P/E

November 19, 1982

TO: HONORABLE EILEEN R. ANDERSON, MAYOR

VIA: ANDREW I. T. CHANG, MANAGING DIRECTOR

FROM: KAZU HAYASHIDA, BOARD OF WATER SUPPLY

SUBJECT: FINAL ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR HONOULIULI WELLS

We recommend your acceptance of the EIS for our proposed water development project. The EIS complies with all the requirements of Chapter 343, Hawaii Revised Statutes.

According to Chapter 343, your acceptance is a formal determination that the EIS adequately describes identifiable environmental impacts and satisfactorily responds to comments received during the review of the statement.

The Honouliuli Wells project could add up to 9.0 million gallons of water to the Ewa-Waianae Water District. The project will be deferred until a water exchange with sewage effluent can be arranged with Oahu Sugar Company and the exchange approved by the Department of Land and Natural Resources.

We enclose a copy of the environmental document for your information.

If you have any questions, please contact me at 548-6180.

L. G. Bathburn

For KAZU HAYASHIDA
Manager and Chief Engineer

Enc.

CONCUR:

Andrew I. T. Chang

Andrew I. T. Chang
Managing Director

ACCEPTED:

Eileen R. Anderson

Eileen R. Anderson, Mayor
City and County of Honolulu

LHYW:cs
cc: K. Hayashida, L. Whang

REVISED
ENVIRONMENTAL IMPACT STATEMENT

HONOULIULI WELLS

BOARD OF WATER SUPPLY · CITY AND COUNTY OF HONOLULU

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293

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CITY AND COUNTY OF HONOLULU

BOARD OF WATER SUPPLY

REVISED ENVIRONMENTAL IMPACT STATEMENT

FOR

HONOULIULI WELLS

HONOLULU, OAHU, HAWAII

TAX MAP KEY: 9-2-01: PORTION OF PARCEL 1

THIS ENVIRONMENTAL DOCUMENT IS SUBMITTED PURSUANT TO CHAPTER 343, HRS

PROPOSING AGENCY: Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

ACCEPTING AUTHORITY: Mayor, City and County of Honolulu

Board Members:

Yoshie H. Fujinaka, Chairman
Robert A. Souza, Vice Chairman
Michael J. Chun
Walter A. Dods, Jr.
Ryokichi Higashionna
Donna M. Howard
Milton J. Agader

Kazu Hayashida Date 9/30/82

KAZU HAYASHIDA

Manager and Chief Engineer

PREPARED BY: Environment Impact Study Corp.
770 Kapiolani Blvd., Suite 605
Honolulu, Hawaii 96813

September, 1982

PROPOSED PROJECT	:	Honouliuli Wells
APPLICANT	:	City and County of Honolulu Board of Water Supply
ACCEPTING AUTHORITY:		Mayor, City and County of Honolulu
CONTACT	:	Mr. Lawrence Whang Board of Water Supply 630 South Beretania Street Honolulu, Hawaii 96843 548-5221

SEPTEMBER, 1982

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES - Cont'd.

Summary

SUMMARY

HONOULIULI WELLS

REVISED ENVIRONMENTAL IMPACT STATEMENT

Honouliuli, Oahu, Hawaii

PROPOSING AGENCY : Board of Water Supply
City and County of Honolulu

ACCEPTING AUTHORITY: Mayor
City and County of Honolulu

The Board of Water Supply proposes to construct six wells and approximately 6,100 linear feet of 24-inch pipe, linking the proposed wells with the existing Honouliuli Line Booster Station. The wells and transmission line will be located within a parcel used for sugar cane production, approximately 1.3 miles northwest of Waipahu, Oahu.

The primary objective of the proposed project is to meet increasing demands for water in the leeward region of Oahu. Specific objectives include the following:

1. Provide water for the planned growth, directed by the General Plan, of the leeward area where water demands are expected to rise from the 1978 consumption rate of 19.30 mgd to 43.20 mgd by the year 2000;

2. Provide for existing and future fire flow requirements; and

3. Provide for water distribution flexibility to insure a reliable water supply to communities to reduce the threat of shortages during droughts.

The proposed project will be funded by the Board of Water Supply, City and County of Honolulu and private users. Construction will be phased. Two wells will be constructed initially, with the other wells phased in as required. Construction costs for the first phase (2 wells) are estimated at $2,179,000 and for the following phases at $1,560,000, for a total project cost of $3,739,000, at 1979 dollars.

The project will proceed only after a water exchange agreement is settled with Oahu Sugar Company and a permit for the proposed development and water exchange is approved by the State according to Department of Land and Natural Resources' (DLNR) Chapter 166 of Title 13. The water exchange would assure that there would be no net increase in pumpage from the Pearl Harbor aquifer.

The climate in the project vicinity is generally hot and dry. The site is located on the lower western slopes of the Koolau Range at an elevation of approximately 380 feet above sea level. Situated on a gentle slope (3.7%), the site is approximately 500 feet west of a tributary to Honouliuli Stream.

Soils on the project site are Molokai silty clay loam. Permeability is moderate, runoff is slow, and the erosion hazard is slight to moderate. The site is underlain by the Koolau Volcanic Series and the Waianae Volcanic Series. Ground water beneath the site consists of potable basal ground water.

No rare or endangered species of plants or animals were observed on the project site. No historical or archaeological sites are known to exist on the project site, which is an area previously disturbed by sugar cane cultivation.

An existing cane haul road provides access to the site. Electrical and telephone service will be provided. Liquid waste will be disposed of in a water-tight container, which will be periodically pumped out. Emergency services serve the urban areas in the general vicinity of the site.

According to the Honolulu General Plan Distribution of Residential Population for the year 2000, the total population of the Ewa, Waipahu, and Waianae areas would be approximately 168,000 ± 5%. The Board of Water Supply planning population for these areas, on which water demand is based, totals 168,400 for the year 2000.

The proposed project is located in an area designated Agriculture by the State and designated Agricultural by the City and County's Development Plan Map. The City and County's Interim Zoning Control Map designates the site as Agriculture-1 (AG-1).

Due to its utility nature, the proposed project is a permitted use according to City Zoning controls. However, a State Special Permit will be required, as well as DLNR approval per Chapter 166 of Title 13.

The proposed development will generate short-term primary impacts affecting air quality, noise levels, and erosion. These construction-related impacts will be mitigated by appropriate measures.

Long-term primary impacts resulting from the project include removal of up to 2 acres of sugar cane from production, removal of up to 2 acres of Prime Agricultural Land from production, a possible drop in head levels at water sources close to the project site, a potential increase in population in the Ewa-Makakilo area, and a potential increase in jobs in the Ewa-Makakilo area.

Secondary impacts include indirect impacts on population growth and the infrastructure to serve that growth.

Several alternatives have been investigated. They include "no action," postponing the project, alternative sites, an alternative transmission line alignment, and alternative water sources. Present BWS policy favors optimization of ground water development.

The construction materials, capital, energy, and labor involved in this project will be irreversibly and irretrievably committed. Water resources will be committed to specific uses which will be difficult to reverse in the future. There will be no net increase in ground water withdrawal from the Pearl Harbor aquifer. The wells and pumpage will be controlled by applicable governmental regulations.

Proposed Project

1

SECTION 1

DESCRIPTION OF THE PROPOSED PROJECT

I. INTRODUCTION

A. General

The increasing demand for water in the Leeward District of Oahu necessitates the development of additonal water sources to meet current and future water needs. After years of studies, the Board of Water Supply, City and County of Honolulu, proposes development of the Honouliuli Wells as one of many ongoing projects to provide water for portions of the Ewa-Waianae and the Pearl Harbor water districts.

The Honouliuli Wells project is one of the actions proposed in the Oahu Water Plan developed in 1975 for the City and County of Honolulu to meet existing and future water needs of the Ewa and Waipahu areas.

B. Project Description

The proposed project will require the development of a well field to tap the underground Pearl Harbor aquifer. Six wells will be drilled with each having electrical pumps rated at 2 million gallons per day (mgd) capacity. Also, the construction of a control building and a connecting water transmission line from the wells to the existing Honouliuli line booster station will be required. Approximately two acres of land will be required for the well field and control station. Other sections of this report will provide information on the impact on the Pearl Harbor aquifer, water demand and pumpage, and other relevant information.

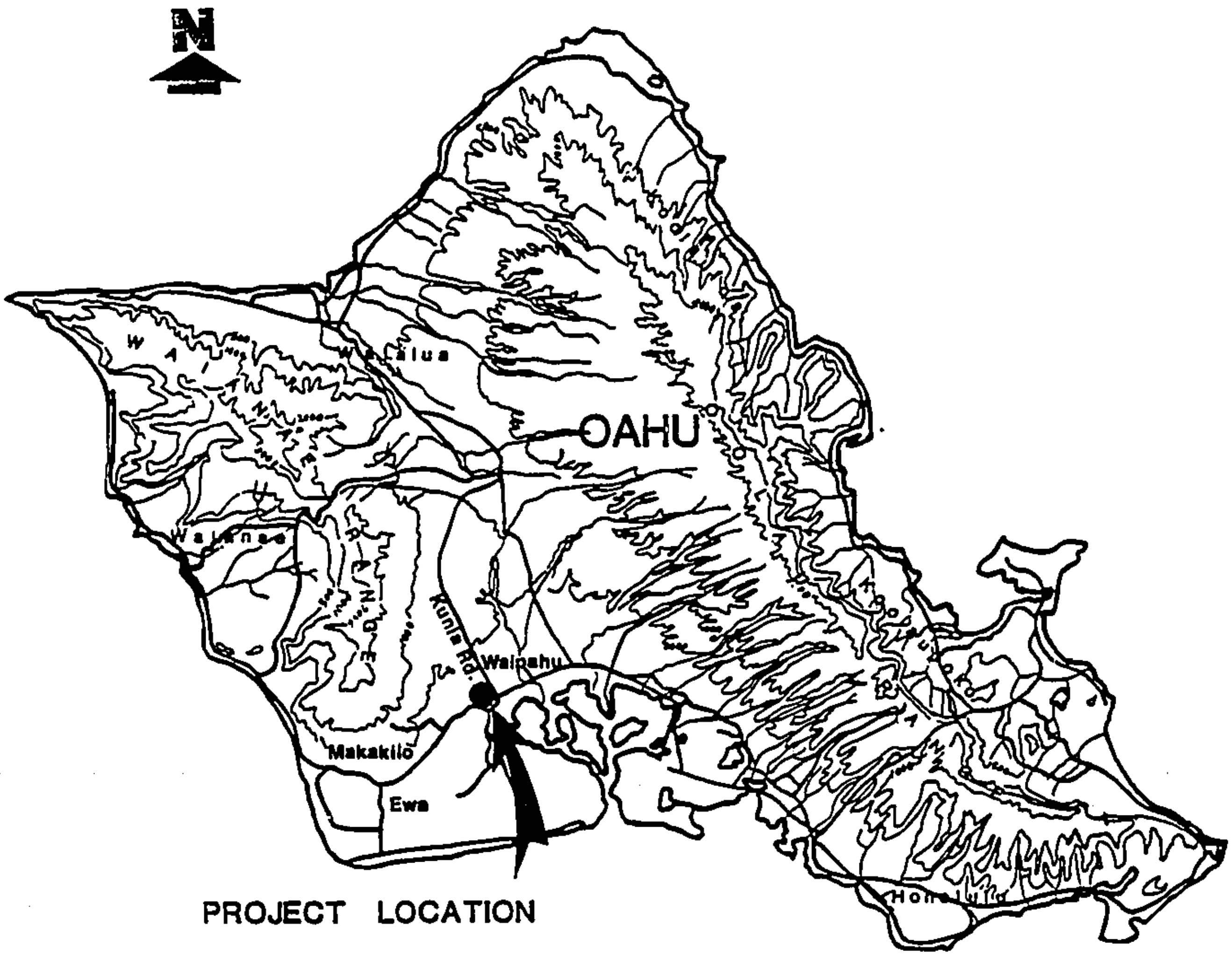
C. Project Location

The proposed Honouliuli Wells field (TMK 9-2-01: portion of parcel 1) is surrounded by cane fields and located approximately 1.3 miles northwest of Waipahu, Oahu and 1/2 mile west of Kunia Road. The only access to the well field is from an existing cane haul road. Please refer to Figures 1-1, 1-2 and 1-3.

II. PROJECT OBJECTIVES

The primary purpose of the project is to meet increasing demands for water in the leeward region of Oahu. Specific objectives include the following:

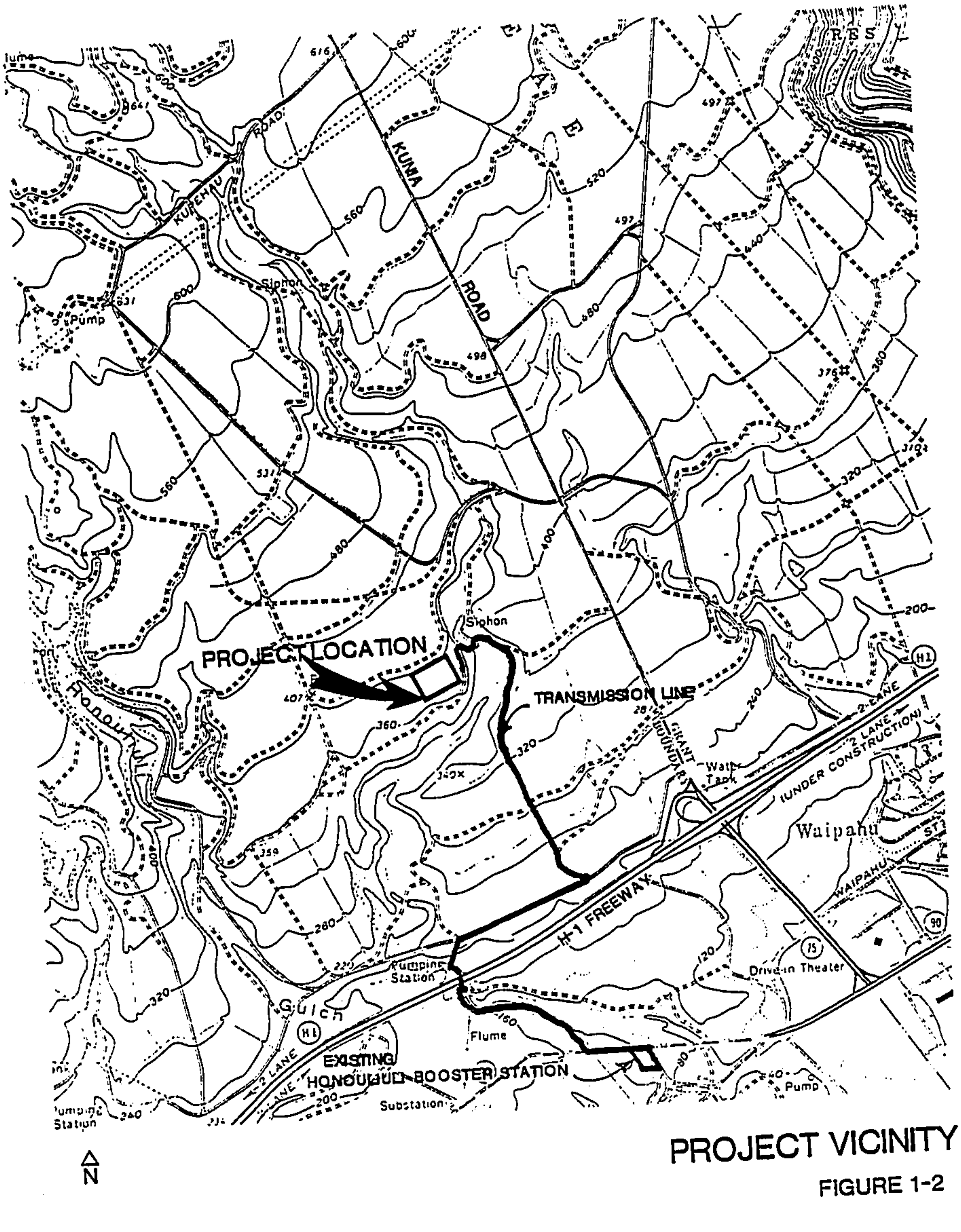
1. Provide water for the planned growth of the leeward area, directed by the General Plan, where water demands are expected to rise from the 1978 consumption rate of 19.30 mgd to 43.20 mgd by the year 2000;
2. Provide for existing and future fire flow requirements; and
3. Provide for water distribution flexibility to insure a reliable water supply to communities to reduce the threat of shortages during droughts.



LOCATION MAP

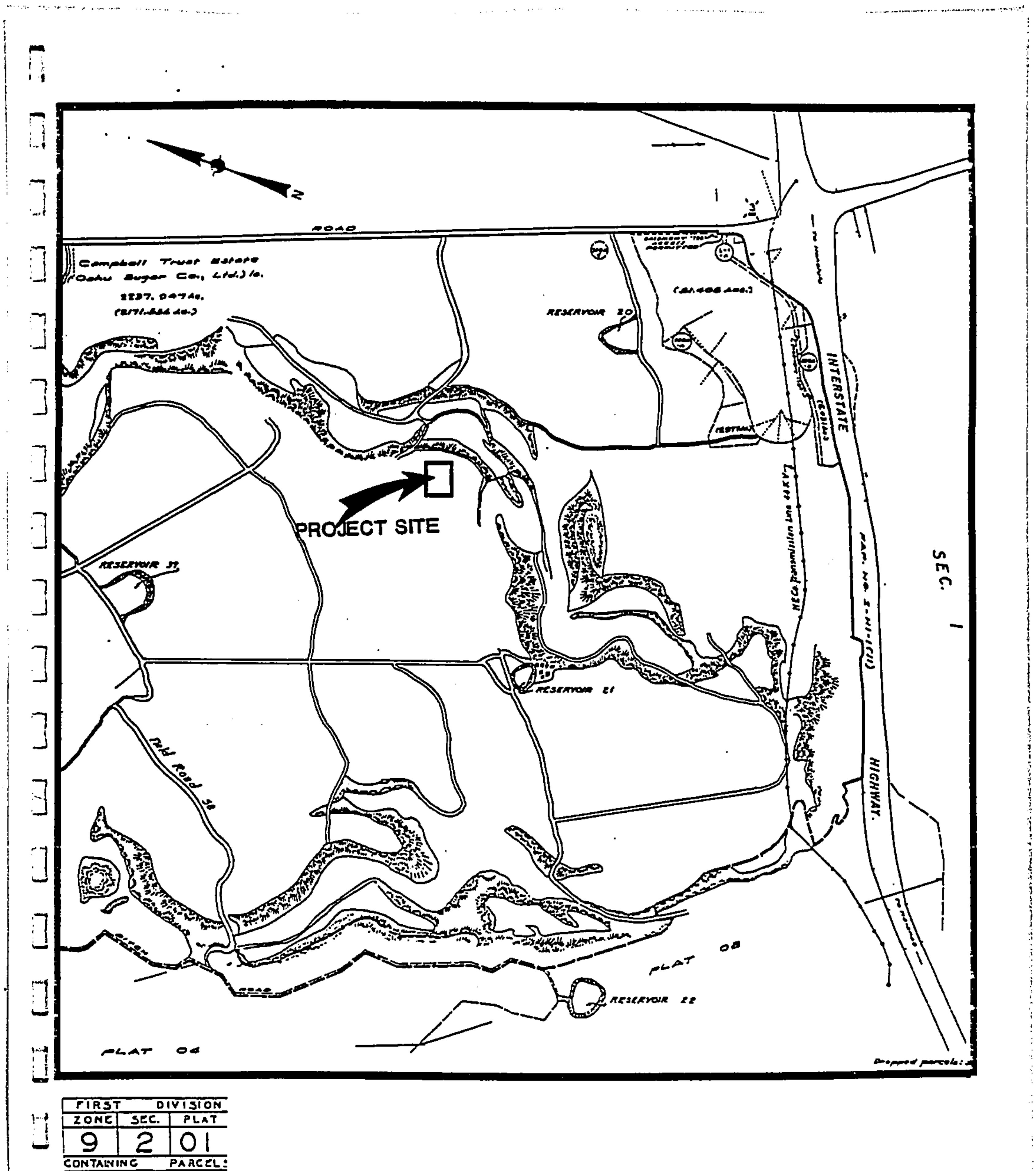
FIGURE 1-1

E.I.S.C.



PROJECT VICINITY

FIGURE 1-2



TMK MAP

FIGURE 1-3

III. EXISTING WATER SYSTEM

A. General Background

The proposed wells will draw from the new State-designated Pearl Harbor Ground Water Control Area (PHGWCA), which includes the Ewa and Wahiawa Judicial Districts and which has been designated for specific control. Refer to Figure 1-4. Existing wells in this area were conditionally certified by July 3, 1980 and new projects must be approved by the State Department of Land and Natural Resources, Division of Water and Land Development. The resident population within the PHGWCA was 214,830 as of July 1979. Details on the PHGWCA are provided in Appendix A.

Water Districts are designated by the BWS according to general service areas. Refer to Figure 1-5.

The areas of Waipahu, Ewa, and Waianae are essentially served by wells located in the Pearl Harbor Water District. The Pearl Harbor Water District consists of a 69-square mile area in south central Oahu. It extends from the crest of the Koolau range and Red Hill at its easterly boundary to Kunia Road on the west. Its southern boundary is the shoreline area of Pearl Harbor Estuary and its northern boundary generally falls below the Waiahole Ditch and Tunnel System.

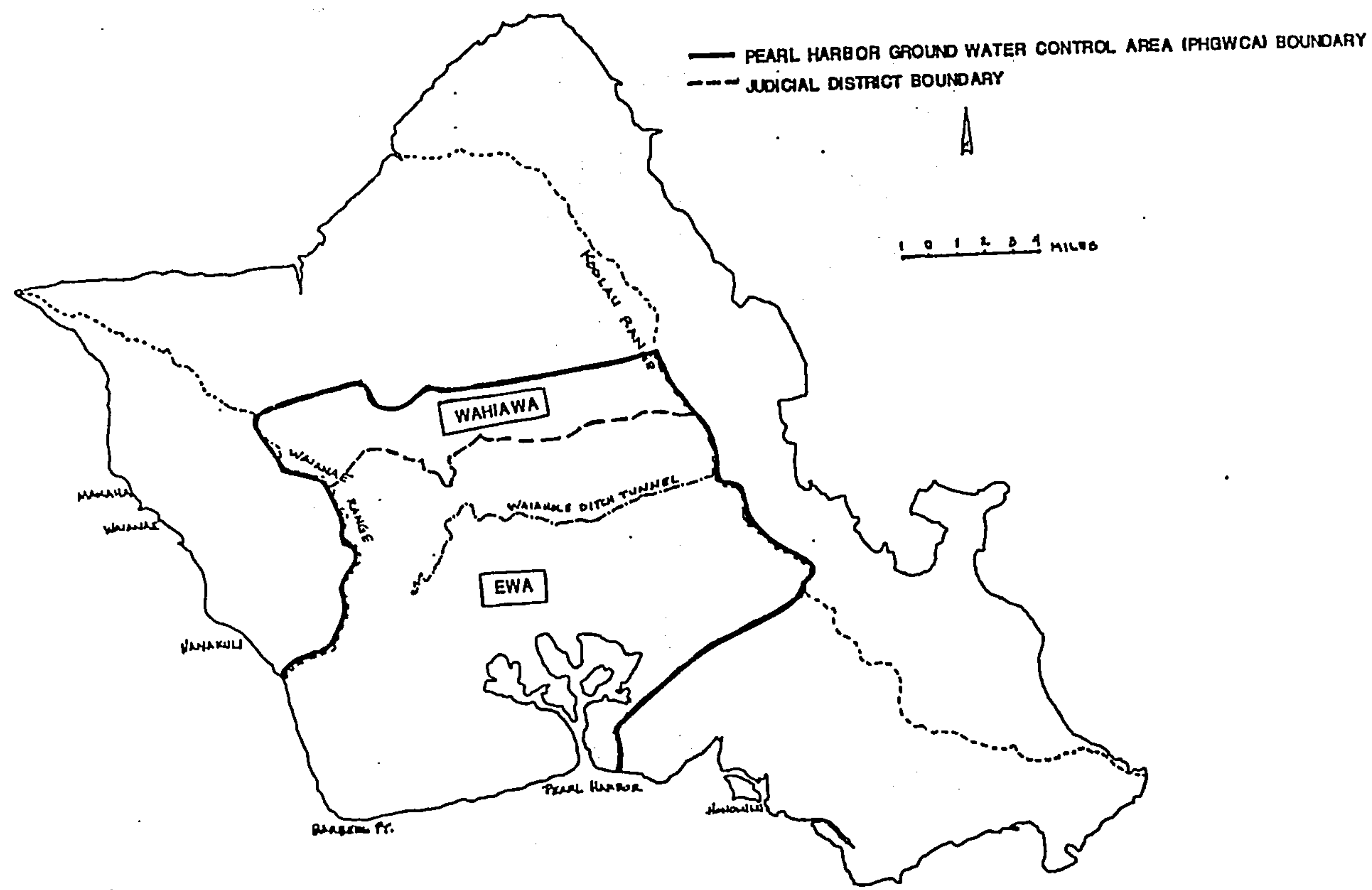
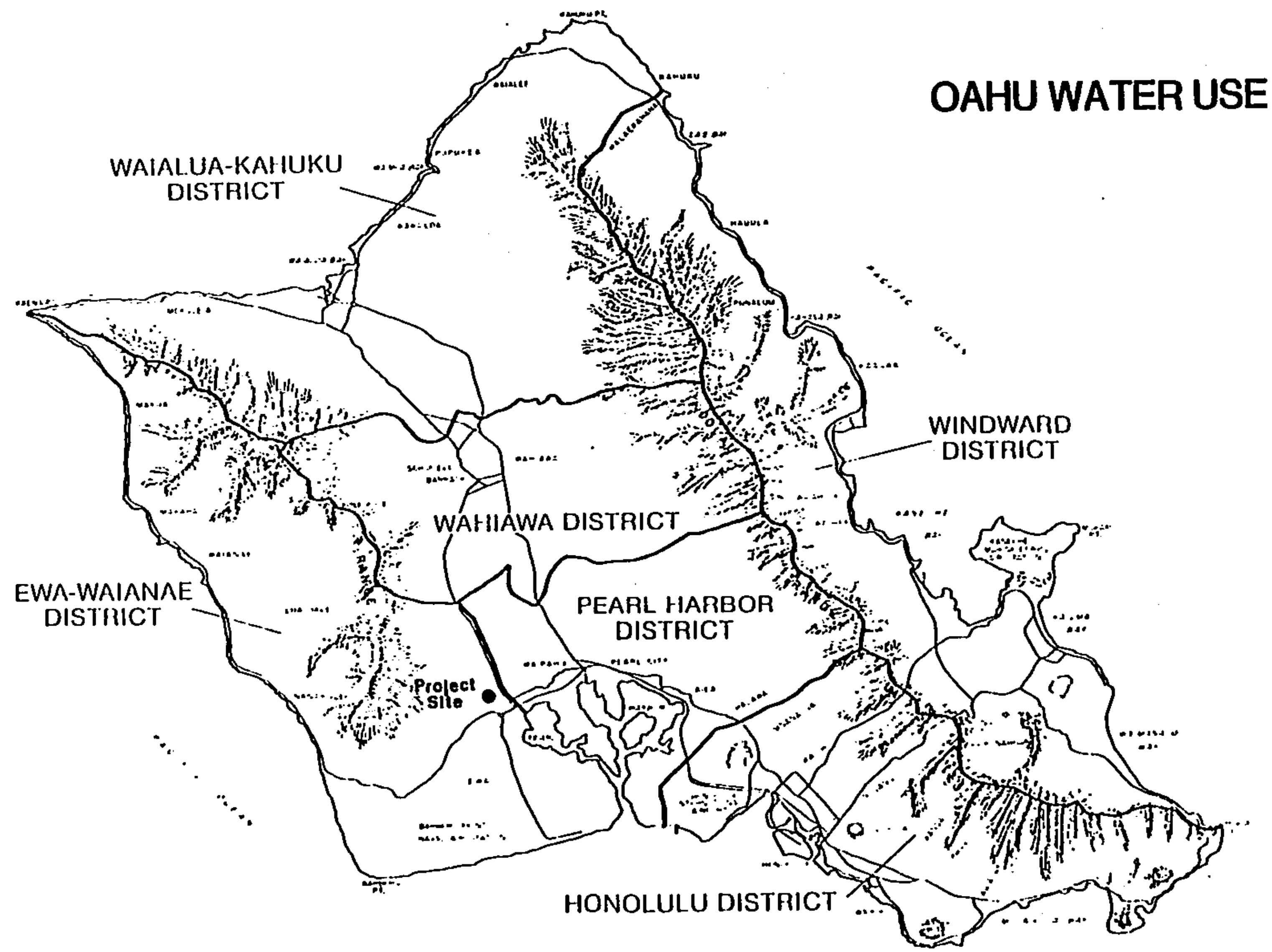


FIGURE 1-4
JUDICIAL DISTRICTS IN PHGWCA

OAHU WATER USE DISTRICTS

FIGURE 1-5



SOURCE: OAHU WATER PLAN. 1975.

There are 22 BWS well fields located in the Pearl Harbor Water District with a combined certified capacity of 70.7 mgd. Of this amount 11.90 mgd (12 well fields) serves users within the Pearl Harbor Water District minus Waipahu, 16.3 mgd (3 well fields) is available for export to serve users in the Ewa-Waianae Water District plus Waipahu, and 42.5 mgd (7 well fields) is available to serve users in the Honolulu Water District. The total resident population within the Pearl Harbor Water District was 124,094 as of July, 1978.

The Ewa-Waianae Water District consists of a 120-square mile area in western Oahu. It includes the region west of the Waianae Ridge Crest from Kaena Point to Nanakuli, Ewa and part of Honouliuli up to Kunia Road on the east. The resident population as of April 1, 1970 was 47,545 and had increased to 60,658 by July 1, 1979.

Historically, most of the water demand for the Ewa-Waianae District has been supplied by wells located in the Pearl Harbor Water District, because fresh water resources in the Ewa-Waianae District were formerly considered economically unfeasible for development. This is because the Waianae Coast experiences the lowest rainfall on Oahu, with approximately 20 inches or less per year falling along the coast and 20 to 30 inches per year falling in the valleys and on the intervening ridges.

The present maximum capacity of existing BWS sources serving the leeward region (Ewa-Waianae District plus Waipahu) is 41.62 mgd. However, since sources within the Pearl Harbor Water District also fall within the PHGWCA, the State has certified pumpage rates which the BWS must not exceed. This has resulted in an actual pumpage limit of 16.30 mgd. Table 1-1 presents a breakdown of maximum capacities by Water District and source, with State pumpage limits for the Pearl Harbor sources also shown.

The BWS is proposing development of additional water sources in the Ewa-Waianae Water District. These include: (1) eight 1-mgd capacity wells in Makaha Valley; and (2) two 1-mgd capacity wells in Waianae Valley. These sources, however, will only be sufficient for the Ewa-Waianae Water District northwest of Makakilo City. The proposed project is proposed to serve the needs of Makakilo City and developments proposed for the Ewa Plain.

B. Existing Transmission System

The existing transmission system consists of the following lines and line boosters [1.1]:

TABLE 1-1

DESIGN CAPACITIES OF WATER SOURCES SERVING THE LEEWARD REGION VERSUS STATE PUMPAGE LIMITS

Ewa-Waianae Water District Sources	Maximum Capacity	Operational Capacity
Waianae Tunnel	2.00 mgd	
Kamaile Wells	1.00	
Waianae Plantation System	0.70	
Makaha Shaft	1.44	
Makaha Well	1.00	
Subtotal:	6.14 mgd	4.61 mgd

Pearl Harbor Water District Sources Serving Ewa-Waianae Water District	Maximum Capacity	Average Pumpage*
Hoaeae Wells	14.44 mgd	6.61 mgd
Kunia Wells I	10.08	4.81
Waipahu Wells	10.96	4.88
Subtotal:	35.48 mgd	16.30 mgd
TOTAL:	41.62 mgd	20.91 mgd

* These figures are the State average allowed pumpages per day; however, they are below the operational capacity of these wells.

Source: [1.1], [1.2]

Water is transported from Hoaeae Wells to Barbers Point 215 Reservoir through a 30-inch main along Farrington Highway. Refer to Figure 1-6. Water from Kunia Wells I is pumped through a 20-inch main along Kunia Road which connects to the 30-inch main at Waipahu Street. Between Fort Weaver Road and Campbell Industrial Park, three transmission mains branch off the 30-inch main: a 16-inch main running down Fort Weaver road to feed Ewa; a 16-inch main going up Makakilo Drive to feed Makakilo via booster pumps; and a 20-inch main running down Kalaeloa Boulevard to Campbell Industrial Park. Beyond Campbell Industrial Park, water is boosted from the Barbers Point reservoir to a 24-inch main along Farrington Highway to Lualualei 242 Reservoir. From Lualualei Reservoir, the transmission main connects to a 20-inch main running down Hakimo, Paakea, Mailiilii, and Lualualei Homestead Road to the Waianae 242 Reservoir.

Beyond Lualualei Homestead Road, the 20-inch main reduces to a 16-inch main along Farrington Highway to Kaulawaha Road in Waianae. From Kaulawaha Road, 24 and 8-inch mains run parallel along Farrington Highway to Water Street in Makaha.

Makaha Shaft and Makaha Well, with help from Makaha Booster Station, serve upper Makaha Valley

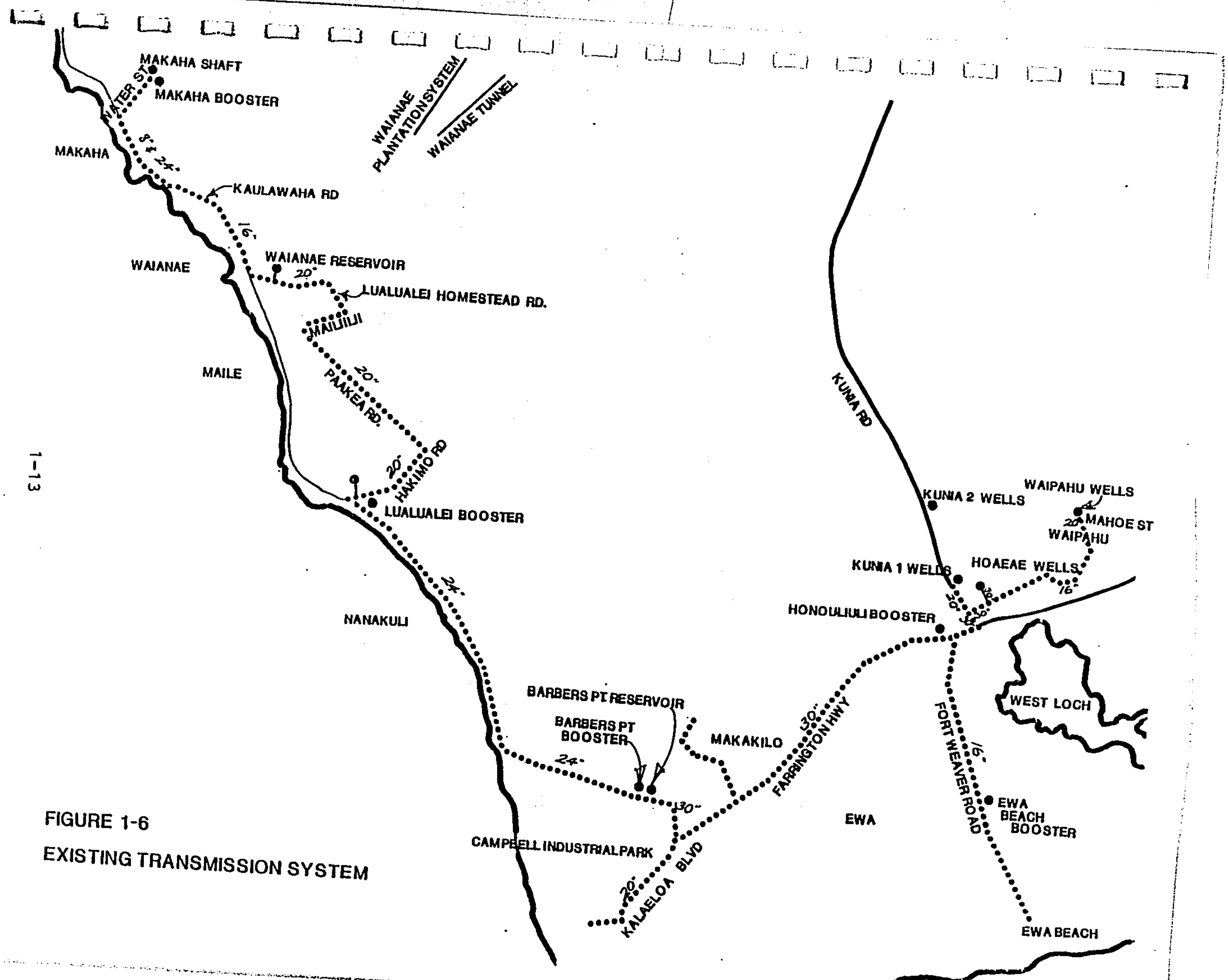


FIGURE 1-6

EXISTING TRANSMISSION SYSTEM

and portions of Makaha town. Waianae Tunnel and Plantation System serve upper Lualualei and Waianae Valleys and, through a pressure regulator, portions of Waianae town.

Kunia Wells II serve homes above the 128-foot elevation and will serve Village Park subdivision in the future. Waipahu Wells, Hoaeae Wells, and Kunia Wells I serve Waipahu and Ewa-Waianae District.

Heavy demands on the existing system necessitated the installation of line boosters to increase carrying capacity and maintain line pressures. The Honouliuli, Lualualei and Barbers Point line boosters help to move water westward, while the Ewa Beach booster increases flow to Ewa.

C. Existing and Projected Water Demand

Average water pumpage rates (demand) of BWS sources within the Pearl Harbor Water District over the last five years are presented in Table 1-2. Sources serving the Ewa-Waianae Water District plus Waipahu total 16.82 mgd.

Average demand of BWS sources within the Ewa-Waianae Water District over the last five years totalled 100.52 mgd, for a total average demand of 20.104 mgd within the Ewa-Waianae Water District plus Waipahu.

TABLE 1-2

BWS SOURCES WITHIN THE PEARL HARBOR WATER DISTRICT

A. SERVING THE EWA-WAIANAE WATER DISTRICT PLUS WAIPAHU

Mean Pumpage 1975-1979 (mgd)			DLNR Preserved Use (mgd)
5.55	Kunia Wells I		4.81
6.83	Hoaeae Wells		6.61
4.44	Waipahu Wells		4.88
16.82 ST		ST	16.30

B. SERVING HONOLULU WATER DISTRICT

0.85	Kaahumanu Wells		1.11
12.82	Punanani Wells		11.97
.27	Waimalu Wells II		0.30
1.17	Kaonohi Wells II		1.10
10.93	Kalauao Wells		11.75
1.97	Kaamilo Wells		1.99
12.48	Halawa Shaft		14.28
40.49 ST		ST	42.50

C. SERVING THE PEARL HARBOR WATER DISTRICT MINUS WAIPAHU

.29	Kunia Wells II		0.96
.59	Waipio Heights Wells		0.63
1.23	Pearl City Shaft		1.32
.38	Pearl City Wells I		0.31
2.12	Pearl City Wells II		2.19
0.93	Waiau Wells		1.44
.39	Newtown Wells		1.05
.08	Waimalu Wells I		0.08
1.19	Kaonohi Wells I		1.10
1.01	Aiea Wells		1.03
.68	Aiea Gulch Wells		0.79
1.07	Halawa Wells		1.00
9.96 ST		ST	11.90
70.35 TOTAL		TOTAL	70.70

SOURCE: [1.2]

Projected water requirements for the leeward region are presented in Table 1-3. Table 1-4 breaks these down by area within the region. The requirements are based on population projections that are, in turn, based on the following:

1. The resident population of the leeward area, consisting of Census Tracts 83 to 88, inclusive, 96, 97, 98 and 89.01.
2. The DPED (Department of Planning and Economic Development) Series II-F Population Projection for the present to the year 2000.

Table 1-3 shows that by 1995, demand will equal the present maximum capacity of the BWS sources (based on design capacities and State pumpage limits) serving the leeward region.

The conclusion, then, is that new sources of water must be developed to service the Ewa-Waianae District plus Waipahu to accommodate growth projected by the State DPED and the General Plan of the City and County of Honolulu.

IV. PROPOSED PROJECT

To meet the requirements discussed in previous sections, several strategies have been proposed. They include: the development of new sources of water (Makaha Wells, Waianae Wells and Honouliuli Wells); a water exchange

TABLE 1-3

TOTAL POPULATION AND WATER DEMAND PROJECTIONS

FOR THE LEEWARD REGION(1)

Year	Total Resid. Population Jan. 1	Population Served - BWS	Population Served - Priv.	Source-Input BWS (mgd)
1978	86,600	73,600	13,000	19.30
1979	89,300	76,300	13,000	20.20
1980	92,700	79,600	13,100	20.90
1985	110,000	96,700	13,300	25.40
1990	127,000	113,800	13,200	30.30
1995-96	149,600	136,600	13,200	37.60
2000-01	168,400	155,400	13,000	43.20

(1) Leeward region refers to the Ewa-Waianae Water District plus Waipahu.

Source: [1.1] (Revised by II-F projections)

TABLE 1-4

POPULATION AND WATER DEMAND PROJECTIONS FOR THE LEEWARD REGION BY AREA

YEAR	WAIANAE RESID. POP. JAN. 1	POPULATION SERVED BWS	POPULATION SERVED PRIV.	SOURCE INPUT BWS MGD	EWA RESID. POP. JAN. 1	POPULATION SERVED BWS	POPULATION SERVED PRIV.	SOURCE INPUT BWS MGD	WAIPAHU RESID. POP. JAN. 1	POPULATION SERVED BWS	POPULATION SERVED PRIV.	SOURCE INPUT BWS MGD
1978	28,800	28,200	600	7.63	35,400	23,300	12,100	7.46	22,400	22,100	300	4.20
1979	28,900	28,400	500	7.75	37,600	25,400	12,200	8.20	22,800	22,500	300	4.30
1980	29,100	28,600	500	7.80	40,500	28,200	12,300	8.80	23,100	22,800	300	4.35
1985	29,900	29,600	300	8.20	55,200	42,400	12,800	12.40	24,900	24,700	200	4.80
1990	30,700	30,500	200	8.63	69,600	56,800	12,800	16.40	26,700	26,500	200	5.30
1995	32,600	32,400	200	9.39	88,500	75,700	12,800	22.30	28,500	28,500	200	5.90
2000	35,000	34,800	200	10.28	104,300	91,500	12,800	26.70	29,100	29,100	-0-	6.20

SOURCE: [1.1] (Revised by II-F projections) program between the Board of Water Supply and Oahu Sugar Company; and a demineralization program [1.3]. This environmental impact statement addresses one of the proposals; namely, the development of Honouliuli Wells. The other strategies are more fully explained under "Alternatives" in Section 6.

The 9.0 mgd of water to be developed at Honouliuli would basically serve developments planned for Campbell Industrial Park, Makakilo, and other areas of the Ewa Plain. Although the system serves the entire leeward coast, the Board of Water Supply (BWS) has plans for developing additional sources in the Waianae and Makaha valleys to stabilize or alleviate export from the PHGWCA to these areas.

Initially, two 2.0 mgd wells will be developed with an installed capacity of 4.0 mgd and an operating capacity of 3.0 mgd. These will alternate pumpage on a daily or weekly basis. On any given day/week one well will be pumping the maximum of 2 mgd and the other will be pumping up to 1 mgd, resulting in the operating capacity of 3 mgd. The next day/week the roles will reverse, so that neither pump is operating full time every day/week. Weekly cycle operations are successfully being used at Kaonohi Wells II (3 wells, each 1.0 mgd).

The surplus amount from the difference between operating capacity and installed capacity is saved for emergencies. Another way to minimize the upconing potential of the well field with respect to the transition zone may also be used; namely, operation of the 2.0 mgd pumps at 1.5 mgd.

The initial two wells will be funded by BWS, Campbell Industrial Park and Makakilo, based on each user's proportionate share of water to be withdrawn. In the future, four more wells will be added, for a total of six wells, with an installed capacity of 12 mgd and operating capacity of 9 mgd. These additional 4 wells will be developed based on water demand and development costs will be paid for by the entity requesting a new well. After development, the cost of maintaining the well(s) and water system would be distributed to all users of the water system.

Before the Board proceeds with the project, arrangements will be made with Oahu Sugar Company for them to cut back an equal amount of ground water pumpage so that net pumpage from the Pearl Harbor aquifer will remain the same. The City will compensate Oahu Sugar for this reduction in pumpage by offering water of lower quality in exchange, on an agreed basis. Such water could theoretically consist of treated sewage effluent, spring water, or surface water. At present, treated sewage effluent is the preferred choice. (Water to mix with the effluent would come from plantation sources). These proposals are discussed in Section 6, pages 6-3 to 6-6.

Oahu Sugar may then use this lower quality water in either drip or furrow irrigation. This water exchange must be approved by the Board of Land and Natural Resources, so that there will be no net increase of pumpage from the Pearl Harbor Groundwater Control Area.

The proposed project is located just within the eastern border of the Ewa-Waianae Water District in the Kunia area, northwest of the town of Waipahu. The wells and control building would be constructed at approximately the 380-foot elevation. A transmission line will connect the wells with the existing Honouliuli Line Booster Station on Farrington Highway west of Waipahu (note Figure 1-2).

The project includes construction of the following:

1. Drilling and casing of six 2 mgd wells having an installed capacity of 12.0 mgd and an operating capacity of 9.0 mgd;
2. Installing a 24-inch transmission line from the wells to the existing Honouliuli Line Booster Station;
3. Installing six pumps, constructing a 3,000-foot access road, constructing a concrete control building to house electrical equipment and appurtenances, and installing a six-foot high security fence around the wells and control building.

Initially, only two wells will be developed; the other four to be developed according to future water demands.

The control building, wells and pumps will be located on a two-acre parcel. Site preparation will involve moderate grading. The building will be approximately 30 feet by 70 feet in floor size and will contain three main rooms. One room will house the electrical control panel, the rate of flow recorder, and the pump controls. The second will contain the chlorine cylinders and the third will be for the chlorinater pumps and appurtenances. Thus, should a chlorine leak occur, protection is provided to the control room and the electrical equipment and controls. The control building will probably be painted and the grounds landscaped.

The wells will be located in a rhomboidal (parallelogram) configuration and spaced approximately 150 feet apart. Refer to Figure 1-7 for a general site layout of the proposed project.

The transmission line will be of cast iron or concrete and buried within the cane haul road, with a minimum cover of three feet to withstand the impact of cane haul trucks or other heavy vehicles.

