Sessums	• Proposed plans for stormwater and wastewater
TRANSMISSION LINES	Jim Williamson	• Reliability/redundancy of the proposed transmission lines
UNDEVELOPED LAND FRONTING PROJECT SITE	Glenn Shepherd and Hana Steel	• Future plans for the undeveloped portion of land fronting Pulehu Road
VISUAL RESOURCES	Steven Moser	• Night visual pollution due to bright lights

CONCERNS	SPEAKER	ISSUES RAISED
WATER	Jim Williamson, Mary Evanson, and Steven Moser	• Water sources for the new project • Viability of existing sustainable yield of aquifer given this and other area projects • Increased aquifer salinity from increased pumping • Impacts of injection wells on aquifer water quality (e.g. types of pollutants and possible migration patterns) • Drilling of wells for water • Projected water demand after completion of project • Re-use of water • Water quality tests at or near the site



APPENDIX K2

DEIS PUBLIC COMMENT MEETING

WAENA GENERATING STATION PROJECT

MAUI ELECTRIC COMPANY, LIMITED

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
PUBLIC COMMENT MEETING

August 26, 1997
Maui Arts & Cultural Center, Visual Arts Classroom
Kahului, Maui

♦

AGENDA

OPEN HOUSE	6:30 - 7:00 P.M.
PUBLIC MEETING	7:00 - 9:00 P.M.

- Welcome
- Presentation
- Public Comments
- Questions and Answers
- Closing Remarks

WAENA GENERATING STATION PROJECT

MAUI ELECTRIC COMPANY, LIMITED

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
PUBLIC COMMENT MEETING

August 28, 1997
Upcountry Swimming Complex Multipurpose Room
Pukalani, Maui

♦

AGENDA

OPEN HOUSE	6:30 - 7:00 P.M.
PUBLIC MEETING	7:00 - 9:00 P.M.

- Welcome
- Presentation
- Public Comments
- Questions and Answers
- Closing Remarks

The Environmental Notice

A Semi-Monthly Bulletin of the Office of Environmental Quality Control

Benjamin J. Cayetano
Governor

Office of
Environmental
Quality Control
Gary Gill
Director

The Environmental Notice reviews the environmental impacts of projects proposed in Hawaii

Other Resources available at OEQC . . .

- *Guidebook for Hawaii's Environmental Review Process*
- *Environmental Impact Study Resource Library*
- *Environmental Education Database*
- *Environmental Council Annual Reports*
- *Rules and Policies*
- *"How to Plant a Native Hawaiian Garden"*

OEQC
235 S. Beretania St.
State Office Tower
Suite 702
Honolulu, HI 96813

Tel. (808) 586-4185
Fax. (808) 586-4186

Molokai & Lanai 1-800-468-4644 ext 64185
Kauai 274-3141 ext. 64185
Maui 984-2400 ext. 64185
Hawaii 974-4000 ext. 64185

August 8, 1997

Maui Waena Power Plant DEIS

Maui Electric Company proposes to build a new 232-megawatt (MW) power plant on 67 acres of land along Pulehu and Waiko Roads in Central Maui. The company will also construct 69-kilovolt transmissions lines from the new plant to substations at the Paia and Puunene sugar mills. The project is needed to maintain reserve capacity, increase system reliability, replace older generation facilities and provide additional capacity to meet projected demand.

Presently, Maui Electric Company has a generation capacity of 212 MW. Peak power demand by the company's customers in 1996 was 177 MW. Maui Electric Company predicts that peak power demand will increase to 299 MW (without demand side management) or 273 MW (with demand side management) in 2016. The first 20-MW combustion turbine is scheduled for operation by the year 2004.

The combustion turbines will be fueled by No. 2 diesel fuel. The fuel will be transported by tanker trucks from Kahului Harbor over Hobron Avenue, Hana Highway, and Pulehu Road to the project site. At full build-out approximately 44 fuel tanker truck trips per day would be required to provide fuel to the power plant. Brackish groundwater supply wells will be developed within the project site to meet water requirements for operation of the combustion turbines and related facilities. Total water consumption at full build-out would be 0.9 million gallons of water per day. Deep injection wells will be used to dispose the process wastewater.

The project may impact air quality, prime agricultural lands, visual resources and traffic. Potential air pollutants include nitrogen oxide, sulfur dioxide, carbon monoxide, volatile organic compounds, particulate matter and sulfuric acid mist. The facility will be visible from areas located on the slopes of Haleakala. For more information on the Draft EIS for this project, please see page 11.

Hazardous Waste Disposal in Campbell Industrial Park

The U.S. Department of Justice is soliciting public comment on a proposed consent decree (in United States vs. Hawaiian Western Steel) to resolve penalty and corrective action claims against Cominco, Inc. under the Resource Conservation and Recovery Act.

Among other things, hazardous waste was disposed of at two sites within Campbell Industrial Park on Oahu. Corrective action at one site is ongoing. The proposed consent decree may be examined in Room 6100 at the Prince Kuhio Federal Building on Ala Moana Boulevard. The deadline for comments is August 20, 1997. Please see page 17.

Coastal Erosion Management Plan Presentations by DLNR

The Land Division of the Department of Land and Natural Resources and Dr. Chip Fletcher of the University of Hawaii School of Ocean, Earth Science & Technology will be making presentations of the Department of Land and Natural Resources' draft Coastal Erosion Management Plan at various Neighborhood Board meetings.

The DLNR feels that it is imperative for communities most interested and affected by the management plan of our shoreline resources to learn about and provide comments on this plan. For a schedule of upcoming draft Coastal Erosion Management Plan presentations, please see page 15.

Draft Environmental Impact Statements

(4) Waena Power Generating Station

District:	Wailuku
TMK:	3-8-03:por. 01
Applicant:	Maui Electric Company, Ltd. P.O. Box 398 Kahului, Hawaii 96732 Contact: Ed Reinhardt (871-8461)
Approving Agency/Accepting Authority:	County of Maui Planning Department 250 South High Street Wailuku, Hawaii 96793 Contact: David Blane (243-7735)
Consultant:	CH2M Hill 1585 Kapiolani Boulevard, Suite 1420 Honolulu, Hawaii 96814-4530 Contact: Mark Willey (943-1133)
Public Comment Deadline:	September 22, 1997
Status:	DEIS First Notice, pending public comment. Address comments to the applicant with copies to the approving agency or accepting authority, the consultant and OEQC.

Maui Electric Company, Limited (MECO) is proposing to construct and operate a 232-MW power generation station on approximately 67 acres adjacent to Pulehu and Waiko Roads in central Maui. The site of the project is owned in fee by MECO. The site is currently under sugarcane cultivation. The purpose of the project is to increase MECO's capacity to meet future energy demands on the island of Maui.

The Waena Generating Station will consist of four 58-MW dual-train combined cycle units which would be installed in four phases. Installation of the first 20-MW combustion turbine will be in the year 2004, with the completion of Phase I scheduled for 2006. Future phases will be implemented at later dates; the timing of the subsequent phases will depend on future load growth, power availability through independent purchase agreements, unit retirements, and environmental considerations.

The power station will include a generating plant area, switching yard, administration buildings, fuel storage tanks, warehouses, and related facilities. Two 69-kilovolt (kV) transmission lines from the site to substations at the Paia Sugar Mill and Puunene Sugar Mill are also proposed as a part of this project. Distribution lines (12 kV) may also lead to the proposed generating station to Puunene. In addition, MECO may relocate its existing transmission and distribution base yard from its location in Kahului to the new facility. Usable portions of the site may be available for future plant expansion or be made available on an interim or long-term basis for energy-related activities until needed by MECO. Although MECO is developing the project in four phases, the entire site will be prepared for subsequent unit installation during the initial Phase I construction.

MECO will be requesting a change in the Maui County Community Plan and Zoning designations for the site to allow for heavy industrial use. In addition, a request will be made to the State Land Use Commission to redesignate the parcel from the Agricultural District to the Urban District.

MECO'S WAENA GENERATING STATION
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
PUBLIC COMMENT MEETING
FACT SHEET

WHAT:
MECO needs to establish a new power plant site for generating unit additions in 2004 and beyond.

WHY:
After the Dual Train Combined Cycle (DTCC) No. 2 addition at Maalaea, Units M17-19, the Maalaea Plant property will not be expanded. Expansion of MECO's Kahului Plant is unlikely due to property limitations.

TO BE INSTALLED:
- On approximately 67 Acres.
- Generation Capacity: Approximately 232 MW over 20 - 30 years.
- Type of Equipment and Structures Proposed:
  - Four (4) Dual Train Combined Cycle Units @ 58 MW each (Combustion turbines, steam turbines, heat recovery steam generators, stacks, steam condensers.) (Combustion turbines are fuel flexible; combined cycle units are the most efficient Utility owned generators in the State of Hawaii.) and supporting facilities. (Note: The installation of the DTCC in phases allows for flexibility in the technology of the generation units to be installed.)
  - Related Facility: T&D Baseyard (Potential)
  - 69 KV Transmission Lines.

WHERE:
- The Waena Generating Station is located a quarter of a mile mauka of the County Central Maui Landfill entrance, at the intersection of Waiko and Pu'ehu Roads. (This site was referred to as Site A-2 in MECO's Siting Study.)
- The nearest community to the Waena Generating Station is Puunene, located approximately two to three miles away.

WHEN:
- Forecasted Operation Date of the first combustion turbine unit on this site is 2004. The site would be fully developed in the first phase, with additional generating units and ancillary facilities added as they are needed.

HOW:
- Over 20 Federal, State and County permits required to permit the land and install the generating unit.
- Requires an Environmental Impact Statement
- County Plan Re-designation (Parallel Path):
  - Through the Wailuku Kahului Community Plan 10 year update, or
  - Through an individual Community Plan Amendment (This process will ensure adequate community input).

DEIS PUBLIC COMMENT MEETINGS TO BE HELD:
- August 26 @ 6:30 PM: Maui Arts and Cultural Center Visual Arts Classroom (Kahului)
- August 28 @ 6:30 PM: Upcountry Swimming Complex Multi-Purpose Room (Pukalani)

CONTACT:
To answer any questions, please contact Neal Shinyama, MECO's Project Coordinator at 871-2341, or Mark Willey of CH2M HILL, MECO's Consultant, at 1 (808) 943-7135, extension 203.

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8/26/97

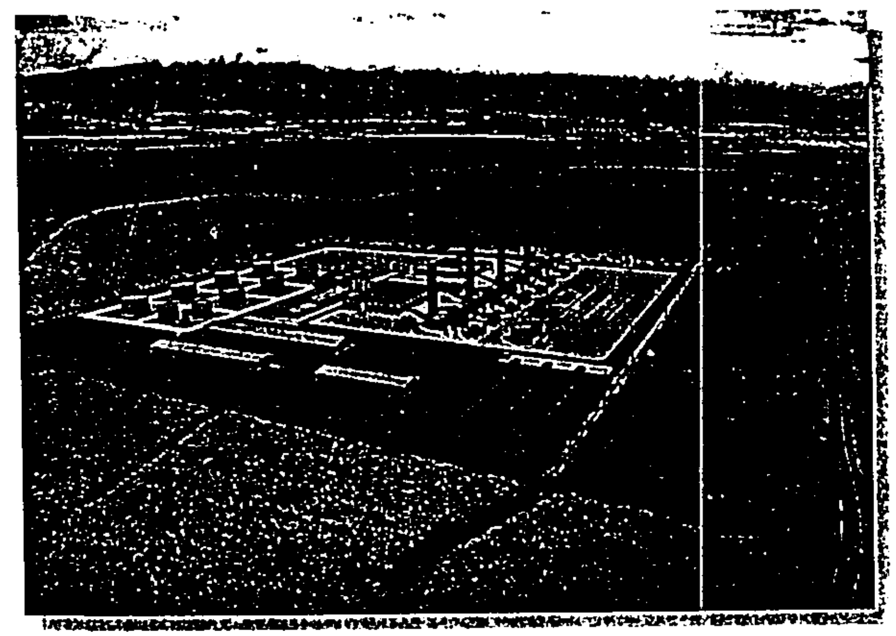
DRAFT ENVIRONMENTAL IMPACT STATEMENT

PUBLIC COMMENT MEETING

MAUI ELECTRIC COMPANY, LIMITED'S

WAENA GENERATING STATION

WAILUKU AND MAKAWAO DISTRICTS – ISLAND OF MAUI



MAUI ELECTRIC COMPANY, LIMITEI

AUGUST 199

Executive Summary

Summary of Project Data

Applicant:	Maui Electric Company, Limited Mr. William A. Bonnet, President PO Box 398 Kahului, Maui, Hawaii 96733-6898
EIS Accepting Authority:	Maui County Department of Planning Mr. David Blane, Planning Director 250 South High Street Wailuku, Maui, Hawaii 96793
EIS Approving Agency:	Mayor, County of Maui
Agent for Applicant:	CH2M HILL, INC. Mr. Mark R. Willey, Project Manager 1585 Kapiolani Blvd., Suite 1420 Honolulu, Hawaii, 96814
Project Parcel:	TMK 3-8-03:01 (portion)
Parcel Size:	67 acres (approximate)
Parcel Ownership:	Fee-simple, Maui Electric Company, Limited
Surrounding Landowners:	County of Maui Alexander & Baldwin - Hawaii
State Land Use Designation:	Agricultural
County Community Plan Designation:	Agricultural
County Zoning Designation:	Interim

Summary of Project Description

Maui Electric Company, Limited (MECO) proposes to design, construct, and operate a 232-megawatt (MW) electrical generating station on approximately 67 acres of land located along Pulehu and Waiko Roads in central Maui. Related 69-kilovolt (kV) transmission lines from the site to substations at the Paia Sugar Mill and Puunene Sugar Mill are also proposed as a part of this project. Distribution lines (12 kV) may also lead to the proposed generating station to Puunene. In addition, MECO may relocate its existing transmission and

distribution base yard from its location in Kahului to the new facility. Usable portions of the site may be available for future plant expansion or be made available on an interim or long-term basis for energy-related activities until needed by MECO.

The facility is planned for 232-MW of power generation capacity to be constructed in four phases. The initial phase of the plan will develop a 58-MW generating capacity, consisting of two 20-MW combustion turbines (CTs), two heat-recovery steam generators (HRSGs), and an 18-MW steam turbine generator. The initial 20-MW CT is planned to be operational by the year 2004 with the first 58-MW unit scheduled for completion by the year 2006.

Future phases will be implemented at later dates; the exact timing of the subsequent units will depend on future load growth, power availability through independent power purchase agreements, and unit retirements. Developing the proposed project in phases will provide the flexibility to meet existing demand without overbuilding and to evaluate future improvements in technology should they become available. Site preparation for these subsequent phases will be performed during the initial Phase I construction.

Summary of Need for the Project

MECO is the legally franchised utility responsible for the production, purchase, transmission, distribution, and sale of electricity on the islands of Maui, Molokai, and Lanai. MECO's total firm capacity for the island of Maui, after completion of its second 58-MW expansion at Maalaea in the year 2001, will be 254-MW from MECO-owned plants. MECO is proposing to construct a new power generation facility in central Maui to accomplish the following:

- Maintain an adequate system margin-of-reserve generating capacity
- Increase overall system reliability
- Replace older generation facilities scheduled for retirement
- Provide additional capacity to meet projected demand for electric service

Peak power demand by MECO's customers increased an average of 5 percent per year between 1983 and 1996, rising from 95.4 MW to 177 MW. MECO considers this growth rate to be above average and anticipates a somewhat slower growth rate in the future (approximately 2.6 percent per year), reaching approximately 299.3 MW without demand-side management measures (266.5 MW with DSM programs implemented) by the year 2016. In order to meet this need, MECO has examined their existing generation resources and determined that there will be a shortfall in their system reserve margin by the year 2004. In order to meet the forecasted demand for electricity, MECO has determined that additional generation will be required through the year 2016. The proposed Waena Generating Station is planned to meet this demand.

Summary of Alternatives Considered

Several alternatives have been considered for the proposed Waena Generating Station including no action, energy conservation, deferred retirement of older units, alternative technologies, alternative sites, and independent power producers.

Alternative technologies considered included biomass conversion, geothermal, hydroelectric, solar, wind, ocean thermal, and coal. MECO analyzed the availability of each of the alternative sources, as well as alternative fuel sources to No. 2 diesel, and determined that none of them would be able to address or meet the immediate generating needs.

Alternative sites considered included over 20 sites identified since 1989. Areas examined included sites in Olowalu, Ukumehame, near Waikapu, and the old Puunene Airport as well as the locations of existing power plants and sugar mills. In 1995, MECO conducted a series of public meetings and presentations to gather input to use in determining a preferred site. Based upon the site analyses performed and input received, MECO determined that the selected 67-acre site at the intersection of Waiko and Pulehu Roads is the most appropriate for the proposed Waena Generating Station. The selection of this site is based upon the following factors:

- The site had the least impact on air quality of those considered.
- The site had the least impact on biological resources of those considered.
- The site had the least impact on area traffic and transportation of those considered.
- The site had the least infrastructure costs of those considered.
- The site had the best location of those considered in relationship to the existing MECO generation and transmission systems.