The proposed alignment follows existing cane roads south of the wells, crosses under the H-1 Freeway, continues

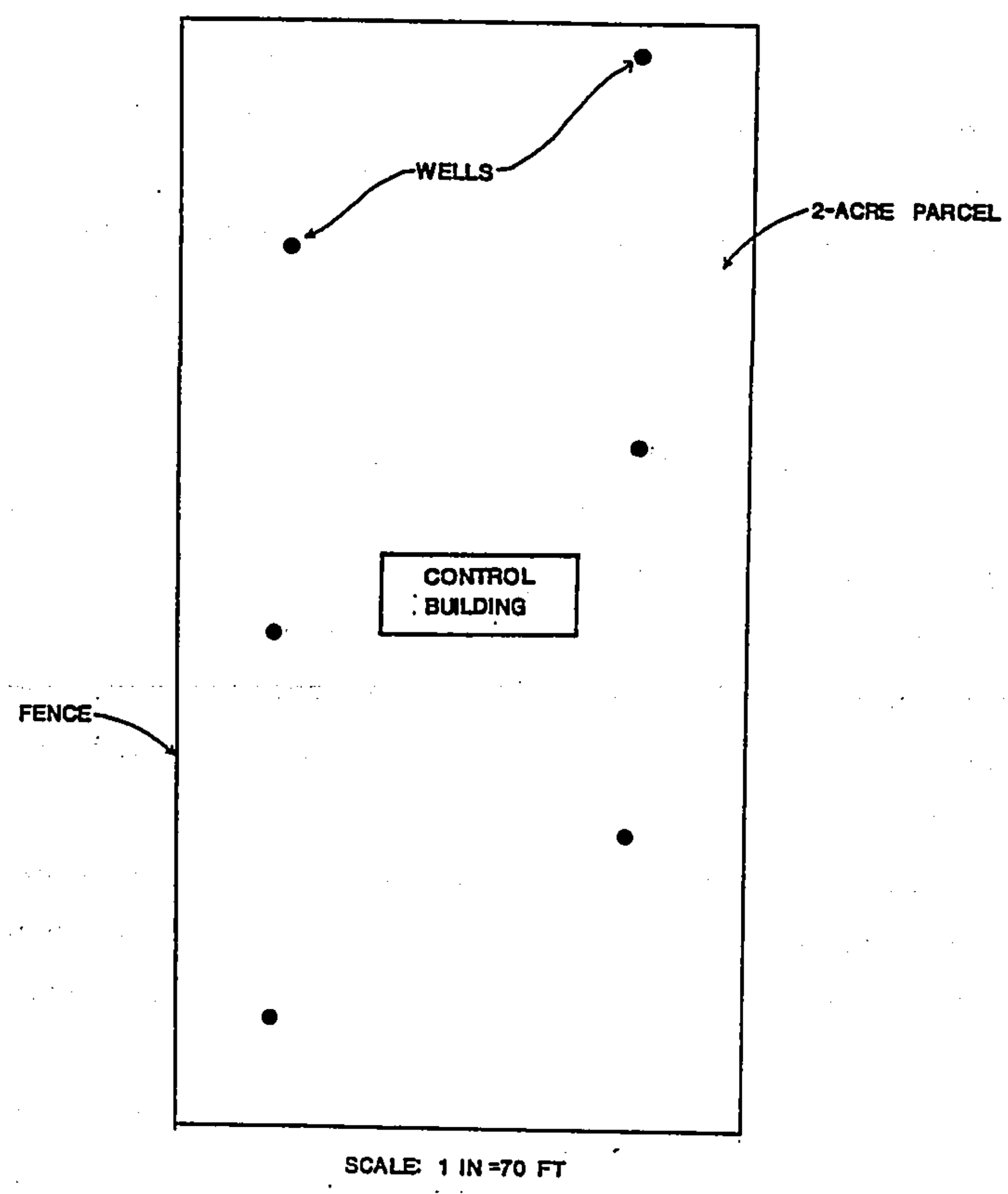


FIGURE 1-7
SITE LAYOUT SCHEMATIC

south to Farrington Highway, and then east to the booster station. This alignment is approximately 6,100 feet (1.2 miles) long.

The well field site was selected after evaluating the potential effects of this new well field on existing wells (Kunia Wells I and II and Oahu Sugar's Ewa Shaft) found in the general vicinity. It is anticipated that this site will have the least hydrologic effect on the existing wells.

V. PHASING AND FUNDING

Initially, two wells would be constructed and other wells phased in as required. Construction will start after a water exchange agreement is settled with Oahu Sugar Company and a permit for the proposed development approved by the State according to DLNR Chapter 166 of Title 13.

After all agreements are settled and permits obtained, drilling of each well will take 6 weeks and construction of the control building and access road would require approximately one year. Approximately 1.5 to 2 years will be required before the water source is operational.

Construction costs of the proposed 6 wells and total facility were estimated at a total of $2,921,000 in 1977 [1.4]. In 1979 prices, the cost is estimated at $3,739,000. The annual operating cost of the proposed project was estimated at $381,200 in 1977. This translates into $129.00 per million gallons produced from the wells.

Since only two wells are planned for initial development and the other four wells are to be developed according to demand, current cost estimates are more applicable to development of the two wells plus necessary appurtenances. Most of the cost will still apply since the transmission line and control station will still be required. Table 1-5 gives a breakdown of construction costs. Funds have not been appropriated to date.

VI. TERMINOLOGY

As previously noted, the proposed wells site is located within the Ewa-Waianae Water District, but will be tapping the Pearl Harbor aquifer. In various hydrologic studies, the Pearl Harbor aquifer is also alternately referred to as the "Pearl Harbor area", or the "Pearl Harbor basin". These terms are defined in Appendix A.

For the purposes of this report, Pearl Harbor aquifer shall refer to the area roughly bounded by the Waianae Range crest on the west, upper Waikele Stream and Waiakalaua Stream on the north, the Koolau Range crest on the east, and South Halawa Stream on the southeast. Refer to Figure 1-8.

Other technical terms are defined in a glossary in Appendix B.

TABLE 1-5

CONSTRUCTION COST ESTIMATE FOR HONOULIULI WELLS[1]

ITEM AND UNIT COST	SUBTOTAL FOR 2 WELLS *	SUBTOTAL FOR ADDITIONAL 4 WELLS	TOTAL FOR 6 WELLS
Pipelines:			
400' of 12" @ $120	$ 48,000	NA	$ 48,000
100' of 16" @ $130	13,000		13,000
200' of 20" @ $140	28,000		28,000
5,400' of 24" @ $150	810,000		810,000
Wells:			
@ $190,000/well	$ 380,000	$ 760,000	$1,140,000
Pumps:			
@ $200,000/pump	$ 400,000	$ 800,000	$1,200,000
Control Station:	$ 500,000	NA	$ 500,000
a) Control building	$ 80,000		
b) Access road	15,000		
c) Mech. & Electrical	200,000		
d) Fencing	26,000		
e) Landscaping	100,000		
f) Site work	80,000		
Total Construction Cost:	$2,179,000	$1,560,000	$3,739,000

1 The associated costs to convey lower quality water to Oahu Sugar Company's fields are not included.
* Estimated cost at 1979 prices.
NA Not applicable because items necessary with initial development of two wells.

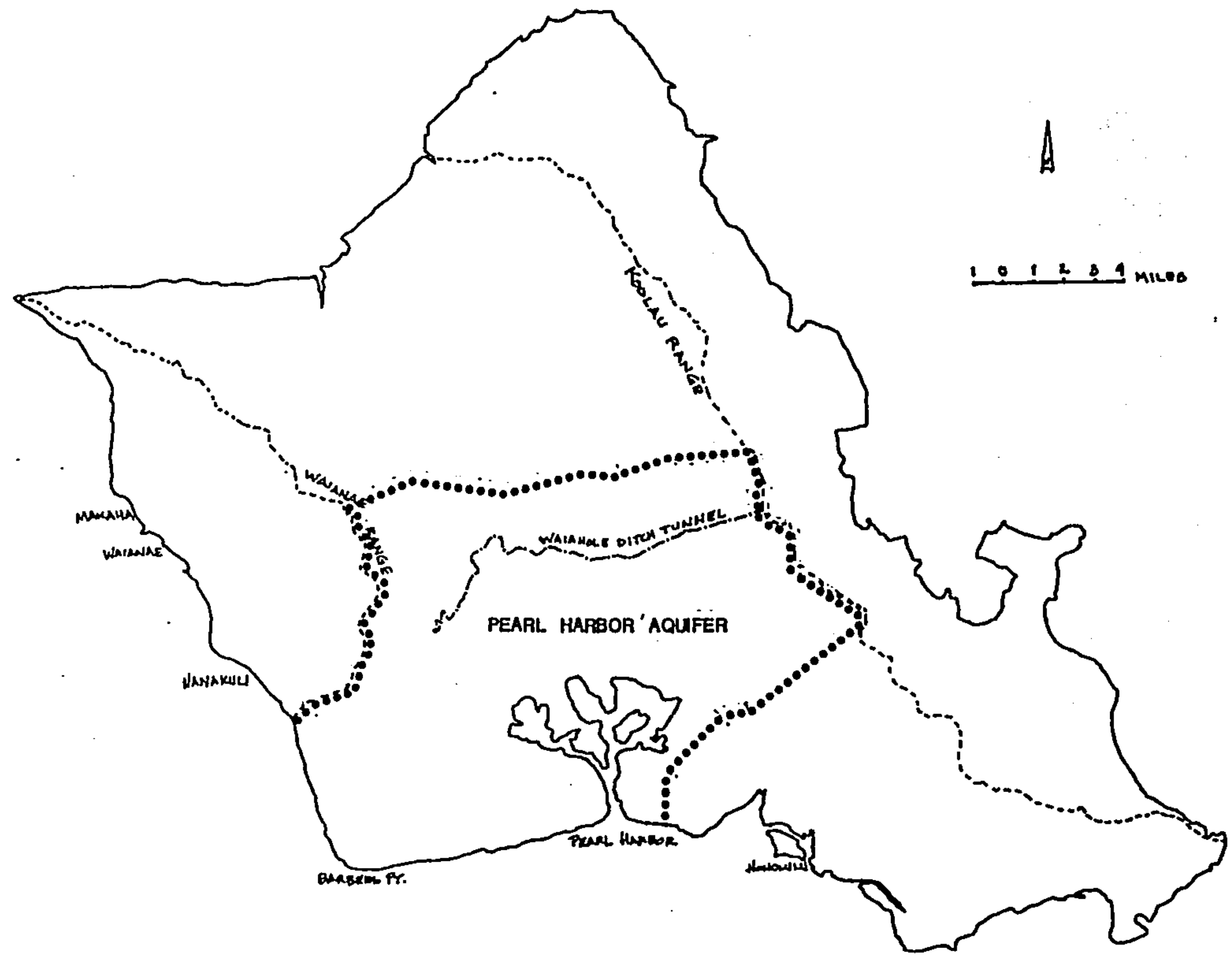


FIGURE 1-8
PEARL HARBOR AQUIFER

REFERENCES

[1.1] Board of Water Supply. 1977. Leeward Oahu Water Supply Study. Prepared by Long-Range Planning Section, Planning and Engineering Division, Board of Water Supply, City and County of Honolulu.

[1.2] State Department of Land and Natural Resources, Division of Water and Land Development. April 11, 1980. Certification of Water Withdrawals and Uses, Pearl Harbor Ground Water Control Area.

[1.3] Board of Water Supply. 1975. Oahu Water Plan. Board of Water Supply, City and County of Honolulu.

[1.4] Op. Cit. [1.1].

Affected Environment

2

SECTION 2

DESCRIPTION OF THE AFFECTED ENVIRONMENT

I. PHYSICAL CHARACTERISTICS

A. Climate

1. Island of Oahu [2.1]

Oahu is the third largest of the Hawaiian Islands and is marked by two important mountain systems. The Koolau Range, at an average elevation of 2,000 feet, forms the northeastern coast. The Waianae Mountains, somewhat higher in elevation, forms the west coast.

The prevailing wind throughout the year is the northeasterly trade wind, although its average frequency varies from more than 90 percent during the summer to only 50 percent in January.

Annual rainfall in the Honolulu area averages 24 inches along the coast but increases to about 35 inches one mile inland and to about 60 to 70 inches two miles inland. Parts of the Koolau Range average 300 inches or more a year. This heavy mountain rainfall sustains extensive irrigation of cane fields and the water supply for Honolulu. East (windward) of the Koolau Range coastal areas receive 30 to 50 inches annually; cane and pineapple fields in central Oahu get about 35 to 40 inches. Oahu is driest along the coast west of the Waianae Range where rainfall averages about 20 inches a year. However, rainfall variations from month-to-month and year-to-year are considerable. More rain occurs islandwide during the winter months than in the summer.

Hawaii's equable temperatures are associated with the small seasonal variation in the amount of energy received from the sun and the tempering effect of the surrounding ocean. The range in temperature averages only 7 degrees between day and night. Daily maximums run from the high 70's in winter to the mid-80's in summer, and daily minimums from the mid-60's to the low 70's.

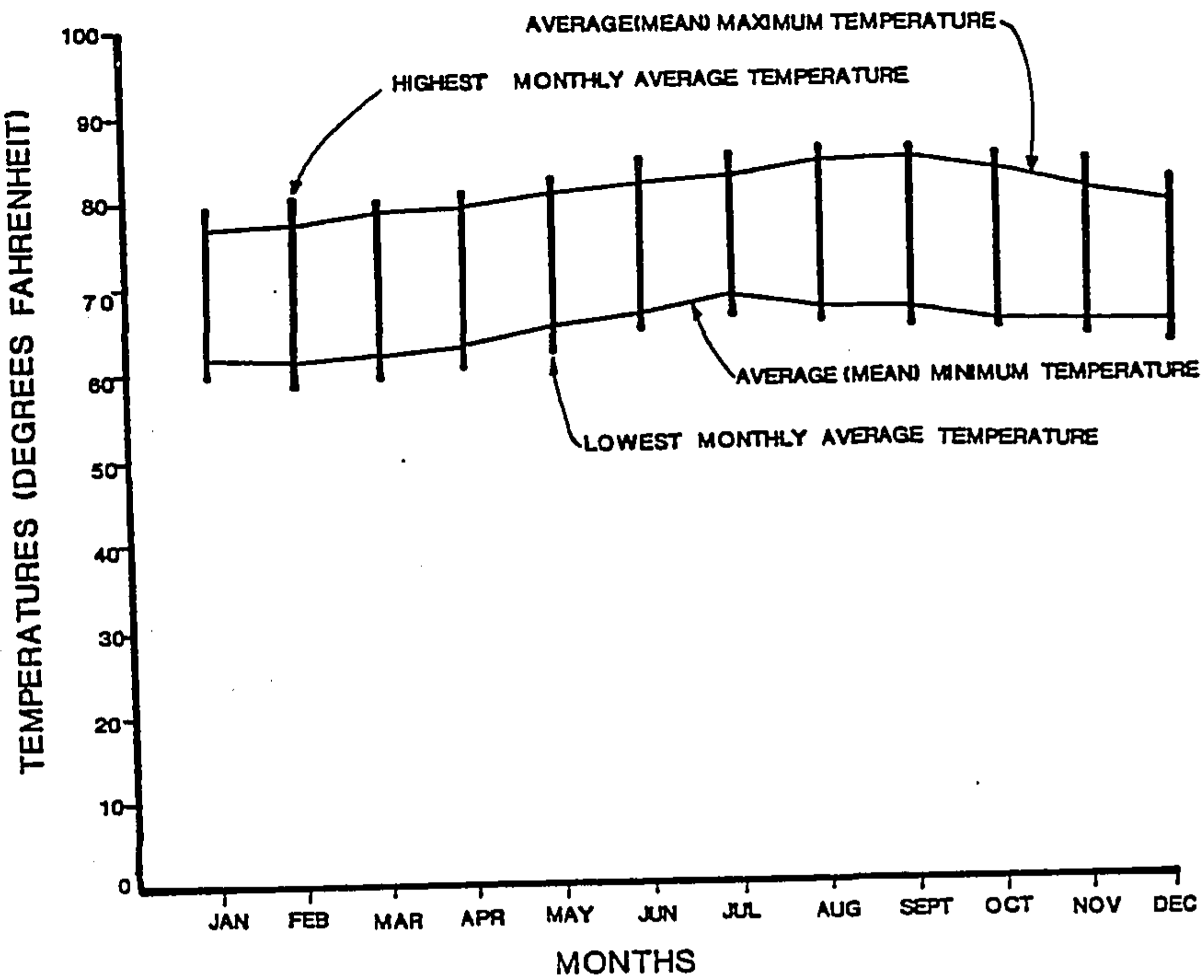
Weather severe enough to interfere with shipping or travel is uncommon. Intense rains during the October to April "winter" season sometimes cause localized flash flooding. Thunderstorms are infrequent and usually mild, as compared with those of the midwestern United States. Only a few tropical cyclones have struck Hawaii since 1950.

2. <u>Kunia Area</u>

The climate in the vicinity of the project site is generally hot and dry. The temperature regime for Kunia Substation 740.4, located at the intersection of Kunia Road and the H-1 Freeway, is depicted in Figure 2-1 [2.2]. Winter temperatures range from the low 60's to the high 70's. Summer temperatures range from the mid 60's to the mid 80's. The coldest months are January and February, with a mean maximum temperature of approximately 77°F and a mean minimum temperature of approximately 60°F. The warmest months are August and September, with a mean maximum temperature of about 84°F and a mean minimum temperature of about 66°F.

During the winter months, tropical storms occasionally buffet the area, bringing with them heavy showers. These showers account for practically all of the rain which falls in the leeward area.

The project site receives approximately 25 inches of rain per year, primarily from November through April. Farther down the slopes, the Ewa Plain normally receives less than 20 inches per year. This is also the case along the Waianae Coast, while the valleys and ridges



TEMPERATURE

KUNIA SUBSTATION 740.4

FIGURE 2-1

Source: Hawaii State Department of Land and Natural Resources, Water and Land Development Division Print Out, statistical summary of minimum and maximum monthly temperatures.

of that area normally receive between 20 to 30 inches. Note Figure 2-2.

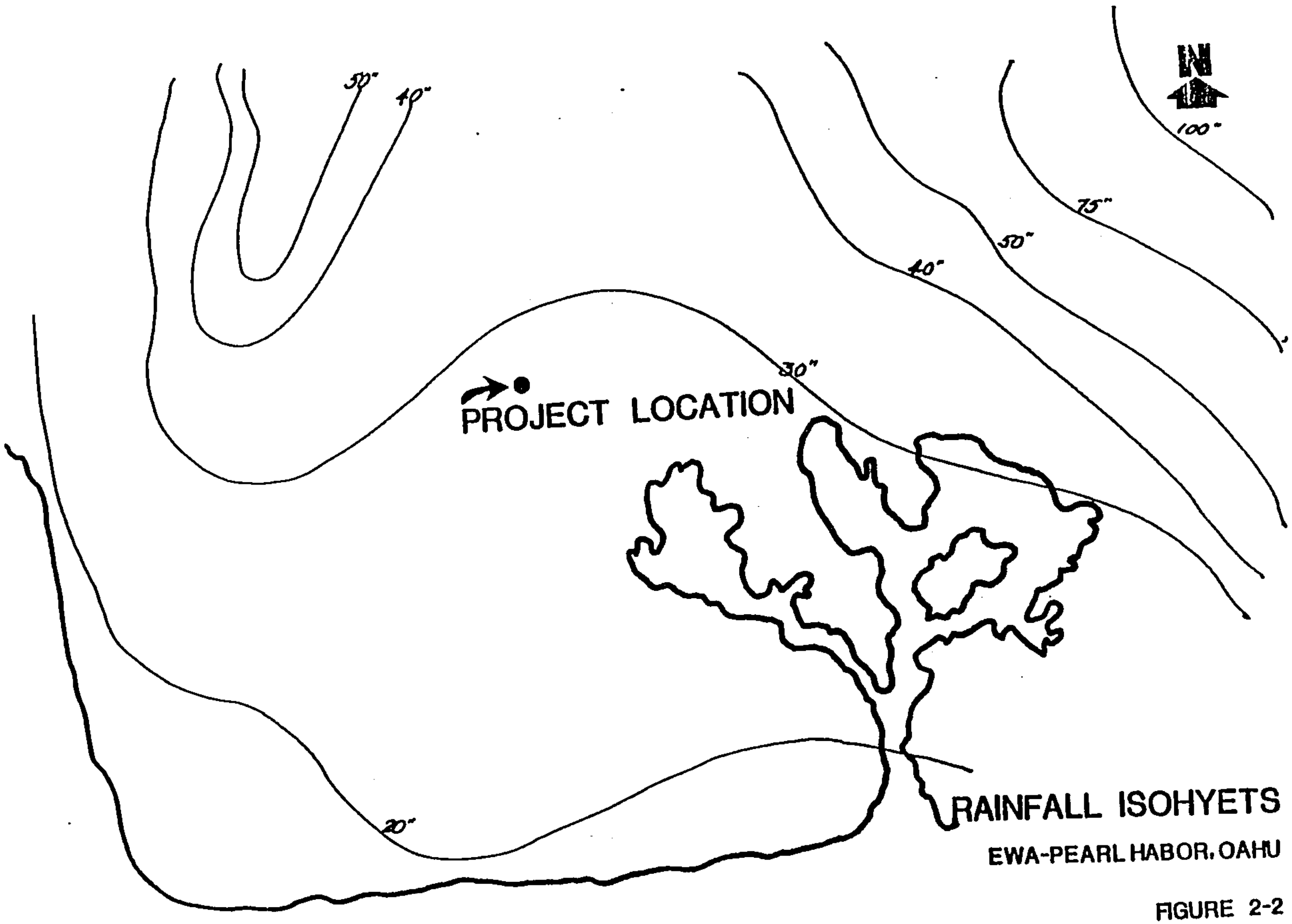
The wind rose for nearby Barbers Point NAS is shown in Figure 2-3. The mean long-term wind speed can be estimated at approximately 8.9 knots, with the most typical wind direction from the northeast for 22% of the time. Other predominant winds come from the north-northeast and the east-northeast, as noted on Figure 2-3.

B. Topography

The project site is located on the lower western slopes of the Koolau Range at an elevation of approximately 380 feet above sea level. Situated on a gentle slope (3.7%), the site is surrounded by fields of cultivated sugar cane and numerous cane haul roads. It is approximately 500 feet west of an unnamed tributary to Honouliuli Stream.

C. Geology [2.3]

The remnants of two shield volcanoes form the island of Oahu. The western part of the island is the eroded Waianae volcano and the eastern part consists of the eroded Koolau volcano. The Waianae shield was greatly eroded before the lavas of the Koolau volcano flowed up against the lower slopes of the Waianae volcano. These events were followed by a long quiet period during which deposition of sediments

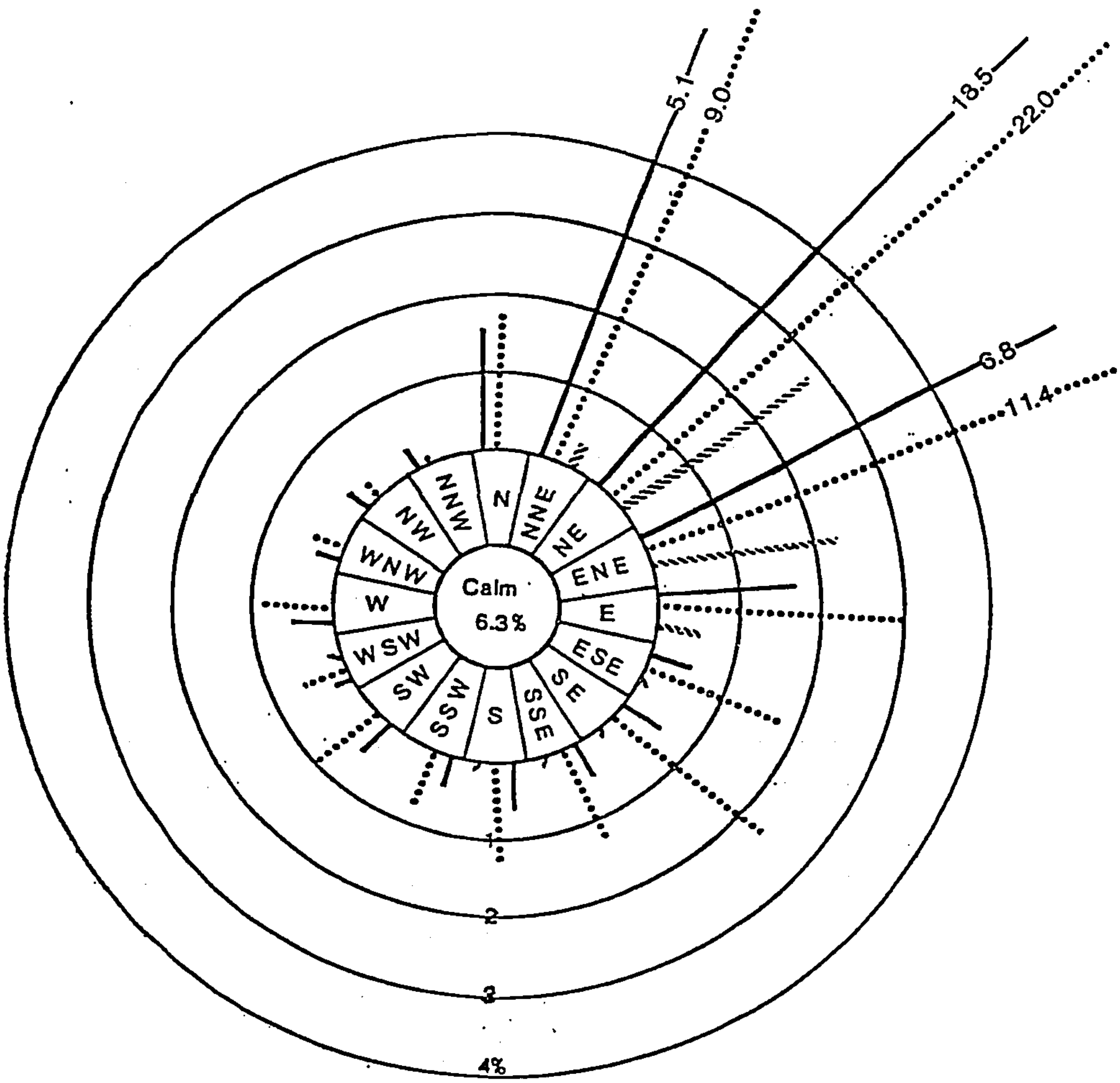


RAINFALL ISOHYETS

EWA-PEARL HABOR, OAHU

FIGURE 2-2

SOURCE: OAHU WATER PLAN, 1963.



LEGEND: KNOTS

1-6

7-16

MORE THAN 16

WIND ROSE

BARBERS POINT NAS

FIGURE 2-3

and changes in sea level (with the resulting reefs) contributed to the building of a flat coastal plain.

The project site is underlain by the Koolau Volcanic Series. This series is primarily composed of tholeiitic basalts. Below this, separated by a geologic unconformity, is the Waianae Volcanic Series, also primarily composed of tholeiitic basalts with some andesitic basalts (hawaiites) in the upper layers. The Waianae Volcanic Series is the older of the two.

Where the two lava series meet, an erosional unconformity exists, marked by the presence of a buried soil bed that had formed on Waianae rocks and was later covered by the Koolau lavas. This unconformity delineates the boundary of the Koolau and Waianae aquifers. While hydraulic continuity exists between these two aquifers, immediately west of the unconformity in the Waianae aquifer, the head drop has been estimated at two to two-and-a-half feet. The proposed project is located east of the unconformity in the Koolau aquifer. Note Figure 2-4.

Further to the south, both of these series are covered by caprock made up of marine sediments and alluvium. These sediments constitute the Ewa

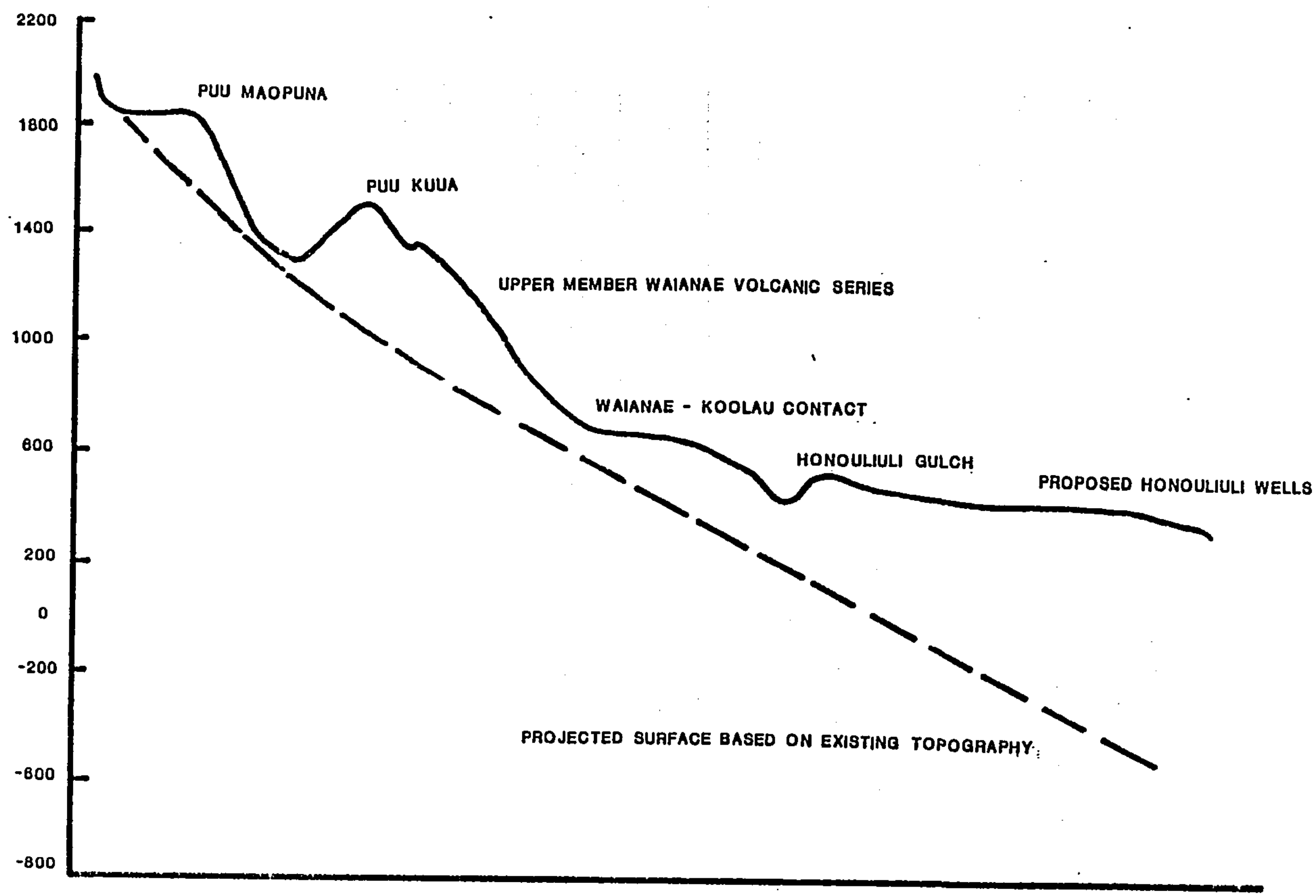


FIGURE 2-4

GENERALIZED CROSS SECTION

SOUR E: BOARD OF WATER SUPPLY

plain and are less permeable than basaltic lavas. The caprock extends seaward from the vicinity of Farrington Highway.

To the west and south of the project site, along the lower southeastern slope of the Waianae Range, is a row of five very late cones (upper member of Waianae Volcanic Series): Puu Kuua, Puu Kapuai, Puu Makakilo, Puu Palailai, and Puu Kapolei. They are composed of a mixture of cinder, spatter and lava flows.

D. Hydrology

1. Surface Water [2.4]

Two major streams drain the vicinity of the project area, Honouliuli Stream and Waikele Stream. Located approximately 0.9 miles west of the project site, Honouliuli Stream is an intermittent stream flowing after periods of heavy rainfall. It empties into the West Loch of Pearl Harbor.

The U.S. Geological Survey (USGS) maintains a gaging station for Honouliuli Stream at a bridge on Farrington Highway 1.8 miles west of Waipahu Post Office. There, a crest-stage gage measures storm flow from an 11.0 square mile drainage area. The annual maximum instantaneous peak discharge for a given day in recent years is as follows:

1975	1,460 cfs
1976	1,990 cfs
1977	207 cfs

A tributary of Honouliuli Stream flows south approximately 500 feet east of the project site. It is dry most of the year.

Waikele Stream, located approximately 1.8 miles east of the project site, is a perennial stream which also empties into West Loch of Pearl Harbor. The USGS maintains a gaging and water quality station on the stream, 300 feet upstream from a bridge on Highway 90 and 0.3 miles southwest of the sugar refinery at Waipahu. It measures flow from a 45.7 square mile drainage area.

The annual average daily flow for a 24-year period (water years 1953 to 1959 and 1961 to 1977) was 38.5 cfs. For water year 1977 (October 1976 through September 1977), the daily flow was considerably less, averaging 20.2 cfs.

The Honouliuli Wells site and most of the proposed transmission alignment are not situated in any known flood-prone area. According to the Flood Insurance Study for Oahu by the Federal Insurance Administration, the area is classified Zone D, or area of undetermined but possible flood hazards. A portion of the alignment is outside the limits of, but within the vicinity of Honouliuli Stream floodplain, and is designated Zone C, or area of minimal flooding. A Department of the Army permit is not required for this project.

2. Ground Water

The ground water beneath the site is part of the great basal aquifer underlying southern Oahu and commonly referred to as the Pearl Harbor aquifer. The Pearl Harbor aquifer is bounded on the south by the caprock of the Ewa Plain. The western boundary is abruptly terminated along a line passing up Makaiwa Gulch to the southern Waianae rift zone. Its northern boundary is the structural feature that impounds the Schofield high-level water body. Its eastern boundary is the rift zone of the Koolau range.

The basal ground water, basically consists of three layers: (1) upper fresh water layer; (2) middle transition zone of brackish water; and (3) bottom salt water layer. The upper layer contains fresh water for domestic use. The water table, is about 15 feet above sea level in the immediate vicinity of the project site. The fresh water extends down to depths in excess of 400 feet below sea level. Within the uppermost portion of this fresh water layer is return irrigation water, extending down from 50 to 200 feet in thickness. This water, although mineralized, is suitable for domestic use.

The upper fresh water layer is contained within the Koolau Volcanic Series. The caprock of the Ewa Plains retards the natural seaward movement of the ground water, causing the water to stand at a higher level in the aquifer than it would if the caprock barrier were absent [2.5].

Below the fresh water basal aquifer is a transition zone of brackish water. Brackish water is also found within the caprock.

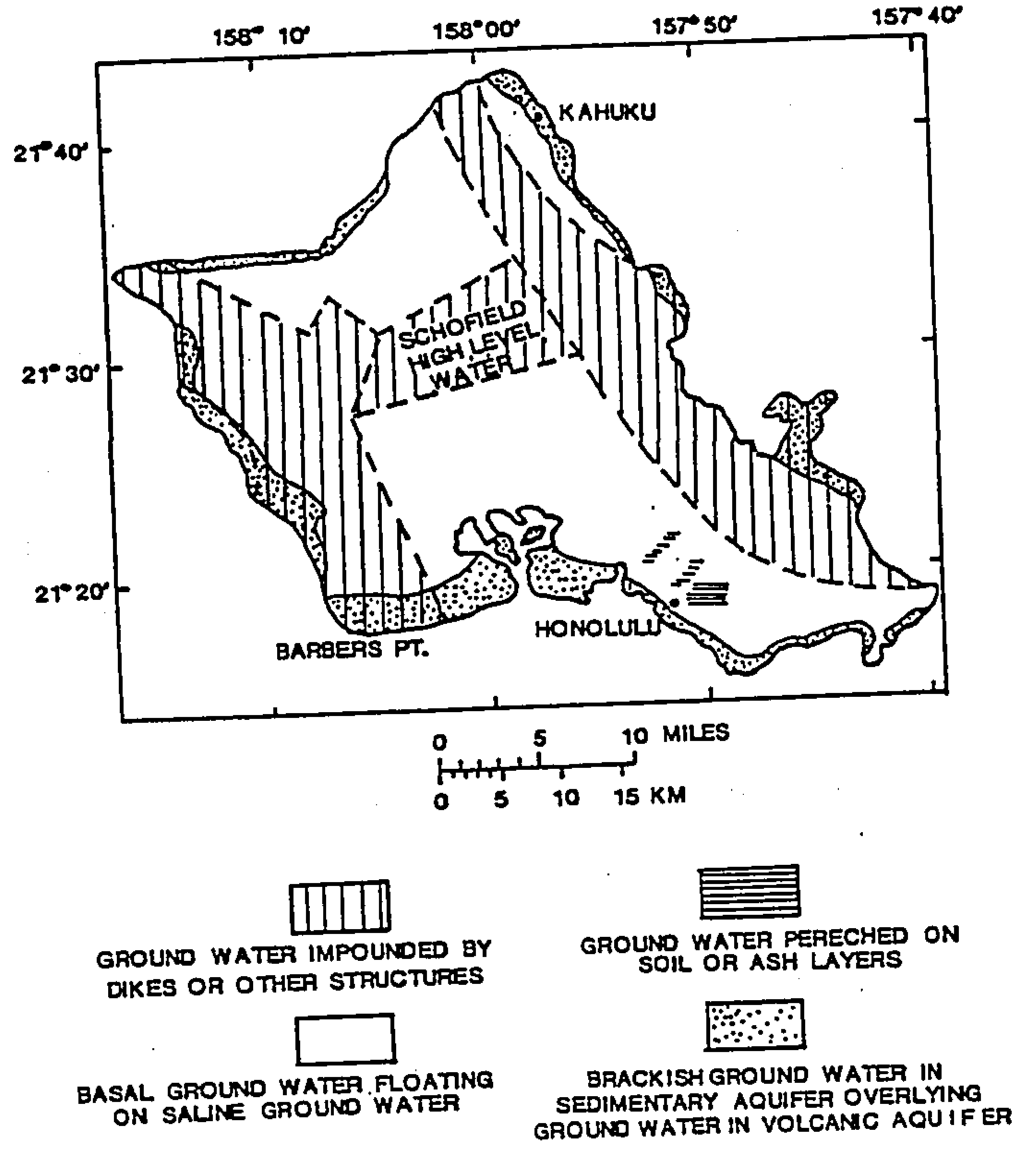
In general, the capacity of the caprock to store and transmit water is small, compared to that of the volcanic series. In the Ewa region, however, furrow irrigation returns large quantities of water into the caprock aquifer. Because of its generally poor quality, the brackish caprock water is used only for agricultural and industrial purposes. In Honolulu, small quantities of caprock water have been developed for air conditioning use [2.6].

Below the brackish water transition zone is a salt water aquifer which extends to an unknown depth below sea level [2.7].

The fresh basal ground water floats on the salt water as a lens-shaped body, because the specific gravity of fresh water is slightly less than that of sea water. The basal ground water occurs in an essentially continuous lens throughout southern Oahu [2.8]. See Figure 2-5. However, the thickness of the lens varies throughout the region, as determined by local heads and artesian areas. Refer to Appendix A for further discussion.

Rainfall is the principal source of fresh basal water on Oahu, supplemented by return irrigation water in this area. In the Pearl Harbor aquifer the head, or elevation of the basal water table, currently reaches a maximum of 25 feet above sea level inland and decreases to about 14 feet near the coast. (Drawdown or discharge heads near the Pearl Harbor springs are about 11 feet).

The lens is a dynamic system through which fresh water moves from areas of recharge (above the 60-inch isohyet - Figure 2-2) to points or zones of discharge (usually along the shore).



GROUND WATER AREAS
OAHU

Figure 2-5

SOURCE: USGS.1977.ELEMENTS NEEDED IN DESIGN OF A GROUND-WATER-QUALITY MONITORING NETWORK IN THE HAWAIIAN ISLANDS. PAPER 2041.

In an aquifer of a given uniform permeability, under natural conditions the thickness of the fresh water lens varies with the amount of water moving through it; that is, the thickness increases as the rate of recharge increases, and vice versa.

Water can be obtained from the basal lens by sinking wells into it. Many of the biggest wells in Hawaii are termed "Maui-type" wells (first used on the island of Maui), consisting of a shaft leading from the ground surface to a narrow, horizontal tunnel in the upper part of the basal lens. The present trend, however, is to drill several vertical wells penetrating only to the uppermost part of the water body, instead of the more costly shaft and tunnel of the Maui-type wells.

Honouliuli Wells will follow the present trend. Examples of this method within the vicinity of the project site are the Hoaeae Wells, Kunia Wells I and Kunia Wells II.

Seasonal changes in the thickness of the lens caused by fluctuations in recharge, pumping from wells and the action of the tides keeps the fresh water-salt water interface (transition zone. Where this brackish water is applied to rate of water pumped from wells must be regulated so that it does not exceed the fresh water recharge of the basal lens, for if it does, salt and brackish water will intrude into the lens, lowering its quality for domestic use.

Artificial discharge from the lens, such as pumping from a well, reduces the amount of water that moves to the shore. This results in a thinning of the lens between the well and the shore, with a thickening of the transition zone towards the coast and a thinning inland, if the rate of withdrawal is constant. If withdrawal is intermittent, the resulting alternate thickening and thinning of the lens will increase the rate of mixing and cause the transition zone to thicken throughout the area influenced by the well. For further discussion, refer to Appendix A. This interception of fresh water by a well may cause increases in salinity of water pumped from other wells seaward of the well.

Pumping in the Pearl Harbor aquifer has an additional effect on the salinity of the basal water because of the use of irrigation water drawn from wells penetrating into the transition sugar cane fields overlying the basal water table, a large part of it moves down to the water table, adding water of relatively high salinity into the fresh water lens [2.9].

In addition to the caprock barrier recharge of excess irrigation water to the basal water body is important in maintaining a high head throughout the area.

By necessity, sugar cane, which covers much of the tillable portion of the region, is heavily irrigated because the soils are highly permeable. Approximately half of the irrigation water applied by the furrow method returns to the aquifer through percolation below the root zone of the plants [2.10].

Agriculture pumpage in the Pearl Harbor aquifer is heavy from about April to October each year during the sugar cane irrigation period. The draft decreases by about 75% during the wet months of October to March, when sugar cane is not irrigated [2.11]. Pumpage for domestic use also undergoes an annual fluctuation, with pumpage in the summer months approximately 20% greater than in the winter months.

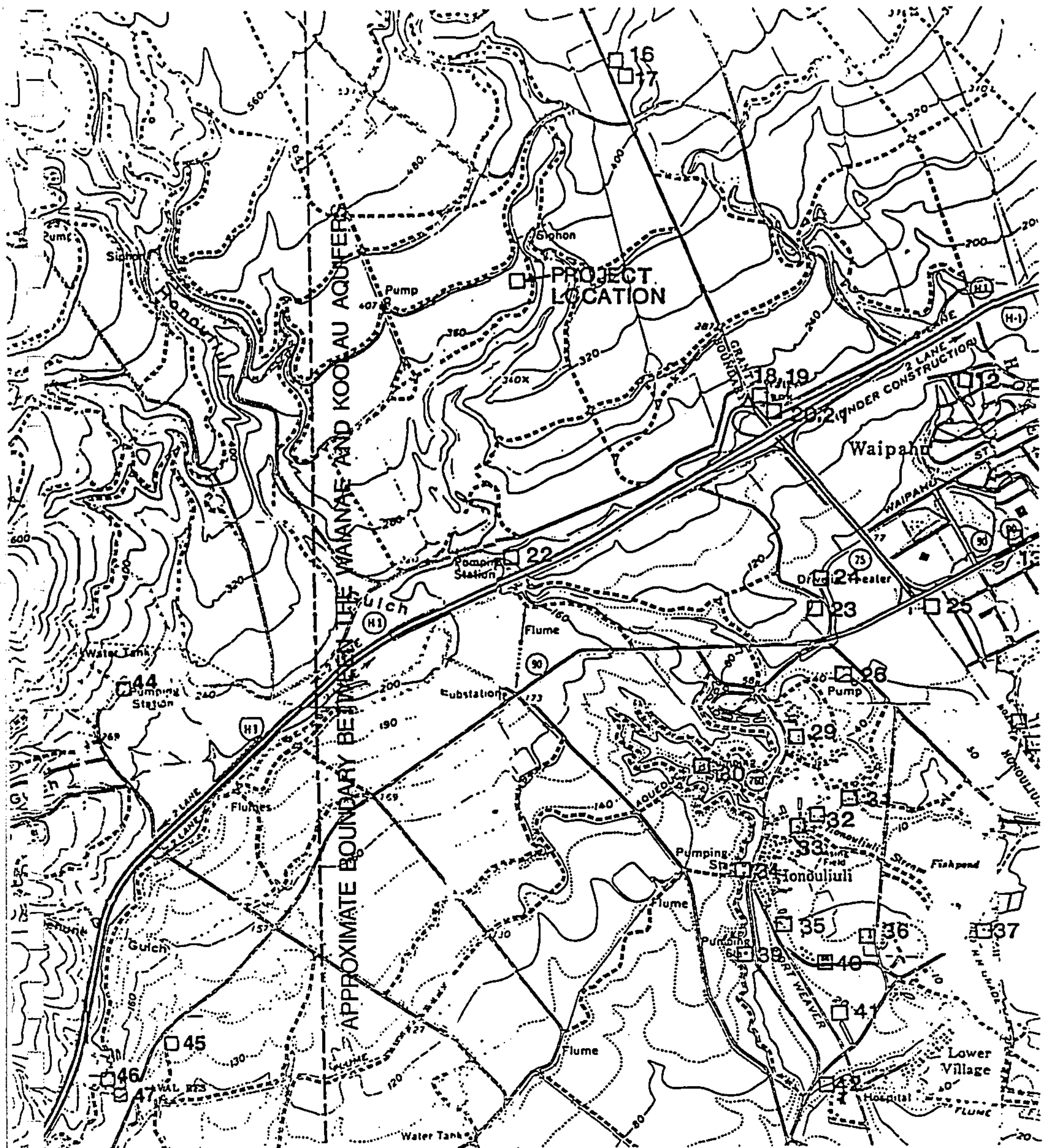
From about 1919 to 1960, pumpage in the Pearl Harbor aquifer averaged 160 mgd, most of which was used to irrigate sugar cane fields. (Natural spring flow averaged 85 mgd). A lowering of the head and shrinking of the fresh water lens initially resulted from this heavy withdrawal, relative to undeveloped conditions, and was accompanied by an inland movement and a thickening of the transition zone near the coast. Most of this change occurred before 1925.