Summary of Potential Impacts

The proposed project will have no significant adverse effects on air quality, geology, water resources, plants, animals, archaeological resources, visual resources, area traffic, or infrastructure. The project is compatible with the existing land uses in the area and will have no adverse impact upon residential or commercial areas. The construction and operation of the facility will provide benefits to the local population, as well as the entire island, by increasing overall system reliability and by providing the necessary electricity to meet projected growth in the population and economy.

The site will result in the removal of approximately 67 acres of prime agricultural lands from active production, however, this represents a very small percentage of the over 36,000 acres of Hawaiian Commercial and Sugar Company (HC&S) land in production. Overall agricultural production on the Island of Maui is not anticipated to be impacted from the project as HC&S is actively expanding their production acreage in other areas of the island.

In addition, the power produced by the facility will aid in further expansion of agricultural endeavors and diversification on the Island of Maui.

Because of the local topography and lack of other structures in the vicinity, the facility will be visible from areas located on the slopes of Haleakala. However, the long distances between the facility and potential viewers will reduce the apparent size of the generating station and the facility will not represent a dominant feature of the landscape.

Short-term construction related impacts will be associated with air-borne particulate matter (fugitive dust), exhaust emissions from on-site construction equipment, increased construction vehicle traffic, and construction noise. These impacts will be temporary in nature and given the distance from the site to the nearest sensitive receptors, do not represent an adverse impact. A summary of potential impacts is shown in Table ES-1.

Summary of Mitigation Measures

Mitigation measures to reduce environmental impacts address both short-term and long-term impacts. Short-term mitigation measures include performing construction activities in compliance with applicable air and noise regulations in order to minimize potential fugitive dust and noise. Measures to mitigate long-term impacts include:

- Adherence to appropriate building codes and standards
- Compliance with applicable federal and state air quality and permitting regulations
- Compliance with applicable federal, state, and county water withdrawal, injection, and sanitary wastewater regulations
- Installation of hooded security lighting to minimize impacts to migratory birds
- Compliance with federal, state, and county archaeological regulations and agreements
- Provision of landscaping and appropriate buffers to screen the facility as much as possible
- Compliance with federal, state, and county solid waste and hazardous waste disposal regulations

Summary of Compatibility with Land Use Plans and Policies

The proposed Waena Generating Station is generally consistent with the Hawaii State Plan and applicable Functional Plans. The facility is also compatible with the goals and objectives of the Maui County General Plan and with the provisions and standards of the Wailuku-Kahului Community Plan and the Maui County Zoning Ordinance. The project is also consistent with the State Land Use Commission standards and criteria for redesignation of lands from "Agricultural" to "Urban." The site is located below the underground injection control (UIC) line and is not located within the County Special Management Area.

Table ES-1
Summary of Potential Impacts

RESOURCE	IMPACT
Air Quality	
Soils and Geology	
Natural Hazards	
Groundwater Resources	
Surface Water Resources	
Biological Resources, Flora	
Biological Resources, Fauna	
Archaeological and Cultural Resources	
Land Use and Ownership	
Prime Agricultural Land	
Population and Employment	
Visual Resources	
Noise	
Infrastructure, Traffic	
Infrastructure, Electrical System	
Infrastructure, Other	
Public Safety and Community Services	

Legend:
- Beneficial Impact (significant)
- Beneficial Impact (not significant)
- No Impact
- Adverse Impact (not significant)
- Adverse Impact (significant)

Summary of Unresolved Issues

Unresolved issues are those that cannot be answered at the present time or are unanswerable. Because the proposed Waena Generating Station has not been designed, several engineering-related issues remain unresolved, including design and type of drainage improvements, locations of groundwater withdrawal and injection wells, and best available control technology for air emissions control. These issues will be fully resolved to comply with all applicable federal, state and county rules and regulations during the preliminary engineering and design phases of the project and submitted to the appropriate federal, state and county agencies for approvals.

In addition to the design-related issues, a long-term unresolved issue associated with the proposed project is the development of alternative energy sources. Development of alternative energy technologies is expected to reduce our current reliance on fossil fuels eventually, although the timing of such a transition remains unclear. Full development of the proposed project, therefore, may be affected by the rate of development of alternative technologies.

Summary of Necessary Permits and Approvals

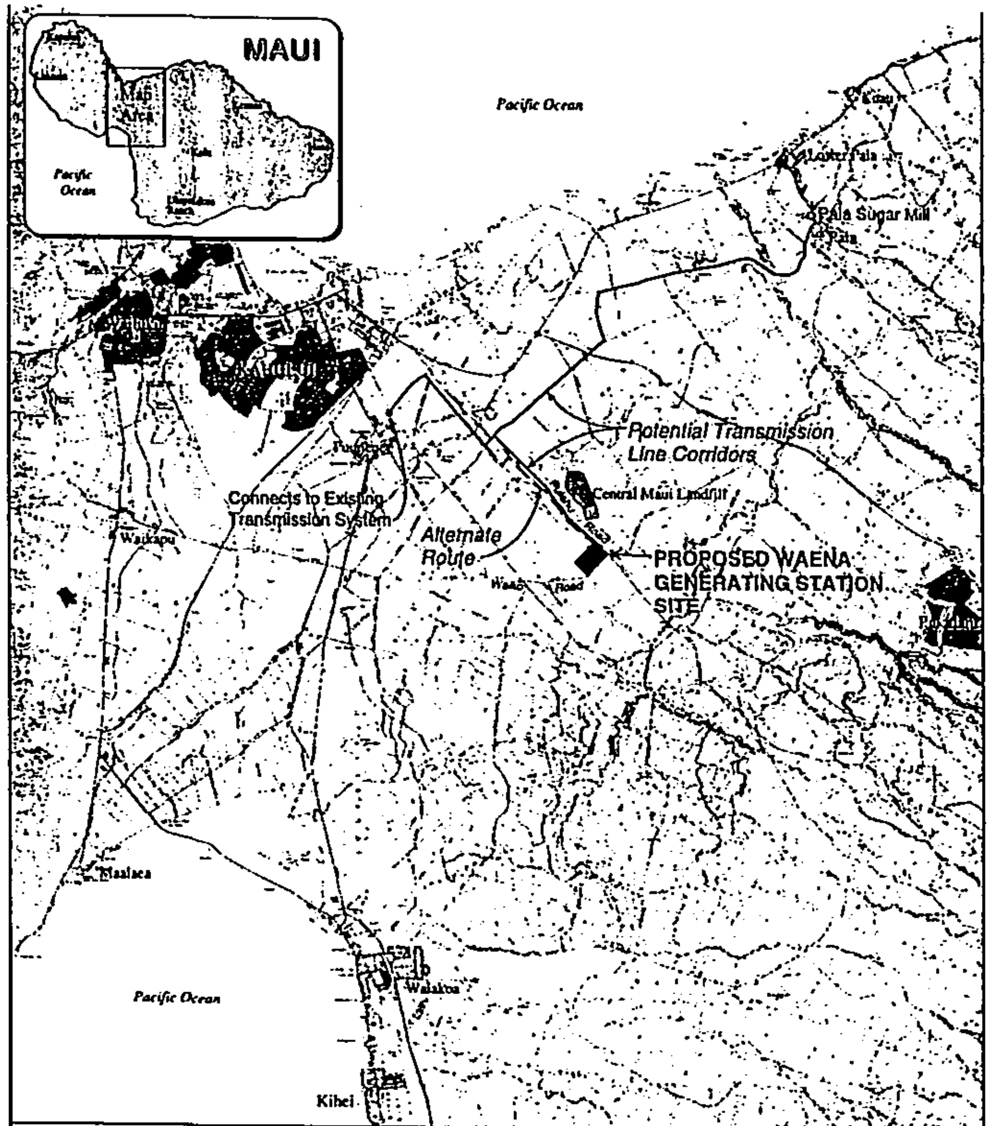
Construction and operation of the proposed Waena Generating Station will require the three following land-related approvals:

- County redesignation of the project site in the Wailuku-Kahului Community Plan from "Agricultural" to "Heavy Industrial"
- State Land Use Commission redesignation of the project site from "Agricultural" to "Urban"
- County rezoning of the project site from "Interim" to "Heavy Industrial"

In addition to the major land entitlements, several federal, state, and county permits will be required for construction and operation of the facility, including air quality permits; water withdrawal and injection permits; and building, grading, and stormwater permits. Table ES-2 contains a list of the permits currently identified as required for the proposed project.

Table ES-2
List of Potential Permits and Approvals
for the Proposed Waena Generating Station and Transmission Lines

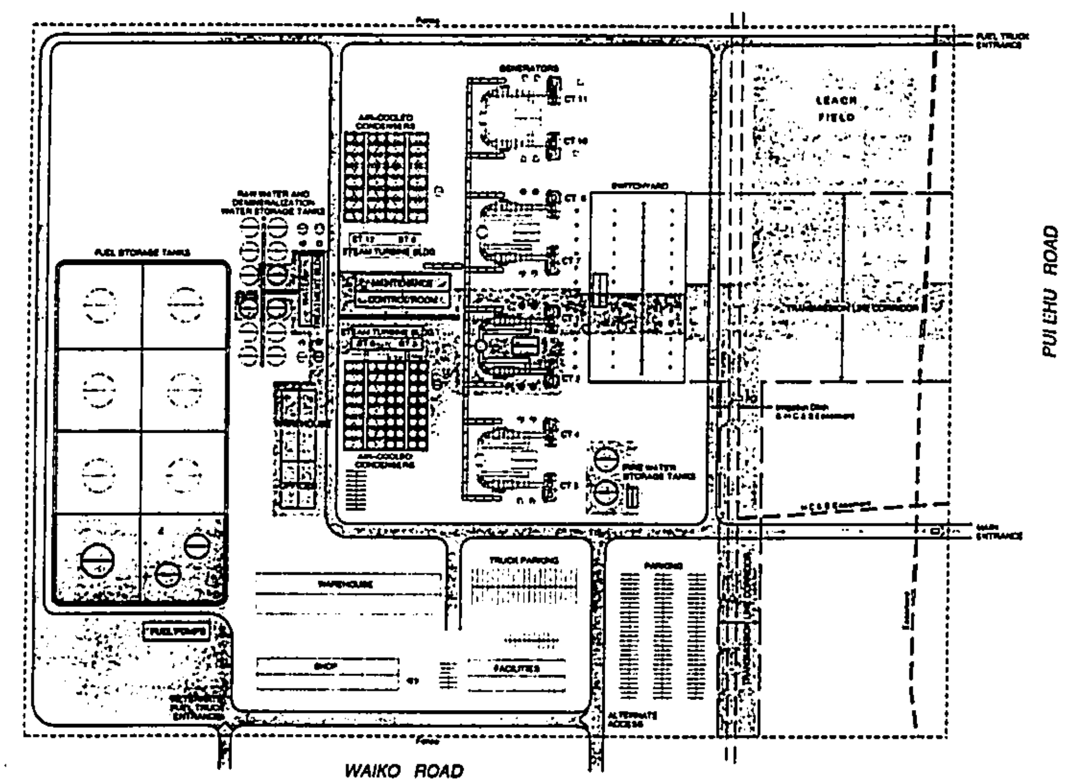
Permit/Approval	Agency
County of Maui	
Environmental Impact Statement Acceptance	Planning Department/Mayor
Community Plan Amendment	Planning Commission/Council/Mayor
Change in Zoning	Planning Commission/Council/Mayor
Height Variance	Board of Variance & Appeals
Combustible and Flammable Liquid Tank Installation	Public Works
Driveway Permit/Work in County Road ROW	Public Works
Flood Hazard Certification or Determination	Public Works
Building, Grading and Stormwater Management Permits	Public Works
State of Hawaii	
Land Use District Designation Reclassification	Land Use Commission
Noise Variance for Construction	Department of Health
Prevention of Significant Deterioration/Covered Source Air Permit	Department of Health
Supply Well Well Construction Permit Pump Installation Permit	Comm. on Water Resource Management/Department of Land & Natural Resources
Underground Injection Control Permit to Construct Permit to Operate	Department of Health
Approval for Domestic Wastewater Treatment	Department of Health
NPDES Construction Dewatering Facility Stormwater Discharge	Department of Health
Authority to Perform Work on State Highway ROW	Department of Transportation
Public Utilities Commission General Order 7 Approval	Public Utilities Commission
Federal	
Determination of No Significant Hazard to Air Navigation	Federal Aviation Administration
Prevention of Significant Deterioration	Environmental Protection Agency



Draft Environmental Impact Statement
Proposed Waena Generating Station
Maui Electric Company, Limited

FIGURE 3-1

PROPOSED WAENA GENERATING STATION SITE AND POTENTIAL TRANSMISSION LINE CORRIDORS



Legend
Proposed Phase I
Full Build Out

Source: Maui Electric Company, Limited, 1997

Draft Environmental Impact Statement
Proposed Waena Generating Station
Maui Electric Company, Limited