Thereafter, an equilibrium was attained, with total discharge (natural and artificial) averaging 280-290 mgd [2.12]. Because the water level in the basal aquifer did not decline rapidly, it was assumed that recharge from both return irrigation water (approximately 45 mgd) and rainfall must have been approximately equal to the discharge. However, new studies indicate that the basal water head in the Pearl Harbor aquifer has been progressively, though slowly, declining [2.13].

Although pumping for agricultural use has decreased since 1931, net ground water discharge has increased with urban development. From the early 1960's to the present time, pumpage has been steadily increasing, so that in 1977 pumpage was approximately 240 mgd and natural spring discharge was approximately 50 mgd.

Artificial discharge from the Pearl Harbor aquifer includes BWS sources, Oahu Sugar sources and military sources. BWS sources account for approximately 70± mgd of the total [2.14]. Figure 2-6 shows developed water sources in the vicinity of the proposed project. Table 2-1 gives data for these sources. For further discussion of pumpage, refer to Appendix A.

A recent State Water Commission Report estimates that the sustainable yield from the Pearl Harbor aquifer ranges from 200 to 245 mgd [2.15]. Further increase in ground water discharge may increase the chloride concentration of water pumped from the wells near the shore of Pearl Harbor unless such increased discharge is balanced by an increased recharge to the basal aquifer. One scheme suggested to accomplish this end was to divert surface flow from the streams in the Pearl Harbor area into recharge areas. This scheme is discussed in Appendix C. Another idea was recently adopted as policy of the Board of Water Supply. This policy requires the



WELLS &SHAFTS

WAIPAHU, KUNIA, HONOULIULI

FIGURE 2-6

SOURCE: DLNR. DIV. OF WATER AND LAND DEVELOPMENT.

TABLE 2-1

WATER SOURCES IN
VICINITY OF HONOULIULI WELLS

Reference Number	DLNR Well No.	Head[4] (ft.)	Chloride (ppm)	Owner	Use[1]	Pumpage MGD
12	2301-34 to 39	17.0	147	BWS, Hoaeae	D	6.83[2]
13	2201-06	18.0	250-350			
16	2402-01	20.6	103	BWS, Kunia II	D	
17	2402-02	24.8	97	BWS, Kunia II	D	.29[2]
18	2302-01	23.8	141	BWS, Kunia I	D	
19	2302-02	22.3	150	BWS, Kunia I	D	
20	2302-03	15.0	104	BWS, Kunia I	D	5.55[2]
21	2302-04	15.0	103	BWS, Kunia I	D	
22	2202-21	24.1	184	Oahu Sugar Co.	I	18.60[2]
23	2201-09	NA	NA	BWS	O	-
24	2201-10	18.4	170	BWS	O	-
25	2201-12	NA	NA			
26	2201-03,04,07	17.6	318	Oahu Sugar Co.	A	2.86[2]
29	2202-01	17.0	280			
30	2202-03 to 14	19.0	383	Oahu Sugar Co.	I	13.02[2]
31	2201-02	16.8	340			
32	2202-02	21.3	183	B. Dumlao	NA	NA
33	2202-22	20.2	190	C. Hokama	D[3]	NA
34	2202-15 to 20	12.0	400	Oahu Sugar Co.	D,A	9.84[2]
35	2102-01	NA	NA			
36	2101-03	14.3	302			
37	2101-13	19.8	185	T. Matsuda	D	0.04
39	2102-02, 04 to 22	17.3	549	Oahu Sugar Co.	A	2.86[2]
40	2101-01	19.8	340	Kahua Meat Co.	NA	0.022[2]
41	2101-04	19.0	NA			
42	2101-05 to 12	16.0	NA			
44	2203-01 to 06	16.8	260	Oahu Sugar Co.	A	NA
45	2103-02	16.9	285	U.S. Navy	O	NA
46	2103-01	16.6	250	U.S. Navy	O	NA
47	2103-03	14.1	258	U.S. Navy	O	NA

1/ D = Domestic
A = Agricultural
I = Industrial
O = Observation well

2/ Ave. 1975-1979.

3/ Also used for piggery.

4/ Heads very due to time of year the measurements are made, and are instantaneous readings.

conversion of sugar cane irrigation water to domestic use whenever sugar cane lands are urbanized, resulting in no net increase in ground water discharge.

E. <u>Water Quality</u>

Water quality data for Honouliuli Stream are unavailable; however, there is an abundance of such data for Waikele Stream. Selected water quality data for years 1975-1977 are presented in Table 2-2.

Waikele Stream is considered as Class 2 waters. The new water quality standards are given in Appendix D. In general, the waters of Waikele Stream exceed the standards for nitrate, phosphorus, turbidity and specific conductance.

Water quality data for the BWS well systems near the proposed site are presented in Tables 2-3 and 2-4. Chloride content is used as an index of the chemical quality of Hawaiian ground waters since most or all of the chloride and dissolved solids in fresh water are derived from sea water. State Safe Drinking Water Regulations require a limit for chloride of 250 ppm for potable water. Tables 2-3 and 2-4 show that the chloride content of water from these wells is presently about one-half, or less, of the required limit. The Safe Drinking Water Act and DOH Chapter 49, Potable Water Systems, are further discussed in Appendix E.

TABLE 2-2

WATER QUALITY DATA, WAIKELE STREAM,

OAHU, HAWAII, WATER YEARS 1975-1977

Parameter	Annual Average (mean) 1975	1976	1977
Dissolved sodium (Na) (mg/l)	47.	45.	60.
Dissolved chloride (Cl) (mg/l)	62.	57.	83.
Dissolved fluoride (F) (mg/l)	.2	.2	.2
Total nitrate & nitrite (N) (mg/l)	2.1	2.4	2.1
Total phosphorus (P) (mg/l)	1.1	1.1	1.8
Dissolved solids (sum of constituents) (mg/l)	223.	206.	280.
Specific conductance (micromhos)	384.	301.	452.
pH (units)	6.9	6.5	6.6
Turbidity (JTU)	25. 1/	174. 2/	10. 3/
Carbon Dioxide (CO_2)(mg/l)	12.	34.	36.
Discharge (cfs)	38.6	40.0	20.2
Fecal coliform (col. per 100 ml)	1623.	3443. 4/	4235.

1/ Range: 2-100 JTU; mode: 18 JTU.
2/ Range: 3-2100 JTU; mode: 7 JTU.
3/ Range: 3-55 JTU; mode: 6 JTU.
4/ Results based on some colony counts outside the acceptable range.

Source: [2.4] and [2.16]

TABLE 2-3

WATER QUALITY DATA, KUNIA AND HOAEAE WELLS, OAHU, HAWAII, FY 1976-77

Source		pH	Parts per million Alkalinity (Ca)	Hardness ($CaCO_3$)	Chloride
Hoaeae Wells	(2301-34)	6.90	77	108	122
	(2301-35)	6.95	77	96	122
	(2301-36)	7.05	80	106	136
	(2301-37)	7.00	78	100	137
	(2301-38)	6.95	70	96	101
	(2301-39)	7.00	72	104	113
Kunia Wells I	(2302-01)	7.00	88	104	135
	(2302-02)	7.00	85	100	119
	(2302-03)	7.00	81	104	108
	(2302-04)	a	a	a	a
Kunia Wells II	(2402-01)	7.10	82	100	97
	(2402-02)	7.20	85	98	92

a Pumps down for maintenance

Source: [2.17]

TABLE 2-4

WATER QUALITY DATA
SELECTED B.W.S. WELLS

Oahu, Hawaii 1968

LOCATION	Waipahu Well 241-1A	Hoaeae Well 256-3A	Kunia Well 256-2A
Year	1968	1968	1968
Date collected	Feb. 28	Feb. 28	Feb. 28
Time collected	1015	0855	0950
Laboratory number	102924	102923	102922
Regional head, feet	23.79	23.35	23.35
Specific conductance micromhos @ 25°C.	485	665	622
pH value	7.35	7.05	7.10
Turbidity (Nephelometric turbidity units)	0	0	0
Color (parts per million)	0	0.5	0
IN PARTS PER MILLION:			
Dissolved oxygen	8.00	7.70	7.80
Free carbon dioxide	5	15	13
Silica	57	71	73
Calcium	8.4	14.4	14
Magnesium	7.9	15.7	16.2
Sodium	73.3	85.9	80
Potassium	2.6	3.8	3.6
Bicarbonate	89	89	107
Sulfate	21	39.3	36.9
Chloride	80	120	103
Fluoride	0.35	0.20	0.25
Nitrate (NO_3)	7.6	9.2	8.4
Phosphate	1.05	.75	.95
Iron > <	0.02	.02	.02
Manganese > <	.02	.02	.02
Copper > . . Less Than . . <	.02	.02	.02
Lead > <	.02	.02	.02
Arsenic > <	.02	.02	.02
Selenium > <	.01	.01	.01
Chromium[a]/> <	.01	.01	.01
Total dissolved solids	348	449	443
Alkalinity	72	72	88
Total hardness	53	100	101

TABLE 2-4 - Continued

WATER QUALITY DATA
SELECTED B.W.S. WELLS

Oahu, Hawaii 1968

LOCATION	Waipahu Well 241-1A	Hoaeae Well 256-3A	Kunia Well 256-2A
IN EQUIVALENTS PER MILLION:			
Calcium (Ca)...........	0.419	0.719	0.699
Magnesium (Mg)..........	.650	1.291	1.332
Sodium (Na)	3.190	3.737	3.482
Potassium (K)	.067	.097	.092
Bicarbonate (HCO_3)........	1.459	1.459	1.754
Sulfate (SO_4)..........	.437	.818	.768
Chloride (Cl)[b/]	2.307	3.419	2.948
Nitrate (NO_3)	.123	.148	.135
TOTALS.............	8.652	11.688	11.210

a/ Hexavalent only.
b/ Includes fluoride and phosphate as PO_4.

Another index of potable water quality is the amount of total dissolved solids (TDS). Proposed EPA secondary standards require a limit of 500 ppm. Table 2-4 illustrates that total dissolved solids in water from these wells is presently within this limit but may be exceeded if transition-zone mixing is increased.

The Waiahole Ditch System transports about 25 mgd from the Waiahole Tunnel on the eastern side of the Koolau Range for irrigation of sugar cane in southwest Oahu. The quality of this water, some of which recharges the basal ground water, is very good, as noted by its chloride content of 11 ppm.

As previously noted, irrigation with brackish water is a source of basal lens degradation. However, the magnitude of degradation is much less than that caused by intrusion of saline water. Irrigation with brackish water has not proven sufficiently detrimental to the basal water quality to prevent domestic, agricultural or industrial uses [2.18]. Slightly brackish water can be used for domestic consumption.

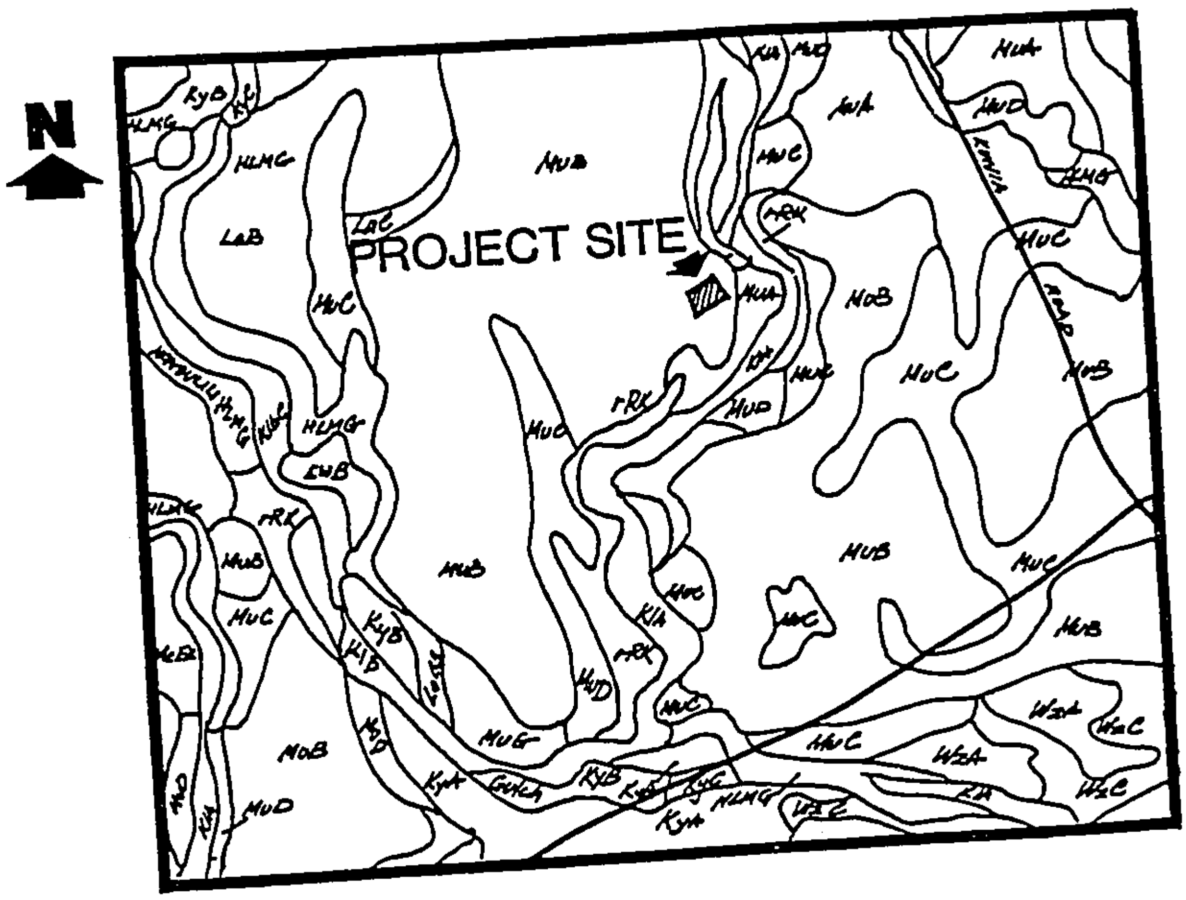
Another source of contamination is from fertilizers used on sugar cane. Agriculturalists have estimated that about 50% of the nitrogen in fertilizers is consumed by the sugar cane. Most of the remainder eventually leaches with percolating water to the water table. Sulfate is also carried to the water table, but phosphate enrichment has not been found in ground water of southern Oahu. Return irrigation water has about 50% more silica. It also has up to 10-20 times the sulfate and 2-3 times the nitrate of unaffected water [2.19]. However, this water is potable.

In general, no overall deterioration of ground water quality has occurred on southern Oahu under the conditions of equilibrium established by long-term patterns of development, use and pumpage of basal water, though local increases in salinity have occurred near the coast [2.20].

F. Soils [2.21]

The soils in the vicinity of the project site are primarily of the Molokai series, with localized areas of Helemano silty clay, rock land, and Kawaihapai clay loam along the streams. Note Figure 2-7.

The soil at the project site is Molokai silty clay loam (MuB), 3-7% slopes. A typical surface layer consists of dark reddish-brown silty clay loam about 15 inches thick. The subsoil is 57 inches thick with a similar profile. The substratum is soft weathered rock. Permeability is moderate, runoff is slow to moderate and the erosion hazard is slight to moderate.



LEGEND

HONOULIULI SITE

MuB - Molokai silty clay loam, 3-7% slopes

ADJACENT SOILS

MuA - Molokai silty clay loam, 0-3% slopes
MuC - Molokai silty clay loam, 7-15% slopes
HLMG - Helemano silty clay, 30-90% slopes
KlA - Kawaihapai clay loam, 0-2% slopes

SOILS
FIGURE 2-7

Adjacent soils include Molokai silty clay loam (MuA), 0-3% slopes and Molokai silty clay loam (MuC), 7-15% slopes. They are very similar to the soil on-site, with the following exceptions: MuA - runoff slow and erosion hazard slight; MuC - runoff medium to rapid and erosion hazard severe. Small areas along the sides of the gulch east of the site consist of Helemano silty clay HLMG, 30-90% slopes. Permeability is moderately rapid, runoff is medium to very rapid, and the erosion hazard is severe to very severe. There are also small areas of Kawaihapai clay loam, 0-2% slopes, along the bottom of the gulch. Permeability is moderate, runoff is slow, and the erosion hazard is slight.

G. Noise

Noise levels were measured with a Bruel and Kjaer Noise Level Sound Meter. The existing ambient noise environment is dominated by the sounds of nature - the wind, birds and rustling vegetation. Noise levels along the existing access road vary from 40 dBA to 43 dBA. During cane harvesting the noise levels are undoubtedly higher.

II. BIOLOGICAL CHARACTERISTICS

A. Flora

The project site falls in Ripperton and Hosaka's

Vegetation zone "B" [2.22]. Kiawe, koa-haole and klu (Acacia farnesiana) are said to grow well in this zone, as well as cactus (Opuntia megacantha) and lantana (Lantana spp.). Both perennial and annual grasses occur. Annual herbs are prominent during and following rainy periods. Sugar cane fields surround the site and the proposed main line alignment.

Appendix F lists the plants observed on and around the site and gives the relative abundance of each. No rare or endangered species of plants were observed on the project site.

B. Fauna

The site does not support a significant population of birds and mammals. Few birds were observed during the field survey, and no mammals were seen. Those species which were observed, as well as those potentially occurring on the site, are listed in Appendix F.

The site does not constitute a sensitive wildlife habitat, due to its proximity to cultivated cane fields.

It should be noted that the Honouliuli Unit of Pearl Harbor National Wildlife Refuge is located 2.8 miles southeast of the project site, along the shore of West Loch. It is approximately 2,000 feet south of the mouth of Honouliuli Stream, and is an important nesting habitat for the native Hawaiian Stilt (*Himanotopus himanotopus knudseni*).

Water to fill the ponds within this refuge is obtained from a well located within the refuge. It is intermittently pumped and the water is saline.

III. SOCIO-ECONOMIC CHARACTERISTICS

A. Population

According to the *General Plan Five-Year Review, Final Report* (1982), the total residential population of Oahu was 762,874 in 1980 [2.23]. The project site is located in the area identified as Ewa. The Ewa area's population of 35,554 in 1980 constituted 4.7% of the island's total population. The population of Ewa for the year 2000 is projected to be between 74,300 to 81,700, or 8.1 to 8.9 of the total Oahu population. Refer to Table 2-5.

B. Land Use

Sugar cane is the primary crop grown in the vicinity of the project site. Figure 2-8 is a Generalized Land Use map of the area showing sugar cane acreage, as well as other uses. The map was developed for the Hawaii Water Resources Regional Study in 1970. As can be seen, other major uses in the area to be served include urban and military.

TABLE 2-5

DISTRIBUTION OF THE RESIDENTIAL POPULATION:

1980 AND 2000

Location	1980[a] Population	% of Total	2000 % of[b] Total	Population[c]
Primary Urban Center	417,240	54.7	47.5-52.5	435,800-481,600
Ewa	35,554	4.7	8.1- 8.9	74,300- 81,700
Central Oahu	100,640	13.2	13.3-14.7	122,000-134,900
East Honolulu	42,213	5.7	6.2- 6.8	56,900- 62,400
Koolaupoko	109,373	14.3	12.3-13.7	112,800-125,700
Koolauloa	10,983	1.4	1.5- 1.7	13,800- 15,600
North Shore	13,061	1.7	1.8- 2.0	16,500- 18,300
Waianae	32,810	4.3	4.3- 4.7	39,400- 43,100
Oahu Total	762,874	100.0	95.0-105.0	871,500-963,300

[a]1980 Census data

[b]From Population Objective C, Policy 4

[c]Population ranges based on the percentages presented in the preceding column and DPED's Series II-F population projection for the year 2000 of 917,400 for Oahu.

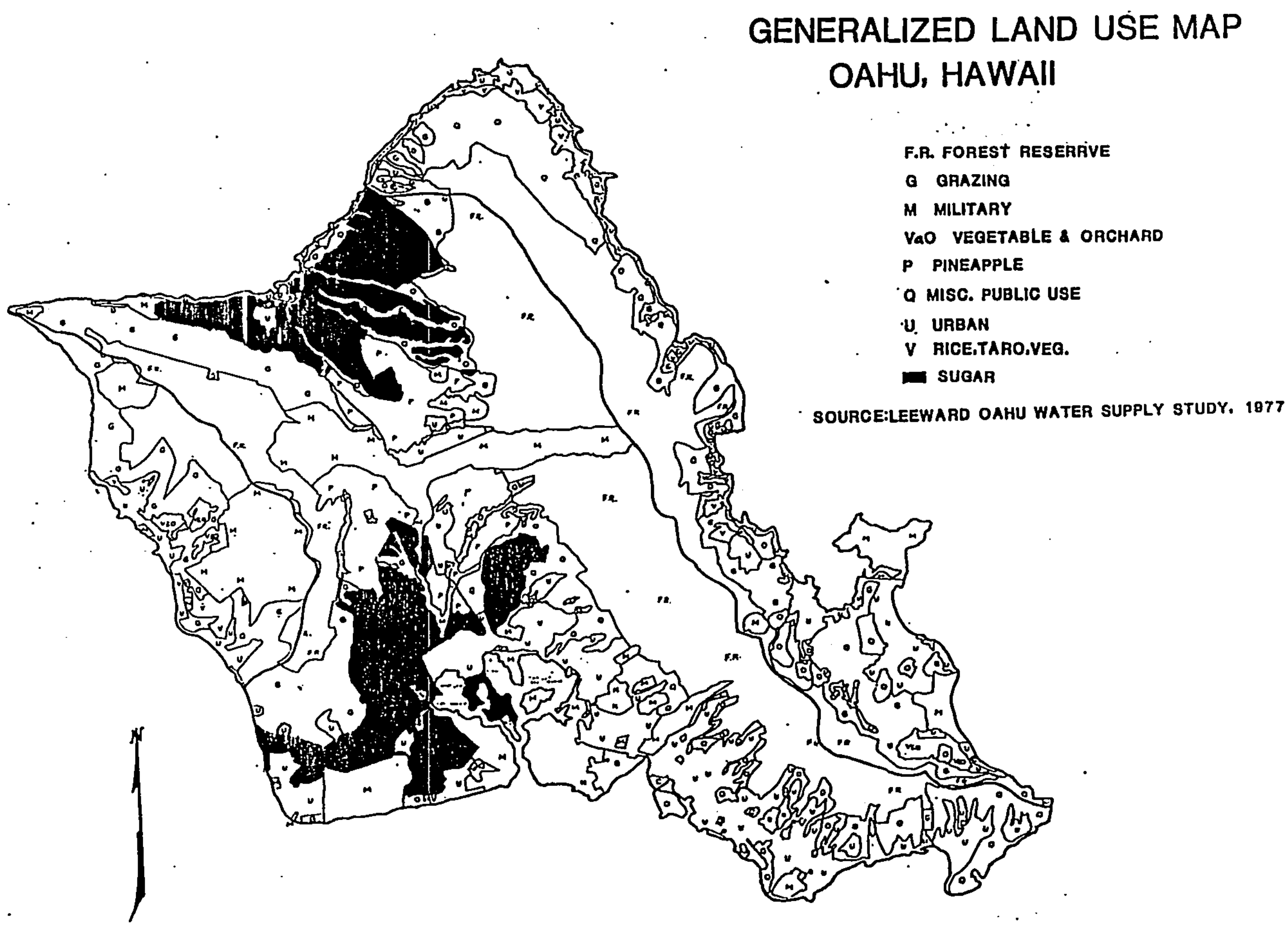

GENERALIZED LAND USE MAP
OAHU, HAWAII
F.R. FOREST RESERRVE
G GRAZING
M MILITARY
V&O VEGETABLE & ORCHARD
P PINEAPPLE
Q MISC. PUBLIC USE
U URBAN
V RICE,TARO,VEG.
SUGAR
SOURCE:LEEWARD OAHU WATER SUPPLY STUDY, 1977
N

FIGURE 2-8

The project site is surrounded by an area designated as "prime agricultural land". This is land which has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops economically when treated and managed according to modern farming methods.

The acreage of urban and agricultural land use in 1978 in the Ewa-Waianae Water District and Waipahu area is shown in Table 2-6. In addition, land which is zoned for urban use within metropolitan Honolulu (WaiaIae-Kahala to Pearl City), Ewa and Waianae and which was undeveloped as of 1978 is shown in Table 2-7.

There are several other development projects proposed for the potential service area of Honouliuli Wells [2.24][2.25]. Those currently under construction, or planned but not necessarily approved, include the following:

<u>Village Park</u>: A 1,745 unit residential development on 316 acres located directly east of the proposed wells project across Kunia Road.

<u>Makakilo</u>: A 3,693 unit residential development of 373 acres located adjacent to (north of) Makakilo City, which currently consists of over 1,700 units. Makakilo will ultimately consist of approximately 6,000 housing units on 865 acres.

TABLE 2-6
1978 EXISTING LAND USES (ACRES)
LEEWARD REGION, OAHU

WAIPAHU SUBTOTAL[1/]

Urban		Agricultural	Vacant Usable	Other	Total Land
Residential	546.3	478.7	182.9	306.5	1,773.4
Multi-family	62.4				
Industrial	88.6				
Commercial	108.0				
Hotel	-0-				
	805.3				

EWA-MAKAKILO SUBTOTAL[2/]

Urban		Agricultural	Vacant Usable	Other	Total Land
Residential	654.9	19,240.9	6,843.9	13,405.5	42,081.1
Multi-family	108.9				
Industrial	1,697.1				
Commercial	129.9				
Hotel	-0-				
	2,590.8				

WAIANAE COAST SUBTOTAL[3/]

Urban		Agricultural	Vacant Usable	Other	Total Land
Residential	2,461.1	1,839.7	8,017.1	24,731.1	38,078.0
Multi-family	123.2				
Industrial	461.4				
Commercial	415.0				
Hotel	29.4				
	3,490.1				

TABLE 2-6, cont'd.

LEEWARD TOTAL

Urban		Agricultural	Vacant Usable	Other	Total Land
Residential	3,662.3	21,559.3	15,043.9	38,443.1	81,932.5
Multi-family	294.5				
Industrial	2,247.1				
Commercial	652.9				
Hotel	29.4				
	6,886.2				

1/ Census tracts: 87.01, 87.02, 87.03, 88.00, 89.01.

2/ Census tracst: 83.00, 84.00, 85.00, 86.01, 86.02.

3/ Census tracts: 96.01, 96.02, 97.00, 98.00.

Source: Table 82: Acreages of 1978 Existing Land Uses on Oahu by Census Tracts. Department of General Planning, City and County of Honolulu.

TABLE 2-7

1978 VACANT USABLE
PRIVATELY-OWNED URBAN LAND,
BY DEVELOPMENT PLAN AREAS

Zone	Primary Urban Center 1/	Ewa	Waianae
Residential	465.0	777.4	1,271.3
Apartment	395.0	11.1	36.3
Hotel	9.4	0	9.0
Business	44.8	24.2	13.1
Industrial	132.5	523.2	0
	1,046.7	1,335.9	1,329.7

1/ Development Plan Areas 1.1, 1.2, and 1.3 (Waialae-Kahala to Pearl City).

SOURCE: Table 95: 1978 Zone District Designations (CZC) of Vacant Usable Land Privately Owned and Controlled by Development Plan Areas (in acres). Department of General Planning, City and County of Honolulu.

West Beach: A resort-residential community with 1,680 residential units and 7,520 resort units on 640 acres located just south of Nanakuli and north of the proposed Barbers Point Harbor. Of this, 190 acres are for a golf course.

Ewa Marina Community: A 1,098 acre residential community surrounding a marina to be located near Oneula. Projected completion of the first increment (5,000 units) is 1985 and of the second increment (3,000 units) is 1990.

Ewa Newtown: A 200 acre residential development to be located on the Ewa Plain.

Barbers Point Deep Draft Harbor: A deep draft harbor on 330 acres (including a 94-acre basin) located in Campbell Industrial Park. Already approved by Congress and the State, this harbor would constitute a second Oahu commercial port.

Honouliuli Wastewater Treatment System: A wastewater treatment plant on 51 acres located in the northeast corner of Barbers Point Naval Air Station. Sponsored by the Environmental Protection Agency, 75% of the construction cost is being funded by the Federal Government. It was placed into operation in January 1982 and provides preliminary treatment. Primary treatment will be provided at a later date.

West Oahu College: A four-year college potentially located on 200 acres at the intersection of Farrington Highway and Fort Weaver Road, with a projected enrollment of 7,000±.

James Campbell Industrial Park: Expansion of the 1,134-acre Campbell Industrial Park to 2,800 acres (1,486 acres to be added). The park is occupied by light, medium and heavy industries, with 99 firms employing over 2,100 persons in 1976.

HPOWER - Honolulu Program of Waste Energy Recovery project is a solid waste recovery facility that would generate power and recover other marketable products from solid waste. It would handle 600, 1,200 or 1,800 tons per day of solid waste. The location has yet to be finalized, but will be in the leeward area.

There are several new subdivisions planned for the Waianae Coast at the present time, and possibly a 412-unit condominium in Makaha Valley [2.26]. A 500-acre agricultural park is also proposed for Waianae Valley. It would be served by a State well in Waianae Valley. Refer to Table 2-8 for a summary of current proposed projects within the Leeward Region. Note however, that the water to be developed at Honouliuli Wells would essentially serve none of the projects in the Waianae area and that the other projects do not

TABLE 2-8

MAJOR PROPOSED DEVELOPMENTS 1/
LEEWARD REGION, OAHU, HAWAII

Location/Proposal	Type of Development	Estimated Completion Date	Acreage	Dwelling Units	Estimated Population 2/
Waipahu-Crestview Area					
Village Park 4/	Housing	1985	316	1,745	5,600
Ewa-Makakilo					
Makakilo 4/	Housing	1995	373	3,693	11,800
West Beach	Housing	2000	640	1,680	33,000 3/
West Beach	Resort	1995		7,520	35,300 3/
Campbell Industrial Park 4/	Employment	2000	1,486	-	-
Honouliuli WWTP	Utility	1982	51	-	-
Barbers Point Deep Water Harbor	Port Employment	2000	330	-	-
West Oahu College	Education	NA	200	-	-
Ewa Marina Community	Recreation & Housing	1990	1,098	7,200	23,040
Ewa Newtown	Housing	NA	200	NA	-
HPOWER	Solid Waste Recovery	NA	NA	-	-
Waianae Coast					
Makaha Condominium	Resort	NA	8	412	742
Waianae Agricultural Park	Agriculture	NA	500	-	-

NA Not Available

1/ Ewa-Waianae Water District plus Waipahu.

2/ Population estimates based on: 3.2 persons per dwelling unit and 1.8 persons per hotel room.

3/ According to the West Beach Project Draft EIS, June, 1980.

4/ Developments that have received full or partial water commitments.

Source: [2.26] and [2.28]

necessarily have a water committment from the BWS. In the Ewa area, the BWS has imposed a moratorium on building until sufficient sources, transmission systems and storage are provided.

C. <u>Economic Aspects</u>

1. <u>General</u> [2.27]

"The economy of Hawaii, especially Oahu, and its development and growth can be largely attributed to its location and climate. Eighty (80) percent of the State's commerce, as well as the population, and nearly all military bases and activities are located on Oahu. The economy is basically service oriented. Manufacturing is modest. Agriculture has been declining."

"Tourism, defense, sugar and pineapple, in that order of importance, represent the four major export industries. Sugar and pineapple dominated the economy up to World War II. Beginning in World War II up to 1970, defense activities prevailed. Tourism is now the major 'industry' and is made of many services from hotel to scenic and travel services, gift shops, restaurants, and entertainment."

"Other industries of non-export category, including the construction industry, provide goods and services to local residents from monies earned through sale of labor, products and other services to the export industry sector. The long-term growth of these industries depends upon the performance of the export industries."

2. Construction

Construction has been on a decline over the past few years. This is demonstrated, in part, by the data presented for residential construction in Table 2-9, which shows private residential construction authorized by permit from 1970-1978. This table also gives the housing vacancy rate for these years.

An upturn in construction was registered in 1978 [2.29] and was expected to accelerate in 1979. Leading the list of construction activities expected to expand that year were multi-family residences, hotels on Maui and government projects.

3. Employment [2.30]

"Employment on Oahu during the first six months of 1978 averaged 313,900 according to information published by the State Department of Labor and Industrial Relations. Employment opportunities reflected a negligible growth rate of 0.2% during the first quarter of 1979. Unemployment showed some improvement, decreasing

TABLE 2-9

PRIVATE RESIDENTIAL CONSTRUCTION AUTHORIZED BY PERMIT AND VACANCY RATES, OAHU: 1970 to 1978

YEAR	DWELLING[(1)] UNITS	TOTAL NUMBER OF BUILDING PERMITS	VACANCY RATE
1970	7,978	16,792	1.7
1971	7,958	17,239	2.3
1972	10,417	17,706	1.7
1973	13,065	22,767	1.5
1974	13,160	19,169	2.0
1975	5,430	16,514	2.3
1976	4,524	15,937	3.0
1977	4,683	15,793	1.6
1978	-	-	1.5

(1) Includes single-family dwellings, duplexes and apartments.

Source: Hawaii State Data Book, 1977 & 1978.

from 7.6% in 1978 to 6.9% in the first quarter of 1979. "Unemployment in the construction industry and related activities were the hardest hit as construction deteriorated in 1975 and 1976. The recovery of the national economy did not help local construction, and the industry continued in a depressed state. A recent uptrend in construction activity and employment may be the turning point in a long-awaited revival."

"The sugar industry, the third largest export industry, is faced with a dilemma as a result of America's abandonment in 1974 of its 40-year-old Sugar Act, which had insulated the domestic sugar industry from competition of surplus world sugar entering into the American market. The market has been chaotic since. Pineapple, the second largest agricultural industry, continues to contribute to the economic health of the local economy. Sales have declined due to intensive price competition from abroad, but the growth prospects for pineapple appear good, especially for fresh pineapple."

The number of people employed in the State declined slightly to 373,000 in March, 1979 from 374,700 in February. The number of unemployed declined to 25,400, or 6.4% of the labor force, in March. All counties showed a decline in the unemployment rate in March, 1979 [2.31].

Jobs in the private sector were up by 8,100 over March, 1978, to a total of 291,800. About 47% of the increase occurred in the service industries, including hotels. The construction industry accounted for another 26% of the increase, though it should be noted that employment in construction was at a relatively low level in early 1978 [2.32].

4. Ewa Submarket [2.33]

"The Ewa submarket is composed of census tracts 73-89.03 and is conterminous with tax key zone 9 and Ewa Judicial District. Comparisons of 1970 census information with Oahu as a whole are shown on Table 2-10. The Ewa submarket had the highest percentage growth rate of any of the other submarkets on Oahu between 1960 and 1970. The growth rate between 1970 and 1976 decreased. The percentage of persons under 5 years and over 65 years are population indicators which are used to forecast the potential of population growth or loss in an area."

"Ewa is one area on Oahu which would exhibit natural growth potential based on population

TABLE 2-10

POPULATION AND HOUSING CHARACTERISTICS
EWA SUBMARKET

ITEM	HONOLULU COUNTY	EWA SUBMARKET
Population 1970	630,528	132,299
Percent Change 1960-1970	26.0%	68.2%
Population Under 5 Years	58,701	13,913
Percent Change 1960-1970	9.3%	10.6%
Population 65 Year and Over	31,385	3,123
Percent Change 1960-1970	5.0%	2.4%
Median Age	24.6	22.6
Number of Households	164,763	27,728
Persons Per Household	3.6	4.17
Population in Group Quarters	36,047	15,021
Percent in Population	5.7%	11.5%
Median School Years	12.4	12.4
Median Income	$12,035	$11,712
Families Below $10,000	53,766	10,656
Percent	38.9%	39.7%
Families Above $25,000	11,745	1,262
Percent	8.5%	4.7%
Housing Units	174,151	29,456
Percent Owner Occupies	45.0%	51.4%
Percent 1-Unit	58.8%	73.0%
Median Value	$38,400	$33,569
Median Rent	130	136
Lacking Some or All Plumbing	5,773	560
Percent	3.3%	1.9%
1.51 or More Persons Per Room	11,361	1,757
Percent	6.9%	6.3%
Population 1976	718,428	167,300
Percent Change 1970-1976	14.0%	26.0%
Housing Units 1976	212,615	40,200
Percent Change 1970-1976	22.0%	36.0%

Source: [2.34] (State of Hawaii Data Book; 1970 Census) age patterns. The higher-than-average number of persons per household and lower-than-average median age reflects the fact that the area has a large percentage of husband-wife families with children. Another indicator of the character of the area is the high percentage of one-unit and owner-occupied housing units; however, multiple-unit construction has increased since 1970 with high-rise construction around Salt Lake and Pearl Ridge areas and family-attached units in other areas such as Makakilo and Mililani Town. The area also has a lower percentage of substandard units (8%) compared with Oahu, as a whole, which has 10%."

IV. INFRASTRUCTURE

A. Roads and Traffic

The project site is located adjacent to an unimproved cane haul road, with access from Kunia Road.

Kunia Road (Federal-Aid Secondary Route 750) is a two-lane highway with a 60-foot right-of-way. Current peak hour traffic is approximately 1,400 vehicles per hour (vph) at Farrington Highway (two directions) and about 1,770 vph at the H-1 interchange [2.35]. Capacity is estimated at 2,400 vph (two-lane uninterrupted).

Farrington Highway at Kunia Road is a four-lane highway. Current afternoon peak hour traffic is approximately 1,977 vph (both directions) while capacity of Farrington Highway at this location is estimated at 3,760 vph (four-lane uninterrupted) [2.36].

The H-1 Freeway, located south of the project site, provides the primary connection between the eastern (Waialae) and western (Nanakuli) parts of southern Oahu.

At the Kunia Interchange, the H-1 Freeway has four eastbound and three westbound lanes. Current peak-hour traffic is approximately 1,754 vph in the morning and 1,868 vph in the afternoon [2.37]. The peak-hour capacities of H-1 are approximately 1,400 vph per lane for Level of Service C (free flow), and about 1,800 vph per lane for Levels of Service E (unstable flow) or F (forced flow) [2.38]. Theoretically, maximum capacity is about 2,000 vph per lane.

Refer to Table 2-11 for a summary of existing traffic counts at these and other locations in the general vicinity of the project site.

B. <u>Water</u>

The existing water system is described in Section 1, Part III.

TABLE 2-11

CAPACITY AND TRAFFIC COUNTS AT SELECTED STATIONS ALONG KUNIA ROAD, FARRINGTON HIGHWAY AND THE H-1 FREEWAY[1]

Station	Existing (vph) AM Peak	PM Peak	Capacity
H-1 at:			
Makakilo Dr.	1,191	1,420	
Honouliuli Bridge	2,053	2,443	
Kunia Interchange	1,754	1,868	9,800[2]
Farrington Hwy. at:			
Kahe Point	1,363	1,751	
Kunia Road	1,172	1,955	3,760
Kunia Road at:			
Farrington Hwy.	1,399	1,428	2,400
H-1	1,763	1,776	

Sources: [2.41], [2.42] and [2.43]

1 All figures are two-directional totals.

2 Seven lanes at level of Service C.

C. Liquid and Solid Waste [2.39],[2.40]

1. Liquid Waste

Liquid waste at the project site will be disposed of in a water-tight container which will be periodically pumped out.

Liquid waste from developments in the areas to be served by the project are treated at the Waipahu Sewage Treatment Plant (STP) and the Makakilo STP.

The Waipahu STP has a maximum capacity of 3.6 mgd equivalent flow of sewage. This capacity is based on total suspended solids and biochemical oxygen demand (BOD) in its discharge to Pearl Harbor's Middle Loch. The State Health Department has limited future sewer connections to the sewage plant to this maximum equivalent sewage flow.

In 1973, the City Public Works Department reserved capacity in the existing plant for future sewer service to serve the Village Park planned development. However, after Phase 4 of Village Park, no further building permits will be issued without the approval of the State Health Department until the proposed Honouliuli Waste Water Treatment Plant (WWTP) is completed.

The Makakilo STP has an operating capacity of 1.3 mgd and can be expanded to a capacity of 2.48 mgd. It treats sewage flow from the Makakilo area by the activated sludge process. Most of the effluent, following secondary treatment, is used for irrigation of the surrounding sugar cane fields. This practice is endorsed and monitored by the State Department of Health.

Construction of the 25 mgd capacity Honouliuli Waste Water Treatment Plant (WWTP) will include replacement of the existing 3.6 mgd Waipahu STP with a 7 mgd capacity Waipahu sewage pumping station (SPS) and a new force main to the Honouliuli WWTP. The Makakilo STP would also be phased out. The Honouliuli regional facility is being designed to accommodate all the effluent from the western portion of Mamala Bay (Halawa Valley to Barbers Point).

The plant is scheduled to go on line in 1982, however, this schedule is subject to the City's financial capabilities and the present completion target date may not be met if adequate funding is not available.

The treated sewage will be discharged into the ocean by a deep water outfall off Barbers Point. The City has received an exemption from secondary treatment from the Environmental Protection Agency (EPA), however, the conditions of the exemption will be appealed. It should be noted that secondary treated effluent could still be made available for irrigation under certain conditions.

2. Solid Waste [2.44]

Solid waste from developments in areas to be served by the project would most likely be disposed of at the Palailai Sanitary Landfill. The Palailai Landfill is a privately owned and operated disposal site presently operating at 250 tons per day. It has a future capacity for receiving up to 600 tons per day, or approximately 20% of the total refuse of Oahu, and has a 10 to 15 year site life, depending on usage.

Palailai Landfill is a former rock quarry being restored by Pacific Rock and Concrete Co., Ltd. under a lease agreement with the landowner, Campbell Estate. A renewable 5-year Conditional Use Permit was granted in 1973 by the City and County of Honolulu for operation of the site as a sanitary landfill. The permit was renewed in 1978 for another 5 years (expires in June, 1983).

The Waipahu incinerator was built in 1970 and has a design capacity of 600 tons per day. It is presently being operated at full capacity.

There is an acute shortage of City and County-owned sites available for disposal of solid waste on Oahu. Although a site has not been selected, future plans call for the development of a new sanitary landfill in the leeward area.

In addition, recent studies indicate it would be feasible to generate power from the solid wastes on Oahu. A joint venture of Amfac, Inc. and Combustion Engineering was chosen to develop a recovery plant, and it is likely that the plant will be located in the leeward area. A plant capacity of up to 1,800 tons of garbage per day is anticipated, and in exchange, the companies would pay the City roughly $10.00 for each ton of garbage.

D. Utilities

1. Electricity

A 46 K.V. Hawaiian Electric Company (HECO) overhead transmission line lies 1,800 feet south-southeast of the project site, running parallel to the H-1 Freeway. There is also a 46 K.V.

circuit on Kunia Road. In addition, there are three power line easements approximately 3,750 feet north-northwest of the project site. Each easement can contain four 138 KV circuits. At present two of the easements each have two 138 KV circuits and one is reserved for future use.

After 50% of the Village Park subdivision is completed (across Kunia Road from the project site), a HECO substation will be built. The proposed location of the substation will be along Kunia Road adjacent to and north of Village Park [2.45].

The project site will have an electrical demand of approximately 700 kilowatts.

HECO has stated that they will have adequate capacity to supply the electrical demand requirements for the service area of the project [2.46]. HECO currently has a generating capacity of 1,186 megawatts, with its capacity increasing to approximately 1,327 megawatts after the Kahe #6 facility goes on line [2.47]. The energy requirements of the area will be fed from a power pool supported by the three generating plants located in downtown Honolulu, Waiau and Kahe.

2. Gas

Honolulu Gas Company (GASCO) reports that there are 16-inch and 6-inch gas lines along Farrington Highway south of Kunia Road, as well as a 10-inch oil line [2.48]. There are no GASCO lines along Kunia Road.

3. Telephone

Telephone service is available approximately 1/2 mile from the project site, along Kunia Road. The pump station will require at least one phone. For Hawaiian Telephone to provide telephone service to the project site, a pole line of approximately 20 poles with associated wiring must be constructed from Kunia Road to the site [2.49]. In all probability electrical service would also be provided via this proposed pole line.

E. Schools

Elementary schools serving the areas in the vicinity of the project site include August Ahrens, Honowai and Waipahu Elementary in Waipahu and Makakilo and Mauka Lani Elementary in Makakilo. The areas are also served by Waipahu Intermediate and Waipahu High in Waipahu, and by Ilima Intermediate and Campbell High in Ewa. Refer to Table 2-12 for a list of the schools' enrollments and capacities.

TABLE 2-12

SCHOOL ENROLLMENTS AND CAPACITIES

School	Present Enrollment	1995 Projected Enrollment 5/	Present Capacity
Elementary 1/			
August Ahrens	1,609	1,420	1,449
Honowai	965	700	803
Waipahu	989	900	877
Makakilo	527	470	654
Mauka Lani 4/	422	880	483
Intermediate 2/			
Waipahu 3/	1,115	1,250	1,164
Ilima	1,213	1,400	1,401
High School			
Waipahu 4/	2,197	2,300	2,051
Campbell	2,356	2,400	2,404

1/ Three new elementary schools are planned, depending on need.

2/ A new intermediate-high school complex is planned for the Ewa area.

3/ A major replacement program is planned.

4/ New permanent facilities are planned.

5/ Projected enrollments are based, in part, on projected new students from the Village Park, Gentry-Waipio and Makakilo subdivision.

Source: Department of Education (as of 9/14/79).

F. Public Services

1. Police

The City and County Police Department substation in Pearl City serves the vicinity of the project site. The project site is located within the Waipahu Police "beat" and could expect a 4± minutes response time to calls [2.50].

The average response time within the entire Waipahu District is about 6 minutes. The existing crime rate in the immediate area is very low, consisting mainly of nuisance calls for dumping solid waste materials and related refuse, motorcycle noise, children and pet problems. There are no immediate plans for an additional police station facility in the area.

2. Fire

The City and County Fire Department serves the vicinity of the project site. The project site would be served by the fire station located in Waipahu Industrial Park on Leonui Street. This station houses an engine company of 18 firefighting personnel, an aerial ladder company of 18 firepersonnel, and headquarters for a battalion chief and his aide [2.51].

The Makakilo area is served by the fire station located on Makakilo Drive. The average response time is estimated to be 3.5 to 4 minutes. At present, Campbell Industrial park has its own Fire Brigade and depends on the support of the Honolulu Fire Department only in extreme emergencies [2.52].

3. Medical

Medical services are available at the Waipahu Clinic and the Punawai Clinic (a Kaiser Foundation Clinic). The Waipahu Clinic has a staff of about 50 and serves the basic health needs of residents from Waipahu to Waianae. By 1985 the staff is expected to increase to 70. Hospital services for residents are available at Wahiawa General Hospital in Wahiawa and Pearlridge Hospital (Fronk Clinic) in Aiea.

G. Parks and Recreation

Public recreational lands and facilities in the leeward area, plus Mililani, are summarized in Table 2-13. There are several private facilities, such as golf courses, in addition to these.

V. ARCHAEOLOGICAL/HISTORICAL CHARACTERISTICS

No historical or archaeological sites are known to exist on the project site, which is in an area previously disturbed by sugar cane cultivation. The closest site

TABLE 2-13

PUBLIC RECREATIONAL LANDS AND FACILITIES

LEEWARD PLANNING AREAS

Area	Total Acreage	Beach Acreage	Hunting Acreage	Improved Acreage	Public Facilities: Trails (miles)	Launching Areas	Tennis Courts	Golf (holes)	Camping Sites	Swimming Pools	Moorages
Ewa-Mililani	14,407	54	—	284	35	—	24	18	14	2	—
Waianae Coast	8,619	78	2,440	249	1	1	16	—	127	1	90

Source: [2.53]

Petroglyphs, approximately 0.9 mile from the project site. However, in the event that unanticipated sites or remains are encountered during construction, all work will stop and the State Historic Sites Office will be contacted.

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Land Use Plans Policies Controls

3

SECTION 3

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

I. GENERAL

The land use controls for the project site and surrounding area are as follows:

Site Land Use

State Land Use Classification: Agriculture

Development Plan: Agricultural

Zoning: Agriculture-1 (AG-1)

Surrounding Land Use

State Land Use Classifications: East - Urban and Agriculture; West - Urban, Conservation and Agriculture; North - Agriculture; South - Urban and Agriculture.

Detailed Land Use Map: North and east - Agriculture, Residential, Apartment and School in the Waipahu-Crestview area, and Industrial near Pearl Harbor.

Development Plan: South and west Agricultural.

Zoning: East - Planned Development Housing (PDH) and AG-1; South and West - AG-1.

II. CITY AND COUNTY OF HONOLULU

The Statement of Objective and Policies of the City and County of Honolulu's General Plan sets forth the broad policies for the long-range development of the City. The project is located in the area identified in the General Plan as Ewa. As required by the City's Revised Charter of 1973, a Development Plan for Ewa has been prepared and adopted in accordance with the provisions of Sections 5-407, 5-409, and 5-411 of the Charter and the City's 1977 General Plan. The purpose of the Ewa Development Plan is to provide a relatively detailed scheme for implementing the objectives and policies of the General Plan for Ewa. Relevant General Plan policies for Ewa encourage its gradual development as a secondary urban center in order to relieve development pressures in the urban-fringe and rural areas. Specific General Plan Objectives and Policies, in the proposed revised wording [3.1], include the following:

A. Population

Objective A, Policy 4--"Seek to maintain a desirable pace of physical development through City and County regulations."

Objective C, Policy 2--"Encourage the gradual development of a secondary urban center in the West Beach-Makakilo area to relieve development pressures in the urban-fringe and rural areas."

Objective C, Policy 3--"Limit growth in the urban fringe and rural areas to a level which essentially maintains their 1980 proportion of the islandwide population."

These policies give a clear direction for the nature and sequencing of development in Ewa. The Primary Urban Center is to be fully developed, and a secondary urban center in the West Beach-Makakilo area of Ewa is to be gradually developed as needed to relieve the pressures in the urban-fringe and rural areas. As a result, expenditures for new public facilities and utilities that provide for new growth should first be directed toward the Primary Urban Center and Ewa.

A description of the distribution of residential population of Ewa for the years 1980 and 2000 is presented in Section 2, "Population".

B. <u>Economic Activity</u>

Objective C, Policy 3--"Provide sufficient agricultural land in Ewa, Central Oahu, and the North Shore to encourage the continuation of sugar and pineapple as viable industries."

Objective G, Policy 1--"Direct economic activity primarily to Honolulu, Aiea, and Pearl City; and secondarily, to the West Beach-Makakilo area."

The proposed project may be located in cane fields. If so, two acres of prime agricultural land would be withdrawn from productivity.

The objective of the proposed project is to provide water for projected growth in the West Beach-Makakilo area.

C. <u>Transportation and Utilities</u>

Objective B, Policy 1--"Develop and maintain an adequate supply of water for residents and visitors."

Objective B, Policy 2--"Develop and maintain an adequate supply of water for agricultural and industrial needs."

Objective C, Policy 3--"Plan for timely and orderly expansion of utility systems."

Objective D, Policy 1--"Give primary emphasis in the capital-improvement program to the maintenance and improvement of existing roads and utilites."

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

As discussed in Section 1, "Proposed Water System", the proposal project would be one of several strategies to provide water for growth projected by the City.

This EIS addresses the above mentioned concerns before the actual implementation of the project.

D. <u>Physical Development and Urban Design</u>

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

Objective A, Policy 2--"Coordinate the location and timing of new development with the availability of adequate water supply, sewage treatment, drainage, transportation and public safety facilites."

Objective A, Policy 3--"Phase the construction of new developments so that they do not require more regional supporting services than are available."

Objective C, Policy 1--"Allocate funds from the City and County's capital improvement program for public projects that are needed to bring about the gradual development of the West Beach-Makakilo area as a secondary urban center."

Objective C, Policy 2--"Encourage the development of a major residential, commercial and employment center within the secondary urban center."

Objective C, Policy 4--"Coordinate plans for the development of the secondary urban center with the State and Federal governments and with the sugar industry."

The development of the Honouliuli Wells is proposed to comply with these policies.

In addition to the Objective and Policies of the General Plan, special provisions for urban design guide public and private development in the Ewa Development Plan Area. Specific urban design considerations include: open space, public views, height controls and density controls. It is not anticipated that the project will detract from the open space and aesthetic values of the area in the vicinity of the project. The height of control building will be significantly less than the 25-feet height limit specified for Agricultural designated areas in Ewa, and the only occasion when the project site will be visible is during the periods when sugar cane is newly planted or just harvested. The density controls specified for Agricultural areas in Ewa are not applicable as the proposed action does not include construction of any dwelling units.

The proposed project is not located on the Development Plan Public Facilites Map which provides notice of approximate site and corridor locations of future public facilities.

Due to its utility nature, the proposed project is a permitted use according to the County zoning controls. The site is outside of the Special Management Area (SMA) and will not need an SMA permit.

III. STATE OF HAWAII

A. Hawaii State Plan

Several objectives and policies stated in the Hawaii State Plan generally relate to the proposed project [3.2]. One policy which relates to population is as follows:

> Section 5 (b) (3): "Insure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the State."

Other objectives and policies which refer to agriculture include the following:

> Objectives:
>
> Section 7 (a) (1): "Increased viability in sugar and pineapple industries."
>
> Section 7 (a) (2): "Continued growth and development of diversified agriculture throughout the State."
>
> Policy:
>
> Section 7 (b) (6): "Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs."

Finally, objectives and policies regarding facility systems include the following:

> Objectives:
>
> Section 16 (a): "Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities."

Policies:

Section 15 (b) (2): "Encourage re-use and recycling to reduce solid and liquid waste and develop a conservation ethic."

Section 16 (b) (1): "Relate growth activities to existing and potential water supply."

Section 16 (b) (2): "Support research and development of alternate water sources."

Section 16 (b) (3): "Reclaim and encourage the productive use of runoff water and waste water discharge."

Section 16 (b) (4): "Assist in improving the quality, efficiency, service and storage capabilities of water systems for domestic and agricultural use."

Section 16 (b) (5): "Support water supply services to areas experiencing critical water problems."

Section 16 (b) (6): "Promote water conservation practices."

The proposed project is consistent with Section 5 (b) (3), since the BWS is developing this water source to support existing and planned developments which are part of the future growth outlined by the Honolulu General Plan.

The project does not appear to be inconsistent with the agricultural objectives and policies listed above, with the exception that the proposed project may possibly remove two acres of existing cane land from cultivation. An effort is being made to site the control station and wells in locations where loss of cane land will be minimal. An agreement regarding water exchange will be resolved with Oahu Sugar Company (OSC) so that its operations are not adversely impacted by their reduction in ground water withdrawal. The amount of sewage effluent that could be diverted for the water exchange proposal will depend on the amount that OSC will accept.

The project does not appear to be inconsistent with the facility systems objectives and policies listed above. The BWS is involved with and supports development of alternate water sources which would minimize demands on existing ground water sources.

Two Priority Directions stated in the Hawaii State Plan also relate in some way to the proposed project [3.3]:

> <u>Section 103 (h) (3): "Encourage restriction of new urban</u> development in areas where water supply is insufficient for both agricultural and domestic uses."

> <u>Section 104 (b) (2): "Plan the development and availability of</u> land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographical area."

The proposed project is not inconsistent with Section 103 (h) (3), since an equitable water exchange will be arranged with Oahu Sugar Company. The project is consistent with Section 104 (b) (2), since it is being provided to support the growth plans of the General Plan of the City and County of Honolulu.

B. Designated Ground Water Control Areas

The BWS is the primary water management agency on Oahu with the authority to limit the amount of water drawn from any well covered under the BWS Rules and Regulations, Section 3-313 (see Appendix G). These rules apply to all areas except designated "ground water control areas" established by the State of Hawaii, Department of Land and Natural Resources (DLNR).

Pursuant to Chapter 177, Hawaii Revised Statutes, as amended, DLNR has authority to designate critical areas and is the primary agency with control of these areas. Chapter 166 of Title 13, which implements this Act, has been adopted and the first designated "ground water control area" was recently declared. It encompasses the Pearl Harbor aquifer and the Schofield high-level water body (Figure 3-1). All those withdrawing water from this area would have had to apply to the State between October 4, 1979 and January 2, 1980. This is described further in Appendix A.

C. Special Use Permit

A State Special Permit will be required. Act 221 of the 1979 Legislative session amended the law for requests involving 15 acres or less, which may be processed and approved at the County level.

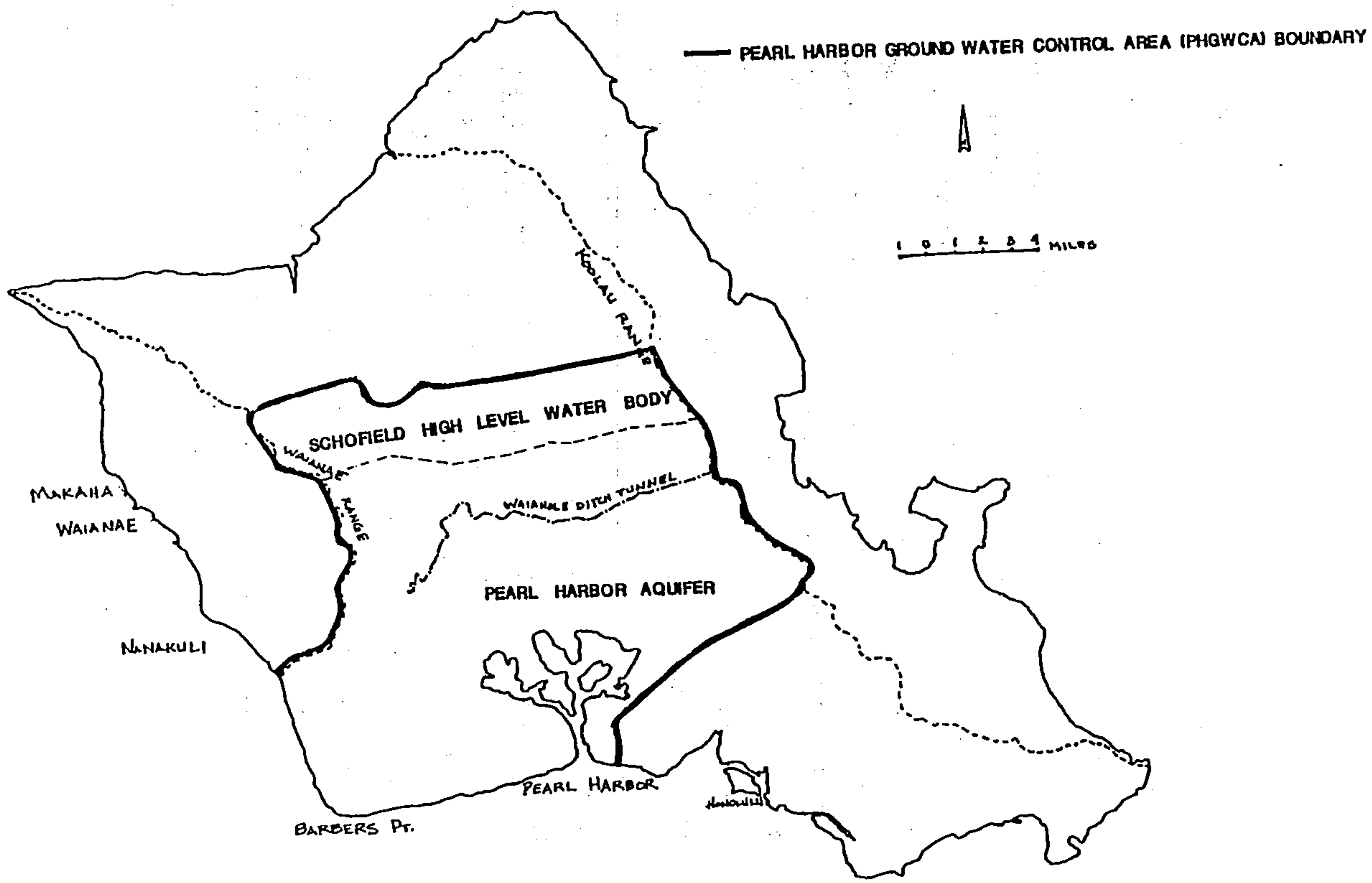

FIGURE 3-1
PEARL HARBOR GROUND WATER CONTROL AREA

For requests over 15 acres, the counties have initial jurisdiction, with denial of a project being final. Projects which are approved by the counties then go to the State Land Use Commission for final approval or denial.

D. State Water Commission Report

The State Water Commission was appointed by the Governor in mid-1977 to review the availability of water supplies and recommend appropriate administrative and legislative actions. After reviewing available reports and receiving testimony from major water purveyors, the Commission focused on major problems and issues. The resulting findings and recommendations are contained in a report titled "Hawaii's Water Resources: Directions for the Future". The priority recommendations from this report are reproduced in Appendix H.

E. State Environmental Policy (Chapter 344, HRS)

The guidelines, "§344.4 item (2) Land, water, mineral, visual, air and other natural resources.

The following guidelines are applicable:

(A) "Encourage management practices which conserve and fully utilize all natural resources;" The conservation of potable water resources is one of the many ongoing conservation programs of the BWS.

(B) "Promote irrigation and waste water management practices which conserve and full utilize vital water resources;"

(C) "Promote the recycling of waste water and solid wastes;" The BWS is actively seeking the use of recycled water for irrigation, thereby conserving potable water supplies. The BWS is also actively participating in irrigation and waste water management policies.

(D) "Encourage management practices which conserve and protect waterbeds and water sources, forestry and open space areas." The BWS actively participates in the protection of waterbeds and water sources.

IV. COASTAL ZONE MANAGEMENT PROGRAM

The proposed project is not inconsistent with the purpose of the Coastal Zone Management (CZM) Act of 1972. The CZM Act declares that it is national policy [3.4]:

"(a) To preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zones for this and succeeding generations;

(b) to encourage and assist the states to exercise effectively their responsibilities in the coastal zone through the development and implementation of management programs to achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic and aesthetic values as well as to needs for economic development;

(c) for all Federal agencies engaged in programs affecting the coastal zone to cooperate and participate with state and local governments and regional agencies in effectuating the purposes of this title; and

(d) to encourage the participation of the public, of Federal, state, and local governments, and of regional agencies in the development of coastal zone management programs. With respect to implementation of such management programs, it is the national policy to encourage cooperation among the various state and regional agencies, including establishment of inter-state and regional agreements, cooperative procedures, and joint action, particularly regarding environmental procedures (Public Law 92-583, Sec. 303, hereafter referred to as CZMA)."

V. HAWAII WATER RESOURCES PLAN [3.5]

The purpose of the Hawaii Water Resources Regional Study was to formulate a comprehensive plan of action to achieve the balanced conservation, development and use of Hawaii's water resources. Coordinated by the U. S. Water Resources Council, the study was conducted by an intergovernmental team representing nearly 50 agencies, with the participation of private industry and the public. The result was the "Hawaii Water Resources Plan", which was published in January, 1979.

Recommendations from the plan which are clearly pertinent to the issue at hand include the following:

"1-1 Develop additional fresh water supplies to meet year 2000 needs statewide.

Oahu: Develop ground water islandwide, especially Schofield Plateau and Waialua areas.

10-2 Develop alternative water sources to supply Oahu in addition to planned development from conventional ground water sources.

Restore dike storage.

Optimize development of Honolulu and Pearl Harbor aquifers.

Increase streamflow diversions compatibly with minimum streamflow requirements.

Recycle wastewater and exchange for high quality irrigation water.

Blend potable water with brackish water for a usable domestic product.

Desalt brackish water supplies for domestic use.

11-1 Reuse treated sewage effluent water for beneficial purposes.

Encourage agricultural operations to locate near existing sewage treatment plants where feasible.

Apply treated effluent to forest watersheds where compatible.

Design waste treatment and reuse as part of a single system to irrigate golf courses, lawns, or other open spaces.

14-1 Use more efficient irrigation methods. [3.6]

Convert to drip or sprinkler irrigation where feasible.

Reduce storage and transmission losses.

14-2 Provide additional irrigation water.

Improve diversion, storage, and transmission systems.

Develop more surface and ground water, compatible with environmental and recreational needs.

Determine the level of treatment necessary to reuse domestic wastewater for sugar cane irrigation.

Study the reuse of treated domestic wastewater for irrigating diversified crops and timber.

Develop systems to reuse treated domestic wastewater as a new source of irrigation water supply.

20-1 Control salt water intrusion into basal fresh water aquifers.

Design and space new wells and regulate pumping schedules of all wells to prevent excessive thinning of fresh water lenses.

Increase fresh water recharge to basal aquifers.

Determine long-term effects of periodic over-draft on ground water quality."

VI. FEDERAL WATER POLLUTION CONTROL ACT/CITY AND COUNTY'S "208" PLAN [3.7]

The 1972 Federal Water Pollution Control Act Amendments (P.L. 92-500) set two basic goals for the nation:

1. That wherever attainable, water quality which provides for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water, must be achieved by July 1, 1983. In other words, the waters are to be "fishable and swimmable" by that time.

2. That the discharge of pollutants into the navigable water of the United States be eliminated by 1985.

The U. S. Environmental Protection Agency (EPA) administers the Act nationally and the State Department of Health (DOH) administers it within the State of Hawaii. Section 101 (a) (5) of the Act requires that "areawide waste treatment and management planning processes be developed and implemented to assure adequate control of resources of pollutants in each State". The specific requirements for the development and contents of these plans are contained in Section 208 of the Act; hence, they are referred to as "208" plans.

The "208" plan for the City and County of Honolulu was completed by DOH and the City and County in October, 1978. It has been approved by the Governor and EPA, and was recently adopted by the City Council.

The plan focuses on streams and coastal water quality, but is not limited to consideration of surface waters only. Recommendations regarding fresh water diversions and salt water intrusion include the following:

- "If the Attorney General determines that the DOH has legal authority to establish minimum stream flow standards, and if no other appropriate State agency has acted to do so, the DOH should adopt minimum flow standards as part of the State's water quality standards (Chpt. 37-A of the Public Health Regulations)."

- "If the Attorney General determines that the DOH does not have adequate legal authority, the DOH should either seek appropriate authority from the legislature or coordinate revisions to the 208 plan which would require another appropriate agency to adopt and implement minimum flow standards."

- "Any minimum flow standards that are developed pursuant to the above recommendations should protect the few "natural" streams that currently exist."

- "DLNR be designated the primary agency responsible for controlling salt water intrusion into groundwaters on Oahu, with the City and County of Honolulu Board of Water Supply sharing such management responsibility to the extent permitted by its legal authority."

tablish State water quality standards for groundwater to address salt water intrusion. If it determines there is such a need, DOH shall adopt appropriate revisions to Chapter 37A, PHR by July 1, 1980."

- "DOH, in its review and approval of new sources of underground drinking water, should discourage development of any such source if its quality may likely exceed chloride standards, set forth in National Secondary Drinking Water Regulations proposed or adopted by the U. S. EPA."

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[3.7] State of Hawaii, Department of Health and City and County of Honolulu. 1978. Water Quality Management Plan for the City and County of Honolulu, Volume 1. State Department of Health and City and County of Honolulu, Honolulu, Hawaii.

Environmental Impacts

4

SECTION 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATIVE MEASURES TO MINIMIZE ADVERSE IMPACTS

This section will summarize and discuss the probable impacts of the proposed action on the environment.

I. INTRODUCTION

The proposed project will generate primary and secondary environmental impacts. Primary impacts are those resulting directly from construction and from the operation of the proposed wells, primarily the discharge of ground water from the wells. Secondary environmental impacts are those indirect impacts which are anticipated over the duration of the project life and may include potential use conflicts and indirect benefits arising from the proposed action. Examples of secondary impacts would include impacts resulting from the water exchange and from potential changes in land use.

II. DISCUSSION OF IMPACTS FROM THE PROPOSED PROJECT

A. Primary Impacts

1. Short-term Impacts

Short-term impacts, beneficial and adverse, generally result from construction related activities. Consequently, these impacts are of short duration and should not last longer than the construction period.

a. Water Quality and Erosion

The well field site is approximately 2 acres in area. During construction proper grading and a revegetation program will be maintained to minimize potential erosion into surrounding cane fields.

Between the H-1 Freeway and Farrington Highway, the proposed transmission line alignment will be located about 60 to 250 feet from Honouliuli Stream for a length of about 2,000 feet. Although soil in this area has a severe erosion hazard rating, proper grading should minimize sedimentation into the stream during construction. Potential sediments being carried to the stream should be minor since the trench width will be about 42 inches. If necessary, siltation basins will be constructed. Denuded areas will be revegetated as portions are completed.

Honouliuli Stream drains into Pearl Harbor's West Loch. The potential amount of sediment contributed by the construction of the transmission line near the stream is negligible compared to the normal amount of sediment carried by the stream. Of the 7,000 square feet of exposed ground which could contribute sediment to the stream, only a portion of that sediment would actually reach the stream.

Potential for soil erosion and sedimentation of Honouliuli Stream will be short-term, lasting only for the duration of the construction period. Therefore, the proposed project is not expected to have a significant effect on the water quality of Honouliuli Stream and Pearl Harbor's West Loch.

b. Noise

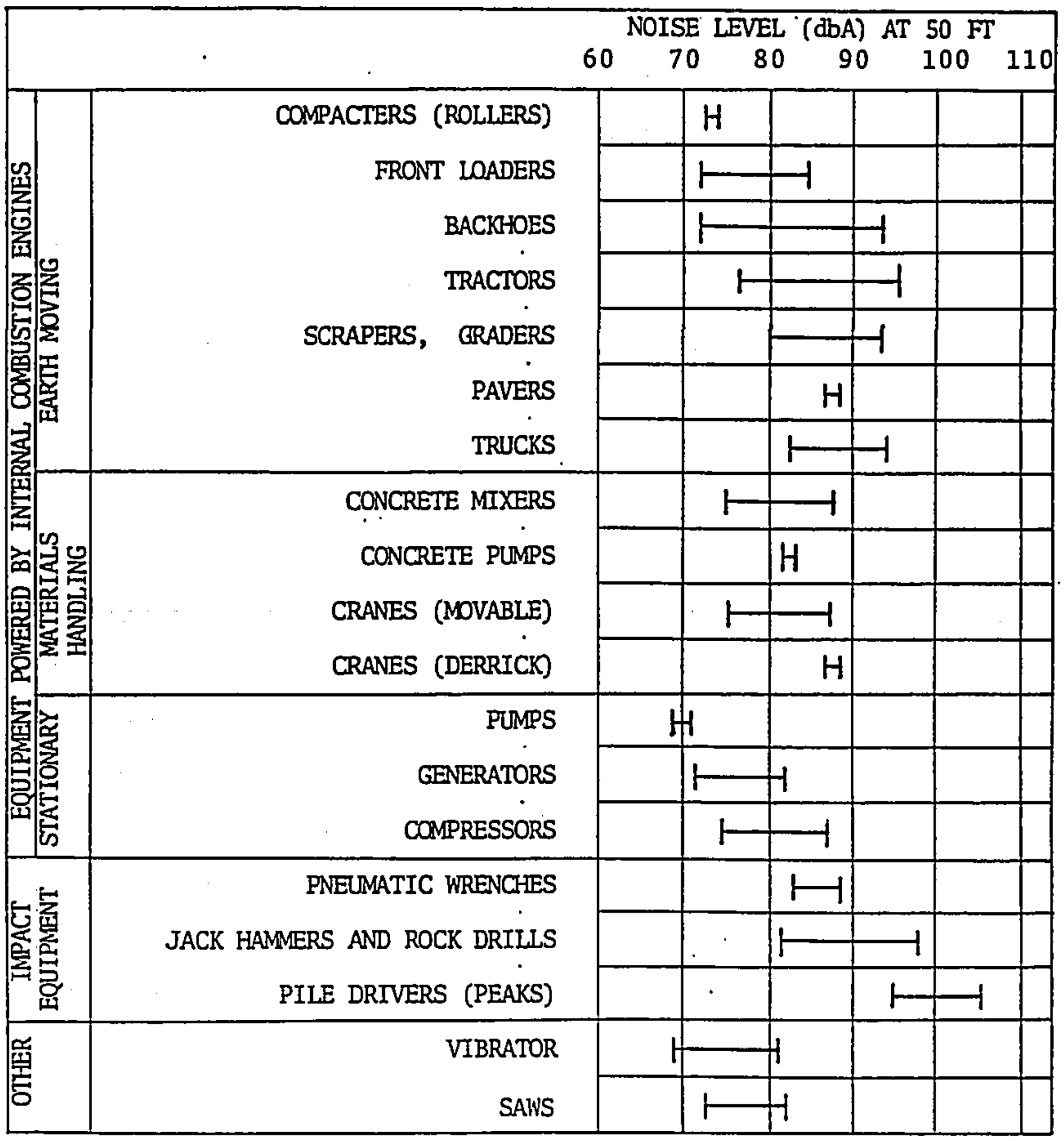
During site preparation and construction, an increase in ambient noise is inevitable. Noise levels (generated by construction machinery) which can be expected are presented in Figure 4-1.

To mitigate impacts of construction noise, the contractor will ensure that mufflers on equipment are in proper operating condition and will limit the hours of construction, if necessary.

As sound waves move uniformly in all directions, the amplitude decreases as they

FIGURE 4-1

CONSTRUCTION EQUIPMENT NOISE RANGES



Note: Based on Limited Available Data Samples

Source: Noise From Construction Equipment and Operations Building Equipment, and Home Appliances, EPA, 1971 move from the source of the sound. In air when the distance doubles, the amplitude drops by half, which is a drop of 6 dB. Therefore, if one moves one meter from the source to two meters from the source, the sound pressure level will drop by 6 dB [4.1]. Given the noise levels presented in Figure 4-1 and assuming the highest noise level generated by pile driving (110 dBA), the theoretical noise levels, in air, from the sound source are estimated as follows:

Distance (feet)	dBA Level
50	110
100	104
200	98
400	92
800	86
1600	80
3200	74
6400	68

These particular estimates would be true only when there are no reflecting or blocking objects in the sound path. An obstacle in the path of the sound wave would reflect and absorb some of the sound, the amount of which would depend on the physical properties of the obstacle [4.2].

The project site is about 0.76 mile from the nearest populated area (new homes at Village Park) and impacts are anticipated to be minimal. Cane fields between the project site and residences will attenuate some of the potential impact so the anticipated noise level at the nearest residence will be less than 68-74 dBA. Chapter 44-B of the Department of Health regulations regarding allowable noise levels on Oahu allows 70 dBA during the day for an agricultural area and 55 dBA for a residential area, except during construction. The increase in noise will be temporary and should last only for the duration of the construction period.

Some wildlife species may be displaced to surrounding areas during construction but could return to the site upon completion. No endangered species would be affected.

c. Economic

During the construction of the wells, control building and transmission line there will be an infusion of cash into the local economy. This will be a short-term, positive impact for the local economy.

The estimated total construction cost for the project is $3,739,000.

d. Traffic

Since most of the proposed alignment of the transmission line is located along a cane haul road, the impact on traffic in this area should be minimal. Potential problems can be mitigated by coordinating with Oahu Sugar Company construction scheduling to avoid conflict with cane haul trucks.

Approximately 875 feet of the alignment will be along Farrington Highway. During construction hours one lane of the highway will be blocked from traffic, but two-way traffic will not be interrupted. Construction will be confined to non-peak traffic hours and traffic control devices will be used for safe direction of traffic. During peak traffic hours the trench will be covered and the blocked lane will be opened.

e. Air Quality

During construction there will probably be some increase in airborne particulate matter in the vicinity of the site; however, this will be temporary and is not expected to be significant. Cane operations presently contribute to similar, if not greater, increases.

During construction along Farrington Highway, the increased emissions are not expected to be significant and will only last for the duration of the construction period.

f. Biological

Vegetation in the vicinity of the project site is not considered rare or endangered by State or Federal agencies. The majority of species are introduced. Significant impacts on the existing botanical community are not expected.

Terrestrial fauna in the project area are primarily introduced species associated with agricultural and urbanized areas. Native birds, with the exception of the pueo, would be unlikely to visit the area, as the site does not offer suitable habitat.

During construction, fauna in the immediate vicinity of construction activities may relocate into adjacent areas, but would be able to return to the site upon completion of construction. Adverse impacts on faunal communities are not anticipated as a result of the proposed action. In fact, landscaping of the control building site may provide new habitat for certain species of birds.

g. Infrastructure

Potential conflicts between the transmission line placement along Farrington Highway and existing gas and oil lines will be mitigated by coordination with GASCO; electrical lines with Hawaiian Electric Company, Inc; and telephone lines with Hawaiian Telephone Company. Coordination for this phase of construction will also be maintained with the State Department of Transportation.

h. Archaeological

There are no archaeological sites listed in the State or Federal registers of historic sites which are located on the subject property. Thus, discussion of impacts are precluded. However, if evidence of a site or cultural remains are discovered during construction, the State Historic Preservation Officer will be notified.

2. <u>Long-term Impacts</u>

Primary long-term impacts, both beneficial and adverse, are those anticipated to result directly from the project. These are impacts that can be expected for the duration of the site's use.

a. <u>Surface Water</u>

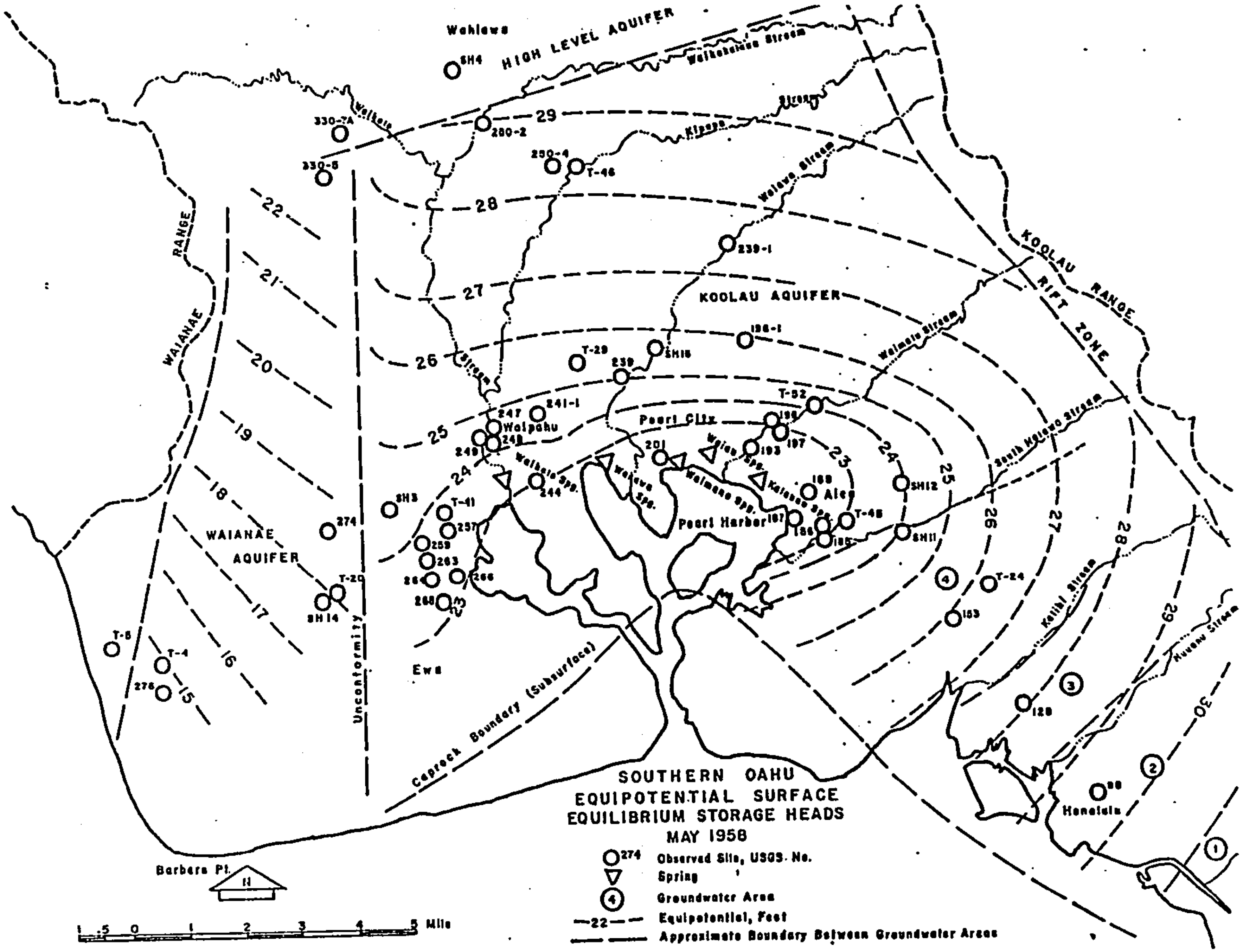
Honouliuli Stream and its tributary, which are located west and east of the site, respectively, are dry most of the year. Their source is surface runoff and possibly dike impounded water within the southeast slopes of the Waianae Range. These dikes overflow during rainy months. Apparently, basal gound water does not contribute significantly to their flow. Hence, drawdown of the ground water in the vicinity of these streams should not have a significant, if any, impact on their flow.

The perennial flow of Waikele Stream is contributed to mainly by the basal water body; however, since it is nearly 2 miles away and not down-gradient from the proposed wells it is unlikely that drawdown from the Honouliuli Wells would affect flow in this stream.

b. Ground Water

BWS' policy is to negotiate an agreement with Oahu Sugar to reduce their pumpage in direct proportion to the amount of water to be developed by Honouliuli Wells. Although there will be no net increase in discharge from the greater Pearl Harbor aquifer, there will still be an effect on a portion of the aquifer; more specifically, the Koolau aquifer (refer to Figures 4-2 and 4-3). The water sources closest to the site and that draw from the Koolau aquifer are Kunia Wells I, Kunia Wells II and Oahu Sugar's Ewa Shaft. These sources will probably experience some drop in head level with continued pumping from the new wells, if the cut-back is not at Ewa Shaft. However, this is difficult to quantify until the wells begin operation and it is known which of Oahu Sugar's water sources will be reduced in pumpage.

Development of a well field may affect nearby wells, because the drawdown produced around the well field results in a "cone of depression" in the water table. The



SOURCE: State of the Groundwater Resources of Southern Oahu, by John Mink (1980)

FIGURE 4-2

POTENTIOMETRIC SURFACE MAP - 1958

SOURCE: State of the Groundwater Resources of Southern Oahu, by John Mink (1980)

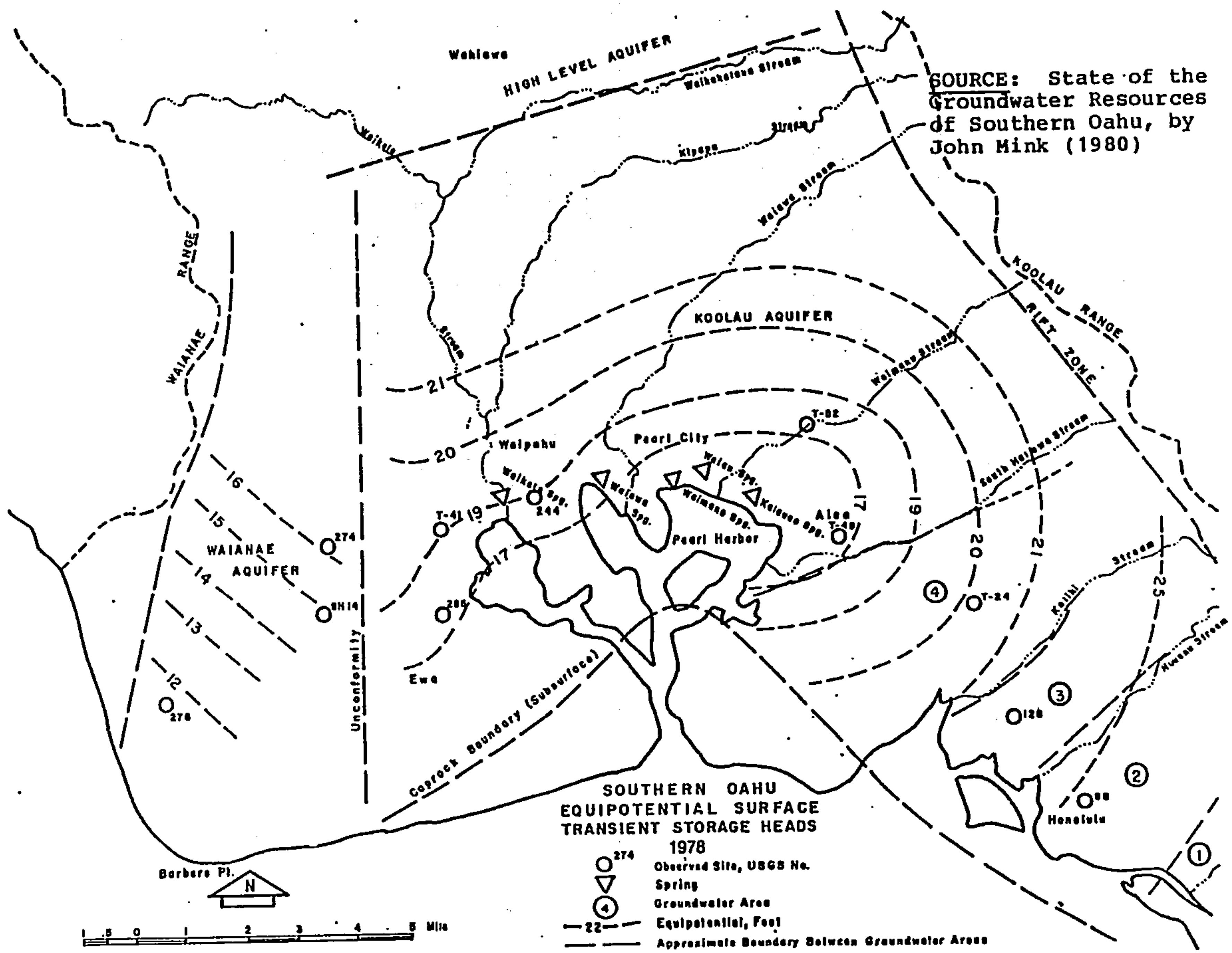


FIGURE 4-3

POTENTIOMETRIC SURFACE MAP - 1978

size of this cone depends upon the character of the water-bearing formation (aquifer) and upon the rate and duration of pumping.

The more permeable the aquifer is or the larger the interconnected openings in the formation are, the less the drawdown at any given pumping rate will be. In cases where the aquifer is very "open" or permeable (as in the volcanic series beneath the site), the drawdown may be almost negligible for low pumping rates [4.3].

All of the adjacent sources will continue to be closely monitored throughout the development and use of the new wells, so that any impacts can be identified and mitigated in a timely manner. In addition, studies were undertaken by John F. Mink to determine whether wells in the Pearl Harbor aquifer could be operated at lower head levels. In summary, he concluded that "at low head a unit change in sustainable yield results in much larger loss of storage head than the same unit change at high head."

To mitigate impacts on head levels, the Honouliuli Wells could be operated at a lower capacity, if necessary. However, significant impacts are not anticipated because the new wells have been planned hydro-geologically to have the least effect on other wells in the vicinity. They are also far enough inland to permit seasonal changes in the thickness of the fresh water lens without increases in salinity in the wells.

c. Water Quality

Surface water quality would be impacted only if drawdown were to reduce surface flow. However, as mentioned above, this situation appears unlikely.

Ground water quality would be impacted if the Honouliuli Wells were to reduce the amount of ground water flowing to the shore in this area, to the extent that the transition zone were to thicken. This is discussed in greater detail on page 2-17. If this occurred, the salinity of the water pumped from other wells seaward of Honouliuli Wells could increase, lowering their quality for domestic use (if domestic wells). Domestic wells are identified in Table

2-1. In addition, the EPA recommended secondary limit for total dissolved solids could be exceeded.

The probability of this occurring is low because it is considered unlikely that drawdown from the Honouliuli Wells will affect the amount of ground water seepage to the shore, since net draft from the aquifer will be equal to the current rate.

The exact effects of pumpage from the new wells cannot be predicted quantitatively at the present time. Thus, there are several wells in the vicinity, including those mentioned above, which will be closely monitored in order to detect increases in the chloride content of the water, which could be indicative of salt water intrusion.*

As above, any significant impacts could be mitigated by operating the wells

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* Under perfect equilibrium conditions in accordance with theory, permanently lowering the storage head of the fresh-water aquifer by 1 foot results in a rise in the transition zone of 40 feet. Conversely, an increase in the rate of recharge will cause a thickening of the freshwater lens and a seaward displacement of the salt water.

at a lower capacity, if necessary, to the extent that other domestic wells would no longer be affected.

A moderate decline in water quality (i.e. increase in chloride content) of the sources used for irrigation would not have a significant impact on sugar cane, as most of the sources have chloride contents well below 1,000 ppm. It should be noted that the chloride content of 1,000 ppm does not represent an absolute demarcation between non-water quality limited growth and dead cane. Reports by sugar industry agriculturists infer that progressive declines in production are related to increases in the chloride concentration of irrigation water.

Since the well serving the National Wildlife Refuge West Loch Unit is presently saline, an increase in the chloride content of the water would not change the present situation.

d. Noise

Pump noise is not anticipated to be a problem at the present time, since the site is surrounded by cane fields. However, if land use should change over the years and noise from the pumps were to impact residential areas, mitigation measures are available, such as building sound barriers around the offending equipment.

e. Population

Development of the wells will require allocating 0.5 mgd, of the initial 3.0 mgd, to Makakilo for a portion of its expansion of the subdivision, since Makakilo will be helping to finance the project. The full expansion will consist of 3,693 dwelling units, accommodating a total population of 11,800 persons (based on 3.2 persons per dwelling unit).

However, the residential population which could be served by 0.5 mgd is approximately 3,200 persons, based on 1,000 dwelling units requiring 500 gallons per day apiece and 3.2 persons per unit.

Subtracting the 1980 Ewa population of 35,554 from the State's Series II-F projected year 2000 population of 74,300 to 81,700 leaves 38,746 to 46,146 remaining. An increase from Makakilo of 3,200 would represent approximately 7-8% of the total projected population increase for the Ewa area until the year 2000.

The total population of the Makakilo expansion, at 11,800 persons, would represent about 25-30% of the projected population increase for Ewa.

The per capita daily water consumption was 228 gallons in 1971. [4.4]

f. Land Use

The project would have little initial impact on land use in the vicinity of the project site, as at least 83% of the first 3 mgd to be developed will serve areas which are already zoned for urban use (Campbell Industrial Park and Makakilo).

Likewise, there should be little impact on cane lands immediately surrounding the site. Every effort is being made to site the wells and control building in a location where loss of cane land will be minimized.

Occasional cane burning should not be a significant effect on the proposed development. While smoke and ashes might dirty the interior of the station, they will not adversely affect the mechanical equipment, which is maintained to minimize the corrosive effects from smoke and ash. Several other BWS stations are located in areas surrounded by sugar cane without adverse impacts to either party.

g. <u>Economic</u>

The proposed development of the wells would directly support the expansions of Campbell Industrial Park and Makakilo subdivision. This, in turn, would contribute to an increase in jobs in the Ewa-Makakilo area for industrial and construction workers, which may be considered a long-term beneficial impact.

It is not anticipated that this project alone will cause an increase in water rates. The rate structure for Oahu is based on uniform rates for regular domestic service throughout the entire island.

The total cost of water production breaks out to $0.13 per 1,000 gallons (in 1977 dollars) and is considered to be relatively low in comparison to alternative sources.

h. Water Demand and Conservation Measures

The project would provide 3 mgd of water to the Ewa-Makakilo area initially. As demand increases, another 6 mgd would be available to the area. It is not anticipated that this water will be exported to the Waianae Coast, as proposed water projects in that area should be sufficient to accommodate future needs of that area.

Approximately 2.0 mgd will be developed in Makaha and Waianae Valleys by 1985, in addition to 0.5 mgd from the recently completed Kamaile Wells. Later, it is anticipated that an additional 4 mgd can be developed from the Makaha and Waianae Wells [4.5].

Refer to Table 4-1 for a summary of present and projected water use in the leeward area.

To mitigate increases in water demand, a long-range water conservation program was begun by the BWS in FY 1976-1977. A leak detection and repair program was started and during the first year over 85 miles of mains in 23 different pressure zones were inspected and repaired. In

TABLE 4-1

SUMMARY OF WATER USE, LEEWARD REGION, 1978-2000

Area	Existing Average Capacity (MGD)(1)	Existing Demand in 1978 (MGD)	Excess Capacity (MGD)	Potential New Sources by 1985 (MGD)	Excess Capacity (MGD)	Increase in Demand by 1985 (MGD)	Excess/ Deficit Capacity (MGD)	Potential New Sources by 1985-2000 (MGD)	Excess Capacity (MGD)	Water Import Discontinuation (MGD)	Excess Capacity (MGD)	Increase in Demand by 2000 (MGD)	Excess Capacity (MGD)
	4.88	4.2 Waipahu		3.0 Honouliuli Wells (3)		17.20 1985		6.0 Honouliuli Wells (3)				32.90 2000	
	7.42	7.46 Ewa-Makakilo (2)				-11.66 1978		12.0 Water Exchange (4)				-17.20 1985	
Waipahu-Ewa-Makakilo	+12.30	-11.66	+0.64	+3.0	+3.64	- 5.54	-1.90	+18.00	+16.10	-0-	+16.10	-15.70	+0.40
	4.20			4.0 Makaha Wells		8.20 1985						10.28 2000	
	4.00			2.0 Waianae Wells		7.63 1978						- 8.2 1985	
Waianae	+ 8.20	- 7.63	+0.57	+6.0	+6.57	- 0.57	+6.00	-0-	+ 6.00	-4.00	+ 2.00	-2.08	-0.08
DISTRICT TOTALS:	+20.50	-19.29	+1.21	+9.0	+10.21	- 6.11	+4.10	+18.0	+22.10	-4.00	+18.10	-17.78	+0.32 (5)

(1) As certified by DLNR. All sources from Pearl Harbor Water District except 4.20 mgd from Ewa-Waianae Water District.
(2) Standard Oil Refinery uses 2.7 mgd of this.
(3) If allowed by DLNR.
(4) Assumes Ewa will get one half of water available for exchange. If for some reason a water exchange cannot be facilitated, the development of alternate sources must occur at an earlier date than presently planned. (Exchange must be approved by DLNR).
(5) After the year 2000, alternate sources will have to be developed for this District.

addition, three abandoned private wells, one of which was leaking, were sealed.