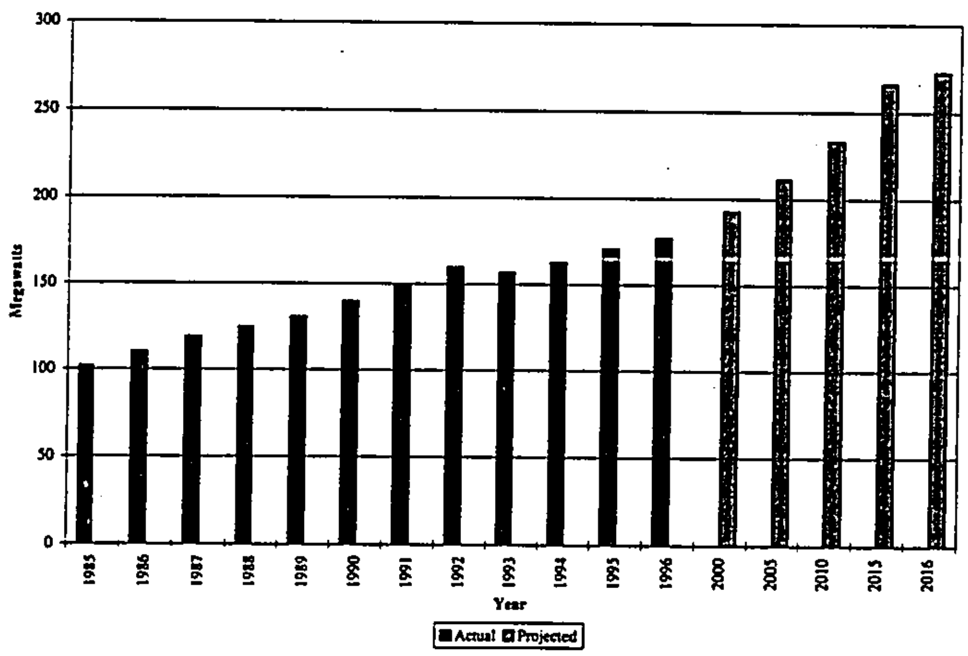
FIGURE 3-3

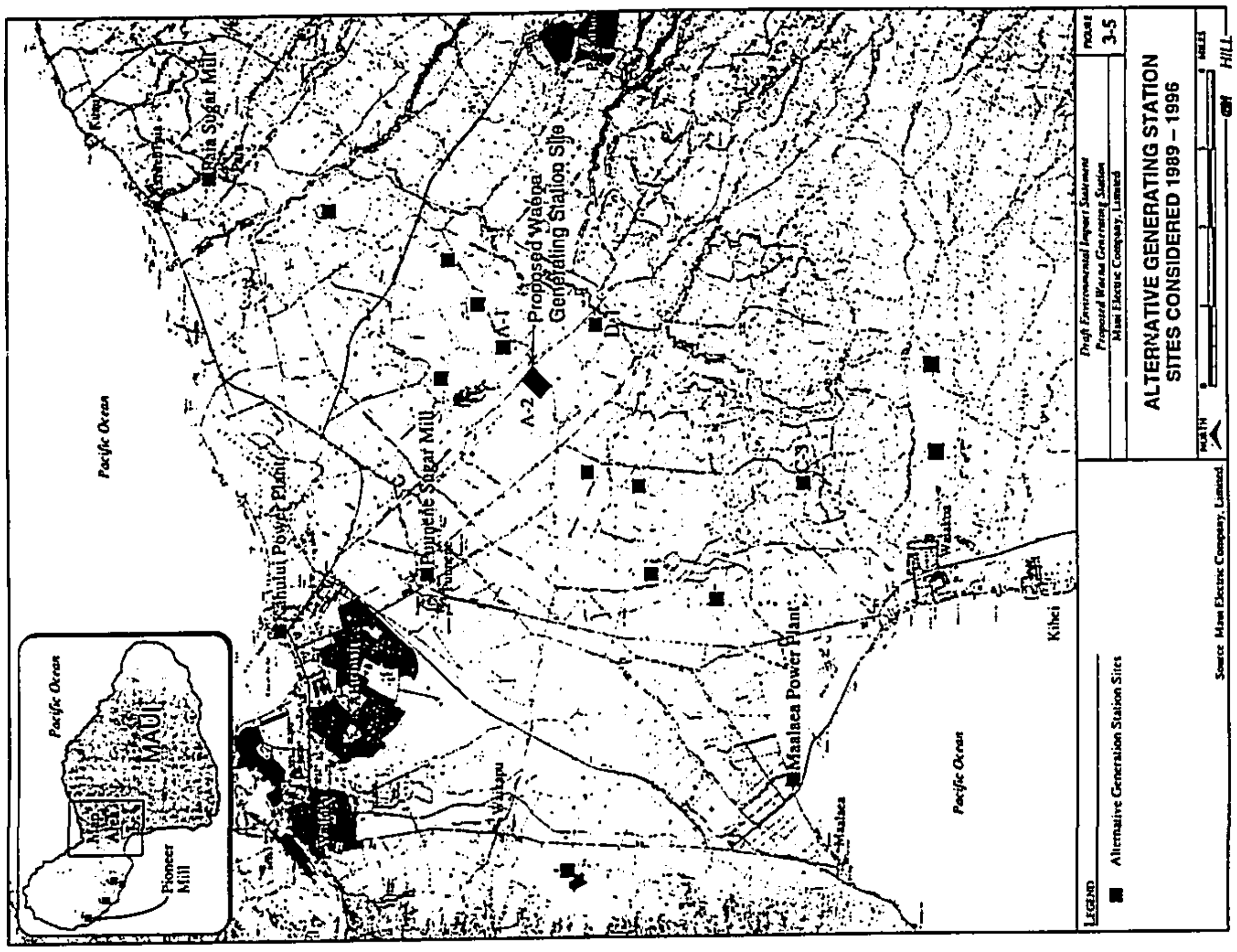
CONCEPTUAL SITE LAYOUT

NORTH NOT TO SCALE

CH2M HILL

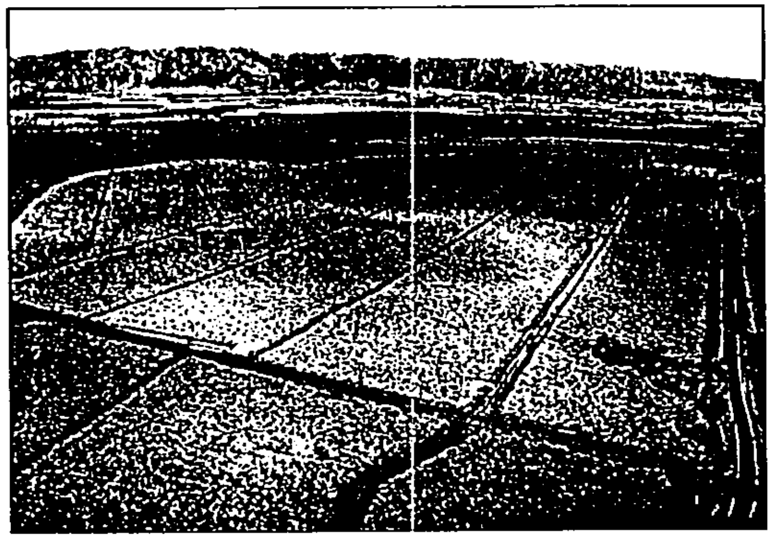
Actual and Projected Peak Electrical Demand for Maui, 1985 - 2016



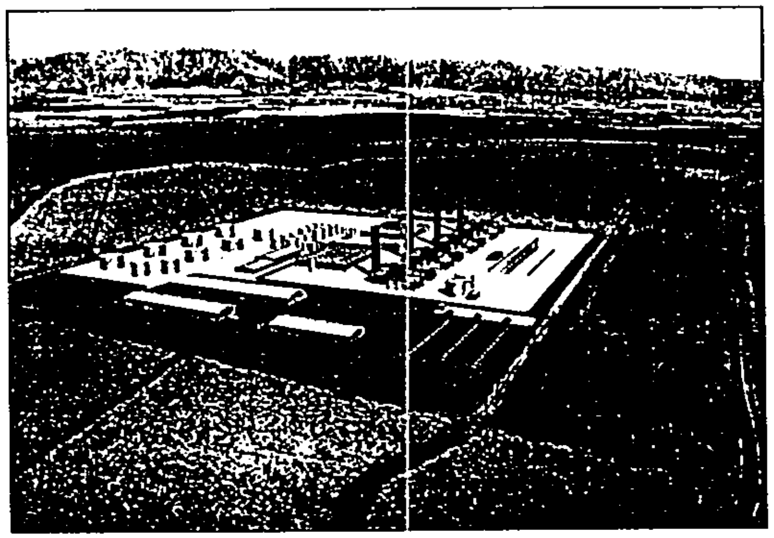


Project Cost and Schedule per Phase (1997 dollars)			
Project Component	**Unit**	**Cost**	**Operation Date**
Land Costs	67 acres	$1,847648	1997
Phase 1	DTCC 1	$105,370,000	2006
Phase 2	DTCC 2	$96,857,000	2010
Transmission Lines		$10,419,000	
Transmission & Distribution Facility		$5,900,000	
Phase 3	DTCC 3	$100,318,000	2016
Phase 4	DTCC 4	$96,848,000	2020
Total Project Cost		**$417,559,648**	