Since then, the BWS initiated a low ground water plan which gives them the power to institute mandatory controls, if necessary. The rules provide for progressively restrictive measures as ground water levels decline, beginning with purely voluntary reductions. Ultimately, surcharges and installation of flow restrictors may be used to insure reduction in usage.

A bill amending Chapter 19, Revised Ordinance of the City and County of Honolulu was passed and became effective November, 1979. It provides for limiting maximum flow rates of faucets, limiting water closet flushing volumes, and recirculation of cooling water for new installations.

In April, 1979 the BWS staff coordinated the first annual Water Conservation Week in Oahu's public schools. This was preceded by a water conservation poster contest in March. Over 400 entries were received and all were displayed during Water Conservation Week.

The BWS Public Relations Office also distributes information on water conservation. During the 1976-77 drought, the office conducted radio and television interviews, released periodic news releases on how consumers could conserve water, initiated news series in the media, held a "Water Conservation Fair," and notified individuals and businesses observed by consumers to be wasting water.

More recently, tours have been arranged and speakers have been made available to discuss the island's water supply and conservation measures. Visual aids are also made available, as well as publications for schools, hotels, restaurants, gardeners, and homeowners or renters.

One pamphlet outlines water conservation measures that residential users have at their disposal, including toilet tank alterations, faucet and flow controls, shorter showers, watering lawns at night, and dry landscaping. A summary of household water saving devices and the new City ordinance requiring conservation devices is shown in Appendix I.

The BWS is also planning adjustments to the water rate structure. Lower block rates are being considered for lower usage, as well as seasonal rates.

BWS' policy favors voluntary conservation and it attempts to educate consumers towards this end. To date, public acceptance and cooperation have been good. The conservation plea that was issued at the height of the 1977 dry period resulted in an estimated 8-10% reduction in consumption. Despite increases in the number of services by the BWS, annual pumpages in 1978 and 1979 were below that of 1977. (A recent study of metered customers indicated that 65% of all the water supplied by the BWS was for domestic use.)

Conservation measures can be adopted by industry as well as by individuals. The primary method used by industry and business is to recycle or reuse cooling waters. This method increases energy consumption, however, and with the tradeoff between energy consumption and water conservation, water conservation loses to the higher energy costs.

Another indirect measure relates to sewer charges. As of July 1, 1981, non-residential users, such as restaurants, bars, laundries, and canneries, paid a sewer charge based on $0.59 per 1,000 gallons. Also, a "suspended solids surcharge" that went into effect in July, 1979, affects food and fruit processors.

The Wastewater Management Division of the City and County of Honolulu's Department of Public Works classifies users according to suspended solids concentration of their effluent. All those with a suspended solids concentration over 200 parts per million (ppm) generally pay more than the basic rate. Large water users, therefore, are faced with high sewer costs as incentives to lower water consumption. The sewer surcharge does not affect residential users, except food and fruit processors.

Other conservation measures being investigated include dual systems and cistern systems. Dual water systems utilize higher quality water for consumption and lower quality water for remaining needs. Cisterns collect and store rainwater, primarily in areas where rainfall exceeds 50 inches per year. However, there are many health and operational problems that must be resolved before such systems can be promoted.

Restoration of dike storage by bulkheading tunnels and decreasing withdrawals during wet weather could make available additional high level dike-confined water during dry periods.

Finally, the reuse of sewage effluent or other lower quality water for irrigation or other uses is a viable form of water conservation, since it decreases the need to pump higher quality water for this purpose. However, the plugging problem of using effluent in drip irrigation systems has to be resolved before this technique can be applied.

B. Secondary Impacts

1. Water Quality

Potential secondary impacts on ground water quality are related to the use of diluted sewage effluent for furrow or drip-irrigation of sugar cane. Since 1971, the University of Hawaii Water Resources Research Center (WRRC) has been conducting field studies of this method in conjunction with the BWS, the City's Wastewater Management Division, Hawaii Sugar Planters Association (HSPA) and Oahu Sugar Company, Ltd.

Results indicate that with a dilution ratio of three parts water to one part secondary treated sewage effluent, the irrigation water meets the needs of sugar growers and meets State Department of Health regulations, which specifiy that sewage receive a minimum of secondary treatment before being used for irrigation. The final progress report notes the following [4.6]:

> "The quality of percolate from the effluent-irrigated sugarcane-cultured soil is of acceptable concentration from the standpoint of groundwater quality protection with the only possible concern for nitrogen which sporadically exceeded the 10mg/l limit for drinking water during the first 6 to 7 months of growth. However, similar exceedance occurred in the ditch water irrigated sugarcane plots and the plots irrigated with effluent during the first year and ditch water during the second year."

It also states that:

> "Both total dissolved solids and chloride in the percolates met the drinking water standards".

Presently, the primary problem is that diluted effluent clogs the holes in drip irrigation tubes over time, limiting its use for drip irrigation. Also, improper location of effluent application can raise the TDS levels of Kunia and Hoaeae Wells above the maximum level of 500 ppm.

2. Land Use

The 3 mgd to be developed initially is to provide water to approved developments. The remaining 6 mgd, which can be developed later, is to provide water for proposed development in the Ewa Plain area and to support current City and County land use plans and policies calling for planned growth in the Ewa region of Oahu.

Indirectly, impacts associated with this growth would primarily be impacts on population and infrastructure, and are discussed below.

a. Population

Based on a daily residential use of 500 gallons per dwelling unit, the 6 mgd could support approximately 12,000 units. Assuming 3.2 persons per unit, this would equal a population of 38,400 persons.

However, industrial and other urban uses would undoubtedly claim a portion of this water, thus the actual increase in population which could be served would likely be less than 38,400. Assuming 0.5 mgd goes to other uses, the "worst case" (most) population accommodated would be 35,200. The total population then, which could be served by the project (adding the 3,200 to be served initially) would be 38,400, or approximately 68% of the Series II-F projected population increase for the area.

The Environmental Assessment for the proposed West Beach Resort notes that Honouliuli Wells are one possible source of water for the resort, the others being existing plantations wells [4.7].

b. Traffic

Assuming a "worst case" condition, or 35,200 persons accommodated by the additional 6 mgd of water, and assuming that metropolitan Honolulu remains the major employment center for the Ewa area, an increase in traffic on the H-1 Freeway and Farrington Highway can be expected.

Traffic impacts due to potential developments in the Ewa-Waianae area are shown in Table 4-2. Since the Makakilo expansion is a residential subdivision about 1/3 the size of the "worst case" condition, tripling the increases associated

TABLE 4-2

POTENTIAL VEHICULAR TRIPS GENERATED BY PROPOSED LAND DEVELOPMENTS SERVED BY THE H-1 FREEWAY IN THE EWA AREA

	1978	1985	1990	1995	2000
(1) Waianae Coast	18,700	25,000	31,000	35,900	37,000
(2) West Beach	-	950	8,920	18,350	19,200
(3) Campbell Industrial Park	5,400	9,050	10,500	13,400	16,600
(4) Barbers Pt. Deep Water Harbor	-	2,050	3,450	5,600	7,000
(5) Makakilo	9,800	29,000	30,700	30,700	30,700
TOTALS	33,900	66,050	84,570	103,950	110,500

Source [4.8]:

(1) State of Hawaii Department of Transportation 1978 volume shown is January 1977 traffic count and 1995 projection. Other traffic volumes for 1985 and 2000 were interpolated by HUD staff.

(2) EIS for West Beach prepared by Environmental Communications Inc.

(3) Report: Plan for Barbers Point Harbor Facilities and Expansion of James Campbell Industrial Park prepared for the Estate of James Campbell by Tippetts-Abbett-McArthy-Stratton, Engineers and Architects, New York, June 1977.

(4) Reference (3) above and Barbers Point Harbor Final EIS prepared by Department of Army, U. S. Army Corps of Engineer District, Honolulu, July 1976.

(5) State of Hawaii, Department of Transportation Letter to Benjamin Lum, Department of Housing and Urban Development, dated February 10, 1978.

with that development would give an example of the impacts that might be expected from the "worst case" condition.

There has been no attempt to translate these potential trips into vehicles per hour for a peak condition because there are so many variables that could influence the projections [4.8]. However, the increase due to the "worst case" condition would be likely to increase peak hour conjestion on H-1, in the Pearl City area if not in Ewa. According to the State Office of Environmental Quality Control, the capacity of H-1 for the Ewa area is about 90,000 vehicles.

c. Liquid Waste

Assuming an average sewage flow of 100 gallons per capita per day, a population of 35,200 persons would generate approximately 3.5 mgd of flow.

The Honouliuli WWTP should have adequate capacity to accommodate an increase in flow of this magnitude. However, if the plant is not completed by the time the 6 mgd water goes on the line, developments to be served would have to delay construction or install their own plants, such as has been done at Makakilo.

The projected de facto population to be served by the Honouliuli WWTP was 132,000 in 1970 and is now expected to increase to 226,800 in the year 2,000 [4.9]. The plant will have an initial capacity (25 mgd) to serve a population of 197,000 and will thus have to be expanded to serve the projected population of 226,800 people [4.10].

d. <u>Solid Waste</u>

Assuming a solid waste generation rate of 4 pounds per capita per day, a population of 35,200 persons would generate approximately 140,800 pounds per day of solid waste (70.4 tons per day). This would be approximately 13% of the daily capacity of Palailai Landfill.

Future solid waste will be disposed of at the Palailai Landfill and/or the new City and County sanitary landfill. The service life of both of these facilities will be shortened in direct proportion to the magnitude of the development. The

City and County Department of Public Works is also proposing a solid waste recovery plant, HPOWER, which may have a capacity to process up to 1800 tons of municipal solid wastes per day.

e. <u>Electricity</u>

Assuming an electricity use rate of 700 kilowatt hours (kwh)/month/unit in a residential area, the annual energy consumption of 12,000 units would equal 100,800,000 kwh/year.

While there will be no technical problems in supplying energy to the Ewa area, any future growth will put an increasing burden on the overall energy sources for Oahu. As the energy requirement is presently satisfied exclusively from fuel oil, consumption of this source will increase.

Coal is being considered as either a partial or a total substitute energy source for Oahu. Such a conversion would save money and oil but may increase air pollution.

In terms of mitigation, primary solutions to the long-term increase in energy consumption are to implement known conservation measures and to develop new ones. In addition, new sources of energy should be investigated. Atomic energy would not be cost-efficient in Hawaii; however, geothermal, wind and solar energy show promise [4.11]. When inexpensive solar collectors can be mass produced and installed in private dwellings, an estimated 30% reduction in electric consumption may occur [4.12]. Finally, the City and County Department of Public Works is proposing a solid waste recovery plant, HPOWER, which would produce electricity as well. The capacity of the plant is presently unknown.

f. Telephone

Hawaiian Telephone Company is able to provide service to the project site after a satisfactory right-of-way is acquired.

g. Schools

As noted on Figure 2-12, future enrollments in the Ewa-Waipahu-Makakilo area are anticipated to exceed present capacities in some cases. However, the Department of Education's long-range capital improvements program (CIP) calls for the construction of several improvements and new schools in the Waipahu-Ewa-Makakilo area. For example, Ewa Intermediate-High is planned to be operational in 1982-1987, with a projected 1995 enrollment of 2,200. These plans are elaborated on in the Environmental Impact Statements for Village Park and Makakilo [4.13, 4.14].

In addition, long range plans include possibly purchasing 200 acres of land at the intersection of Fort Weaver Road and Farrington Highway for a four-year college. This addition to the University of Hawaii would serve 7,500 students and would include dormitory facilities.

It appears likely, then, that there would be no significant impact on educational facilities in the area if further growth were to occur, other than the increased public costs that would be necessary to build, staff and maintain the new schools.

h. Police

A population of 35,200 persons would generate a need for an additional 74 police officers, based on a service ratio of 2.1

officers per 1,000 persons. The additional manpower needed, as well as support personnel and equipment, would be an added public cost but would provide some job opportunity.

i. Fire

The existing fire station at Makakilo can provide adequate fire protection to the existing subdivision and its future expansion. However, as the surrounding commercial and industrial areas develop, additional fire stations will be required, resulting in increased public costs but some job opportunity.

j. Medical

The present health care system in central Oahu appears adequate to serve the proposed Makakilo expansion [4.15]. However, the long-term adequacy of this system will be negatively impacted by cumulative growth in the area, including Village Park. The additional facilities, staffing and operating funds necessary to provide adequate medical care will result in increased public costs but some job opportunity.

k. Parks and Recreation

City Ordinance #4621 requires the dedication of park lands within residential developments. Thus, the estimated 12,000 units in our example would require approximately 96 acres of park land to be dedicated, based on 350 square feet of park land per single family unit, or 30 acres based on 110 square feet per townhouse unit.

However, the residents will undoubtedly also use the beaches and other parks in the vicinity, which are already heavily used. Thus, adverse impacts can be expected with regard to these facilities, which would result in increased public costs for maintenance.

l. Agriculture

By providing water to urban developments it has been suggested that the project could indirectly impact agriculture by putting those urban developments into competition with agricultural enterprises for available land on the Ewa Plain. This is an issue which will have to be addressed by all government agencies, pursuant to

C.1.4. of the Honolulu General Plan (refer to page 3-5).

Based on BWS water consumption guidelines (Table A-9), the industrial or commercial use (0.5 mgd) in our example would require about 125 acres and the residential use (5.5 mgd) would require 1,375-2,200 acres of land (depending on multifamily or single family use). Assuming an average of 1,788 acres were necessary for residential use, a total of 1,913 acres would theoretically be required for urban development (assuming no agricultural use of the available water).

Since about 1,336 acres of vacant privately-owned land are already zoned for urban use in the Ewa Development Plan Area (Table 2-7), up to 577 acres might theoretically have to be rezoned, most likely from agriculture. (In 1978 there were 5,211 acres of vacant usable privately-owned land zoned for agriculture in the Ewa area). However, some of the water will undoubtedly serve urban development on publicly-owned land. Thus, it is possible that no land would need to be rezoned.

By providing water in trade to Oahu Sugar Company, the BWS believes it will mitigate impacts on agriculture to the maximum extent possible given its jurisdiction.

REFERENCES TO SECTION 4

[4.1] B & K Instruments, Inc. Handbook.

[4.2] Ibid. [4.1]

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[4.4] Oh, Ho-Sung and Yamauchi, Hiroshi. 1974. An Economic Analysis of the Patterns and Trends of Water Consumption Within the Service Areas of the Honolulu Board of Water Supply. Water Resources Research Center, Technical Report No. 94.

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[4.9] Whang, Lawrence. 1979. Personal communication. Board of Water Supply, City and County of Honolulu, Honolulu, Hawaii.

[4.10] Miyahira, Wallace. November, 1979. Department of Public Works, City and County of Honolulu.

[4.11] U. S. Department of Housing and Urban Development. 1978. Draft EIS on Makakilo. HUD, Honolulu Area Office, Honolulu, Hawaii.

References to Section 4, (cont'd)

[4.12] Op. Cit. [4.9].

[4.13] Op. Cit. [4.9].

[4.14] Op. Cit. [4.8].

[4.15] Op. Cit. [4.8].

Probable Environmental Effects

5

SECTION 5

PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

This section will briefly discuss probable adverse environmental impacts and mitigative measures, when applicable, and the rationale for proceeding with the proposed action, notwithstanding unavoidable effects.

I. PRIMARY SHORT-TERM IMPACTS

A. Probable Impacts and Mitigative Measures

During construction of the wells, control station, access road and transmission line, there will be an increase in existing noise. As stated in Section 4, however, the level for the loudest activity should be less than 68-74 dBA at the nearest residence. This will be of short duration, lasting only for the construction period, and can be mitigated by the contractor ensuring proper functioning of mufflers on equipment and by limiting the hours of construction, if necessary.

Construction of these facilities may also result in short-term increases in fugitive dust, which is expected to be comparable to, if not less than, cane harvesting activities experienced regularly in this area. If dust should be a serious problem it will be mitigated by water sprinkling.

During development of the access road and transmission line there will be minor disruption to traffic patterns on Kunia Road, Farrington Highway, and the cane haul roads, lasting only for the duration of these construction phases. It should not result in significant adverse impacts with proper direction of traffic and coordination of construction with appropriate agencies and companies.

Although emissions from construction vehicles are inevitable, the expected level of emissions should be insignificant and are not anticipated to result in adverse environmental impacts. They will last only for the duration of construction.

Construction of the transmission line along Honouliuli Stream should be a minor source of sediments with proper construction practice during trenching and filling. If necessary, siltation basins will be provided.

Some clearing and grubbing are necessary for site preparation, but vegetation at the site is not considered rare or endangered and most are exotic common species. This site also does not provide critical habitat for native fauna species. Denuded portions will be revegetated after construction.

Although fauna species present at the site will relocate to adjacent lands during construction, they will be able to return to the site after construction has been completed. Species to be affected are common to agricultural and urban areas and the small numbers that will relocate are not expected to significantly affect the existing faunal community.

B. Reasons for Proceeding

The probable short-term adverse impacts encountered during the construction phase of the proposed project are minor and acceptable mitigative measures will be taken.

II. PRIMARY LONG-TERM IMPACTS

A. Probable Impacts and Mitigative Measures

Of concern is the effect the proposed wells will have on water levels of existing wells in the immediate vicinity of the project site. These existing wells will be closely monitored and appropriate mitigative measures will be taken in the operation of the Honouliuli Wells to alleviate adverse impacts.

It is not anticipated that draft from the new wells will significantly impact the location of the transition zone or cause an increase in chloride content of the other wells in the vicinity, since net draft from the aquifer will not increase. However, if this were to occur, the situation could be mitigated through adjustments in operations of the new wells.

In addition to the above precautions, the proposed wells must be approved by the State Board of Land and Natural Resources prior to construction. Subchapter 5 - Permits To Use Water In Designated Areas, of Chapter 166 of Title 13 13-166-22 states, in part, that:

> §13-166-22 Use permit required. In a designated water control area, no withdrawal of water nor any well or other works for withdrawal shall be constructed until an application for a permit to use the water has been filed and a permit issued by the board as provided in §177-10, Hawaii Revised Statutes. [Eff. June 22, 1981] (Auth: HRS §177-7) (Imp: HRS §177-19)
>
> §13-166-23 Applications for use permit: filing fee. (a) A person shall file an application with the board to withdraw ground water within a designated ground water control area. No withdrawal of water shall be made by the applicant until receipt of a permit issued by the board.

The BLNR must also approve any water exchange agreements between the BWS and Oahu Sugar Company.

Finally, maintenance of the well system will require a commitment for the duration of its use.

B. Reasons for Proceeding

Development of any new water source will have environmental costs as well as benefits, and it is the professional opinion of the BWS that potential impacts associated with draft from Honouliuli Wells will be sufficiently minor to warrant proceeding with the project in this case. Careful monitoring of the other wells in the vicinity of the site will continue.

Although development of the wells will require commitment of funds, the relative cost is low compared to most of the other alternatives. Further, it is BWS policy to optimize development of Oahu's ground water resources before proceeding with other alternatives. This reason is elaborated in Section 6.

Several characteristics of basal water make this alternative desirable. Basal water is readily accessible in many parts of the islands, little water is lost through evaporation, no construction is required to provide storage capacity, and water is of good quality, requiring no treatment [5.1].

III. SECONDARY IMPACTS

A. Probable Impacts and Mitigative Measures

As previously stated, the BWS plans to develop the proposed wells if a water exchange agreement can be negotiated with Oahu Sugar Company. This involves a one-to-one exchange of Oahu Sugar's ground water pumpage with water of lesser quality. The secondary impact associated with exchange of lesser quality water is the potential impact this lesser quality water may have on the ground water's quality. However, results of research conducted on recycling sewage effluent for irrigation indicate that with a dilution ratio of three parts water to one part secondary treated effluent, the irrigation water meets State Department of Health regulations.

B. Reasons for Proceeding

The development is proposed to provide necessary support requirements of the goals and objectives of the City and County of Honolulu's General Plan, which calls for growth in the Ewa area. Associated with this growth are some potential adverse impacts to support services. These include increased traffic and load on existing roadways, waste disposal concerns, energy concerns, load on existing parks, needs for schools, and increased demands on existing emergency services. With careful planning, however, improvements and new facilities and service can be provided to assist this growth.

REFERENCES TO SECTION 5

[5.1] Hawaii Water Resources Regional Study. 1977. Hawaii Water Resources Plan (Review Draft). Hawaii Water Resources Regional Study, Honolulu Hawaii.

Alternatives

6

SECTION 6

ALTERNATIVES TO THE PROPOSED ACTION

I. NO ACTION

A no action alternative would result in no development of the Honouliuli Wells by the Board of Water Supply. Approximately 0.6 mgd excess exists within the present system, but it would not be enough to satisfy the current needs of the Campbell Industrial Park and Makakilo expansions, nor will it meet the support needs of the other 1,495 acres of vacant land zoned urban within the Ewa area.

Although alternate water sources are being seriously investigated, feasible sources, such as desalinization, are not presently considered to be cost effective nor technologically reasonable. (A discussion on alternate water sources is presented later in this section). The BWS plans to optimize development of ground water sources on Oahu to meet existing demands and needs for the near future.

Water from other existing sources could not be delivered to the Ewa area without a simultaneous decrease in amounts allocated to existing users.

II. RESCHEDULING THE ACTION

Well development could be postponed for at least another year or two, or until an acceptable water exchange has been developed for the sugar industry. However, as previously mentioned, the main problem with using sewage effluent for drip irrigation involves clogging of the drip irrigation lines. Since at least two years are required before the water can go on line after the wells are drilled and it is possible that the remaining problems with drip irrigation could be solved by that time, postponing development until the problem is resolved would only add unncessary delays to the project. This would primarily cause delays in serving the future users, particularly Campbell Industrial Park and Makakilo. In addition, sewage effluent may be used for furrow irrigation as well.

III. ALTERNATIVE SITES

There are no alternative sites as desirable or available for the proposed project. Wells to be drilled in the Makaha and Waianae Valleys are to provide water for the Waianae Coast and to reduce or eliminate export of water from the Pearl Harbor District. Thus, these sites cannot be considered as alternatives to the Honouliuli Wells.

The proposed location has been situated to have the least geohydrological effect on adjacent existing water sources, such as Kunia Well I and II and Oahu Sugar's

Ewa Shaft. Thus, other locations in the general vicinity of the proposed site would be less desirable.

IV. ALTERNATIVE ALIGNMENT

One alternate alignment for the transmission line was examined and rejected. The line would have gone east from the wells to Kunia Road, south on Kunia Road to Farrington Highway, and west on Farrington Highway to the Honouliuli booster station. This alignment was the least favored because it would have involved greater traffic interruptions on the highways concerned and noise impacts. It was finally rejected after the State Department of Transportation (DOT) indicated that the alternate alignment would conflict with the completion of the new Kunia Interchange.

V. ALTERNATIVE WATER SOURCES

A. Water Exchange Program

This program would consist of an exchange of water between Oahu Sugar Co. and the Board of Water Supply. A transfer of preserved use will be arranged so that there will be no net increase of pumpage from the Pearl Harbor Groundwater Control Area. Presently, Oahu Sugar is pumping for sugar cane irrigation approximately 7 mgd of water that meets the acceptable chloride concentration levels for drinking water. The BWS would trade water of lower quality for this potable water on an agreed basis. The lower quality water for exchange would come from any of the potential sources listed below. In addition, another 20 mgd of slightly brackish water could be converted to domestic use if this water were to be blended with water of lower mineral content; thus, from 40 to 70 mgd would be available for exchange.

1. Sewage Effluent [6.1]

According to the EIS for the Mamala Bay Wastewater Treatment and Disposal System, the Honouliuli Wastewater Treatment Plant is estimated to treat 25 mgd of sewage by the year 1990. The Mililani Wastewater Treatment Plant is anticipated to treat about 8 mdg at the same time for a total of 33 mgd available for the exchange program, if it is found to be cost effective. The amount of sewage effluent that could be diverted for the water exchange proposal will depend on the amount that Oahu Sugar Company would accept for irrigation. The effluent would be mixed with higher quality water on a ratio of one part effluent to three parts water and then used for drip or furrow irrigation.

The existing Mililani Sewage Treatment Plant is located on the West Bank of Kipapa Gulch, 15,000 feet north of the Oahu Sugar Co.

mill in Waipahu. The effluent is presently discharged into Kipapa Stream and flows to Pearl Harbor. The effluent mixture from this plant will be used in irrigation mauka of the H-1 Freeway, as shown in Appendix J.

The Honouliuli WWTP is the other sewage treatment plant besides Makakilo WWTP in this cane growing area that can furnish cane irrigation water. It will be located outside the east boundary of Barbers Point Naval Air Station, makai of Ewa Village. The treated effluent from Honouliuli WWTP could be used in irrigation makai of the H-1 Freeway, as shown in Appendix J.

The cost of supplying the sewage effluent has been estimated at $.09 per thousand gallons for the Mililani STP and $.13 per thousand gallons for the Honouliuli WWTP. [6.2]. Studies by the University of Hawaii Water Resources Research Center indicate that the 1-3 mixture ratio is adequate to meet State Department of Health standards and sugar needs as well [6.3].

It should be noted that sugar cane is not the only crop that can be irrigated with sewage effluent. Forage crops can also be irrigated with effluent, remove a large portion of the nutrients, and can be used for ground water recharing.

This alternative will require the approval of the City Department of Public Works.

2. Pearl Harbor Springs [6.4]

The average discharge of water of low salinity from Pearl Harbor Springs, free flowing artesian sources, and other leakages is approximately 55 mgd [6.5]. About 25 mgd of this is from Pearl Harbor Springs. About 12 mgd of the total discharge is pumped to sugar cane fields, and the remaining estimated 43 mgd discharges into the sea. Thus, pending DLNR approval, only a portion of this water could be economically captured and used for additional cane irrigation, or possibly mixed with effluent and then applied.

Three major springs are located at Kalauao, Waiau, and Waiawa. They have been and still are used for irrigation. To improve the use of the springs for sugar cane irrigation, these waters must be collected and pumped westward to the cane growing areas.

A more feasible scheme would also encompass an integrated pipeline pumping system involving all three spring areas and two surface streams -- Waikele and Waiawa. Assuming that the pumping installations are sized to accommodate the lower flows expected during the summer months, up to 33 mgd of water suitable for cane irrigation can be delivered to cane growing areas from the three spring areas and the two surface streams. It is estimated that the cost of supplying water from the springs will be approximately $.12 per thousand gallons [6.6].

Diverting spring and stream waters in this area may impact water quality in Pearl Harbor. A feasibility study is being conducted by the BWS to evaluate the impacts and potential impacts will be addressed prior to pursuing this alternative.

3. West Loch Reservoir [6.7]

Another alternative which has been suggested is to dam West Loch to create a reservoir to capture flood flows from Waikele Stream. Although the dry weather flow is presently being used for irrigation, flood flows rush into West Loch unused because there is no large storage basin to capture them.

A large storage reservoir in West Loch would make it possible to store the high flows during the rainy months for use during the drier summer months. A dam extending 2,700 feet on a bearing of north 75° east from Nichol's Point to Waipio Peninsula can form a 2.3 billion gallon reservoir. Using existing hydrographic data, the proposed reservoir would be able to sustain a flow of about 10 mgd. The dam would be designed to prevent adjacent lands from becoming inundated.

To deliver the stored flood water, an intake structure pumping station and pipeline would be required. Delivery of this source of water to the Waikele area would require a pipeline 16,500 feet long. Consequently, this would be a relatively expensive source, at $.68 per thousand gallons [6.8], and the environmental impacts would need to be studied in some detail before proceeding. Trapping of sediments in the reservoir would shorten the useful life span of the reservoir unless periodic dredgings were performed.

Important environmental concerns include preventing eutrophication of the Loch, maintaining the oyster beds, and maintaining habitat necessary to the life cycle of endemic fish and crustaceans. Goby (*Awaous stamineus*) and Hawaiian prawn (*Macrobrachium grandimanus*), which are diadromous, are both found in Waikele Stream [6.9].

4. Brackish Water

Brackish water wells are another potential source of irrigation water. These could be developed in the caprock of the Ewa Plain or Waianae Coast. As long as the chloride content is below 1,000 ppm, the water would be suitable for sugar cane. About 25 mgd is presently being drafted from this area for irrigation, and there may not be any additional water to develop.

B. Brackish Water Demineralization

Brackish water in the caprock and transition zone comprises a large potential water source presently unused due to excessive mineral content. Caprock water occurs in the Ewa Plain and Waianae coastal areas. In the Ewa area, chloride content of the water generally ranges from 1000 ppm or less to 2000 ppm and total dissolved solids (TDS) up to 4000. The two most advanced demineralization processes are electrodialysis and reverse osmosis.

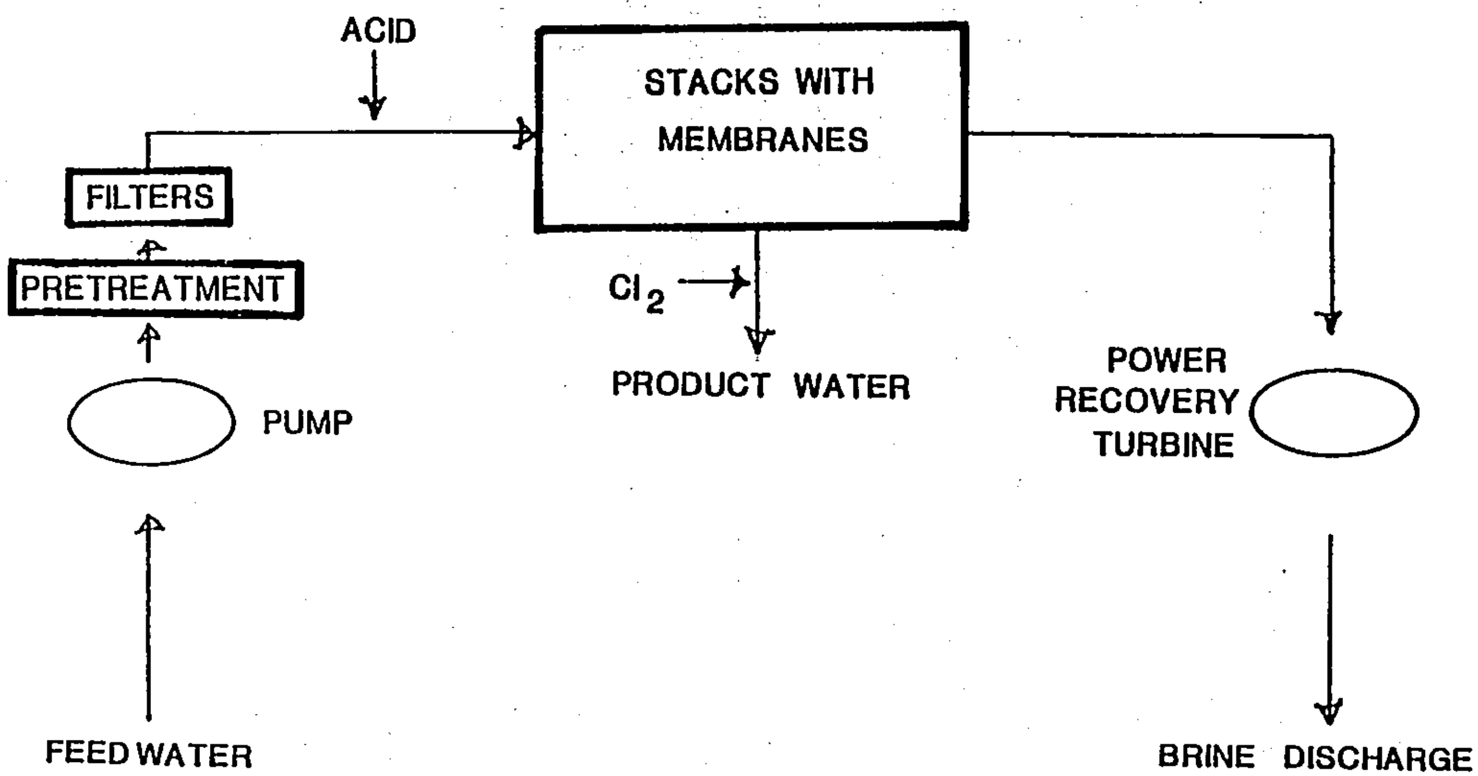
1. Electrodialysis

In electrodialysis, brackish water is pretreated and filtered, and then forced through an electrically-charged stack of selectively permeable membranes. The mineral salts in the water separate into positively-charged and negatively-charged ions that pass through the membranes, leaving fresh water behind [6.10]. After chlorination, this product water is suitable for domestic use.

A single stack may contain as many as 600 membranes and pass up to 250,000 gallons per day of product water. To obtain higher feed-to-product concentration ratios, multiple stacks in stages (series) are required. The number of stages selected is based on feed water hardness (calcium and magnesium concentration), total dissolved solids (TDS), temperature and the presence of any particularly troublesome ions [6.11]. A conceptual design of the process is shown in Figure 6-1.

Operational problems include corrosion, scale formation, and a phenomenon known as "concentration polarization", which limits the portion of dissolved solids that can be removed in a single stack to 50% of the dissolved solids in the feed water. Pre-treatment of the feed water and the addition of acid can aid in control of these problems.

The salt composition of the waste brine is nearly the same as that of the feed water,



CONCEPTUAL DESIGN
ELECTRODIALYSIS SYSTEM
FIGURE 6-1

ADAPTED FROM: WATER DESALTING IN HAWAII FIG. 4-5.

and the concentration can usually be built up to levels acceptable for disposal into the sea or coastal injection wells [6.12].

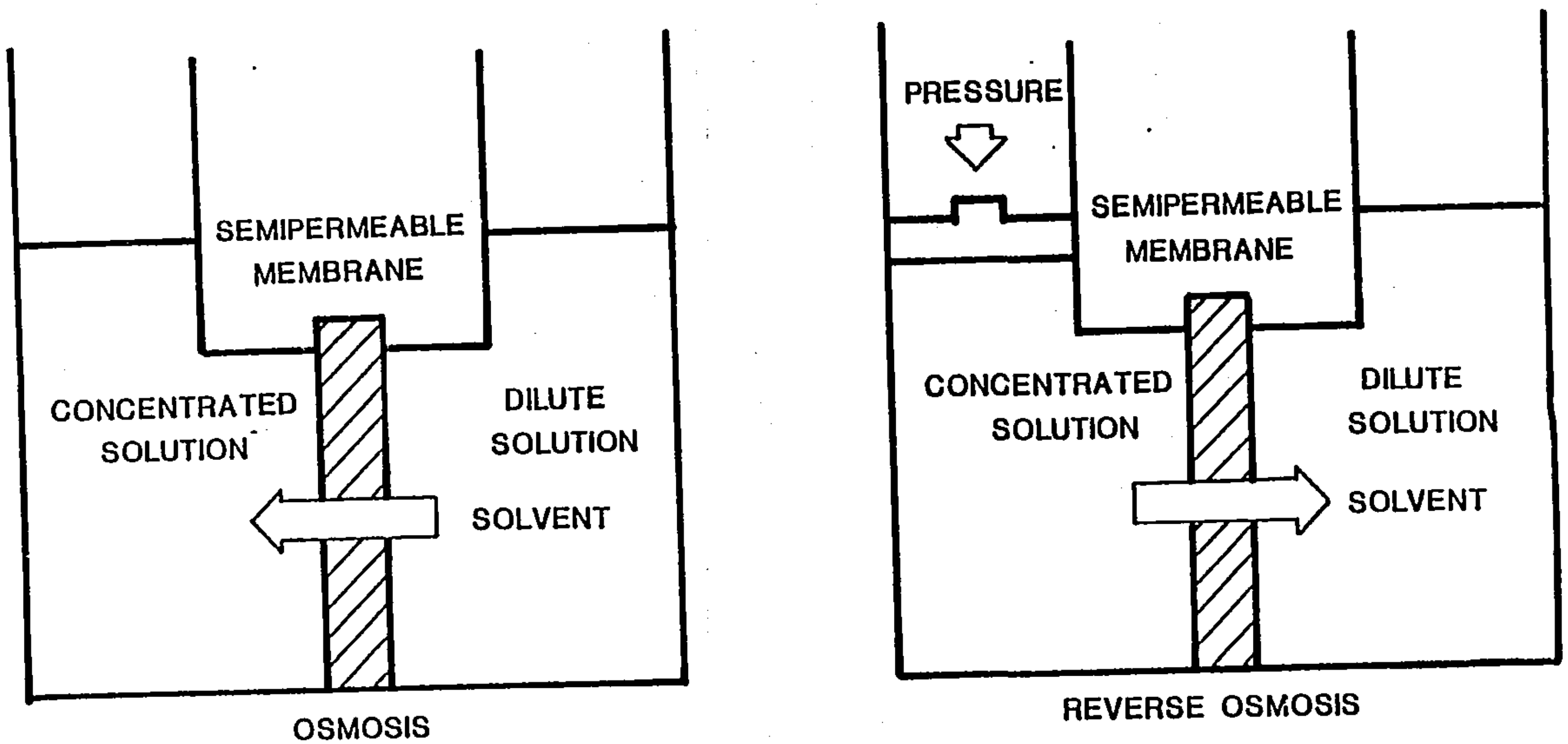
Two major operating and maintenance costs are membrane replacement and electric power. The life expectancy of electrodialysis membranes is about five years if they are properly cared for. Electric power is required to pump the fluid streams through the stacks and force the ions through the membranes. About eight kwhr per 1,000 gallons of product per 1,000 ppm salt reduction are typical at economical current densities and without feed pre-heating. Of this power demand, 3 kwhr are for pumping and 5 kwhr are the processed power requirements. The energy requirement is nearly in direct proportion to the salt removal rate [6.13].

Electrodialysis has provided municipal water for about 10 years in plant sizes up to about 2 mgd.

2. <u>Reverse Osmosis</u> [6.14]

Osmosis occurs if two solutions of different concentration, but in the same solvent, are separated from one another by a semi-permeable membrane that allows the passage of the solvent but not the solute. The phenomenon of osmosis is that the solvent flows from the dilute solution to the more concentrated solution until the pressure on the more concentrated side of the membrane rises to a value known as the "osmotic pressure difference" between the two solutions. Reverse osmosis occurs when a pressure greater than the osmotic pressure difference is applied to the more concentrated solution and the solvent is forced to flow into the dilute solution. The principals of osmosis and reverse osmosis are illustrated in Figure 6-2.

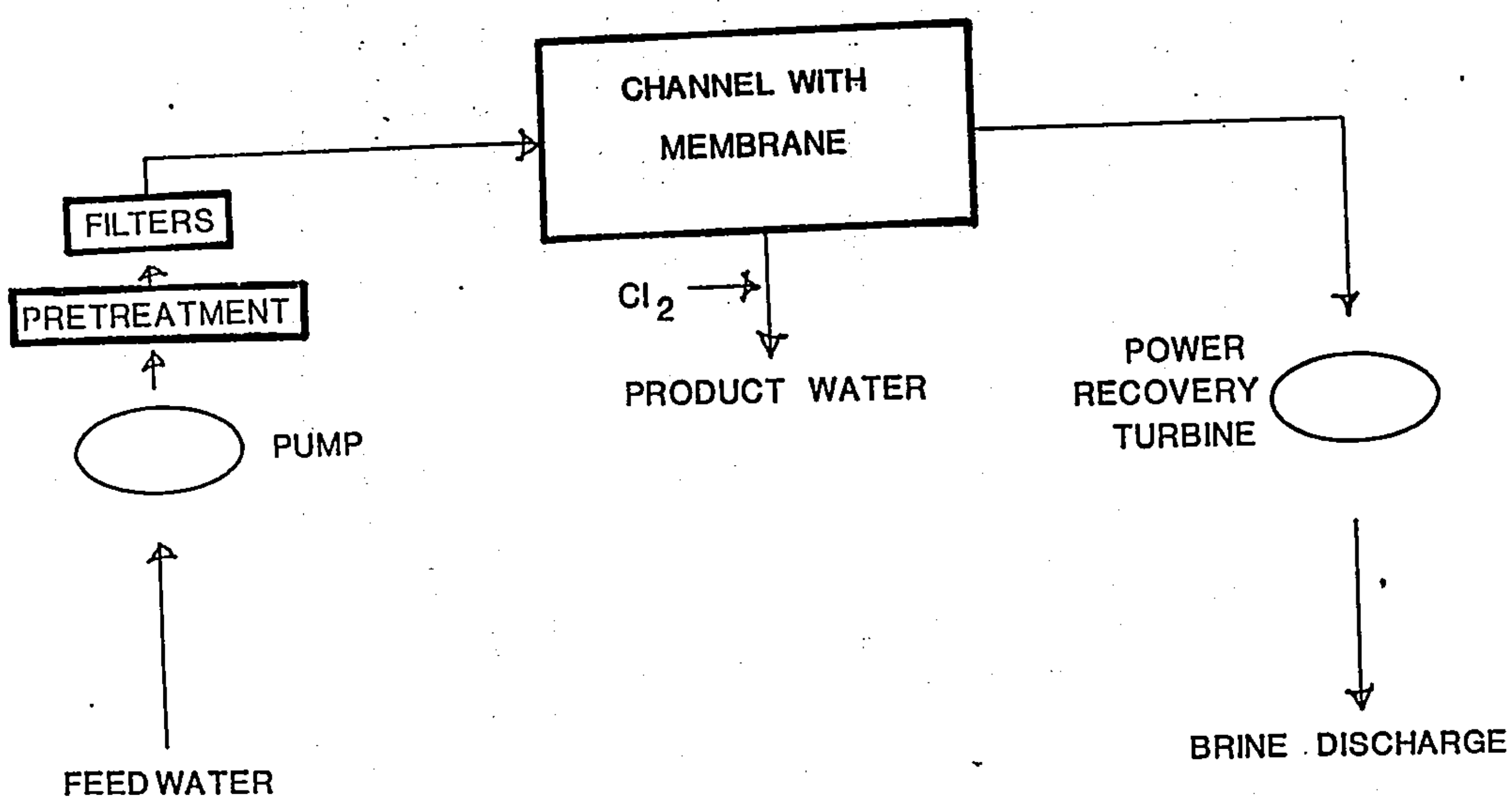
In practice, brackish water is pre-treated and filtered and then raised to operating pressures (usually 400 to 600 psi) and fed into reverse osmosis modules containing membranes. Part of the feed water passes through the membranes into the product water stream. The more concentrated feed stream with reduced flow then flows into other modules, where more water is added to the product water stream. A conceptual design of the process is shown in Figure 6-3. It can be seen from the design that the process is such a simple one that only a mechanical force is required for its operation.



PRINCIPLES OF OSMOSIS AND REVERSE OSMOSIS

FIGURE 6-2

SOURCE: WRRC TECHNICAL REPORT #73.



SOURCE: WRRC TECHNICAL REPORT #73.

CONCEPTUAL DESIGN
REVERSE OSMOSIS SYSTEM

FIGURE 6-3

All currently available membranes allow some of the salt to pass through into the product water. The amount of salt passing through the membrane is proportional to the salt concentration at the membrane face; therefore, higher concentration feed waters produce a lower quality product. In a multi-stage operation, the concentration of feed water will at some stage become so great that the product water produced in that stage will be unacceptable; thus, with feed waters of higher concentration (between 2,500 and 10,000 ppm total dissolved solids), only one or two stages may be the maximum that can be used.

Operational problems include the fact that with continuing operation, the water production rate tends to decline due to membrane compaction and membrane fouling by scale and contaminants. This production decline can be as high as 20-30% in a single year for high pressure (up to 1,000 psi) plants. For low pressure, less than 300 psi, plant compaction is generally insignificant.

The salt composition of waste brine is nearly the same as the feed water, as in the case for electrodialysis.

The major operating cost is electric power consumption for pumping. The power demand is typically about 400 kw per million gallons per day production capacity for low concentration feed water. This increases to about 600 kw per mgd for high concentration feed waters. The higher the recovery ratio, the less the energy required per unit volume of production since less pressure is required.

The major maintenance cost is the high pressure pump, which should be provided as multiple parallel pumps with stand-by capacity to improve plant availability. The high maintenance costs have been attributed to the high pressured corrosive fluids and entrained particulate matter.

Reverse osmosis plants have been used for several years to produce municipal water, many of them in Florida. Most of them are less than 1 mgd; however, in the City of Cape Coral, Florida, a 4.7 mgd plant went on line in March, 1977. It utilizes six reverse osmosis modules, each with 22 membranes and a 500,000 gallon per day capacity. The feed water carries approximately 1,250 ppm of total dissolved solids (TDS), while the product water contains less than 65 ppm. With an operating cost of 59 cents per thousand gallons and an allocation of 22 cents per thousand gallons to cover amortized capital costs, a total production cost of 81 cents per thousand gallons was obtained in late 1977 [6.15].

Four reverse osmosis pilot units have been tested on Oahu at the following locations: Mililani Sewage Treatment Plant, Wahiawa Sewage Treatment Plant, Well 82-2A (located on the Diamond Head side of the Neal S. Blaisdell Center Exhibition Hall), and Well 119 (located at Honolulu Gas Company in the Iwilei District near Honolulu Harbor). Raw sewage, primary effluent and final effluent from conventional sewage treatment plants, as well as brackish ground water from both basaltic and reef limestone aquifers were then field tested at 600 psig operating pressure [6.16].

The operation on wastewaters suffered from the problem of performance decline. However, the operation with brackish water yielded promising results. The solute rejection was high and maintained almost unchanged throughout the test period.

Based on a cost model developed for estimating de-salting costs by reverse osmosis plants with spiral-wound modules (one type of module), product water costs in Hawaii were estimated at 83.7 cents, 63.4 cents, and 49.7 cents per 1,000 gallons for 1, 10 and 50 mgd plants, respectively [6.17].

A 10 mgd reverse-osmosis plant treating water of the quality found in the Ewa plain can be built for about $8 million and operate at about $0.40 to $0.50 per 1,000 gallons [6.18]. Capital and operating costs of a like-sized electrodialysis plant are comparable. If Waiau and Waiawa springs were used as sources (with 1000 TDS), a 10 mgd reverse osmosis plant could operate at about $0.25 to $0.30 per 1,000 gallons [6.19].