Source: Maui Electric Company, Limited

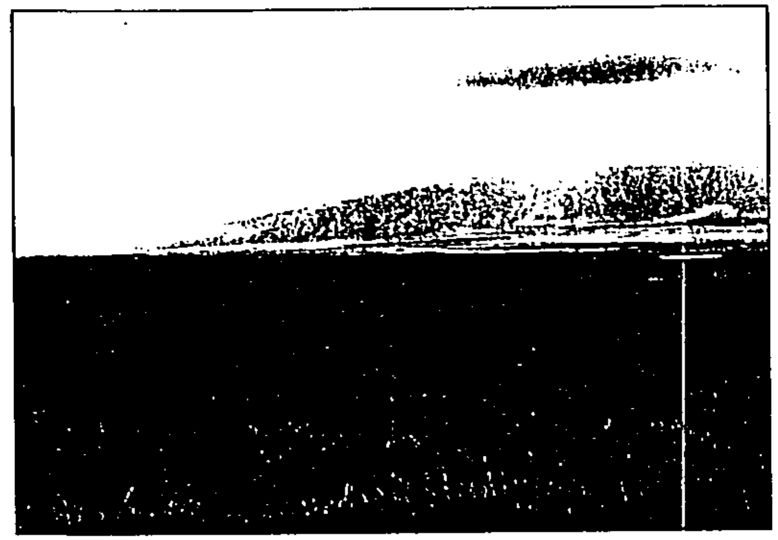


Elevated View of Project Site from Pulehu Road—Existing Condition

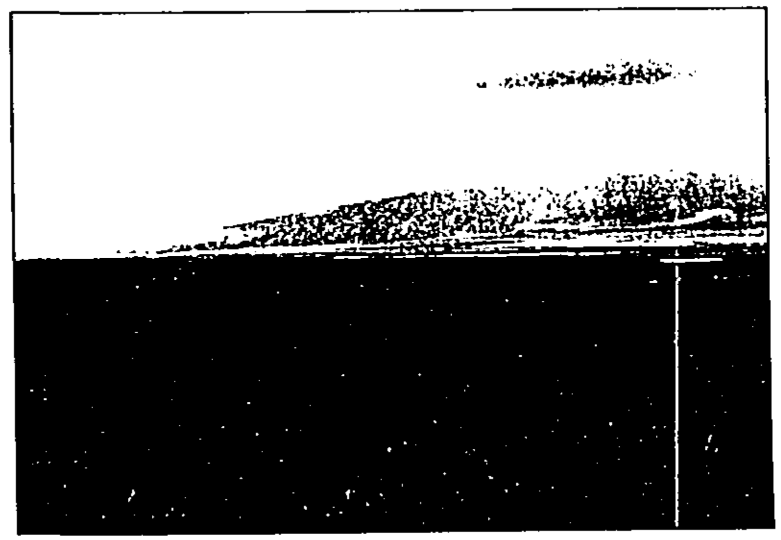


Elevated View of Project Site from Pulehu Road—Project Simulation

Figure 4-5
Key View 1

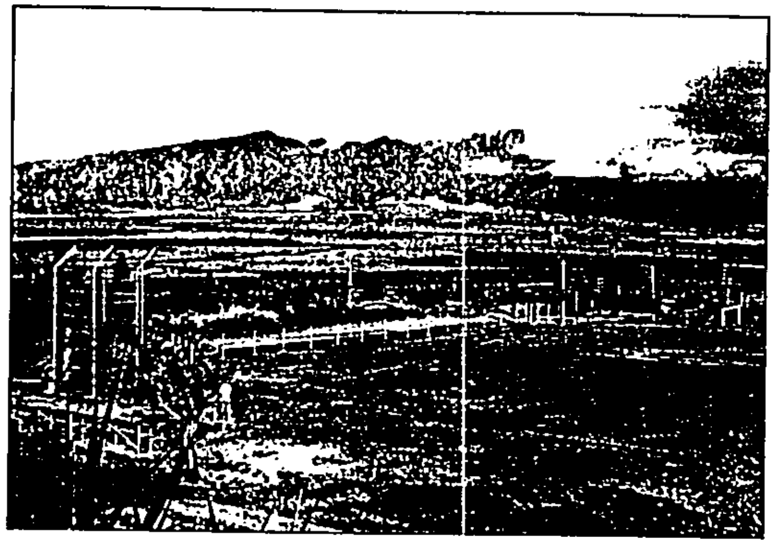


View of Project Site from Haleakala Highway— Existing Condition

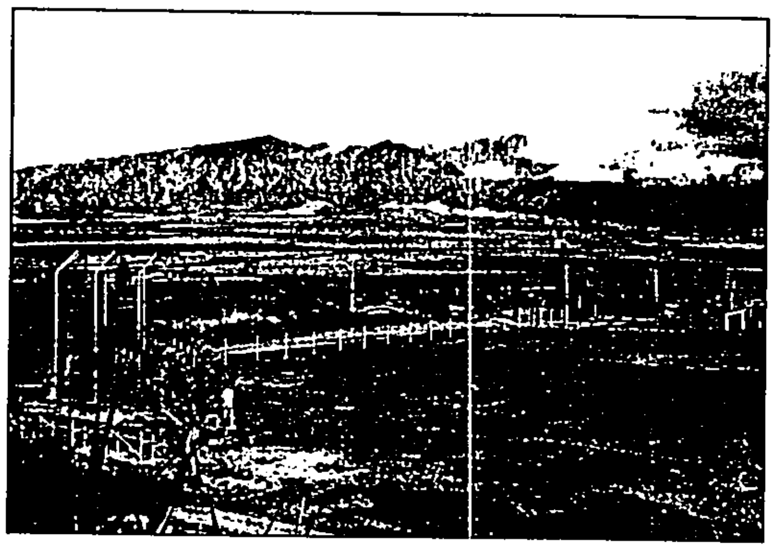


View of Project Site from Haleakala Highway— Project Simulation

Figure 4-6
Key View 2

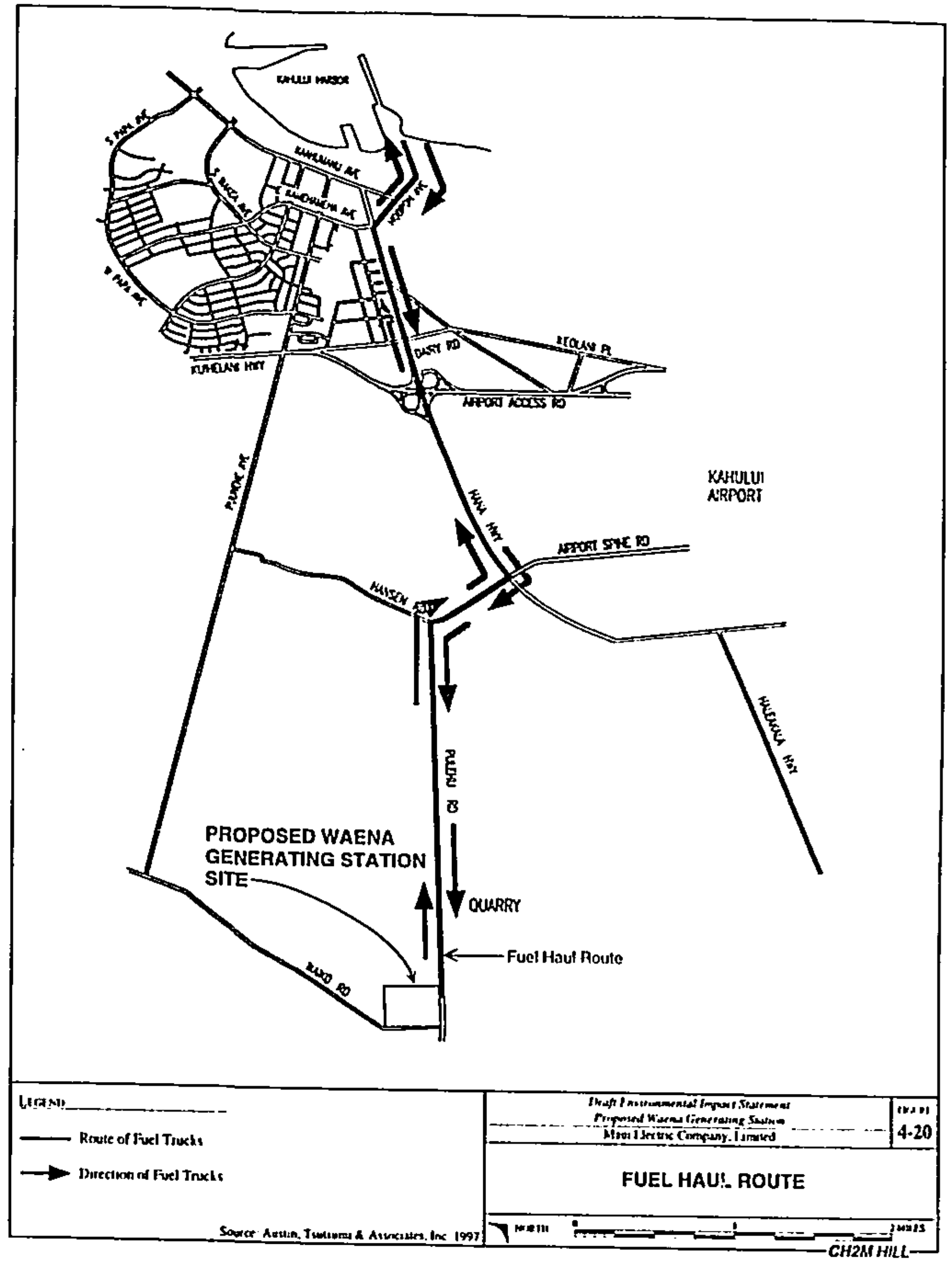


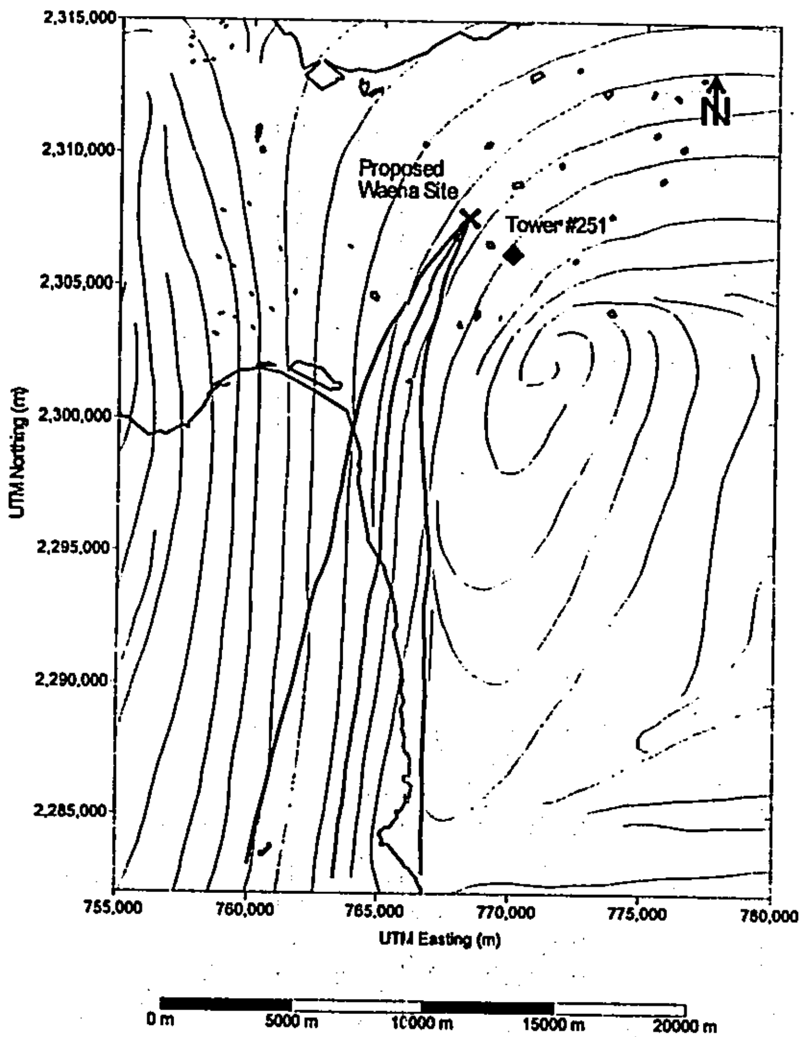
View of Project Site from Pukalani Community Center—Existing Condition



View of Project Site from Pukalani Community Center—Project Simulation

Figure 4-7
Key View 3





Vortex Concentration Calculation

$$Cs(\mu g/m^3) = \frac{t(days) \times Q(lb/h) \times P}{V(m^3)} \times \frac{24(hours)}{1(day)} \times \frac{453.59(g)}{1(lb)} \times \frac{10^6(\mu g)}{1(g)}$$

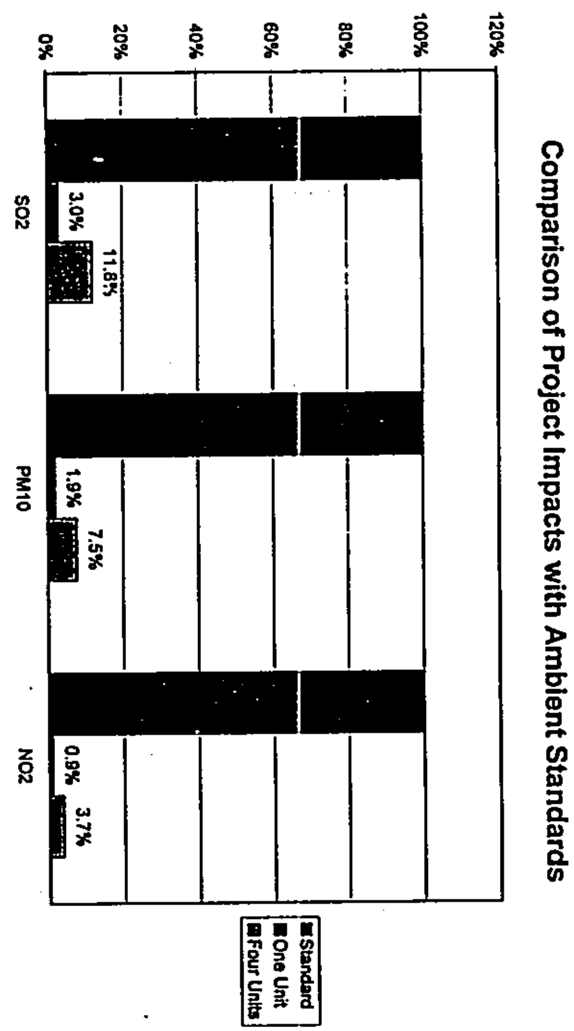
Where:

- t = Amount of time in days
- V = Volume of box in cubic meters (3.65×10^{11} m^3)
- Cs = Concentration level in micrograms per cubic meter
- Q = Emission rate in pounds per hour
- P = Fraction of plume to be entrained (0.0035)

Four Units, 31 Days for SO_2

$$Cs(\mu g/m^3) = \frac{31 days \times 220(lb/h\ per\ unit) \times 4\ units \times 0.0035}{3.65 \times 10^{11} m^3} \times \frac{24(hours)}{1(day)} \times \frac{453.59(g)}{1(lb)} \times \frac{10^6(\mu g)}{1(g)}$$

$Cs = 2.8\ \mu g/m^3$



Waena Power Generating Station
Public Draft EIS Comment Meetings
August 26 & 28, 1997

MEETING SUMMARY

These meeting minutes summarize the Draft Environmental Impact Statement (DEIS) Comment Meetings for the Waena Power Generating Station held at the following locations:

- August 26 - Maui Arts and Cultural Center Visual Arts Classroom
- August 28 - Upcountry Swimming Complex Multi-Purpose Room (Pukalani)

PURPOSE

To solicit the public's comments regarding the Draft EIS for Maui Electric Company's (MECO's) proposed Waena Generating Station.

AGENDA

6:30 to 7:00 PM - Open House
7:00 to 9:00 PM - Public Meeting

- Presentation
- Public Comments
- Question and Answer Period
- Closing Remarks

ATTENDANCE

See attached list.

PRESENTATION

(The following is a summary of the presentation at both meetings.)

Mark Willey, CH2MHILL, Project Manager for the EIS and Land Use Entitlement process, began by stating the agenda for the meeting. Mr. Willey described the various handouts that were available (see attached) and explained that written comments on the DEIS will be accepted by MECO through September 22, 1997.

MECO (William Bonnet, President in Kahului; Ed Reinhardt, Manager of Engineering in Pukalani), began by stating the purpose of the meeting (see above). MECO stressed the importance of keeping the public informed of the project's status and of the need for the public to keep MECO aware of any concerns. In this way there will be "no surprises" for either MECO or the public.

After a comprehensive site selection process, MECO has selected the subject 67 acre site and purchased it in fee from Alexander & Baldwin, Hawaii.

The site selection process, started off by examining potential locations throughout the island of Maui. Subsequent studies narrowed the alternative sites down to twelve and then down to three. The final three sites consisted of two in the Pulehu area: "A-2", the subject site, located on Pulehu Road approximately 1/4 mile mauka of the Central Maui Landfill, and "D-1", located approximately 1 1/2 mile mauka (east) of Site "A-2" along Pulehu Road. The third site, "C-3" was located near the old Puunene Airstrip. The two Pulehu sites were given higher ratings based primarily on their relation to existing infrastructure and distance from residential areas. The air quality modeling study indicated that "A-2" was the only site where a 232-MW generation station would comply with air quality standards given existing emission sources. Air quality was one of the most critical environmental screening factors in the site selection process.

At the end of this extensive site selection process, "A-2", the subject site, was identified as the preferred alternative.

When complete, the 67 acre site would contain four 58-MW dual-train combined cycle (DTCC) units for a total capacity of 232 megawatts (MW). Each of the DTCC units would consist of two 20-MW combustion turbines and an 18-MW steam turbine. Full build out of all four DTCC units is estimated to take approximately 30 years. To accomplish the 2004 commercial operation date for the first 20-MW combustion turbine, the engineering effort will need to commence by late 2000 with construction to start around 2002.

The largest development increment is 20-MW. This provides flexibility over the long term to incorporate any possible changes in generating technologies which may occur in the future. In addition, the units selected for the site are capable of utilizing different fuels should fuels other than diesel become economically feasible in the future

Mr. Willey explained that MECO is presenting a request for a Community Plan Map Amendment from "Agricultural" to "Heavy Industrial" for the site to the County Council as part of the Wailuku-Kahului Community Plan Ten Year Update process in order to allow for a careful consideration of community wide planning issues. MECO has also filed a separate application with the Maui County Planning Department in order to allow for a detailed review of the request on an individual basis. The filing of a separate Community Plan Amendment has triggered the preparation of the DEIS which is currently available for public review. The Public Comment Period for the Draft EIS ends September 22, 1997. The final EIS will provide full disclosure and review of anticipated environmental impacts and proposed mitigation measures.

Other required approvals include a State Land Use District Boundary Amendment from "Agricultural" to "Urban" from the Land Use Commission and a Change in Zoning from "Interim" to "Heavy Industrial" from the Maui County Council. The project will also be required to meet air quality standards for emissions pursuant to requirements established by the Federal Environmental Protection Agency and the State Department of Health.

PUBLIC COMMENTS

Following the project presentation, concerns and comments regarding the DEIS were officially taken. Concerns and comments received from individuals attending the meetings are summarized below. Responses to comments will be mailed to the individuals attending the meetings and included in the Final EIS.

August 26, 1997 (Maui Arts & Cultural Center)

Jack F. Mueller, Chairman, Infrastructure Committee, Maalaea Community Association

Comments:

1. *"We believe that MECO should prepare a plan to provide a standardized system of partial load dropping in the event of extraordinary loss of generating facilities."*

2. *Move proposed Maalaea 19 CT, Maalaea 18 steam turbine, and present Maalaea Unit 17 CT to new Waena site.*

Steven Moser, MD

Comments:

1. *Peak Demand.) The calculations for future growth of power needs for Maui County may be overstated.*

2. *Resource Planning.) This tendency to centralize all power production presents possible problems in the event of natural or man-made disasters, such as hurricanes, fires, earthquakes, or sabotage. It also concentrates all of the environmental degradation into one main area, instead of distributing it. Finally it creates an infrastructural nidus for future industrial growth in the areas adjacent to the current large industrial project, further blighting the rural nature of the Central Valley of Maui.*

3. *Fuel Transport and Handling.) Forty-four tanker truck deliveries per day in the built power plant scenario represents a potential hazard for travel on our busy highways.*

4. *Best Available Control Technology.) Note: No commitment for BACT makes it difficult to comment on alternatives.*

5. *BACT for Sulfur Dioxide and Sulfuric Acid Mist.) BACT for sulfur would logically include use of the lowest sulfur content fuel, i.e., .05%, but this is rejected for economic reasons in favor of .4% sulfur content, despite the 8-fold increase in sulfur emissions anticipated.*