Table 6-1 gives a further comparison of these two demineralization methods. Neither has any clear advantage over the other and the final selection of one process may depend upon operational considerations.

The BWS is presently proposing a 1 mgd reverse osmosis pilot plant to be built in 1982. To be located at Hawaiian Electric Company

TABLE 6-1

COMPARISON OF DESALTING METHODS[1]/

Consideration	Electrodialysis(ED)	Reverse Osmosis(RD)
Stage of Demonstration	Up to 2 MGD, less than 10 years	Up to 4 MGD, less than 5 years
Design and Construction Period	1-2.5 years based on size	1-2.5 years based on size
Land Requirement	.4-4 acres	.7-6.8 acres
TDS Range	Low TDS	Greater than ED
Removal Capability	Limited to 50% per pass	Up to 99% per pass, removes organics
Sensitivity to Operating Conditions	High (voltage, pH, flow, concentration)	Low
Pretreatment	Med. requirement	Modest to extensive
Production Rate	Slight decrease with time	Decrease with time
Waste Disposal	Lesser problem	Lesser problem
Mechanical problems	Some	Some
Corrosion	Very little	Very little
Scaling	May limited recovery	May limit recovery
Field Cleaning	Easy equipment disassembly	In-site chemical cleaning
Water Temperature	Ambient	Ambient
System Complexity	Medium	Low
System Pressure (leakage)	Low	High, leakage problem
Energy demand	8,000 kwh/mgd, direct proportion to TDS	400 kwh/mgd, increases somewhat with TDS

TABLE 6-1 - cont'd.

COMPARISON OF DESALTING METHODS[1/]

Consideration	Electrodialysis(ED)	Reverse Osmosis(RD)
O & M Cost	Least up to 4 mgd	1.2-1.6 times ED up to 4 mgd
Capital Cost	Least of all methods	1-1.5 time ED
Unit Water Cost	Low for low TDS	In range of ED

1/ Based on low TDS and plant size of 0.5 to 20 mgd

Source: [6.11]

property in Waiau, the plant would operate from two to three years and will provide the Board with realistic costs of constructing and operating a desalinization plant. The BWS has applied for federal funding and was selected as fifth of 37 applicants by the Office of Water Research and Technology.

If a large scale reverse osmosis plant, or other costly alternative, is used in future years, then water rates will have to be restudied and may increase.

C. Surface Water [6.20]

In the past surface streams on Oahu have not been used for domestic sources due to readily available, reliable, high quality ground water sources. Diversion of the flow from Lulumahu Ditch in Nuuanu Valley into a modified slow sand filter is the single example of a surface water source presently in use. Raw water quality is excellent except during rainy periods.

The more typical surface stream will probably require more extensive treatment, including the usual purification processes consisting of coagulation, flocculation, sedimentation, filtration and chlorination. The desirable points of diversion typically occur far from existing distribution-transmission works and would require relatively large initial outlay of capital as well as continual treatment costs. Pumping costs will vary from case to case.

Two large windward streams, Kahana and Punaluu, present the best opportunities for surface water development. In both cases the streams largely represent the outflow of ground water and thus present the potential of ground water development first. This potential in both cases should be thoroughly examined before resorting to surface water development because there are considerable economic and operational advantages to ground water development. After all the ground water potentials have been developed, the remaining streamflow can be developed via treatment plants.

In the case of Kahana Stream, the State is planning a regional park encompassing the entire valley. Present BWS ground water development plans in Kahana are oriented entirely on the northwest side of the valley. After ground water is fully developed, stream flow should be monitored for a few years to determine the residual flow. Only then would the treatment of Kahana Stream flow be considered. Preliminary sites for diversion and treatment plants have been selected but close coordination with State park planning will be necessary to avoid future problems. It should be noted that Kahana and Punaluu Streams are included in the Nationwide Rivers Inventory which recognizes the scenic and historic value of the streams.

Punaluu Stream also offers ground water development potentials, and stream development should await further study of this potential.

A third possible surface source is the Kalauao Spring area in Aiea. It is the only one of the Pearl Harbor Springs that presently yields water that meets mineral quality standards for potable water, but needs purification to meet all other standards. The highly developed nature of surrounding land as well as the close proximity of two major highways are negative factors because of the potential for contamination beyond the capability of treatment processes. Flow varies from 10 to 15 mgd.

In addition to the above three potential major surface sources, there are a number of smaller streams in Central Oahu and Honolulu that have some potential. In central Oahu, Waialua Sugar Company is presently diverting Kaukonahua, Helemano, Poamoho and Opaeula Streams into its irrigation system. All of these streams have domestic water supply potential if given adequate treatment.

Kalihi, Nuuanu and Waiakeakua (Manoa) Streams in Honolulu have some potential for surface water development. The combined mean flows during June, 1973, was about 5.5 mgd. The option of combining the flows for centralized treatment must be weighed against high transmission costs in an urbanized setting. The straight line distance between Kalihi and Waiakeakua is about 20,000 feet; however, the alternative of three separate treatment plants would cost more to operate.

Yield from surface sources can be substantially increased if large storage reservoirs could capture flood flows. However, local experience with reservoirs has not been good. The only successful reservoir is Lake Wilson in Wahiawa where local geology is favorable for water storage.

The typical stream valley shows a narrow elongated valley floor covered with relatively impervious strata and valley sides exposing considerable bare bedrock. Large reservoirs in such a valley would probably hold water at shallow depths but would prove to be leaky as more of the valley sides were submerged.

Diversion of stream flows with minimal storage appears to be more economically feasible, but stream yields will not be large because flood flows must necessarily be passed through due to lack of storage. Also capture of flood flows will result in rapid silting of the reservoir and loss of storage.

D. Desalinization of Sea Water

This alternative would use techniques similar to desalinization of brackish water, but utilizing feed water of higher salinity (15,000-20,000 ppm). Numerous studies have shown the cost of desalting sea water to be two to three times as much as desalting brackish waters [6.21]. Technical development of desalinization methods continues to improve and lower product water costs. However, rising energy costs and inflation tend to negate these gains. This source of domestic water will continue to be viable, but expensive.

E. Wastewater Reclamation [6.22]

The direct reuse of reclaimed wastewater is at the far end of a scale of uses that includes industrial, aesthetic and agricultural applications. There has been an understandable reluctance to accept direct recycling of treated wastewater for human consumption in the past. Historically, there are two emergency instances where virtually direct reuse was practiced but the necessity for these two cases has long since passed. Direct reuse is presently practiced at Windhoek, South Africa.

In all of the three above cited instances, dire necessity dictated the direct use, albeit with some dilution. The only alternative was to do without water. While wastewater would be used for irrigation, it is unlikely that direct reuse will occur since so many other alternatives are available.

F. Blending

Another technique which could be used here is that of blending water of high quality with water of lower quality. Water from the more brackish Pearl Harbor Springs could be blended with high quality water to meet domestic water quality standards. As mentioned on page 6-4, approximately 20 mgd may be available, via a water exchange program.

G. Individual Demineralization Units [6.23]

A final alternative is the use of compact desalting units for residential use. There would be some opportunity to use these in areas having only saline water sources. Each dwelling unit would purify only water needed for drinking and cooking. Sanitary uses would be met by the saline supply.

Some home desalting units are already in use, and a similar situation exists in Bermuda where many homes have catchment basins above their homes for fresh water, with brackish water supplying their other needs. It may be expected that such dual water supply systems will increase in use over the next 10 to 30 years.

REFERENCES TO SECTION 6

[6.1] Board of Water Supply. 1975. Oahu Water Plan. Board of Water Supply, City and County of Honolulu.

[6.2] Governor's Steering Committee for Carrying Capacity Studies. 1976. Carrying Capacity Prototype Investigations in the State of Hawaii. Prepared in consultation with Intasa, Inc. of Menlo Park, California. Honolulu, Hawaii.

[6.3] Whang, Lawrence. 1979. Personal communication. Board of Water Supply, City and County of Honolulu.

[6.4] Op. Cit. [6.1].

[6.5] Board of Water Supply. Letter to Environment Impact Study Corp. Dated March 14, 1980 (attachment 1).

[6.6] Op. Cit. [6.2].

[6.7] Op. Cit. [6.1].

[6.8] Op. Cit. [6.2].

[6.9] Timbol, Amadeo S. and John A. Maciolek. April 1978. Stream Channel Modification in Hawaii Part A: Statewide Inventory of Streams, Habitat Factor and Associated Biota. Prepared by the Hawaii Cooperative Fishery Research Unit, University of Hawaii for the U. S. Fish and Wildlife Service.

[6.10] Titelbaum, Olga A. 1970. Glossary of Water Resource Terms. Prepared for the Federal Water Pollution Control Administration. Published by the National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia.

[6.11] Duncan, J.M. and B.J. Garrick. 1974. Water Desalting in Hawaii. Report R50. Hawaii Dept. of Water and Land Development, Honolulu, Hawaii.

[6.12] Ibid. [6.10].

[6.13] Op. Cit. [6.10].

[6.14] Op. Cit. [6.10].

[6.15] CH2M Hill Reports, Fourth Quarter 1977. CH2M Hill, Portland, Oregon.

[6.16] Chang, Bei-Jiann, R.H.F. Young and J.C.S. Chow. 1973. Application of Reverse Osmosis Technology to Hawaiian Low Quality Waters. Technical Report No. 73. University of Hawaii Water Resources Research Center, Honolulu, Hawaii.

[6.17] Ibid. [6.15].

[6.18] Op. Cit. [6.1].

[6.19] Op. Cit. [6.1].

[6.20] Op. Cit. [6.1].

[6.21] Op. Cit. [6.10].

[6.22] Op. Cit. [6.1].

[6.23] Hawaii Water Resources Regional Study. 1977. Hawaii Water Resources Plan (Review Draft). Hawaii Water Resources Regional Study, Honolulu, Hawaii.

Short Term Uses · Long Term Productivity

7

SECTION 7

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

> This section will include a brief discussion of the extent to which the proposed action involves trade-offs between short-term environmental gains at the expense of long-term losses, or vice versa, and a discussion of the extent to which the proposed action forecloses future options, narrows the range of beneficial uses of the environment, or poses long-term risks to health or safety.

Development of Honouliuli Wells, according to constraints imposed by the BWS and in conformance with the new Chapter 166 of Title 13 should not result in long-term adverse impacts to the Pearl Harbor ground water aquifer. Development of these wells will rely on an agreement with Oahu Sugar Company to exchange their current ground water pumpage with lesser quality water for their irrigation purposes. Therefore, development of these wells will not result in a net increase in current withdrawal from the aquifer.

Until pilot studies on development of alternate water sources are complete, ground water development will have to be optimized to meet current and near future water demands of planned growth for this region of Oahu. The water exchange with Oahu Sugar is an attempt to optimize use of existing water sources and current economically feasible alternatives.

Optimizing current options will provide the BWS with the time required to develop alternate potable water sources. Current estimates are that it will be another 20 years before feasible alternates will be available.

The wells will be carefully monitored to determine their effect on the aquifer and surrounding wells. The project, therefore, will not narrow the range of beneficial uses of the environment or pose long-term risks to health and safety.

Commitment of Resources

8

SECTION 8

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

This section considers the commitment of resources that is made once the project is implemented.

City and County and private funds, labor, construction and building materials, and fuel will be committed to the project. Additional maintenance and operation, manpower, and funds will be required. As previously stated, the designed operating capacity of the wells will be about 9 mgd. Initially, 3 mgd is to be developed to supply the needs of the approved expansions of Makakilo and of Campbell Industrial Park. The remaining 6 mgd are to be provided for future approved projects and to supply the needs current land use plans and policies designated for this region of Oahu.

Development of the 9 mgd of water is contingent upon a water exchange agreement with Oahu Sugar Company, whereby they will decrease their withdrawal by the same amount in exchange with water of less quality but suitable for irrigation. Therefore, there will be no net increase in commitment of water since that amount is currently committed for use. The water exchange with Oahu Sugar will enable them to maintain current irrigation flows while enabling the BWS to optimize ground water development for domestic use.

Government Polices to Offset Adverse Effects

9

SECTION 9

AN INDICATION OF WHAT OTHER INTERESTS AND CONSIDERATIONS OF GOVERNMENTAL POLICIES ARE THOUGHT TO OFFSET THE ADVERSE ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION

As indicated in Section 4, Anticipated Environmental Impacts and Mitigative Measures to Minimize Adverse Impacts, most of the adverse impacts are short-term and related to construction activities. Those impacts which are long-term are primarily secondary, or indirect, and are related to the effects of the wells on the ground water aquifer. In accordance with agreements with Oahu Sugar Company, there will be no net increase in ground water withdrawal from the Pearl Harbor aquifer. The agreements will still provide Oahu Sugar with the same amount of irrigation flow with nonpotable water suitable for irrigation. The BWS will then have use of approximately 9 mgd total potable ground water to meet current and future water demands and to comply with current land use plans and policies for this area, as designated by the City and County of Honolulu's General Plan of 1977.

Approvals

10

SECTION 10

LIST OF NECESSARY APPROVALS

1. City and County grading permit, grubbing permit, stockpiling permit, and building permit.

2. Construction permits will be required from the Highways Division, State Department of Transportation, for any work which falls within a State highway right-of-way.

3. Compliance with Section 29 of Chapter 49, Public Health Regulations, which requires approval of the Director of Health prior to use of any new source to serve potable water.

4. Compliance with Chapter 166 of Title 13 of the State Department of Land and Natural Resources, which requires approval of the Board of Land and Natural Resources prior to construction of "any well or other works" for withdrawal of water within a Designated Ground Water Control Area.

5. State Special Permit.

Organizations and Persons Consulted

11

SECTION 11

ORGANIZATIONS AND PERSONS CONSULTED DURING THE NOP CONSULTATION PROCESS

The following list includes those agencies and organizations to whom Preparation Notices were sent or comments received during the review process. Those with an asterisk sent in written comments, and the comments and corresponding responses are presented on the indicated pages.

	PAGE
FEDERAL	
* U.S. Army Corps of Engineers	11-2
* U.S. Department of the Interior, Geological Survey, Water Resources Division	11-4
* U.S. Department of Agriculture, Soil Conservation Service	11-10
U.S. Navy	
STATE	
* Department of Agriculture	11-12
* Department of Health	11-15
* Department of Land and Natural Resources	11-16
* Department of Planning and Economic Development	11-17
* Department of Transportation	11-19
* Land Use Commission	11-20
CITY AND COUNTY OF HONOLULU	
* Department of General Planning	11-21
* Department of Land Utilization	11-26
* Department of Public Works	11-27
Department of Transportation Services	
OTHER	
Alu Like	
Dr. Bryce Decker	
* Ewa Neighborhood Board	11-31
* Hawaiian Electric Company, Inc.	11-32
* Hawaiian Telephone Company	11-33

RECEIVED
BD OF WATER SUPPLY
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DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858

PODED-PV

30 November 1979

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Thank you for allowing the U.S. Army Corps of Engineers to review and comment on the Notice of Preparation for Honouliuli Wells Environmental Impact Statement. Our comments are provided as Inclosure 1.

Sincerely yours,

KISUK CHEUNG
Chief, Engineering Division

1 Incl
As stated

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

PODED-PV

30 November 1979

Review Comments
for
Notice of Preparation for Honouliuli Wells
Environmental Impact Statement

Item	Page	
1	1-7 & 1-9	A map is needed to understand the description of the Ewa-Waianae District water supply system.
2	1-18	Line 2: The sources noted are not identified in Figure 2-6 in Section 2.
3	Table 1-5	The following items are not shown in the cost estimate: a. access road b. booster station c. power lines d. fencing e. landscaping f. maintenance costs
4	2-22	Para 2: These water quality standards have been superceded by the Water Quality Standards of Chapter 37-A, as amended, 6 September 1979. Change this paragraph to conform to new standards.
5	2-30	Suggest providing an equivalent noise level that a layman can relate to, i.e., 40-43 dBA is the equivalent noise level of a quiet room in a residential area at night.

Incl 1

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
DAT QUON PANG, Vice Chairman
RYOKICHI HIGASHIONNA
TERESITA R. JUBINSKY
WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

December 4, 1979

Mr. Kisuk Cheung
Chief, Engineering Division
U. S. Army Engineer District,
Honolulu
Department of the Army
Building 230
Fort Shafter, Hawaii 96858

Dear Mr. Cheung:

Subject: Your Letter of November 30, 1979, on the Honouliuli Wells Environmental <u>Impact Statement Preparation Notice</u>

Thank you for reviewing our environmental document. Your comments will be addressed in the environmental impact statement.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environmental Impact Study Corp.

Pure Water... man's greatest need - use it wisely

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P. O. Box 50166
Honolulu, Hawaii 96850

RECEIVED
BD OF WATER SUPPLY
DEC 13 3 35 PM '79

December 10, 1979

Mr. Kazu Hayashida
Manager and Chief Engineer
Honolulu Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Kazu:

Attached are the comments made by my staff on the EIS preparation notice for the Honouliuli Wells. I hope they will be useful in the preparation of your final environmental impact statement.

Thank you for giving us an opportunity to comment on this document.

Aloha,

Benjamin L. Jones
District Chief

Attachment

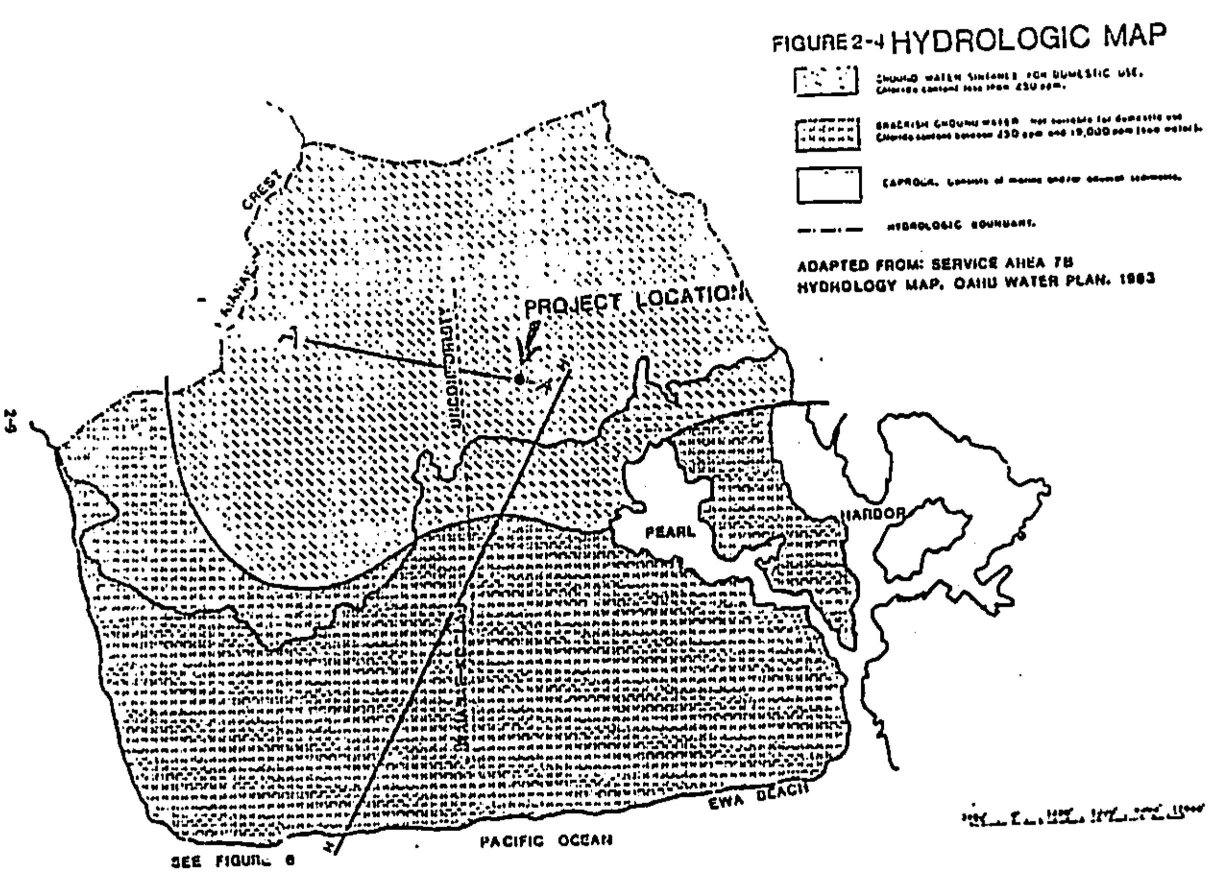
Comments on Notice of Preparation of
Environmental Impact Statement
Honouliuli Wells

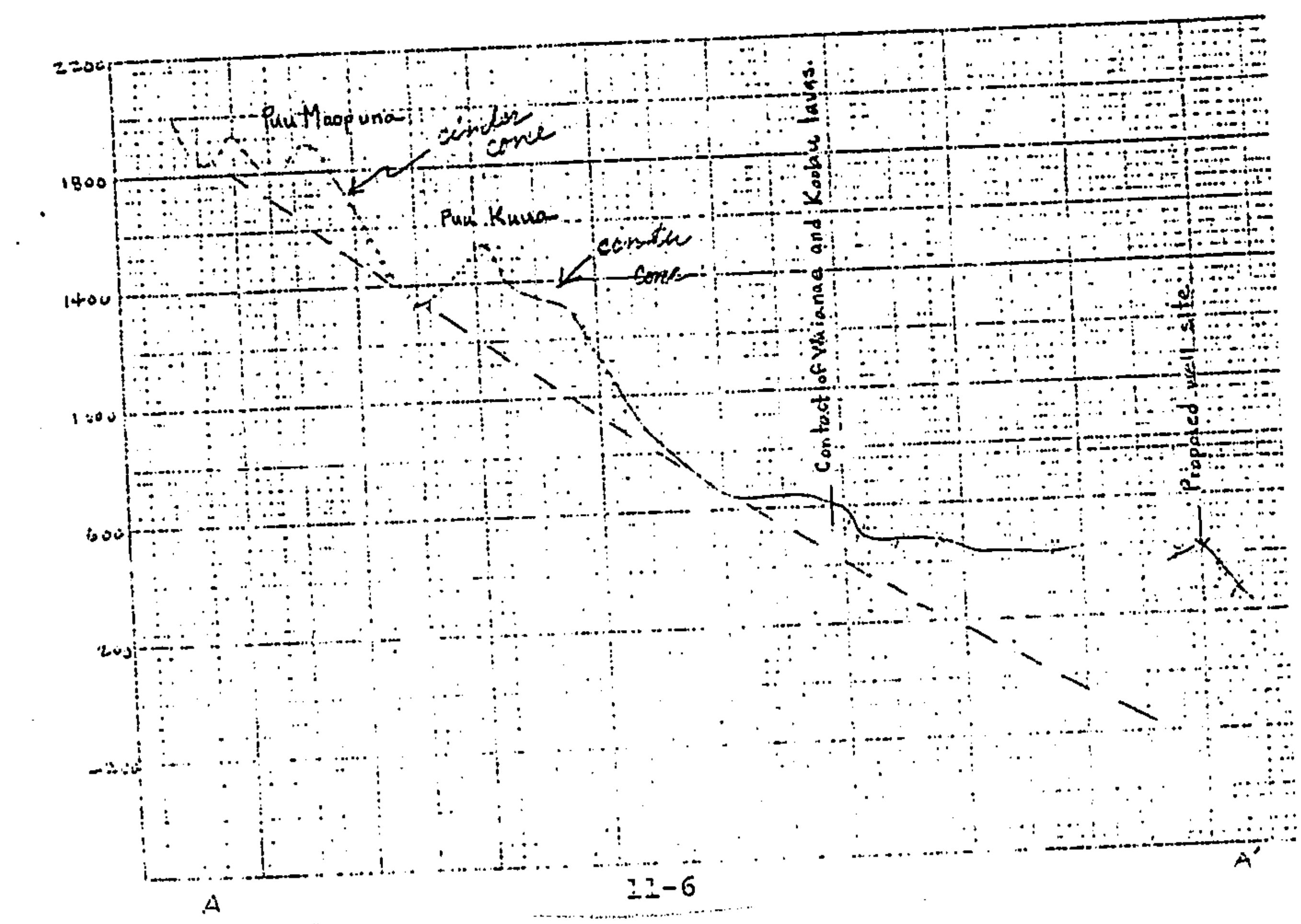
Page	Para.	Line	
1-15	2	1-8	This cyclic mode of operation is generally considered to be a bad technique from a standpoint of transition zone mixing as was indicated on page 2-16. Unless there is a compelling reason to operate in this way, it might be better to have two 3 mgd wells with one acting as standby.
1-15	5	1-4	Tradeoffs with reduced pumpage for irrigation must take into account the fact that the water qualities in question might not be the same and the fact that under present irrigation techniques, about half of the water is returned to the ground water system.
1-18	1	3	This figure should be 2.7.
2-8 and figure 2-5			A geologic profile drawn normal to the Waianae slope suggests that the bottom of, the Koolau lavas is at about 200 feet below sea level rather than the approximately 600 feet indicated in the text or the approximately 1,000 feet indicated on Figure 2-5.
2-11	3		The annual peak discharges shown are instantaneous peaks.
2-12	2	8	The drainage area is 45.7 square miles.
2-12	4	2 and 3	The upper layer of water is also overlain by a lower quality return irrigation water of unknown thickness. This may or may not be suitable for domestic use.
2-12	4	7	The thickness of the fresh water body may be correct but not all of it may be contained within the Koolau volcanic series.
2-13	3		The wording of this paragraph would indicate that return irrigation water increases the capacity of the caprock to store and transmit water.

Page	Para.	Line	
2-14	1	5	This discussion is misleading as is figure 2.6. Although the entire area is underlain by basal water, the characteristics of these basal water bodies in relation to head and therefore lens thickness are quite different.
2-14	2	4-7	Minimum heads are about 11 feet near the Pearl Harbor Springs.
2-18	3		Our data indicate that water levels in the Pearl Harbor area, especially in the east side have declined progressively since 1910 at a rate of about 1/10th foot per year.
2-19			Present artificial discharge from Pearl Harbor basin is approximately 240 mgd. Total discharge of pumping plus natural flow is approximately 275 mgd. The State Water Commission report gave a range in sustainable yield of 200 to 245 mgd.
2-24	1	2-10	Although chlorides are well within limits, total dissolved solids in some cases approaches the limits of acceptable water quality. Other constituents also will enter into the long term acceptability of these sources.
2-24	3	1-2	Irrigation with brackish water maybe a major source of contamination of the basal lens.
2-25			Alkalinity and hardness should be shown as their chemical equivalents (C_aCO_3, etc.).
2-26			Units for turbidity and color should be shown and the nitrate oxidation state should be indicated.
4-11	1 and 2		We agree that careful monitoring will be necessary to determine the effects of pumpage in Honouliuli and other wells in the vicinity. The likelihood is that there will be some impact. Even increased chlorides in the irrigation water would have a cumulative impact if that water were used to irrigate inland from the caprock.

Page	Para.	Line	
4-19, 20 and 21			This discussion presents a confusing array of possible mixes of water use particularly on Page 4-20, paragraph 3. The discussion does not take into account the additional sewage effluent to be used for irrigation. The discussion also seems to indicate that only drip irrigation would be used for returning sewage effluent of, in fact, furrow irrigation may be the best way to apply much of this water. To some extent this discussion is mixing apples and oranges because much of the water that is being discussed for irrigation is not potable.

FIGURE 2-4 HYDROLOGIC MAP





BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
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WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

January 17, 1980

Mr. Benjamin L. Jones
District Chief
Water Resources Division
U. S. Geological Survey
P. O. Box 50166
Honolulu, Hawaii 96850

Dear Mr. Jones:

Subject: Your Letter of December 10, 1979, Commenting on the EIS Preparation Notice for the Honouliuli Wells

We have the following reply to your comments:

1. This cyclic mode of operation is generally considered to be a bad technique from a standpoint of transition zone mixing as was indicated on page 2-16. Unless there is a compelling reason to operate in this way, it might be better to have two 3 mgd wells with one acting as standby. (p. 1-15)

   To minimize the upconing potential of the well field, the proposed 2.0 mgd pumps will be retained and throttled to 1.5 mgd. The pumps may be alternated on a weekly interval instead of a daily one. This weekly operation is being used successfully at our Kaonohi Wells.

2. Tradeoffs with reduced pumpage for irrigation must take into account the fact that the water qualities in question might not be the same and the fact that under present irrigation techniques, about half of the water is returned to the ground water system. (p. 1-15)

   We concur with you. However, the tradeoff amount will be on a gallon for gallon basis.

3. This figure should be 2-7. (p. 1-18)

   We concur. The correction will be made in the EIS.

4. A geologic profile drawn normal to the Waianae slope suggests that the bottom of the Koolau lavas is at about 200 feet below sea level rather than the approximately 600 feet indicated in the text or the approximately 1,000 feet indicated on Figure 2-5. (p. 2-8)

   The intent of Figure 2-5 is for descriptive purpose only. The dimensions are not exact.

5. The annual peak discharges shown are instantaneous peaks. (p. 2-11)

   The EIS will be corrected to indicate the flows are the maximum instantaneous peak discharges.

6. The drainage area is 45.7 square miles. (p. 2-12)

   We concur. The EIS will be corrected.

7. The upper layer of water is also overlain by a lower quality return irrigation water of unknown thickness. This may or may not be suitable for domestic use. (p. 2-12)

   The EIS will be corrected to indicate that the upper layer of groundwater is return irrigation water of a thickness ranging up to 200 feet. This return irrigation water is usable for domestic use.

8. The thickness of the fresh water body may be correct but not all of it may be contained within the Koolau volcanic series. (p. 2-12)

   Data from drilling and geophysical logs indicate that the fresh water is in the Koolau volcanic series.

9. The wording of this paragraph would indicate that return irrigation water increases the capacity of the caprock to store and transmit water. (p. 2-13)

   The paragraph will be reworded.

10. This discussion is misleading as is figure 2-6. Although the entire area is underlain by basal water, the characteristics of these basal water bodies in relation to head and therefore lens thickness are quite different. (p. 2-14)

We concur that lens thicknesses as determined by local heads and artesian areas are variable.

11. Minimum heads are about 11 feet near the Pearl Harbor Springs. (p. 2-14)

Heads around springs are drawdown or discharge heads.

12. Our data indicate that water levels in the Pearl Harbor area, especially in the east side, have declined progressively since 1910 at a rate of about 1/10th foot per year. (p. 2-18)

The average head loss over a long term trend shows a progressive decline in heads, but this is not true when viewed over a shorter period.

13. Present artificial discharge from Pearl Harbor basin is approximately 240 mgd. Total discharge of pumping plus natural flow is approximately 275 mgd. The State Water Commission report gave a range in sustainable yield of 200 to 245 mgd. (p. 2-19)

The EIS will be reworded to indicate the total discharge and the range of the estimated sustainable yield from the Pearl Harbor Basin.

14. Although chlorides are well within limits, total dissolved solids in some cases approaches the limits of acceptable water quality. Other constituents also will enter into the long term acceptability of these sources. (p. 2-24)

We concur with your comments. The section will be revised to indicate other constituents also determine the acceptability of the source, especially total dissolved solids (limit = 500 ppm).

15. Irrigation with brackish water maybe a major source of contamination of the basal lens. (p. 2-24)

Brackish water may be a major source of degradation of the basal lens. We refrain from using the word contamination in this instance since it implies to make something impure. However, slightly brackish water could still be used for domestic consumption.

16. Alkalinity and hardness should be shown as their chemical equivalents (C_aCO_3, etc.). (p. 2-25)

Alkalinity and hardness are always assumed to be expressed in terms of $CaCO_3$.

17. Units for turbidity and color should be shown and the nitrate oxidation state should be indicated. (p. 2-26)

The units for turbidity, color, and nitrate will be shown in the EIS as:

1. *Turbidity: Nephelometric turbidity units*
2. *Color: parts per million*
3. *Nitrate: NO_3.*

18. We agree that careful monitoring will be necessary to determine the effects of pumpage in Honouliuli and other wells in the vicinity. The likelihood is that there will be some impact. Even increased chlorides in the irrigation water would have a cumulative impact if that water were used to irrigate inland from the caprock. (p. 4-11)

We concur that increasing chlorides in the irrigation water would have a cumulative impact if it were used inland from the caprock. However, since Oahu Sugar would be required to cut back its pumpage, the amount of brackish water used for irrigation would decrease and result in improved water quality.

January 17, 1980

19. This discussion presents a confusing array of possible mixes of water use particularly on Page 4-20, paragraph 3. The discussion does not take into account the additional sewage effluent to be used for irrigation. The discussion also seems to indicate that only drip irrigation would be used for returning sewage effluent of, in fact, furrow irrigation may be the best way to apply much of this water. To some extent this discussion is mixing apples and oranges because much of the water that is being discussed for irrigation is not potable. (p. 4-19, 20, 21)

Oahu Sugar Company has not yet made any firm commitment to use treated sewage for furrow irrigation. Presently, the City's Department of Public Works is negotiating with Oahu Sugar Company on the use of treated sewage.

Also, Oahu Sugar Company has made a commitment to convert all of its fields to drip irrigation except for those fields receiving mill waste water. So far, the research project at the City's Mililani Sewage Treatment Plant indicates that it is not feasible to use secondary treated sewage in drip irrigation systems.

We agree that the water being discussed is not potable and we will consider deleting this portion of the discussion on recharge.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: √Environment Impact Study Corporation

United States Department of Agriculture
Soil Conservation Service
P. O. Box 50004
Honolulu, Hawaii
96850

RECEIVED
BD OF WATER SUPPLY
DEC 6 11 55 AM '79

December 4, 1979

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania St.
Honolulu, HI 96843

Dear Mr. Hayashida:

Subject: Notice of Preparation for Honouliuli Wells Environmental Impact Statement

We reviewed the subject notice and have the following comment:

The proposed project area is located on land that is classified as prime agricultural land. Prime agricultural land is defined as land which has the soil quality, growing season, and moisture supply needed to produce sustained high yields of crops economically when treated and managed according to modern farming methods.

The Soil Conservation Service advocates the preservation of prime agricultural lands. We suggest that the EIS contain statements to the fact that the project area is located on prime agricultural land. The environmental impact section should state that 2+ acres of prime agricultural land will be taken out of production.

Thank you for the opportunity to review this document.

Sincerely,

JACK P. KANALZ
State Conservationist

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

December 14, 1979

Mr. Jack P. Kanalz
State Conservationist
Soil Conservation Service
U. S. Dept. of Agriculture
P. O. Box 50004
Honolulu, Hawaii 96850

Dear Mr. Kanalz:

Subject: Your Letter of December 4, 1979, Commenting on the EIS Preparation Notice for the Honouliuli Wells

Thank you for reviewing our environmental document. Your concerns for the preservation of prime agricultural lands and the impact of the project on prime agricultural lands will be addressed in the environmental impact statement.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

HEADQUARTERS
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860

IN REPLY REFER TO:
002A:amn
Ser 2431

RECEIVED
BOARD OF WATER SUPPLY
DEC 3 12 45 PM

30 NOV 1979

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Honouliuli Wells, Kunia, Oahu
EIS Preparation Notice

Per the Environmental Quality Commission EQC Bulletin of 23 November 1979, it is requested that this Command be a consulted party in the EIS Preparation Notice for Honouliuli Wells, Kunia, Oahu.

Sincerely,

J. W. Carl

J. W. CARL
LIEUTENANT COMMANDER, CEC, USN
DEPUTY FACILITIES ENGINEER
BY DIRECTION OF THE COMMANDER

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

December 5, 1979

Lt. Commander J. W. Carl, USN
Deputy Facilities Engineer
Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860

Dear Commander Carl:

Subject: Your Letter of November 30, 1979 on the EIS Preparation Notice for Honouliuli Wells

We have placed your name on our consulted party's list. A copy of our preparation notice is enclosed for your review and comments. We would appreciate receiving your comments by January 15, 1980.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

H. J. Rathburn

for KAZU HAYASHIDA
Manager and Chief Engineer

Encl.

cc: Environmental Impact
Study Corp.

GEORGE R. ARIYOSHI
GOVERNOR

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

RECEIVED
BD OF WATER SUPPLY
DEC 5 12 30

JOHN FARIAS, JR.
CHAIRMAN, BOARD OF AGRICULTURE
YUKIO KITAGAWA
DEPUTY TO THE CHAIRMAN

November 28, 1979

MEMORANDUM

To: Mr. Kazu Hayashida, Manager and Chief Engineer
Board of Water Supply, City and County of Honolulu

Subject: Notice of Preparation for Honouliuli Wells Environmental Impact Statement

The Department of Agriculture has reviewed the above-captioned Notice of Preparation and offers the following comments.

1. The proposed Honouliuli Wells project would eventually be developed to withdraw 9 MGD from the Pearl Harbor aquifer with no net increase in pumpage achieved by a cutback of an equal amount of pumpage by Oahu Sugar Company.

2. The Board of Land and Natural Resources, found evidence of long-term decline in water levels, increase in salinity and in ground water basin withdrawals for the Pearl Harbor ground water basin, and on September 28, 1979, designated the Pearl Harbor Ground Water Control Area. The zero net increase in pumpage of this project is in keeping with the findings of the Board.

3. It appears that the objective would be achieved by either of two alternatives: (a) withdrawal of Oahu Sugar Company lands from production and reallocation of the irrigation water to domestic use; or (b) development of an alternative irrigation water source to replace the potable water to be withdrawn by this project. Either alternative would seem to require a water exchange agreement between the Board of Water Supply and Oahu Sugar Company.

4. Based on figures provided, this Department believes that from 900 to 1,800 acres of sugarcane land in production would have to be urbanized to release sufficient water for domestic use. The difference in acreage depends on whether furrow or drip irrigation is assumed.

5. Correspondence with Oahu Sugar Company indicates that while the plantation has plans to phase out approximately 3,000 acres over the next decade, it will do so in large part to enable diversion of its existing water resources from the phased-out fields to more adequately irrigate other areas. It is, therefore, not the primary intent of the plantation to phase out its fields to make water available for urbanization.

11-12

6. Alternative (b), above, could take place in several ways, including substitution of sewage effluent water or spring and stream water for potable water presently withdrawn for irrigation.

7. According to figures provided, sewage effluent water could be provided for irrigation at a cost ranging from 9¢ to 13¢ per 1,000 gallons. Spring and stream water could be developed for irrigation at a cost of 12¢ per 1,000 gallons. The operating costs of the proposed wells would be 13¢ per 1,000 gallons.

8.. While tests have shown that use of treated effluent appears to be compatible with certain stages of plant growth of sugarcane if the effluent is properly mixed with potable water, problems remain with clogging of drip irrigation systems. The long-run economic feasibility of the use of treated effluent for irrigation on a year-round basis remains to be demonstrated.

9. The population projection figures cited do not reflect the latest allocation of growth contained in the Department of General Planning's "Development Plans Population Capacity," (September, 1979), which shows a lower total population for Ewa in the year 2000.

10. The Notice of Preparation appears to be equivocal on whether the proposed project would either cause a significant increase in growth or indirectly contribute to the secondary impacts associated with growth. The report does suggest that the later stages of the project, which would develop 6 MGD of water, could support 12,000 dwelling units. At 6 units per acre, these units would require approximately 2,000 acres of land to be urbanized.

Based on information contained in the Notice of Preparation, this Department believes that the Honouliuli Wells project has the potential to contribute to the premature urbanization of prime agricultural lands in sugarcane production, either through reduction in the amount of water available for sugarcane irrigation, or through stimulation of additional urban growth in the Ewa-Waipahu area. We believe that the need for additional domestic water in this region must be met by development of alternative sources as suggested in the Notice of Preparation, and by carefully worked out water exchange agreements which ensure the provision of present quantities of irrigation water to Oahu Sugar Company.

Thank you for the opportunity to comment.

John Farias, Jr.

JOHN FARIAS, JR.
Chairman, Board of Agriculture

cc: Mr. Susumu Ono, DLNR
Mr. Hideto Kono, DPED
Mr. David W. Ballie, Amfac Sugar

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

COPY

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
DAT QUON PANG, Vice Chairman
RYOKICHI HIGASHIONNA
TERESITA R. JUBINSKY
WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

December 31, 1979

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

Dear Mr. Farias:

Subject: Your Letter of November 28, 1979, Commenting on the EIS Preparation Notice for the Honouliuli Wells

Thank you for your comments on the proposed project.

We submit the following reply to your comments:

1. The proposed Honouliuli Wells project would eventually be developed to withdraw 9 MGD from the Pearl Harbor aquifer with no net increase in pumpage achieved by a cutback of an equal amount of pumpage by Oahu Sugar Company.

   We concur with the statement.

2. The Board of Land and Natural Resources, found evidence of long-term decline in water levels, increase in salinity and in ground water basin withdrawals for the Pearl Harbor ground water basin, and on September 28, 1979, designated the Pearl Harbor Ground Water Control Area. The zero net increase in pumpage of this project is in keeping with the findings of the Board.

   We concur with the statement.

3. It appears that the objective would be achieved by either of two alternatives: (a) withdrawal of Oahu Sugar Company lands from production and reallocation of the irrigation water to domestic use; or (b) development of an alternative irrigation water

Water... man's greatest need — use it wisely

source to replace the potable water to be withdrawn by this project. Either alternative would seem to require a water exchange agreement between the Board of Water Supply and Oahu Sugar Company.

   We will be negotiating with Oahu Sugar Company and Campbell Estate on a suitable water exchange agreement.

4. Based on figures provided, this Department believes that from 900 to 1,800 acres of sugarcane land in production would have to be urbanized to release sufficient water for domestic use. The difference in acreage depends on whether furrow or drip irrigation is assumed.

   We concur with the statement.

5. Correspondence with Oahu Sugar Company indicates that while the plantation has plans to phase out approximately 3,000 acres over the next decade, it will do so in large part to enable diversion of its existing water resources from the phased-out fields to more adequately irrigate other areas. It is, therefore, not the primary intent of the plantation to phase out its fields to make water available for urbanization.

   Our correspondence with Oahu Sugar Company indicates that their cutback in acreage for urbanization is due to poor water quality at Waiawa. Furthermore, AMFAC, owner of Oahu Sugar, proposes to divert part of the irrigation water for urbanization of some of their land.

6. Alternative (b), above, could take place in several ways, including substitution of sewage effluent water or spring and stream water for potable water presently withdrawn for irrigation.

   We concur with this statement.

7. According to figures provided, sewage effluent water could be provided for irrigation at a cost ranging from 9¢ to 13¢ per 1,000 gallons. Spring and stream water could be developed for irrigation at a cost of 12¢ per 1,000 gallons. The operating costs of the proposed wells would be 13¢ per 1,000 gallons.

We concur with this statement. Estimated cost figures are good for the dates referenced in the EIS Preparation Notice and must be updated if a decision is made to proceed with any of the items discussed.

8. While tests have shown that use of treated effluent appears to be compatible with certain stages of plant growth of sugarcane if the effluent is properly mixed with potable water, problems remain with clogging of drip irrigation systems. The long-run economic feasibility of the use of treated effluent for irrigation on a year-round basis remains to be demonstrated.

   We concur with this statement.

9. The population projection figures cited do not reflect the latest allocation of growth contained in the Department of General Planning's "Development Plans Population Capacity," (September, 1979), which shows a lower total population for Ewa in the year 2000.

   The latest Department of General Planning's population distribution will be used in the environmental impact statement. The population for Ewa is projected to be 95,400 in the year 2000. However, the distribution figures are subject to change until the City Council adopts the "new General Plan."

10. The Notice of Preparation appears to be equivocal on whether the proposed project would either cause a significant increase in growth or indirectly contribute to the secondary impacts associated with growth. The report does suggest that the later stages of the project, which would develop 6 MGD of water, could support 12,000 dwelling units. At 6 units per acre, these units would require approximately 2,000 acres of land to be urbanized.

    Although the additional water to be developed could support dwelling units on about 2,000 acres, the land would not necessarily be agricultural lands. The water could be used for developments in areas already zoned "urban."

11. Based on information contained in the Notice of Preparation, this Department believes that the Honouliuli Wells projects has the potential to contribute to the premature urbanization of prime agricultural lands in sugarcane production, either through reduction

in the amount of water available for sugarcane irrigation, or through stimulation of additional urban growth in the Ewa-Waipahu area. We believe that the need for additional domestic water in this region must be met by development of alternative sources as suggested in the Notice of Preparation, and by carefully worked out water exchange agreements which ensure the provision of present quantities of irrigation water to Oahu Sugar Company.

It is our policy to develop water and have it available in order to avoid having our system's water demand exceed its supply. Presently, the most economical way of furnishing water is to develop groundwater, which could be pumped directly into the water distribution system with little or no treatment.

The decision to urbanize agricultural land was made by the landowner. Our concern is where will the water to support the development come from? In order for Campbell Estate to develop their lands, they would be required to develop their own water facilities or give up water which we could pump to supply water to their development. We do not specify how any land is to be used. Also, approval from the State Land Use Commission must be obtained to rezone agricultural land to urban use.

We are presently trying to negotiate a viable water exchange agreement.

The only source of alternative water supply in the Ewa area would be to desalt seawater or brackish water. However, this is a very expensive alternative and would be considered only as a last resort.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: ✓Environment Impact Study Corp.

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

GEORGE A. L. YUEN
DIRECTOR OF HEALTH
~~Audrey W. Mertz, M.D., M.P.H.~~
Deputy Director of Health
Henry N. Thompson, M.A.
Deputy Director of Health
James S. Kumagai, Ph.D., P.E.
Deputy Director of Health

RECEIVED
BD OF WATER SUPPLY
Dec 11 7 53 AM '79

In reply, please refer to:
File: EPHS -SS

December 6, 1979

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City & County of Honolulu
630 South Beretania Street
Honolulu, HI 96843

Dear Mr. Hayashida:

Subject: Request for Comments on Proposed Environmental Impact Statement for Honouliuli Wells

Thank you for the opportunity to comment on the subject preparation notice. The following comments are submitted for your information:

1. As you are aware, Section 29 of Chapter 49, Public Health Regulations requires approval of the Director of Health prior to the use of any new source to serve potable water. It is our understanding that the Honouliuli Wells will serve potable water, in which case they will be subject to the terms and conditions of Section 29. As required under Section 29, an engineering report must be submitted to the Department. Such report must satisfactorily address concerns such as existing and potential sources of contamination, anticipated benefit, and expected impact on surrounding existing wells.

2. The location of these wells in the Pearl Harbor area and the recent designation of the area by the Department of Land and Natural Resources as a ground water control area focuses special attention on any discussion of the hydrologic budget. Page 1-15 of the document refers to arrangements to be made with the Oahu Sugar Company so as not to increase the net pumpage from the Pearl Harbor Basin. Such arrangements if agreed to by the Oahu Sugar Company may have to be legally binding in order to prevent any such increase. All possible steps must be taken to insure constant adherence to the terms of the arrangements by all parties involved. We believe the existing conditions dictate the utmost caution in this area.

Sincerely,

Brian J. Choy
for JAMES S. KUMAGAI, Ph.D.
Deputy Director for
Environmental Health

BC:sc

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

December 18, 1979

Mr. George A. L. Yuen
Director
Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

Attention Dr. James S. Kumagai

Dear Mr. Yuen:

Subject: Your Comments of December 6, 1979 on the Proposed Environmental Impact Statement for Honouliuli Wells

Thank you for your comments on our proposed water project.

We will comply with the requirements of Section 29 of Chapter 49, Public Health Regulations when we proceed with our Honouliuli Well Project.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

L.G. Rathburn
for KAZU HAYASHIDA
Manager and Chief Engineer

cc: /Environmental Impact Study Corporation

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

RECEIVED
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JAN 9 11 15 AM '80

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

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

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

January 3, 1980

REF NO.: APO-1200

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 South Beretania Street
HOnolulu, HI

Dear Mr. Hayashida:

Thank you for sending us the preparation notice for the Honouliuli Wells EIS.

We suggest that the EIS cover the following points:

1. Extent of the aquifer.
2. Current and future demands upon the aquifer, including industrial and agricultural uses.
3. Current and future replenishment and loss rates, including identification of components.
4. Direct and indirect impacts upon agriculture.

If we may be of any further service, please feel free to contact Gordon Soh of our Planning Office at 548-6461.

Very truly yours,

SUSUMU ONO, Chairman
Board of Land and Natural Resources

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

COPY

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
DAT QUON PANG, Vice Chairman
RYOKICHI HIGASHIONNA
TERESITA R. JUBINSKY
WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

January 22, 1980

Mr. Susumu Ono
Chairman
Board of Land and
Natural Resources
P. O. Sox 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Subject: Your Letter of January 3, 1980, on the Preparation Notice for the Honouliuli Wells Environmental Impact Statement

Thank you for your comments. The four points that you suggested we include in the EIS will be covered in that document.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

Pure Water... man's greatest need – use it wisely

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

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

GEORGE R. ARIYOSHI, Governor
HIDETO KONO, Director
FRANK SKRIVANEK, Deputy Director

RECEIVED
BD OF WATER SUPPLY

Ref. No. 0387

December 7, 1979

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Subject: Notice of Preparation for Honouliuli Wells Environmental Impact Statement

We have reviewed the subject document and offer the following comments.

With regard to the discussion on the relationship of the proposed project with the objectives of The Hawaii State Plan, on pages 3-7, 3-8, and 3-9 of the project document, we would like to clarify an apparent misunderstanding of the terms objectives and policies. As used in the State Plan, objectives reflect end-states toward which concentrated effort is focused and which, when attained, will represent a step toward achievement of related goals. Policies are courses of action carried out in order to achieve related objectives. The project document speaks only of objectives but lists both objectives and policies without any differentiation between the two.

In addition, the relationship of the statement:

> "The proposed project is not inconsistent with these objectives, providing that a safe and equitable method of water exchange can be arranged." (pages 3-8 & 3-9)

to the State Plan objectives and policies is unclear and should be explained more fully.

Finally, we note that Part III of the State Plan relating to Priority Directions, particularly Sections 103(h)(3) and 104(b)(2) appear pertinent to the proposal.

We have no other comments to offer at this time, but would like to comment on the EIS when it is available for review.

Sincerely,

Hideto Kono

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

December 18, 1979

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

Dear Mr. Kono:

Subject: Your Comments of December 7, 1979 on the Notice of Preparation for Honouliuli Wells Environmental Impact Statement

Thank you for your comments on our proposed well project.

In the preparation of the EIS, the use of the terms objectives and policies will be clarified. Also, the relationship of the following statement to the State Plan will be more fully explained:

> "The proposed project is not inconsistent with these objectives, providing that a safe and equitable method of water exchange can be arranged."

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

L.G. Rathburn

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environmental Impact Study Corporation

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

RECEIVED
BOARD OF WATER SUPPLY
DEC 26 12 00 PM '79

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JAN 18 1980
EISC

RYOKICHI HIGASHIONNA, PH.D.
DIRECTOR

DEPUTY DIRECTORS
JAMES R. CARRAS
JAMES B. McCORMACK
DOUGLAS S. SAKAMOTO
JACK K. SUWA

IN REPLY REFER TO

December 19, 1979

STP 8.5902

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Hayashida:

Subject: Notice of Preparation for Honouliuli Wells Environmental Impact Statement

Thank you for giving us the opportunity to review and comment on the above-captioned notice. We have the following comments to offer which could improve the preparation of the EIS.

1. The document does not clearly indicate the area of service of the proposed system, especially on future developments. This should include those listed in Table 2-8, "Major Proposed Developments Leeward Region, Oahu, Hawaii." A plan depicting the sites in relation to the proposed system may be adequate.

2. There should be further discussions on the level of demand which will initiate the construction of the other four wells and the capital costs assessments to the users.

3. Construction permits will be required from our Highways Division should any work fall within our highway rights-of-way.

Very truly yours,

Ryokichi Higashionna

Ryokichi Higashionna
Director of Transportation

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

January 2, 1980

Dr. Ryokichi Higashionna
Director of Transportation
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Dr. Higashionna:

Subject: Your Letter of December 19, 1979 Commenting on the Notice of Preparation for Honouliuli Wells Environmental Impact Statement

Thank you for your comments on our proposed project.

A plan depicting future developments in relation to the proposed Honouliuli Wells system will be inserted in the EIS.

Also, the section on water demand will be expanded to explain the need for the additional four wells and the capital cost assessments to the users.

If any work falls within any State highway rights-of-way, construction permits will be obtained from your Highways Division.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environmental Impact Study Corporation

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

LAND USE COMMISSION

Suite 1795, Pacific Trade Center, 190 S. King Street, Honolulu, Hawaii 96813

GEORGE R. ARIYOSHI, Governor
CHARLES W. DUKE, Chairman
SHINICHI NAKAGAWA, Vice Chairman

COMMISSION MEMBERS:
William Yuen
Shinsei Miyasato
Mitsuo Oura
George Pascua
Carol Whitesell
Edward Yanai
GORDAN FURUTANI, Executive Officer

RECEIVED
BD OF WATER SUPPLY
DEC 4 1979

November 30, 1979

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Subject: EIS Preparation Notice for Honouliuli Wells Environmental Impact Statement

We have no comments to offer regarding the subject statement at this time; however, we appreciate the opportunity to comment on this matter.

Sincerely,

GORDAN Y. FURUTANI
Executive Officer

GYF:jy

RECEIVED
DEC 11 1979
EISC

December 6, 1979

Mr. Charles W. Duke
Chairman, Land Use Commission
Suite 1795
Pacific Trade Center
190 South King Street
Honolulu, Hawaii 96813

Attention Mr. Gordon Y. Furutani

Dear Mr. Duke:

Subject: Your Letter of November 30, 1979 on the EIS Preparation Notice for the Honouliuli Wells

Thank you for your comments.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corp.

HHS:pvk
cc: K. Hayashida
L. Whang

79-4754

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

RECEIVED
BD OF WATER SUPPLY
DEC 5 4 11 PM '79

GEORGE S. MORIGUCHI
CHIEF PLANNING OFFICER

DGP11/79-3602(CT)

December 5, 1979

MEMORANDUM

TO : MR. KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER BOARD OF WATER SUPPLY

FROM : GEORGE S. MORIGUCHI, CHIEF PLANNING OFFICER

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE FOR HONOULIULI WELLS, DATED NOVEMBER 1979 COMMENTS REQUESTED NOVEMBER 15, 1979

The environmental impact statement should focus on the hydrology of the Pearl Harbor ground water control area, the existing use of water resources, the existing water distribution system, and possible future use of the water resources. Details follow.

<u>Hydrology</u>

Discussion on this (p. 2-11 et. seq.) covers the Pearl Harbor area generally. The graphics and tabular data cover only the service area 7B and water sources in the vicinity of the Honouliuli wells. Table 2-1 (p. 2-21a) accounts for about 50 mgd in water pumpage out of the 160 mgd average during 1919 to 1958. Discussion in the EIS should be broadened to cover the entire basin and its resources: who are the major users? how much are they pumping? from where? to where? for what use?

It is indicated that the area of recharge is above the 50-inch isohyet. (P. 2-14.) But Figure 2-4 does not show where this isohyet extends. Also, the 250 ppm isochlor and the extent of caprock are not labelled. These should be shown on a map of the ground water control area so that a reviewer can get a better understanding of the problem facing the Board of Water Supply and Department of Land and Natural Resources in managing water resources here.

<u>Water Distribution System</u>

The existing water transmission system in the water district is described. (P. 1-7 et. seq.) Water demand data and projections are provided for the entire Leeward area. A suitable map showing the major elements of the distribution system and demand for the various major urbanized areas should be provided in the EIS. The Project Vicinity Map (Figure 1-2) is good, but only shows the well site and transmission line to the Honouliuli Booster Station.

<u>Water Use</u>

Discussion in the EIS preparation notice (p. 2-18) indicates that 1919 to 1958 pumpage averaged 160 mgd. Current pumpage is not reported. Total discharge during 1931 to 1965 is said to have averaged 250 mgd, with present discharge estimated at 240 mgd. The difference between "pumpage" and "total discharge" should be explained, with an indication as to where major natural discharge is occurring. Here again, the discussion should cover the entire Pearl Harbor Basin, rather than be limited to the Honouliuli area.

<u>Sustainable Yield</u>

It is indicated that the sustainable yield from the Pearl Harbor Basin is about 245 mgd. (P. 2-19.) With present discharge at 240 mgd, the ultimate development of wells at Honouliuli operating at 9 mgd could bring total discharge above sustainable yield unless the increase in domestic use is offset by a reduction in irrigation use. The EIS should indicate, if possible, where such reductions in irrigation use are presently contemplated. This could have a bearing on the future land use pattern in the area.

<u>Use of Honouliuli Water</u>

It is indicated that " . . . at least 83% of the first 3 mgd to be developed will serve areas which are already zoned for urban use (Campbell Industrial Park and Makakilo) . . . " (p. 4-13), and " . . . will require allocating 0.5 mgd, of the initial 3.0 mgd, to Makakilo for expansion of the subdivision, since Makakilo will be helping to finance the project." (P. 4-12.) This leaves 17% or about 0.5 mgd for other areas of the Ewa Plain. Further, it "is not anticipated that any of this water will be delivered to the Waianae Coast." (P. 4-14.)

It is also estimated that the subsequent 6 mgd operating capacity proposed could support up to 12,000 units or a population of about 35,200. (P. 4-24.) This is a significant increase.

Accordingly, the EIS should indicate, insofar as is possible at this time, what other areas are prospects for use of the additional 6 mgd in the later phase of the project, plus the 0.5 mgd not accounted for in the initial phase. One such area mentioned is West Beach. (P. 4-24.) For what areas has the Board of Water Supply made firm commitments for providing water? For what areas have there been requests for future water?

Related to this, it might be appropriate for the EIS to include discussion of the impact of the Department of Land and Natural Resources' designation of the Pearl Harbor Basin as a "ground water control area" pursuant to Chapter 177, Hawaii Revised Statutes. (P. 3-9.)

Growth Policy

Appendix A discusses Policy Constraints and Assumptions of the Directed Growth Alternative, which is based on housing needs generated by a population of 1,398,000 by 1995. Material here is taken from an outdated (1974) report using a high population projection which was not officially adopted. The officially adopted population projection at that time was the DPED Series E-2 (1,039,000 for Oahu for the year 2000), and this has since been replaced by DPED's II-F projection of 917,400 for Oahu for the year 2000.

It is recommended that Appendix A be evaluated and either omitted or revised to reflect the current population projection (II-F) and possible constraints under Chapter 177.

Drip Irrigation

Discussion of impacts on ground water (pp. 4-19 to 4-21) seems to indicate that drip irrigation and furrow irrigation require the same amount of water. The general impression is that drip irrigation, being more efficient, would require less water all other things being equal, e.g., growing conditions, yields, etc. This should be clarified.

Other

P. 2-64 Bruce Duncan is not a member of the Department of General Planning staff, but Deputy Director of the Department of Land Utilization.

2-52 Kunia Road capacity of 9,800 vph seems to be an error.

P. 3-1 The General Plan referred to here is the 1964 General Plan. This should be noted.

3-3 The General Plan referred to here is the Revised General Plan, Resolution No. 238, January 18, 1977.

6-17 It is indicated that Well 82-2A is on the "Diamond Head side of the Neil Blaisdell Center Exhibition Hall." Our previous mayor was Neal S. Blaisdell.

Thank you for affording us the opportunity of reviewing your preparation notice.

George S. Moriguchi

GEORGE S. MORIGUCHI
Chief Planning Officer

GSM:fmt

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

COPY

IK F. FASI, Mayor
IE H. FUJINAKA, Chairman
T QUON PANG, Vice Chairman
OKICHI HIGASHIONNA
RESITA R. JUBINSKY
LLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

January 7, 1980

TO : MR. GEORGE S. MORIGUCHI
CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM : KAZU HAYASHIDA
BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF DECEMBER 5, 1979, COMMENTING ON THE ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE FOR HONOULIULI WELLS

In response to your comments, we submit the following:

1. Hydrology

Discussion on this (p. 2-11 et. seq.) covers the Pearl Harbor area generally. The graphics and tabular data cover only the service area 7B and water sources in the vicinity of the Honouliuli wells. Table 2-1 (p. 2-21a) accounts for about 50 mgd in water pumpage out of the 160 mgd average during 1919 to 1958. Discussion in the EIS should be broadened to cover the entire basin and its resources: whoare the major users? how much are they pumping? from where? to where? for what use?

The EIS will address your questions based on data in the attached table which will also be inserted into the EIS.

It is indicated that the area of recharge is above the 50-inch isohyet. (P. 2-14.) But Figure 2-4 does not show where this isohyet extends. Also, the 250 ppm isochlor and the extent of caprock are not labelled. These should be shown on a map of the ground water control area so that a reviewer can get a better understanding of the problem facing the Board of Water Supply and Department of Land and Natural Resources in managing water resources here.

Figure 2-4 will be revised to show the 50-inch isohyet and the labelling of the 250 ppm isochlor and the caprock boundary.

Pure Water... man's greatest need - use it wisely

2. Water Distribution System

The existing water transmission system in the water district is described. (P. 1-7 et. seq.) Water demand data and projections are provided for the entire Leeward area. A suitable map showing the major elements of the distribution system and demand for the various major urbanized areas should be provided in the EIS. The Project Vicinity Map (Figure 1-2) is good, but only shows the well site and transmission line to the Honouliuli Booster Station.

A map showing the major transmission mains, reservoirs, and pump stations and a table showing the demands of major urbanized developments within the Honouliuli area will be inserted in the EIS.

3. Water Use

Discussion in the EIS preparation notice (p. 2-18) indicates that 1919 to 1958 pumpage averaged 160 mgd. Current pumpage is not reported. Total discharge during 1931 to 1967 is said to have averaged 250 mgd, with present discharge estimated at 240 mgd. The difference between "pumpage" and "total discharge" should be explained, with an indication as to where major natural discharge is occurring. Here again, the discussion should cover the entire Pearl Harbor Basin, rather than be limited to the Honouliuli area.

"Pumpage" means water pumped, whereas "discharge" includes water pumped and all free flows of groundwater (springs and tunnels). The differences between the two words will be explained in the EIS.

4. Sustainable Yield

It is indicated that the sustainable yield from the Pearl Harbor Basin is about 245 mgd. (P. 2-19.) With present discharge at 240 mgd, the ultimate development of wells at Honouliuli operating at 9 mgd could bring total discharge above sustainable yield unless the increase in domestic use is offset by a reduction in irrigation use. The EIS should indicate, if possible, where such reductions in irrigation use are presently contemplated. This could have a bearing on the future land use pattern in the area.

The present "pumpage" from the Pearl Harbor area is approximately 240 mgd and not "discharge" as was stated in the preparation notice. Therefore, any increase in domestic pumpage in this ground water control area will require a like pumpage reduction from Campbell Estate's lessees or the use of alternative water sources. The EIS will address this pumpage control problem and show where and how pumpage reductions are contemplated.

5. Use of Honouliuli Water

It is indicated that " . . . at least 83% of the first 3 mgd to be developed will serve areas which are already zoned for urban use (Campbell Industrial Park and Makakilo) . . ." (p. 4-13), and " . . . will require allocating 0.5 mgd, of the initial 3.0 mgd, to Makakilo for expansion of the subdivision, since Makakilo will be helping to finance the project." (P. 4-12.) This leaves 17% or about 0.5 mgd for other areas of the Ewa Plain. Further, it "is not anticipated that any of this water will be delivered to the Waianae Coast." (P. 4-14.)

It is also estimated that the subsequent 6 mgd operating capacity proposed could support up to 12,000 units for a population of about 35,200. (P. 4-24.) This is a significant increase.

Accordingly, the EIS should indicate, insofar as is possible at this time, what other areas are prospects for use of the additional 6 mgd in the later phase of the project, plus the 0.5 mgd not accounted for in the initial phase. One such area mentioned is West Beach. (P. 4-24.) For what areas has the Board of Water Supply made firm commitments for providing water? For what areas have there been requests for future water?

Related to this, it might be appropriate for the EIS to include discussion of the impact of the Department of Land and Natural Resources' designation of the Pearl Harbor Basin as a "ground water control area" pursuant to Chapter 177, Hawaii Revised Statutes. (P. 3-9.)

There are no commitments for the remaining 6.5 mgd of estimated source capacity from the proposed Honouliuli Wells. The water will be held in reserve to handle future growth in the Ewa-Waianae areas.

The EIS will discuss the impact that the Department of Land and Natural Resources' designation of the Pearl Harbor Basin as a ground water control area has on the development of ground water sources.

6. Growth Policy

Appendix A discusses Policy Constraints and Assumptions of the Directed Growth Alternative, which is based on housing needs generated by a population of 1,398,000 by 1995. Material here is taken from an outdated (1974) report using a high population projection which was not officially adopted. The officially adopted population projection at that time was the DPED Series E-2 (1,039,000 for Oahu for the year 2000), and this has since been replaced by DPED's II-F projection of 917,400 for Oahu for the year 2000.

It is recommended that Appendix A be evaluated and either omitted or revised to reflect the current population projection (II-F) and possible constraints under Chapter 177.

Appendix "A" will be deleted from the EIS.

7. Drip Irrigation

Discussion of impacts on ground water (pp. 4-19 to 4-21) seems to indicate that drip irrigation and furrow irrigation require the same amount of water. The general impression is that drip irrigation, being more efficient, would require less water all other things being equal, e.g., growing conditions, yields, etc. This should be clarified.

Section 4IIB1, pages 4-19 to 4-21, will be clarified.

8. Other

P. 2-64	Bruce Duncan is not a member of the Department of General Planning staff, but Deputy Director of the Department of Land Utilization.
2-52	Kunia Road capacity of 9,800 vph seems to be an error.
3-1	The General Plan referred to here is the 1964 General Plan. This should be noted.

Mr. George S. Moriguchi
Page 5

January 7, 1980

P. 3-3 The General Plan referred to here is the Revised General Plan, Resolution No. 238, January 18, 1977.

6-17 It is indicated that Well 82-2A is on the "Diamond Head side of the Neil Blaisdell Center Exhibition Hall." Our previous mayor was Neal S. Blaisdell.

The appropriate changes will be made in the EIS.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

KAZU HAYASHIDA
Manager and Chief Engineer

Attach.

cc: Environment Impact Study Corporation

GROUNDWATER WITHDRAWAL IN MGD FROM DESIGNATED AREA (TMK ZONE 9 & 7)

PEARL HARBOR AND WAHIAWA

	1970	1971	1972	1973	1974	1975	1976	1977	1978
BWS									
Local Use	20.56	21.21	22.00	26.23	24.52	30.25	29.76	29.50	29.11
Export to Waianae	2.00	2.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00
Export to Honolulu	13.46	26.20	31.28	33.60	34.07	31.83	39.68	40.41	42.41
TOTAL	36.02	49.41	56.28	62.83	61.59	65.08	72.47	73.91	75.52
SUGAR PLANTATION									
(1) Oahu Sugar	66.78	62.84	61.01	61.29	39.74	49.93	55.46	61.89	63.18
(2) Ewa Plantation	87.28	84.84	78.21	81.36	71.23	69.39	77.62	81.95	69.36
TOTAL	154.06	147.68	139.22	142.65	110.97	119.32	133.08	143.84	132.54
NAVY									
TOTAL	25.43	19.45	21.39	23.43	21.74	23.11	23.32	17.59	12.24
ARMY									
TOTAL	5.06	4.63	5.50	5.89	5.20	5.58	4.70	4.75	4.37
PRIVATE (3)									
TOTAL	2.00	1.70	1.70	3.50	3.50	4.50	4.50	4.70	3.50
GRAND TOTAL	222.57	222.87	224.09	238.30	203.00	217.59	238.07	244.79	228.17

(1) Exclude Waiahole Tunnel & Ditch and Waikele Stream & Springs.
(2) Exclude Shallow Caprock Wells.
(3) Exclude H.E.Co. Tunnel, Watercress Wells and Spring.

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII

FRANK F. FASI
MAYOR

RECEIVED
BD OF WATER SUPPLY
DEC 7 3 53 PM '79

TYRONE T. KUSAO
DIRECTOR

79/EC-9(SE)
11/79-4866

December 7, 1979

MEMORANDUM

TO : KAZU HAYASHIDA, MANAGER & CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM : TYRONE T. KUSAO, DIRECTOR

SUBJECT : NOTICE OF PREPARATION FOR HONOULIULI WELLS
ENVIRONMENTAL IMPACT STATEMENT(EIS)

We have reviewed the above EIS Preparation Notice and feel that you have thoroughly covered all aspects of the project.

As a minor comment, we would like to point out that a county Conditional Use Permit will not be required for the proposed project, contrary to what is reported on Page 3-9 of the Preparation Notice. In addition, the document incorrectly asserts that a state Special Use Permit (SUP) will not be required because the site is less than 15 acres. Act 221 SLH, 1979 does not eliminate the requirement for a state SUP. Rather it allows the county Planning Commission to make the final decision on projects proposed on sites less than 15 acres in size.

If you have any questions concerning the procedures for the SUP, please call Henry Eng at 523-4248.

Robert B. Duncan
for TYRONE T. KUSAO
Director of Land Utilization

TTK:sl

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

December 17, 1979

Mr. Tyrone T. Kusao
Director
Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Kusao:

Subject: Your Comments of December 7, 1979 on the Notice of Preparation for Honouliuli Wells Environmental Impact Statement

Thank you for your comments on our proposed water project.

We will make the corrections noted in your letter in the EIS.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

for KAZU HAYASHIDA
Manager and Chief Engineer

cc: ✓Environmental Impact
Study Corporation

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

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Nov 30 4 25 PM '79

FRANK F. FASI
MAYOR

WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER

ENV 79-386

November 28, 1979

MEMORANDUM

TO : MR. KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM : WALLACE MIYAHIRA, DIRECTOR AND CHIEF ENGINEER

SUBJECT: EIS PREPARATION NOTICE FOR HONOULIULI WELLS

We have reviewed the subject Preparation Notice and have the following comments.

1. The West Beach development (page 2-38) will have about 7,200 resort units which should be considered in determining future water demand. See Table 2-8.

2. Seventy-five percent of the eligible construction cost of the Honouliuli WWTP (page 2-41) is being funded by the Federal government.

3. The Waipahu incinerator (page 2-55) has a designed capacity of 600 tons per day. The water needs of the proposed HPOWER plant that may be located in the Barbers Point Industrial Park should be considered in determining the overall water needs of the area. The initial plant may have a capacity to process 600, 1200 or 1800 tons of municipal solid wastes a day.

4. The term non-residential user is preferred over industrial users (page 4-17) with respect to sewer service charges.

5. The initial capacity (25 mgd) of the Honouliuli WWTP will be able to serve a population of 197,000. The plant will have to be expanded to serve the projected 2000 population of 226,800 people (page 4-27).

6. The plan to discharge secondary effluent from the Mililani STP into the Waiahole Ditch has been changed (page 6-4). The present plan is to convey the effluent to Oahu Sugar Company (OSC) Field 215 until 1996. Field 215 is located 1½-2 miles mauka of OSC mill in Waipahu.

7. The Honouliuli WWTP (page 6-4) is located makai of Ewa village. The pumping of Honouliuli (page 6-5) effluent to Ewa Shaft near the H-1 Highway for further distribution to OSC fields is a concept not fully acceptable to the US Navy and the BWS.

8. The concept of a dam (page 6-7) across West Loch for storing water from Waikele Stream should be elaborated.

Wallace Miyahira
WALLACE MIYAHIRA
Director and Chief Engineer

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

COPY

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
D. QUON FANG, Vice Chairman
OKICHI HIGASHIONNA
RESITA R. JUBINSKY
ALLACE S. MIYAHIRA
OBERT A. SOUZA
LAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

December 5, 1979

REC[illegible]ED
DEC 1 0 1979
EIS

TO : MR. WALLACE MIYAHIRA
DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM : KAZU HAYASHIDA
BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF NOVEMBER 28, 1979, ON THE EIS PREPARATION NOTICE FOR THE HONOULIULI WELLS

Thank you for your comments on our proposed project. Your comments will be incorporated into the environmental impact statement.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

L.G. Rathburn

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environmental Impact Study Corp.

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DEC 20 9 36 AM '79

ALU LIKE
WORKING TOGETHER

ADMINISTRATIVE OFFICES
2828 Paa Street, Suite 3035 Honolulu, Hawaii 96819
Telephone: (808) 833-5871

December 14, 1979

Mr. Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Whang:

I am writing to request that I be consulted in the preparation of an Environmental Impact Statement for the Honouliuli Wells at Kahe, Oahu as noticed in the November 23, 1979 Environmental Quality Commission Bulletin.

Second, I also wish to be consulted in the preparation of the EIS at Makaha Exploratory Well II noticed in the Environmental Quality Commission Bulletin of November 8, 1979.

Please keep me informed about the submission of information and documents and testimony in the preparation of the EIS on both of these projects.

Very truly yours,

Winona E. Rubin
Winona E. Rubin
Director, Alu Like

WER/dd

E alu like mai kakou, E na o'iwi o Hawai'i
Let us work together, natives of Hawai'i

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

COPY

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
DAT QUON PANG, Vice Chairman
RYOKICHI HIGASHIONNA
TERESITA R. JUBINSKY
WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

December 27, 1979

Ms. Winona E. Rubin
Director
Alu Like
Suite 3035
2828 Paa Street
Honolulu, Hawaii 96819

Dear Ms. Rubin:

Subject: Your Letter of December 14, 1979 on the Environmental Impact Statements for Honouliuli Wells and Makaha Exploratory Well II

We have placed your name on the list of consulted parties for the proposed Honouliuli Wells. A copy of the Honouliuli Wells EIS preparation notice is enclosed for your review and comments. We would appreciate your comments by January 28, 1980.

Also enclosed is a copy of the environmental assessment for Makaha Exploratory Well II. Please submit your comments on the assessment by January 28, 1980.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

L.G. Rathburn

KAZU HAYASHIDA
Manager and Chief Engineer

Encl.

cc: Environmental Impact
Study Corporation

Pure Water...man's greatest need—use it wisely

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

RECEIVED
DEC 12 1979
EISC

December 7, 1979

Dr. Bryce Decker
Department of Geography
University of Hawaii
2530 Dole Street
Honolulu, Hawaii 96822

Dear Dr. Decker:

Subject: Your Telephone Request of December 6, 1979 on the Honouliuli Wells EIS Preparation Notice

Thank you for your interest in our project. Your name has been added to our consulted party's list. Enclosed is a copy of the preparation notice for your review and comments. We would appreciate receiving your comments by January 15, 1980.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

Encl.

cc: Environmental Impact Study Corp.

EWA NEIGHBORHOOD BOARD NO. 23
P. O. BOX 267
EWA BEACH, HAWAII 96706

RECEIVED
BD OF WATER SUPPLY
DEC 7 1979

December 5, 1979

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Subject: Notice of Preparation for Honouliuli Wells Environmental Impact Statement

We received your request for comments on your EIS preparation notice too late to take action by the Ewa Neighborhood Board No. 23 prior to December 7, 1979.

In view of the anticipated increase of the Leeward Area population it is obvious that steps must be taken to ensure a viable water supply for the future.

I presume that it may be necessary to revise your EIS estimates as a result of the Department of General Planning's upward revision of the Ewa Area population to 93,000 by the year 2000.

Will there be a sharp increase in the cost of water to the present residents to subsidize the cost of construction and maintenance for anticipated future users?

Thank you for an opportunity to comment on the EIS preparation notice.

Sincerely,

Charles R. Beamer
Chairman

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

December 18, 1979

Mr. Charles R. Beamer
Chairman
Ewa Neighborhood Board No. 23
P. O. Box 267
Ewa Beach, Hawaii 96706

Dear Mr. Beamer:

Subject: Your Letter of December 5, 1979, Commenting on the EIS Preparation Notice for the Honouliuli Wells

Thank you for your comments on our proposed project.

The EIS will be revised to indicate that the Ewa Area Development Plan population for the Year 2000 is estimated to be 95,400 by the Department of General Planning.

Any future increases in the cost of water would follow the normal inflationary trend. Governmental agencies and private developers will be required to share in the construction costs for water facilities needed to increase water supply.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

for KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environmental Impact Study Corporation

HAWAIIAN ELECTRIC COMPANY, INC.
Box 2750 / Honolulu, Hawaii / 96840
December 4, 1979

JOHN C. McCAIN, Ph.D
MANAGER, ENVIRONMENTAL DEPARTMENT

RECEIVED
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DEC 6 ...

ENV 2-1
General
NV/G

Mr. Lawrence Whang
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Whang:

Subject: Comments on Notice of Preparation - Honouliuli Wells EIS

Several members of the staff of Hawaiian Electric Company have reviewed the Notice of Preparation for the Honouliuli Wells EIS and have the following comments:

Page 2-56 (D.1) Sentence 1 - Lines are 46 kv, not 44 kv. There are three parallel easements, not two as stated in the last sentence of the first paragraph. Two of the easements have two 138 kv circuits on each easement. The third easement is reserved for future use. Each easement can contain four 138 kv circuits.

The third paragraph should read "The project site will have an electrical demand of 700 kilowatts."

The first sentence of the fourth paragraph should read "HECO has stated that they will have adequate capacity to supply the electrical demand requirements for the service area of the project." The generating capacity values should be 1,209,400 kw and 1,350,400 not 1,210,000 and 1,400,000 as stated.

Since Section 5 - Adverse Environmental Effects is not contained in this document, we are unable to comment on the environmental aspects of the project.

Yours truly,

John C. McCain

JCMc:cm

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

December 10, 1979

REC...
DEC 12 1979
EISC

Dr. John C. McCain
Manager, Environmental Department
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawaii 96840

Dear Dr. McCain:

Subject: Your Letter of December 4, 1979, Commenting on the Notice of Preparation for the Honouliuli Wells EIS

Thank you for reviewing our environmental document. We will make the corrections noted in your letter when the EIS is prepared.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environmental Impact Study Corporation

MHS:am
cc: K. Hayashida
L. Whang

79-4802

HAWAIIAN TELEPHONE

RECEIVED
BD OF WATER SUPPLY
DEC 7 1 14 PM '79

December 4, 1979

Donald M. Kuyper
President

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Notice of Preparation for Honouliuli
<u>Wells Environmental Impact Statement</u>

We have reviewed the subject Environmental Impact Statement (EIS) Preparation Notice as transmitted under your covering letter dated November 15, 1979 and offer the following comments:

Page 2-57, paragraph 3, indicates that telephone service is available in the vicinity of the project site. In actuality the closest telephone facilities are located on Kunia Road, approximately a half a mile away from the project site. To provide telephone service to the project site, a pole line of approximately 20 poles with associated wiring must be constructed from Kunia Road to the site. In most probability, electrical service will also be provided via this proposed pole line.

It is our understanding that access to the project site will be from an existing unimproved cane haul road as no permanent public access roadway will be constructed initially. As such, the exact location of the proposed pole line cannot be determined until satisfactory right-of-way is acquired from the Oahu Sugar Company, Ltd., and the James Campbell Trust Estate, lessee and owner respectively. Negotiations for said right-of-way and determination of cost-sharing responsibilities will commence when notification of project approval is received.

Thank you for giving us the opportunity to review and comment on this EIS Preparation Notice. If you should have any further questions, please contact our Engineering and Construction Staff Manager, Mr. Richard Mau, at 546-3650.

Sincerely,
D. M. Kuyper

PO BOX 2200 • HONOLULU HAWAII 96841 • TELEPHONE (808) 546-3855 • CABLE TELHAWAII

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

December 13, 1979

Mr. Donald M. Kuyper
President
Hawaiian Telephone Co.
P. O. Box 2200
Honolulu, Hawaii 96841

Dear Mr. Kuyper:

Subject: Your Letter of December 4, 1979
Commenting on the EIS Preparation
<u>Notice for Honouliuli Wells</u>

Thank you for your comments on our proposed project.

The EIS will be corrected to indicate the location of the nearest telephone facilities and your requirements for providing telephone service to the project site.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,
Li Rathburn
for KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environmental Impact
Study Corp.

LEGAL AID SOCIETY OF HAWAII
85-535 FARRINGTON HIGHWAY
WAIANAE, HAWAII 96792
TELEPHONE (808) 696-6321

MELVIN M. M. MASUDA, ESQ
Executive Director

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Dec 10

December 4, 1979

Mr. Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 S. Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Whang:

I am writing to request that my clients and I be consulted in the preparation of an environmental impact statement for the Honouliuli Wells at Kahe, Oahu as noticed in the November 23, 1979 Environmental Quality Commission Bulletin.

Second, I also wish to be consulted in the preparation of the EIS at Makaha Exploratory Well II noticed in the Environmental Quality Commission Bulletin of November 8, 1979.

I am writing on behalf of and represent farmers at Camp Kaala in Waianae Valley and Neighborhood Board No. 24 (Waianae Coast), Nanakuli Hawaiian Homestead Association, the Waianae Hawaiian Civic Club, Nikilua Farm Bureau, and the Waianae Land Use Concerns Committee.

Please keep me informed about the submission of information and docuemtns and testimony in the preparation of the EIS on both of these projects.

Very truly yours,

William M. Tam

William M. Tam
Staff Attorney

WMT:dm

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

COPY

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
DAI QUON PANG, Vice Chairman
RYOKICHI HIGASHIONNA
TERESITA R. JUBINSKY
WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

December 18, 1979

Mr. William M. Tam
Staff Attorney
Legal Aid Society of Hawaii
85-535 Farrington Highway
Waianae, Hawaii 96792

Dear Mr. Tam:

Subject: Your Letter of December 4, 1979 on the Environmental Impact Statement for Honouliuli Wells and Makaha Exploratory Well II

We have placed you and your clients on the list of consulted parties for the Honouliuli Wells project. A copy of the Honouliuli Wells preparation notice is enclosed. We would appreciate your comments on it by January 18, 1980.

Also enclosed is a copy of the environmental assessment for Makaha Exploratory Well II. Any comments you may have on the assessment should be sent to us by January 18, 1980.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

L.G. Rankin
For KAZU HAYASHIDA
Manager and Chief Engineer

Encl.

cc: ✓Environmental Impact
Study Corporation

Pure Water... man's greatest need – use it wisely

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Mililani Town Inc
130 Merchant Street
P O Box 2780
Honolulu Hawaii 96803
Telephone (808) 548-4811

December 19, 1979

Mr. Lawrence Whang
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 69813

Dear Mr. Whang:

Honouliuli Wells, Kunia, Oahu

Pursuant to the Bulletin of the Environmental Quality Commission, this is to request that Mililani Town, Inc. be a party to be consulted in the preparation of the EIS.

We do have an interest in the proposed project. We are not quite certain what the consultation relates to but wish to be kept informed of the project.

Very truly yours,

George Yim
Vice President

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

COPY

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
DAT QUON PANG, Vice Chairman
RYOKICHI HIGASHIONNA
TERESITA R. JUBINSKY
WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

January 4, 1980

Mr. George Yim
Vice President
Mililani Town, Inc.
P. O. Box 2780
Honolulu, Hawaii 96803

Dear Mr. Yim:

Subject: Your Letter of December 19, 1979, on the EIS Preparation Notice for the Honouliuli Wells

We have placed your name on our consulted party's list and have enclosed a copy of our EIS Preparation Notice for your review and comments. We would appreciate receiving your comments by January 21, 1980.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

Encl.

cc: Environment Impact Study Corp.

Pure Water... man's greatest need – use it wisely

"REPRESENTING ALL THE PEOPLE OF WAIPAHU"

Waipahu Community Association

HONOLULU SAVINGS AND LOAN BUILDING
94-229 WAIPAHU DEPOT STREET
WAIPAHU, HAWAII 96797
TELEPHONE 677-4950

RECEIVED
BD OF WATER SUPPLY
DEC 5 8 03 AM '79

November 30, 1979

Mr. Lawrence Whang
Board of Water Supply
City & County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Whang:

SUBJECT: EIS PREPARATION - HONOULIULI WELLS, KUNIA, OAHU

The Waipahu Community Association wishes to be a consulted party in the preparation of the environmental impact statement of the above subject.

Thank you.

Yours truly,

for C. O. "Andy" Anderson
President

lfo

COMPRISING OF:
Crestview/Seaview Association, D. O. E. - Leeward District, Friends of Waipahu Cultural Garden Park, Harbor View Neighborhood Association, Leeward Community College, Oahu Sugar Company, Robinson Heights Association, Waikele Neighborhood Association, Waikele Rice Association, Waipahu Advocates for the Elderly, Waipahu Businessmen's Association, Waipahu Highlands Association, Waipahu Jackrabbits, Waipahu Recreation Advisory Council, Waipahu Recreation Center.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

COPY

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
DAT QUON PANG, Vice Chairman
RYOKICHI HIGASHIONNA
TERESITA R. JUBINSKY
WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

REC...
DEC 11 1979
EISC

December 6, 1979

Mr. C. O. Anderson
President
Waipahu Community Association
94-229 Waipahu Depot Street
Waipahu, Hawaii 96797

Dear Mr. Anderson:

Subject: Your Letter of November 30, 1979 on the EIS Preparation Notice for Honouliuli Wells, Kunia, Oahu

Thank you for your interest in our proposed project. Your organization has been placed on our consulted party's list and a copy of our preparation notice is enclosed for your review and comments. We will appreciate receiving your comments by January 15, 1980.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

Encl.

cc: Environmental Impact Study Corp.

Pure Water... man's greatest need – use it wisely

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JAN 15 12 58 PM '80

"REPRESENTING ALL THE PEOPLE OF WAIPAHU"

Waipahu Community Association

WAIPAHU

HONOLULU SAVINGS AND LOAN BUILDING
94-229 WAIPAHU DEPOT STREET
WAIPAHU, HAWAII 96797
TELEPHONE 677-4950

January 14, 1980

Kazu Hayashida
Manager & Chief Engineer
Board of Water Supply
630 So. Beretania
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Thank you for allowing the Waipahu Community Association, the opportunity to review the environmental impact statement for the proposed Honouliuli Wells water management expansion program.

Your proposed development of additional water sources/alternate resources to meet the needs of the 1980's, is a carefully documented and complete study covering each aspect of public needs, and safety restraints that will ensure continuance of adequate health/welfare standards for Oahu residents.

Sincerely,

for C. O. "Andy" Anderson
President

COA/ls

copy to: file

COMPRISING OF
Crestview/Seaview Association, D. O. E. - Leeward District, Friends of Waipahu Cultural Garden Park, Harbor View Neighborhood Association, Leeward Community College, Oahu Sugar Company, Robinson Heights Association, Waiani Neighborhood Association, Waikele Hills Association, Waipahu Advocates for the Elderly, Waipahu Businessmen's Association, Waipahu Highlands Association, Waipahu Jackrabbits, Waipahu Recreation Advisory Council, Waipahu Recreation Center

---

COPY

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

FRANK F. FASI, Mayor
YOSHIE H. FUJINAKA, Chairman
DAT QUON PANG, Vice Chairman
RYOKICHI HIGASHIONNA
TERESITA R. JUBINSKY
WALLACE S. MIYAHIRA
ROBERT A. SOUZA
CLAUDE T. YAMAMOTO

KAZU HAYASHIDA
Manager and Chief Engineer

January 21, 1980

Mr. C. O. Anderson
President
Waipahu Community Association
94-229 Waipahu Depot Street
Waipahu, Hawaii 96797

Dear Mr. Anderson:

Subject: Your Letter of January 14, 1980
Commenting on the Proposed
Honouliuli Wells

Thank you for your comments which will be appended to the environmental impact statement.

Should you have questions or require additional information, please call Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study
Corporation

Pure Water... man's greatest need – use it wisely

EIS Review Period

12

SECTION 12

ORGANIZATIONS AND PERSONS CONSULTED DURING THE EIS REVIEW PERIOD

The following list includes those agencies and organizations to whom the Environmenal Impact Statement was sent during the EIS review process. Those with an asterisk sent in written comments. The comments and their responses follow this list.

RECEIVED
BOARD OF WATER SUPPLY

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY SUPPORT COMMAND, HAWAII
FORT SHAFTER, HAWAII 96858

20 JAN 1982

APZV-EHE-E

Honorable Eileen Anderson
Mayor of City and County of Honolulu
530 South King Street
Honolulu, Hawaii 96813

Dear Mayor Anderson:

The Environmental Impact Statement for the Honouliuli Wells, Honolulu, Oahu, Hawaii has been reviewed and we have no comments to offer. It is anticipated that there will be no adverse impacts on Army installations or activities resulting from the proposed project.

Thank you for allowing us the opportunity to comment on the proposed project.

Sincerely,

Original signed by

ADOLPH A. HIGHT
COL, EN
Director of Engineering and Housing

Copy Furnished:
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

EILEEN R. ANDERSON, Mayor

YOSHIE H. FUJINAKA, Chairman
ROBERT A. SOUZA, Vice Chairman
MICHAEL J. CHUN
WALTER A. DODS, JR.
RYOKICHI HIGASHIONNA
DONNA M. HOWARD
DAT QUON PANG

KAZU HAYASHIDA
Manager and Chief Engineer

COPY

January 27, 1982

Colonel Adolph A. Hight
Director of Engineering and Housing
Headquarters U. S. Army Support Command, Hawaii
Department of the Army
Fort Shafter, Hawaii 96858

Dear Colonel Hight:

Subject: Your Letter of January 20, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

Pure Water... man's greatest need – use it wisely

820459

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858

RECEIVED
FEB 24 4 14 PM '82

PODED-PV

16 February 1982

Honorable Eileen Anderson
Mayor of the City and County
of Honolulu
Honolulu, Hawaii 96813

Dear Mayor Anderson:

Thank you for the opportunity to review the Environmental Impact Statement (EIS) for the Honouliuli Wells, Honouliuli, Oahu, Hawaii, sent to us on 12 January 1982. Based on our review, we provide the following comments.

a. A Department of the Army permit is not required for this project.

b. The Honouliuli Wells site and most of the proposed transmission alignment are not situated in any known flood-prone area. According to the Flood Insurance Study for Oahu by the Federal Insurance Administration, the area is classified Zone D, or area of undetermined but possible flood hazards. A portion of the alignment is outside the limits of, but within the vicinity of Honouliuli Stream floodplain, and is designated Zone C, or area of minimal flooding. See the attached Flood Insurance Rate Map for the Honouliuli area (Incl 1).

Sincerely,

EDMUND A. THAL
Major, Corps of Engineers
Deputy District Engineer

1 Incl
As stated

CF:
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 3, 1982

Major Edmund A. Thal
Deputy District Engineer
U. S. Army Engineer District,
Honolulu
Department of the Army
Fort Shafter, Hawaii 96858

Dear Major Thal:

Subject: Your Letter of February 16, 1982, on the Environmental Impact Statement (EIS) for Honouliuli Wells

Thank you for reviewing the EIS for our proposed water development project. Your letter to the Mayor has been referred to us for reply, and it will be appended to the revised EIS.

We shall indicate in the revised EIS that a Department of Army permit is not required for the project and shall also mention the flood zone designations of the proposed well site and transmission main alignment.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

MHS:am
cc: Eileen R. Anderson, Mayor
Andrew I. T. Chang, Managing Director
Environment Impact Study Corporation

820574

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

March 2, 1982

BD OF WATER SUPPLY RECEIVED
MAR 9 10 05 AM '82

Honorable Eileen Anderson
Mayor, City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Dear Mayor Anderson:

Subject: Environmental Impact Statement for Honouliuli Wells, Honolulu, Oahu, Hawaii
Tax Map Key: 9-2-01: Portion of Parcel 1

The subject environmental impact statement was reviewed by Harti Ikehara and Patricia Shade of this office. Their combined comments are enclosed.

Sincerely yours,

Benjamin L. Jones
District Chief

Enclosures

cc: Board of Water Supply, City and County of Honolulu

General Comments

There are four critical points in the EIS for the Honouliuli Wells and the Waste Water Treatment Plant which require a more thorough discussion and explanation.

1) A specific source of exchange water has not been defined.

2) The project is contingent on a specific agreement between the Board of Water Supply and the Oahu Sugar Co., Ltd., whereby Oahu Sugar agrees to accept the proposed lower quality exchange water. There is no indication in the EIS that Oahu Sugar has agreed to such an arrangement.

3) There are contradictory passages in the report regarding the routing of water from the Honouliuli Waste Water Treatment Plant.

4) Some mention needs to be made of the current high pumpage in the Honouliuli area. This area has the highest concentration of ground-water draft in the State on a per-area basis. Thus, regardless of any water exchange agreement that there would be no net increase in pumpage from the Pearl Harbor aquifer, the concentration rather than the total draft may be the overriding factor in justifying the project.

A discussion of the first three points follows:

The first three points listed above become intertwined in the text. On pages 1-20 a specific source of exchange water is not defined and no definite agreement appears to have been made between the Board of Water Supply and Oahu Sugar Co., Ltd.:

Page	Comment
1-20	"Before the Board proceeds with the project, arrangements will be made with Oahu Sugar Company for them to cut back an equal amount of ground water pumpage so that net pumpage from the Pearl Harbor aquifer will remain the same. The City will compensate Oahu Sugar for this reduction in pumpage by offering water of lower quality in exchange, on a gallon-for-gallon basis. Such water could theoretically consist of treated sewage effluent, spring water, or surface water. At present, treated sewage effluent is the preferred choice."

On pages 6-4 there is a question as to the routing of sewage effluent from the Honouliuli Waste Water Treatment plant:

Page	Comment
6-4	"The Honouliuli WWTP is the other sewage treatment plant in this cane growing area that can furnish cane irrigation water."