6. *Project Schedule and Cost.) Could any of this massive expenditure for diesel burning plants be deferred to energy conservation measures and alternative energy development so that we could be less dependent on foreign petrochemicals?*

7. *Conservation and Energy Efficiency.) This discussion of demand side energy conservation (DSM) does not show any consideration for the effects of a concerted effort at widespread implementation in this country. ... How much above the anticipated 10% reduction in peak electrical demand over 20 years could be realized with an aggressive, state supported DSM program.*

8. *Air Quality: Existing Conditions.) There are no on-site air quality data for the proposed project site. It is difficult to see how the baseline readings at Maalaea could be substituted for the proposed site when there are so many pollution sources to the northwest and northeast of the proposed sight (sic), in closer proximity than to Maalaea, including Puunene Sugar Mill, Kahului Airport, Kahului Power Plant and Paia Sugar Mill. The details of the location of the Maalaea monitoring site is (sic) not given in relation to the Maalaea plant itself: is it upwind or downwind, and how far away? Also, the Maalaea plant is outside the Maui vortex.*

9. *Operational Air Emissions.) The DEIS evades the need to do a full impact analysis of the various pollutants.*

10. *Impacts on Haleakala National Park.) Second paragraph: Are we really to believe that this readily visible degradation of air clarity generated from a 24 MW generator will be worse than the haze generated from a plant generating ten times as much power?*

11. *Impacts Due to the Maui Vortex.) In reviewing the Appendix C3 which is the study supporting the conclusion that there is no impact, I found several questionable assumptions from a layman's point of view. The calculations are based on using the winds at 0200 (2AM), at which time the winds during regular tradewind conditions are very different as compared to daytime. ... It is never made clear to my satisfaction why this time of day was used in the calculations, as well as why they used the value of .35% as the percent of the plume that would be caught in the vortex at night time.*

12. *Not addressed in this confusing analysis are the daytime vortical conditions and their effects, and more importantly the true worst case scenario of prolonged inversions when the Kona winds are blowing for extended periods of time.*

13. *Groundwater: Existing Conditions.) An examination of Figure 4-2 shows that the plant sits right on the Underground Injection Control line at its eastern edge. It is difficult to see how we can be so precise as to allow degradation on one side, while trying to maintain purity on the other side of this arbitrarily drawn line, especially when there are potable water resources on the downhill side as demonstrated in this case.*

14. *There is an assumption made in this section that there will be no mixing of the effluent with aquifer groundwater. This is contradicted in Appendix E, the Groundwater Resource Assessment, page 12, which states, "...the resultant wastewater totals .44 mgd, which will be returned to the basal aquifer by means of injection wells."*

August 28, 1997 -Upcountry Swimming Complex Multi-Purpose Room (Pukalani)

Jonathan Starr

Comments:

1. *MECO should study photovoltaic potential as well as other sustainable power generation with more demonstration projects.*

2. *MECO should do more to assist islandwide energy conservation measures.*

James V. Williamson, Consulting Engineer

Comments:

1. *Why doesn't MECO get involved in a real hands-on manner in encouraging solar water installations by providing no-interest loans, and even some grants. This would be a DSM program which could result in significant savings in the need to construct future generation.*

2. *I suspect that the estimated 2.6% annual load growth in the future is too high. However, despite the importance of this assumption, there are no supporting data.*

3. *MECO should make every effort to renew the generation agreement with HC&S when it expires in 1999. In my view the EIS incorrectly deletes the mill's 16MW from the future resources.*

4. *Instead of supply water requirements from wells I strongly recommend (and suggest the County mandate) piping in reclaimed wastewater from the Kahului wastewater treatment plant.*

5. *The EIS includes a summary table which shows that the cost of a fuel line alternative would be $10 million more than a trucking alternative. However, even though I question this conclusion there is no detailed basis shown to verify this.*

6. *The stacks are a potential hazard for air traffic (not mentioned in the EIS).*

7. *The frequency and location of monitoring stations for air emissions should be spelled out. The EIS should state that DOH will perform the monitoring.*

8. *MECO should be making every effort now to reduce the emissions at the plant to a BACT (Best Available Control Technology) equivalent to LAER, the Lowest Achievable Emission Rate. If this is done, particularly for oxides of nitrogen (NOx) and fuel sulfur content, air emissions will not, and should not, generally be an unresolved issue as stated in the EIS.*

9. *How can reduction of sulfur content to 1/8 of that of the present fuel oil ever be considered minimal? As for the additional cost, as stated above, this has to be related to*

the community willingness to accept a commensurate reasonable increase in power rates to clean up the air.

10. *The estimated cost of obtaining 0.05% fuel oil from the mainland, as compared to the cost of the present 0.4% fuel, should be shown in the EIS. The alternative of production at the Oahu refineries should also be discussed. The impact on power rates of using low sulfur fuel should be shown, including credit for reduction of stack height and lower SCR maintenance costs and higher plant efficiency.*

11. *I feel strongly that SCR equipment should be installed on future dual-train combine cycle units. SCR should be installed in the HRSG which means that one complete combined cycle unit (combustion turbine and unfired heat recover unit), should be installed at one time.*

Scott Crawford, Maui Tomorrow

Comments:

1. *Maui should develop a long-term plan to move away from the use of fossil fuels.*
2. *The ability to convert to another type of fuel is important. Could an oil generating crop that produces vegetable oil be used to power the machines. This would provide a replacement crop to sugar cane.*
3. *MECO should more aggressively pursue demand-side management and conservation programs. More information on these programs should be made available to the public.*

QUESTION & ANSWER PERIOD

Following the formal comment period, a question and answer and informal discussion session was held to clarify different aspects of the project.

CLOSING REMARKS

Mr. Willey reminded everyone to sign in on the sign-in sheets. All names on the lists will be added to the project mailing list and receive a copy of the meeting summaries. The mailing list will be used to inform interested parties of upcoming meetings and to send out notices and project information.

Maui Electric Company, Limited
Waena Generation Station
Draft EIS Public Comment Meeting
Attendance List

August 26, 1997, Maui Arts & Cultural Center, Kahului, Maui

Jack Mueller
Maalaea Community Association
250 Hauoli St. #301
Wailuku, HI 96793

Ed Lindsey
Na Kupuna O Maui
1087 A Poobela Rd.
Makawao, HI 96768

Jim Judge
662 Omaopio Rd.
Kula, HI 96790

Glenn L. Shepherd
477 S. Alu Rd.
Wailuku, HI 96793

Jason Schwartz
Energy Exchange
PO Box 356, Suite 208
Paia, HI 96779

Steven Moser, MD
1883 Mill St.
Wailuku, HI 96793

August 28, 1997, Upcountry Swimming Complex, Pukalani, Maui

Carl Freedman
4234 Hana Highway
Haiku, HI 96708

Jim Williamson
672 Kumulani Dr.
Kihei, HI 96753

Jonathan Starr
S.R. 182
Hana, HI 96713

Randall Moore
Hawaiian Commercial & Sugar
PO Box 266
Puunene, HI 96784

Scott Crawford
Maui Tomorrow
PO Box 178
Hana, HI 96713

Gary Kubota
Honolulu Star-Bulletin
Neighbor Island Bureau
PO Box 31000
Honolulu, HI 96849-5027

CH2M HILL
1585 Kapiolani Blvd
Suite 1420
Honolulu, HI
96814-4530
Tel 808.943.1133
Fax 808.941.8225

CH2MHILL
Celebrating 50 Years

October 9, 1997

139792.EI.03

[Title] [First Name] [Last Name]
[Company]
[Adress1]
Address2]
[City], [State] [Postal Code]

Dear [Title] [Last Name]:

Subject: Waena Generating Station Draft EIS Public Comment Meetings

Thank you for taking time to attend our public comment meetings to solicit comments on the draft environmerital impact statement (EIS) prepared for the Waena Power Generating Station. Enclosed you will find a summary of the two meetings held, listing who from the public attended and what comments were made during the meetings

At this time, Maui Electric Company, Limited (MECO) is preparing responses to the many comments received during the comment meetings and from the comment letters received during the public comment period, which closed September 22, 1997. The responses to these comments will be mailed to the individuals who made them and will be reproduced in the Final EIS submitted to the Maui County Department of Planning. If you have made an official comment, either through the comment meetings or by sending in a comment letter, you will receive a copy of the Final EIS. Copies will also be available to review through the public libraries and the Maui County Department of Planning.

Again, thank you for your interest and participation in the project. Should you have any further questions concerning the project, please feel to contact me at (808) 943-7135, ext. 203.

Sincerely,

CH2M HILL

Mark R. Willey
Project Manager

HNL/SPLTRRPS
Enclosure
c: David Blane, Maui County Planning Department
Ed Reinhardt, MECO
Neal Shinyama, MECO
Mike Yuen, HECO