It appears from the above statements that the primary source of exchange water could be from the Honouliuli WWTP, but there has not yet been a definitive agreement. If the effluent from the Honouliuli WWTP is the likely source of exchange water, then the following statement must be clarified:

Page	Comment
2-55	"The treated sewage (from the Honouliuli WWTP) will be discharged into the ocean by a deep water outfall off Barbers Point....If secondary treatment is required, the treated effluent possibly could be reclaimed for irrigation purposes, however, exact plans for any eventual reclamation have not been finalized for the Honouliuli WWTP."

These critical inconsistencies of the proposed operational plan must be addressed if the EIS is to be fundamentally sound.

In addition to the conflicts presented in the preceding discussion, regarding the routing of water from the Honouliuli WWTP, there may be a conflict with the Hawaii State Plan's proposals for water conservation. Policies of the Hawaii State Plan are stated on page 3-6:

Page		Comment
3-6	Section (b)(2):	"Encourgage re-use and recycling to reduce solid and liquid waste and develop a conservation ethic."
	Section (b)(3):	"Reclaim and encourage the productive use of run-off water and waste water discharge."

It appears from this EIS that if the EPA will allow primary-treated sewage effluent to be discharged into the ocean (pages 2-54, 2-55), then this is the destination of the effluent from the Honouliuli WWTP. When the plant is at capacity, 25 mgd, this is more than 10% of the sustainable yield of the Pearl Harbor ground water body. The Board of Water Supply should clarify whether only a portion of this effluent is slated for the ocean discharge, or if the ocean discharge is being proposed only for flood-water runoff.

Page	Comment
3-7	The EIS states that "The project does not appear to be inconsistent with the facility systems objectives and policies.", which are those in the State Plan listed as sections (b)(2) and (3). The project does appear to be inconsistent with the objectives and policies of the State Plan if the effluent from the Honouliuli WWTP is to be discharged into the ocean rather than reused.

Specific Comments

This project also proposes to phase out the Makakilo STP which is utilizing effluent for irrigation (page 2-54). How will this water be replaced?

Page	Comment
2-40	The EIS has the location of West Beach "just west of Nanakuli and north of the proposed Barbers Point Harbor." Should be south? East? of Nanakuli.
3-7	"....(refer to Sections 1 and 6)." Of what document?
4-11	"These sources may experience some drop in head level with continued pumping from the new wells, if the cut-back is not at Ewa Shaft." If the cut-back is not at Ewa Shaft, the Kunia Wells series "will probably" or "most likely" have a drop in head level.
	Similarly, "Development of a well field may affect nearby wells..." A better choice of words would be "generally" or usually".
4-12	Who is undertaking the studies to determine pumpage feasibilities at lower head levels? What are some tentative results?
4-16	Several facts regarding population statistics are given. What is the source of these estimates? What can be concluded from the demographic predictions, regarding water allotment?
4-17	Why will smoke and ashes not affect the mechanical equipment? What protective devices or measures are taken? Is the equipment completely protected from fine ash? Is it underground?
4-20	What is a "low ground water plan"? Why would (or does) low (reserves of) ground water give BWS power to determine the optimum meter replacement period?
4-24	What aspect of dual systems and cistern systems are being investigated? What are some preliminary conclusions?
	The EIS merely states here that the reuse of sewage effluent is a form of water conservation. There is no mention here about how BWS is putting this into practice. Specifically, what sewage treatment plants are the source of the effluent and how much of it goes where for what purpose?

Page	Comment
4-32	Where is the reference for Hawaiian Telephone's statement regarding no difficulties in servicing this facility? In addition, the statement in the EIS is rather broad, and doesn't even really refer to the pumping station specifically. "... to the Ewa area" could use rewording to specify the facility in question.
4-33	What is a Department of Education CIP? Should be defined.
4-35	Increased public costs are mentioned as a possible effect if more medical services are needed for future population growth. Would not such services create increased job opportunity? This socioeconomic effect is not included for medical services, as it is for fire and police services in the preceding paragraphs.
	It would seem that there would be adverse sociological impacts in the area if the beaches and other parks are "already heavily used." Thus, "adverse impacts..." is not adequately explored. The specific kinds of adverse impacts should be addressed in the Revised EIS.
6-4	"The diluted effluent from Honouliuli WWTP will be used in irrigation..." So far the agreement has not been finalized. If the implicit user is Oahu Sugar Co., then the verb should be in the future subjunctive: "The ... effluent ... would be used..."
	"... about 25 mgd could be supplied by the Honouliuli WWTP and about 8 mgd by the Mililani STP."
	Here the BWS is proposing that 33 mgd of effluent will be available for the exchange with Oahu Sugar. How can the BWS be proposing to trade the total capacity of the Honouliuli WWTP (25 mgd) when, if the EPA okays primary treatment of sewage effluent, this same 25 mgd may be slated for a sewage outfall?
6-5	"43 mgd of low salinity spring water" is discharging into the ocean. How firm is this number, when it is being presented as if it could be captured and used as a source of exchange water?

Appendices

Page	Line	Comment
A-4	23	"Whichever" is misspelled.

Page	Line	Comment
A-29/30	Figure	A definition and graphic depiction do not match. The definition: The depth of the 50 percent concentration point is forty times the height of the water table. The figure shows the depth arrow extending past the 50 percent concentration (dashed) line to the bottom of the brackish transition zone. Solution: Alter the figure.
A-46b	--	Table A-7. The footnote (2), next to "214", is in a confusing location. It should be repositioned adjacent to the total figure-264 mgd.
A-52	--	"with an useful certainty". Should "an" be "any?"
A-56	--	Why give two statistics which cannot be compared? Either give the total water use in 1977, or give the breakdown of the 1975 figure into the pumpage and Surface Water components. Otherwise, if read quickly, it appears that water demand/pumpage dropped from 470 mgd in 1975 to 400 mgd in 1977. Or is this what is really being said?
A-60	Table	"Commercial" is misspelled
A-66	17	"relatively" is misspelled
	19	"It appears that". Add "that".
B-2	4	"recharge" is misspelled.
		It should be specified "impermeable natural fill".
B-3	13	"elements of (sodium..." should be "elements (of sodium..."
D-2	8	"resulting from" is misspelled.
J	All	Appendix J "Proposed Honouliuli Effluent Reuse Areas" should be included in the body of the report. It is a critical component of the entire proposal.

Typos

Page	Line	Comment
S-1	2	"Linear" is misspelled.

Page	Line	Comment
S-3	3	"No rare of endangered..." Should be "No rare or endangered..."
2-12	14	"For water year 1977 (October 1976 to September 1977), ..." Should be either "(October 1976 through September 1977)" or "...to October 1977)"
2-13	6	"This water is suitable for domestic use although mineralized." Should be "This water, although mineralized, is suitable for domestic use."
2-15	Figure	The description in the key for brackish ground-water symbol in Figure 2-6 has "... volcanic aquafier" rather than "volcanic aquifer."
2-29	Figure	Figure 2-8 needs a legend.
2-43	25	"Manufacturing is modest."
4-5	22	"These particular estimates only would be true when there are..." Shouldn't it be "estimates would be true only when there are ..."?
4-7	7	"Potential problems by coordinating construction with Oahu Sugar..." Should be "...by coordinating with Oahu Sugar Co. construction scheduling to avoid conflict..."
4-13	10	"This is discussed in greater depth..." Should be either "at greater depth" or in greater detail."
4-14	15	"...decline in...quality...of the sources used ... on sugar cane, as most of them have chloride contents..." Do you mean the sugar cane or the water? Should probably be "... as most of the sources have..."
4-21	7	"... information on water conservation..."
4-22	12	"...acceptance and cooperation has been good." Should be "...have been good."
	23	"...adopted by industry as well as individuals." Should be "...industry as well as by individuals."
4-23	10	"...paid a sewer charge based on $0.25..."
4-24	8	"...decreasing withdrawls..." Should be "withdrawals."
6-9	21	"...is shown in Figure 6-1."

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

RECEIVED
MAR 23 1982
EISC

March 18, 1982

Mr. Benjamin L. Jones
District Chief
Water Resources Division
Geological Survey
U. S. Department of the Interior
P. O. Box 50166
Honolulu, Hawaii 96850

Dear Mr. Jones:

Subject: Your Letter of March 2, 1982 on the Environmental Impact Statement (EIS) for Honouliuli Wells

Thank you for reviewing the draft EIS for our proposed water development project. Your letter to the mayor has been referred to us for reply and will be appended to the revised environmental document.

We offer the following information in response to your comments:

1. Until the re-use of treated sewage effluent by Oahu Sugar Company (OSC) is resolved, the matter of exchange cannot be pursued. Therefore, no specific OSC sources are mentioned in the draft EIS for possible exchange.

2. The Honouliuli Waste Water Treatment Plant (WWTP) is the preferred source of water to be exchanged with OSC. Although the primary effluent disposal system for the Honouliuli WWTP is the ocean outfall, modifications can be made in the future if it is found to be cost effective to accommodate the water exchange program.

3. The proposed water exchange concept is consistent with the Hawaii State Plan since it encourages the re-use of liquid wastes and use of runoff water. By using lower quality water for irrigation purposes below H-1 Freeway, the pumping of potable groundwater for irrigation use would be minimized thus promoting conservation.

   The amount of sewage that could be diverted for the water exchange proposal will depend on the amount that OSC would accept. This information will be incorporated into the EIS.

4. The water from the Makakilo WWTP could be replaced with effluent from the Honouliuli WWTP.

5. Page 2-40 will be corrected to indicate West Beach is located south of Nanakuli.

6. On page 3-7, Sections 1 and 6 refer to the EIS for Honouliuli Wells.

7. We concur with your statement that the Kunia Wells will probably experience a drop in head level if the cut back is not at Ewa Shaft.

8. The study to determine pumpage feasibilities at lower head levels was made by John F. Mink. He concluded that "at low head a unit change in sustainable yield results in much larger loss of storage head than the same unit change at high head".

9. The population statistics are based on the State's II-F population projections, the Board of Water Supply's Water System Standards, and the master plan for Makakilo City.

   We cannot conclude any demographic predictions regarding water allotment.

10. We shall revise our statement on page 4-17 to indicate that smoke and ashes will not adversely effect mechanical equipment. Our mechanical equipment is maintained to minimize the corrosive effects from smoke and ash.

11. In Chapter 3 of our Rules and Regulations are conditions and actions that may be implemented during periods of "low" groundwater levels.

    The statement on optimum meter replacement period on page 4-20 will be deleted.

12. The feasibility of dual systems and cistern systems is being reviewed as part of our conservation program.

    There are many health and operational problems that must be resolved before such systems can be promoted.

    The feasibility of re-using treated sewage effluent for sugarcane irrigation has been confirmed. However, the plugging problem of using the effluent in OSC's drip irrigation system has to be resolved.

13. The EIS will be revised to indicate Hawaiian Telephone Company is able to provide service to the project site after a satisfactory right-of-way is acquired (page 4-32).

14. The Department of Education's CIP is their capital improvements program which is a planning tool to determine fiscal cost allotments for their construction projects.

15. Pages 4-34 and 4-35 will be revised to reflect your comments that public costs would increase but, at the same time, would provide job opportunities for health care.

16. On page 6-4, the last sentence will be revised to indicate that treated effluent could be used for irrigation makai of the H-1 Freeway.

    Although 33 mgd of sewage would be available for re-use, OSC's plans to utilize the effluent is uncertain. The ocean outfall would still be the primary method of disposal.

17. The 43 mgd of spring water mentioned on page 6-5 is an estimated amount from which only a portion may be economically developed. This information will be reflected in the revised EIS.

18. We will correct the misspelling of "whichever" on page A-4.

19. Figure A-14 will be corrected to show the depth arrow extending only to the 50% concentration line.

20. The footnote (2) in Table A-7 is correctly located since the figure 214 refers to pumpage.

21. The phrase "with an useful certainty" will be revised to read "with any useful certainty" on page A-52.

22. The data on water demand versus sustainable capacity on page A-56 is presented to show that island-wide demand is approaching the island's sustainable capacity. We had no intention of implying that water demand has dropped.

23. All the typographical errors and editorial revisions that are mentioned in your comments will be corrected in the revised EIS.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

For L.G. Rathburn

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Eileen R. Anderson, Mayor
Andrew I. T. Chang, Managing Director
Environment Impact Study Corp.

United States Department of Agriculture — Soil Conservation Service — P. O. Box 50004, Honolulu, Hawaii 96850

January 28, 1982

FEB 1 11 24 AM '82

Honorable Eileen R. Anderson
Mayor, City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Mayor Anderson:

Subject: EIS for Honouliuli Wells - Board of Water Supply

We have reviewed the subject environmental impact statement and have no comments to make.

Thank you for the opportunity to review this document.

Sincerely,

Jack P. Kanalz

JACK P. KANALZ
State Conservationist

cc:
Board of Water Supply, City and County of Honolulu
Environmental Quality Commission, State of Hawaii

The Soil Conservation Service is an agency of the Department of Agriculture

SCS-AS-1
10 78

MAYOR'S OFFICE
CITY & COUNTY

United States Department of the Interior

FISH AND WILDLIFE SERVICE
'82 JAN 26 P1 1:08 300 ALA MOANA BOULEVARD
P.O. BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:
ES
Room 6307

JAN 2 2 1982

Mayor Eileen Anderson
City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Re: EIS - Honouliuli Wells, Honouliuli, Oahu, Hawaii

Dear Mayor Anderson:

We have reviewed the subject Environmental Impact Statement (EIS) and offer the following comments.

The EIS would be enhanced by including a description of aquatic resources and resource uses within Honouliuli Stream, and by describing potential project related impacts upon these resources. (For example, fishes and crustaceans inhabiting the terminal reach of nearby Waikele Stream provide a subsistence fishery for residents of the Ota Camp area. Reduction of stream flow at Waikele might lead to a net loss of these resources.) We also urge the Board of Water Supply to consider the cumulative impacts of this and other ongoing water development projects upon stream and coastal water quality, recreation, wetland agriculture, aquaculture, and other instream uses, and the biological productivity of Oahu's streams and nearshore waters.

We would appreciate receiving an EIS Preparation Notice for future water development projects so that we may evaluate fish and wildlife resources during the early planning stages and avoid conflicts or delays in project review. Thank you for the opportunity to comment on this EIS.

Sincerely yours,

Ernest Kosaka

Ernest Kosaka
Project Leader
Office of Environmental Services

cc: Board of Water Supply
NMFS
HDF&G
EPA, San Francisco

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 4, 1982

MAR 1 1 1982
EISC

Mr. Ernest Kosaka
Office of Environmental Services
Fish and Wildlife Service
U. S. Department of the Interior
P. O. Box 50167
Honolulu, Hawaii 96850

Dear Mr. Kosaka:

Subject: Your Letter of January 22, 1982, to the Mayor on the Environmental Impact Statement (EIS) for Honouliuli Wells

Thank you for reviewing the EIS for our proposed project. Your letter to the Mayor was referred to us for reply. It will be appended to the revised environmental document.

We have the following comments on your letter:

1. A description of aquatic resources and resource uses within Honouliuli Stream was not included because there is no hydrologic relation between the basal water and the intermittent stream.

2. Impacts, both individual and cumulative, from our water development projects on stream and coastal water quality, recreation, wetland agriculture, aquaculture, instream uses, and biological productivity of streams and nearshore waters are included in the EIS as applicable.

We shall send future EIS Preparation Notices to your agency so you may evaluate fish and wildlife resources during the early planning stages. Any additional information which your agency can supply for inclusion in the EIS's will be appreciated.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

MHB:am
cc: Eileen R. Anderson, Mayor
Andrew I. T. Chang, Managing Director
Environment Impact Study Corporation

HEADQUARTERS
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860

IN REPLY REFER TO:
002:09P2:ci
Ser 269

10 FEB 1982

Honorable Eileen Anderson
Mayor
City & County of Honolulu
Honolulu, Hawaii 96813

Dear Mayor Anderson:

Environmental Impact Statement (EIS)
for Honouliuli Wells, Board of Water Supply
City & County of Honolulu (July 1981)

As requested by the Environmental Quality Commission, State of Hawaii letter of 12 January 1982, the subject EIS has been reviewed and the following comments are provided for your information.

1. Water Exchange Agreement (S-2). It is stated that the project will proceed only after a water exchange agreement is settled with the Oahu Sugar Company and a permit for the proposed development and water exchange is approved by the State according to Department of Land and Natural Resource's Regulation No. 9.

Comment: Since publication of the EIS, the future of the sugar industry and the Oahu Sugar Company in particular appears in doubt. Should the Oahu Sugar Company be phased out in the near future and should the attempt be made to increase urban land use of its properties, the picture would change, and the agreement affected. These options and impacts must be assessed to insure that no net increase in pumpage from the Pearl Harbor acquifer would occur even if Oahu Sugar operations were reduced or phased out.

2. Development Orientation (1-19). The 9.0 mgd of water to be developed at Honouliuli would basically serve developments planned for Campbell Industrial Park, Makakilo, and other areas of the Ewa Plain. It is unclear how future authorized development will be served.

Comment: The City & County Development Plans for the Ewa District have encouraged further urban development that will place heavy demands upon the future water supply. By allowing development to outstrip water supplies, the City & County now is forced to provide new wells. The availability of adequate water should be a prerequisite for urban development approvals.

3. Military Requirements. The present estimates for U. S. Navy water uses in the Pearl Harbor area are based upon normal or peacetime conditions.

Comment: During an emergency or defense build-up, facilities, fleet, and personnel within Pearl Harbor may require heavier water consumption, and this may require stringent conservation by all users.

4. Naval Air Station, Barbers Point Water Supply. The Navy's Barbers Point water tunnel is the sole source of supply for NAS BARPT. The quality of the water, specifically chlorides, is marginal at present and could be adversely affected by the Honouliuli Wells, especially when fully developed and pumping at the 9.0 mgd operating capacity.

Comment: It is recommended that a connection be made between the proposed transmission main and the Navy's existing reservoir so that the Honouliuli Well water can be diverted for Navy use in the event that the Navy's Barbers Point water source deteriorates in quality to an unacceptable level. Otherwise, the Navy must object to the proposed Honouliuli Wells, as there is no assurance that the Navy's Barbers Point water source will not be adversely affected.

FEB 11 2 07 PM '82

5. West Loch Reservoir (6-6/8). Among the alternative water sources cited is the West Loch Reservoir. Under this plan, West Loch would be dammed to create a reservoir to capture flood flows from Waikele Stream. The large storage reservoir in West Loch would make it possible to store the high flows during the rainy months for use during the drier summer months. The dam of 2,500 feet could provide a 2.3 billion-gallon reservoir.

Comment: The U. S. Navy is on record as willing to support such a West Loch Reservoir, and it recommends that it be considered as the viable alternative to Honouliuli Wells. It increases the available fresh water by capturing runoff normally lost to the sea and once installed, would require little manpower or energy for operation and little maintenance. Since it would be located in an area controlled by the U. S. Navy, it could then negotiate for rights to part of the water produced, thereby increasing the water available to the Navy.

Therefore, the U. S. Navy recommends that the City & County of Honolulu reconsider the problems involved with Honouliuli Wells, and address the five major points raised before further considering the project.

Should the City & County of Honolulu, Board of Water Supply, or consulting firm representatives wish to discuss the matter further, please contact Lieutenant Commander Robert L. Elsbernd (471-8471) to arrange appointments.

Sincerely,

M. M. DALLAM
CAPTAIN, CEC, U. S. NAVY
FACILITIES ENGINEER
BY DIRECTION OF THE COMMANDER

Copy to:
Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 25, 1982

Captain M. M. Dallam
Facilities Engineer
Headquarters, Naval Base
Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860

Dear Captain Dallam:

Subject: Your Letter of February 10, 1982, on the Environmental Impact Statement (EIS) for Honouliuli Wells

Thank you for reviewing the draft EIS for our proposed water development project. Your letter to the Mayor has been referred to us for reply, and it will be appended to the revised environmental document.

We have the following response to your comments:

1. *Comment: Since publication of the EIS, the future of the sugar industry and the Oahu Sugar Company in particular appears in doubt. Should the Oahu Sugar Company be phased out in the near future and should the attempt be made to increase urban land use of its properties, the picture would change, and the agreement affected. These options and impacts must be assessed to insure that no net increase in pumpage from the Pearl Harbor aquifer would occur even if Oahu Sugar operations were reduced or phased out.*

   The Pearl Harbor aquifer (Pearl Harbor ground water control area) has a limitation on draft of 225 mgd. Total pumpage for that ground water control area cannot exceed that limit no matter what use is proposed in that area.

2. *Comment: The City & County Development Plans for the Ewa District have encouraged further urban development that will place heavy demands upon the future water supply. By allowing development to outstrip water supplies, the City & County now is forced to provide new wells. The availability of adequate water should be a prerequisite for urban development approvals.*

   We have not allowed development to outstrip water supplies. In the Ewa area, we have imposed a moratorium on building until sufficient sources, transmission systems and storage are provided.

3. *Comment: During an emergency or defense build-up, facilities, fleet, and personnel within Pearl Harbor may require heavier water consumption, and this may require stringent conservation by all users.*

   We concur that stringent conservation measures may need to be imposed to stretch our available water supply to meet any emergency or defense build-up at Pearl Harbor.

4. *Comment: It is recommended that a connection be made between the proposed transmission main and the Navy's existing reservoir so that the Honouliuli Well water can be diverted for Navy use in the event that the Navy's Barbers Point water source deteriorates in quality to an unacceptable level. Otherwise, the Navy must object to the proposed Honouliuli Wells, as there is no assurance that the Navy's Barbers Point water source will not be adversely affected.*

   We have no objection to making an interconnection with the Navy sharing in the cost. However, the well project should not affect the Navy wells because the sustainable yield of the basin will be maintained as there will be no net increase in pumpage.

5. *Comment: The U. S. Navy is on record as willing to support such a West Loch Reservoir, and it recommends that it be considered as the viable alternative to Honouliuli Wells. It increases the available fresh water by capturing runoff normally lost to the sea and once installed, would require little manpower or energy for operation and little maintenance. Since it would be located in an area controlled by the U. S. Navy, it could then negotiate for rights to part of the water produced, thereby increasing the water available to the Navy.*

   The proposed West Loch Reservoir is in a conceptual stage and we find that it is not cost effective nor viable at this time. In any event, we will be working closely with the Navy, should we decide to investigate this project further.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

MHS/HHM/KH:bw
cc: Eileen R. Anderson, Mayor
Andrew I. T. Chang, Managing Director
Environment Impact Study Corporation

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

REPLY TO ATTN OF: DEEV (Mr Yamada, 449-1831)

26 JAN 1982

SUBJECT: Environmental Impact Statement for the Honouliuli Wells

TO: Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

1. This office has reviewed the subject EIS and has no comment to render relative to the proposed project.

2. We greatly appreciate your cooperative efforts in keeping the Air Force apprised of your project and thank you for the opportunity to review the document.

Kenneth W. Cowan

KENNETH W. COWAN, Colonel, USAF
Director of Civil Engineering

Cy to: Mayor Eileen Anderson
City and County of Honolulu
630 South King Street
Honolulu, HI 96813

✓Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96813

FEB 1 11 25 AM '82

JAN 19 1982

(P)1032.2

Honorable Eileen Anderson
Mayor
City and County of Honolulu
Honolulu, Hawaii

Dear Mayor Anderson:

Subject: Environmental Impact Statement
Honouliuli Wells

Thank you for this opportunity to review and comment on the subject project.

The project will not have any adverse environmental effects on any existing or planned facilities serviced by our department.

Respectfully,

HIDEO MURAKAMI
State Comptroller

MI:jnt 3-2
cc: Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA
HONOLULU, HAWAII 96843

EILEEN R. ANDERSON, Mayor

YOSHIE H. FUJINAKA, Chairman
ROBERT A. SOUZA, Vice Chairman
MICHAEL J. CHUN
WALTER A. DODS, JR.
RYOKICHI HIGASHIONNA
DONNA M. HOWARD
DAT QUON PANG

KAZU HAYASHIDA
Manager and Chief Engineer

COPY

January 27, 1982

Mr. Hideo Murakami
State Comptroller
Department of Accounting
and General Services
P. O. Box 119
Honolulu, Hawaii 96810

Dear Mr. Murakami:

Subject: Your Letter of January 19, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

Pure Water... man's greatest need — use it wisely.

GEORGE R. ARIYOSHI
GOVERNOR

MAYOR'S OFFICE
CITY & COUNTY

'82 FEB 23 PM 2:53

JACK K. SUWA
CHAIRMAN, BOARD OF AGRICULTURE

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
P. O. Box 22159
Honolulu, Hawaii 96822

February 22, 1982

MEMORANDUM

To: Mayor Eileen Anderson
City and County of Honolulu

Subject: Environmental Impact Statement
Honouliuli Wells
TMK: 9-2-01: Portion of Parcel 1 - Oahu

The Department of Agriculture has reviewed the subject Environmental Impact Statement and offers the following comments.

We note that the proposed project is dependent upon arrangements with Oahu Sugar Company "for them to cut back an equal amount of ground water pumpage so that net pumpage from the Pearl Harbor aquifer will remain the same." As stated on page 1-20, "The City will compensate Oahu Sugar for this reduction in pumpage by offering water of lower quality in exchange, on a gallon-for-gallon basis." This raises a question regarding the impacts the proposed water exchange would have on Oahu Sugar Company.

In the Board of Water Supply reply to the Department of Agriculture's concerns (Page 11-13 to 14) is a statement that Board of Water Supply's correspondence with Oahu Sugar Company "indicates that their cutback in acreage for urbanization is due to poor water quality at Waiawa." Thus, it would seem that a water exchange might be detrimental to Oahu Sugar Company by providing them lower quality water and thus potentially reducing their yield which varies with irrigation practices, quality of the water and with cane variety. Page 1-20 further states that treated sewage effluent is the preferred choice with water for mixing coming from plantation sources.

Research by Dr. L. Stephen Lau, Principal Investigator of the Mililani Recycling project found that: "Chlorinated, secondarily treated, domestic sewage effluent with N concentrations up to approximately 25 ppm, can be successfully used in furrow irrigation for the entire 2-year crop cycle of sugarcane if the effluent is diluted with fresh water so that the concentration of effluent is 25% or less." ("Recycling of Water from Sewage by Irrigation: Final Summary of a Dilution Study, Mililani, O'ahu, Hawai'i," Project Bulletin, University of Hawaii, Water Resources Research Center, No. 26, Feb. 1981). This would mean that Oahu Sugar would have to provide

"Support Hawaiian Agricultural Products"

a substantial amount of additional water to mix with effluent if it only receives effluent for its high quality water. From the information provided, this would seem to be an inequitable arrangement for Oahu Sugar Company.

We believe it would be useful for the EIS to differentiate between the approved and planned (without approval) major proposed developments on pages 2-40 through 2-44 and in Table A-10 on page A-61. It is unclear which of the projects are to be located on land already in the Urban District, which would require a District boundary amendment, and how much land would still be unurbanized Urban District land which could later be developed and further increase the potential demand for water. While we recognize that the Board of Water Supply does not specify how any land is to be used, the availability of water may indeed be an impetus to the decision by the landowner to urbanize agricultural land.

This Department remains deeply concerned about the secondary impacts that this project may have upon prime agricultural lands in sugarcane production in the Ewa-Waipahu area.

Thank you for the opportunity to comment.

Jack K. Suwa
JACK K. SUWA
Chairman, Board of Agriculture

cc: Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

April 19, 1982

Mr. Jack K. Suwa, Chairman
Board of Agriculture
State of Hawaii
P. O. Box 22159
Honolulu, Hawaii 96822

Dear Mr. Suwa:

Subject: Your Letter of February 22, 1982, on the Draft Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement for our proposed water development project. Your letter to the Mayor which will be appended to the revised environmental impact document, has been referred to us for direct reply.

We offer the following information in response to your comments:

1. Our joint study with the City Department of Public Works, the University of Hawaii, and Oahu Sugar Company indicates that mixing one part of secondary treated sewage effluent with three parts of Waiahole Ditch water is suitable for sugarcane irrigation. The amount of water to be exchanged depends upon the amount of Waiahole Ditch water available for mixing with the treated effluent and the irrigation requirements of fields to be retained in furrow irrigation. Oahu Sugar Company will have to decide how much treated effluent they can use.

   A study by the University of Hawaii has indicated that the use of secondary treated sewage effluent in drip irrigation systems is unacceptable since it causes plugging in the tubes. If this problem is resolved, additional water could be exchanged with the plantation. The university is currently working on this problem.

2. Only developments westward of Kunia Road would be served by the proposed project. The proposed developments listed in Table A-10 that have received full or partial water commitments are:

   A. Village Park

   B. Makakilo

   C. Campbell Industrial Park

   D. Gentry Waipio

   E. Mililani Town

   F. Royal Summit

The six developments with either full or partial water commitments occupy lands that were rezoned from agricultural use to urban use. All the other proposed developments are on lands presently zoned for agricultural use. Before any additional agricultural zoned land can be used for urban purposes, a zone change amendment will be required.

Land use is the responsibility of the City's Planning Department and the State Land Use Commission. We have the responsibility to provide water to service the land uses determined by the City's Development Plans. Although water is an important utility, it does not determine land use; there are many other factors that are considered in setting the land uses covered in the Development Plans.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Eileen R. Anderson, Mayor
Andrew I. T. Chang,
Managing Director
Environment Impact Study Corp.

RECEIVED
BD OF WATER SUPPLY
JAN 21 1 5 PM '82

State of Hawaii
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 Diamond Head Road
Honolulu, Hawaii 96816

19 JAN 1982

HIENG

Mayor Eileen Anderson
City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Dear Mayor Anderson:

Honouliuli Wells

Thank you for providing us the opportunity to review your proposed project, Honouliuli Wells Environmental Impact Statement.

We have completed our review and have no comments to offer at this time.

Yours truly,

Jerry M. Matsuda
JERRY M. MATSUDA
Captain, HANG
Contr & Engr Officer

cc: Board of Water Supply
EQC w/EIS

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

January 27, 1982

Captain Jerry M. Matsuda
Contract and Engineering
Officer
Office of the Adjutant General
Department of Defense
State of Hawaii
3949 Diamond Head Road
Honolulu, Hawaii 96816

Dear Captain Matsuda:

Subject: Your Letter of January 19, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corp.

GEORGE R. ARIYOSHI
Governor of Hawaii

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

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820495

GEORGE A. L. YUEN
DIRECTOR OF HEALTH

VERNE C. WAITE, M.D.
DEPUTY DIRECTOR OF HEALTH

HENRY N. THOMPSON, M.A.
DEPUTY DIRECTOR OF HEALTH

DEPUTY DIRECTOR OF HEALTH

DEPUTY DIRECTOR OF HEALTH

In reply, please refer to:
File: EPHSD-SS

February 26, 1982

MEMORANDUM

To: Mayor Eileen Anderson
City and County of Honolulu

From: Deputy Director for Environmental Health

Subject: Environmental Impact Statement (EIS) for Honouliuli Wells, Honouliuli, Oahu

Thank you for allowing us to review and comment on the subject EIS. On the basis that the project will comply with all applicable Public Health Regulations, please be informed that we do not have any objections to this project.

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

Brian J. J. Choy
for MELVIN K. KOIZUMI

cc: Office of Environmental Quality Control
Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

April 7, 1982

Mr. Charles G. Clark, Director
Department of Health
State of Hawaii
P. O. Box 3378
Honolulu, Hawaii 96801

Attention: Mr. Melvin K. Koizumi

Dear Mr. Clark:

Subject: Your Letter of February 26, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the environmental impact statement of our proposed water development project. Your letter to the Mayor which will be appended to the revised environmental impact document, has been referred to us for direct reply.

The final construction plans will be submitted to your department for review. We acknowledge that you may impose environmental restrictions on the project.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,
Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: Eileen R. Anderson, Mayor

Andrew I. T. Chang,
Managing Director
Environment Impact Study Corp.

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

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

February 9, 1982

Honorable Eileen Anderson
Mayor of Honolulu
630 So. King Street
Honolulu, HI 96813

Dear Mayor Anderson:

We have reviewed the EIS for Honouliuli Wells and appreciate the opportunity to do so.

The proposed project involves the drilling of a battery of six wells, each having a capacity of 2 mgd for a total of 12 mgd installed capacity. The production capacity is rated at 9 mgd and the intended use is to provide additional municipal water supply for urban development in the Ewa area.

As pointed out in the EIS, the Honouliuli Wells are located in the Pearl Harbor Ground Water Control Area administered by the Board of Land and Natural Resources. As such, prior approval of the Board is necessary before the project can proceed. Also, before the Board of Land and Natural Resources can accept and process a water withdrawal permit, a water exchange agreement between the Board of Water Supply and Oahu Sugar Company needs to be worked out between the parties. The object of the agreement would be no net increase in groundwater withdrawal from the Pearl Harbor aquifer.

Our records indicate that this project does not occur on historic properties listed on the Hawaii Register or the National Register of Historic Places or eligible for inclusion on the National Register of Historic Places. Due to the lack of archaeological surveys in the vicinity, we are not aware that significant resources exist in the project area. This

does not confirm the absence of historical, cultural, architectural and/or archaeological resources on the property. If any previously unidentified sites or remains (such as artifacts, shell, bone, or charcoal deposits; human burials; rock or coral alignments, pavings, or walls) are encountered, please inform the applicant to stop work and contact our historic sites office at 548-7460 immediately.

Sincerely,

SUSUMU ONO, Chairman
Board of Land and Natural Resources
and State Historic Preservation Officer

cc: BWS

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 24, 1982

Mr. Susumu Ono, Chairman
Board of Land and Natural
Resources
State of Hawaii
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Ono:

Subject: Your Letter of February 9, 1982, on the Draft Environmental Impact Statement (EIS) for Honouliuli Wells

Thank you for reviewing the draft EIS for our proposed project. Your letter to the Mayor has been referred to us for reply and will be appended to the revised environmental document.

We have the following response to your comments:

1. A transfer of preserved use will be arranged so that there will be no net increase of pumpage from the Pearl Harbor Groundwater Control Area.

2. A clause will be included in the construction contract stating that if any historical, cultural, architectural, and/or archaeological resources are encountered, all work will stop and your Historic Sites Office will be contacted.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

RMA/HHM:am
cc: Eileen R. Anderson, Mayor
Andrew I. T. Chang, Managing Director
Environment Impact Study Corporation

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

RECEIVED
BD OF WATER SUPPLY
FEB 19 1 43 PM '82

GEORGE R. ARIYOSHI
HIDETO KONO
FRANK SKRIVANEK

COPY

February 16, 1982

Ref. No. 4277

The Honorable Eileen R. Anderson
Mayor
City and County of Honolulu
Honolulu, Hawaii 96813

Dear Mayor Anderson:

SUBJECT: Environmental Impact Statement for Honouliuli Wells

We have reviewed the subject document and find that it has adequately assessed the environmental impacts which can be anticipated to result from the proposed project.

Further, we note that the EIS has adequately addressed our comments of December 7, 1979, with regard to the objectives, policies and priority directions of the Hawaii State Plan.

Thank you for the opportunity to comment on this matter.

Sincerely,

Hideto Kono

cc: Board of Water Supply
City and County of Honolulu

Office of Environmental Quality Control

STP 8.8012

January 21, 1982

The Honorable Eileen Anderson
Mayor, City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Dear Mayor Anderson:

Environmental Impact Statement
Honouliuli Wells

Thank you for the opportunity to comment on the subject EIS.

We have reviewed the document and concluded that we have no substantive suggestions to offer to improve the document.

Very truly yours,

Ryokichi Higashionna
Ryokichi Higashionna
Director of Transportation

cc: Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 10, 1982

Dr. Ryokichi Higashionna, Director
Dept. of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Dr. Higashionna:

Subject: Your Letter of January 21, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

For KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

LAND USE COMMISSION

Old Federal Building, Room 104, 335 Merchant Street,
Honolulu, Hawaii 96813

RECEIVED
JAN 13 2 ... '82

GEORGE R. ARIYOSHI
Governor

WILLIAM W. L. YUEN
Chairman

CAROL B. WHITESELL
Vice Chairman

COMMISSION MEMBERS:
Richard Choy
Everett Cuskaden
Shinsei Miyasato
Teofilo Tacbian
Robert Tamaye
Edward Yanai

GORDAN FURUTANI
Executive Officer

January 14, 1982

Honorable Aileen Anderson
Mayor, City and County of Honolulu
630 South King Street
Honolulu, HI 96813

Subject: Environmental Impact Statement Prepared for Honouliuli Wells

Dear Mayor Anderson:

Thank you for the opportunity to review the above project. We have no comments regarding the proposal except to confirm that the well sites are located within the State Land Use Agricultural District.

Sincerely,

GORDAN Y. FURUTANI
Executive Officer

GYF:gm
cc: Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

January 25, 1982

Mr. Gordon Y. Furutani
Executive Officer
Land Use Commission
Department of Planning & Economic Development
335 Merchant Street, Room 104
Honolulu, Hawaii 96813

Dear Mr. Furutani:

Subject: Your Letter of January 14, 1982, On The Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement (EIS) for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineering

cc: Environment Impact Study Corp.

University of Hawaii at Manoa

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

Office of the Director

February 22, 1982

RE:0349

Mayor Eileen Anderson
City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

'82 F-- 23

MAYOR'S OFFICE
CITY & COUNTY

Dear Mayor Anderson:

Draft Environmental Impact Statement
Honouliuli Wells
Honouliuli, Oahu

The Environmental Center has reviewed the above cited document with the assistance of James Parrish, Hawaii Cooperative Fishery Research Unit; Paul Ekern, Agronomy and Soil Science; Doak C. Cox, Jacquelin N. Miller and David Peterson, Environmental Center. Personnel from other departments with expertise in water resources were also consulted.

The potential impacts of the proposed project that are of greatest concern are of a hydrologic nature. Unfortunately, the DEIS does not adequately describe the regional hydrogeology and contains many unsupported assertions. Impacts on the hydrologic regime in turn may create water quality problems.

Hydrogeology

The basal aquifer system from which groundwater will be taken is not well defined in the DEIS.

Appendix A (pages A-5, A-7 and A-8) mentions two isopiestic areas in the Pearl Harbor Ground Water Control Area (PHGWCA), one in Koolau lavas, the other in Waianae lavas. However, no attempt is made in the DEIS text to discuss the existence and the importance of the distinction between these isopiestic areas in relation to the effects of pumping. Present or recent heads are indicated for wells in the area in Table 2-1, page 2-22a, and the locations of the wells are shown in Figure 2-7, page 2-21, but the locations and heads are not combined in an isopiestic map.

The hydrologic separation between the Koolau and Waianae lavas results principally from a prism of sediments unconformably overlying the Waianae lavas and underlying the Koolau lavas. Figure 2-4, however, shows only an "unconformity" in a generalized form, far from accurately mapped. Figure 2-5 indicates the "unconformity" as an inclined surface, sloping downward to the east and northeast and implies that only brackish and

AN EQUAL OPPORTUNITY EMPLOYER

salt water can be found in the Waianae aquifer. However, depending on the location of the section line used to draw the geologic cross-section, it is likely that fresh waster exists in the Waianae lavas as well.

Figure 2-4 shows the unconformity as lying west of the site of the proposed wells, suggesting that the wells will tap the Koolau aquifer alone. However, in a letter from the USGS to the BWS dated December 10, 1979 (page 11-4 through 11-6), the depth of the unconformity is estimated at of 200 feet below sea level, well above the 600-foot depth below sea level shown at the site of the proposed wells in Figure 2-5. If the boundary is at a shallower depth, the potential for withdrawing groundwater from the Waianae aquifer as well as the Koolau aquifer is enhanced.

The EIS appropriately indicates the very grave impact that the proposed development would have on the basal groundwater resources of the area if there were not offsetting measures in the form of water exchanges. It also indicates that, in spite of the exchanges there will be some impacts. As stated on page 4-11, these impacts will be selective, insignificant at some existing wells and possibly significant at others. The DEIS further suggests the differences will be in part related to the distances between the proposed and existing wells. It does not seem to recognize at all the much greater influence of the separation between the two aquifers.

The distribution of the effects of the draft of the proposed wells will depend, of course, on whether they tap the Koolau aquifer alone or that aquifer and the Waianae aquifer as well. The distribution of the effects of the reductions in draft from existing wells resulting from the proposed water exchanges will depend upon which of two aquifers are tapped by the wells whose draft will be reduced. As we will show later, the water exchanges may affect the quantity and quality of water recharged to either both of the two aquifers. The distribution of the recharge effects will depend on the areas in which the changes in recharge will occur relative to the boundary between the areas recharging the two aquifers.

There is simply no way in which the impacts of the proposed project can be discussed intelligently without reference to the existence and spacial relations of the two aquifers.

Brackish Water Mixing

Discussions on pages 2-17 and A-32 state the potential for enlarging the brackish transition zone in areas lying towards the coast. If the project wells tap the Koolau lavas, such effects may be observed in Kunia I and Hoaeae wells with a consequent increase in dissolved solids levels. Although the water quality reports of Tables 2-3 and 2-4 indicate relatively low chloride concentrations for these wells, total dissolved solids (TDS) levels lie just under the EPA recommended secondary limit of 500 ppm, and may exceed the limit if transition-zone mixing is increased.

The water quality of these and other neighboring wells is a serious cause for concern, particularly in the light of discussions given in Appendix A in which it is stated (pages A-52, 53) that "water from the well field does show a general decline in chloride concentration, owing to the sealing of the deeper wells in the group." No clarification is given as to whether the wells have been sealed because they were originally drilled too deep or because they have gradually experienced increased dissolved solids levels with time.

The DEIS (pages 4-11 through 4-14) uses a general approach in discussing potential effects on the quantity and quality characteristics of neighboring wells, stating that (page 4-12) the "new wells have been planned hydro-geologically to have the least effect on other wells in the vicinity." It would be helpful if those wells most likely to be affected by the change in pumpage location could be addressed more specifically. Objective assumptions and procedure used in the hydrogeological planning process, including a single map indicating all well locations with respect to the regional potentiometric surface, would also assist in understanding the impact assessment.

We encourage the close monitoring of neighboring wells to identify quantity and quality impacts (pages 4-12 and 4-14), so that modifications in well operation can be quickly implemented. The pumping of all project wells at a continuous rate, as opposed to alternating discharges between wells (pages 1-19, 1-20), is also strongly recommended to prevent accelerated mixing in the transition zone.

<u>Water Budget</u>

Assuming that all groundwater withdrawal occurs in the same volcanic aquifer, the water exchange proposal assures no net increase in pumpage. However, the potential for reduced recharge does exist. If Oahu Sugar elects to use drip irrigation during the application of exchange water provided by BWS, the secondary recharge that has historically occured under furrow irrigation will be reduced considerably.

From the text given on page A-56, it can be deduced that existing water demands in the PHGWCA closely approach and may already exceed the groundwater supply which includes recharge from furrow irrigation (approximately 50 percent of water applied). If drip irrigation becomes the alternate mode of application, average annual groundwater replenishment will be curtailed accordingly, possibly well below the water demands foreseen for the end of this century. Perhaps a discussion of this possible shortage should be included in the secondary impacts section of Chapter 4.

The map of Appendix 3 does not show those areas set aside for drip irrigation, and those designated for conventional furrow methods. Economics, and the difficulties associated with the application of effluent through drip irrigation, will likely dictate where each respective form of irrigation can take place.

A reference recommended for citing in the DEIS, and useful in determining the most optimum irrigation method for explicit geographical areas is: Ruhe, et, 1965; "Nature of Soil Parent Materials in the Ewa-Waipahu Area, Oahu, Hawaii," Soil Sci. Amer. Proc. 29:282-287.

The inference on page A-16 that most recharge from rainfall occurs above the 50-inch isohyet area can be questioned. Recent research by personnel from the Water Resources Research Center (WRRC) suggests that signficant recharge occurs primarily in those regions above the 60-inch isohyet and possibly higher. This conclusion is reached from studies of accumulated manganese in soil on the dry side of this rainfall level.

A realistic assessment of the water budget in the PHGWCA should account for a future reduction in the sugar-cane industry. If sugar cane production is phased out, irrigation demands will probably be greatly reduced, thus reducing Waihole Ditch imports and lowering secondary recharge. Similarly, the gradual encroachment of urban areas onto the Ewa Plain will reduce areas of recharge from all agricultural sources, including the areas of pineapple cultivation.

<u>Biological</u>

The discussion on pages 2-31 and 2-32 mentions terrestial flora and fauna but says nothing about aquatic species. If reduced flows, increased siltation or any other effects on stream life on Waikele Stream or the lower reaches of Honouliuli Stream are possible, then it is worth considering what life forms exist there.

To reduce siltation over the 2,000 feet of transmission line construction adjacent to Honouliuli Stream, precautionary grading techniques, as mentioned on page 4-2, should be heavily emphasized. In the interest of avoiding deleterious effects on fauna in the lowest reaches of the stream, construction of the transmission line during the dry season is suggested.

Yours truly,

Doak C. Cox
Director

cc: Office of Environmental Quality Control
James Parrish
Paul Ekern
Jacquelin Miller
David Peterson
Water Resources Research Center

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 19, 1982

Dr. Doak C. Cox, Director
Environmental Center
University of Hawaii at Manoa
2550 Campus Road, Crawford 317
Honolulu, Hawaii 96822

Dear Dr. Cox:

Subject: Your Letter of February 22, 1982, on the Draft Environmental Impact Statement (EIS) for Honouliuli Wells

Thank you for reviewing the draft EIS for our proposed water development project. Your letter to the Mayor has been referred to us for reply and will be appended to the revised environmental document.

We offer the following information in response to your comments:

1. *The basal aquifer system from which groundwater will be taken is not well defined in the DEIS.*

   This section will be rewritten incorporating data from Mr. John Mink's 1980 Report on Southern Oahu.

2. *Appendix A (pages A-5, A-7 and A-8) mentions two isopiestic areas in the Pearl Harbor Ground Water Control Area (PHGWCA), one in Koolau lavas, the other in Waianae lavas. However, no attempt is made in the DEIS text to discuss the existence and the importance of the distinction between these isopiestic areas in relation to the effects of pumping. Present or recent heads are indicated for wells in the area in Table 2-1, page 2-22a, and the locations of the wells are shown in Figure 2-7, page 2-21, but the locations and heads are not combined in an isopiestic map.*

   A discussion on the existence and the importance between the two isopiestic areas in the Pearl Harbor Ground Water Control Area will be included in the revised EIS.

   Figure 2-7 will be revised to indicate the approximate boundary of the two isopiestic areas.

3. *The hydrologic separation between the Koolau and Waianae lavas results principally from a prism of sediments unconformably overlying the Waianae lavas and underlying the Koolau lavas. Figure 2-4, however, shows only an "unconformity" in a generalized form, far from accurately mapped. Figure 2-5 indicates the "unconformity" as an inclined surface, sloping downward to the east and northeast, and implies that only brackish and salt water can be found in the Waianae aquifer. However, depending on the location of the section line used to draw the geologic cross-section, it is likely that fresh water exists in the Waianae lavas as well.*

   Figure 2-4 shows the unconformity as lying west of the site of the proposed wells, suggesting that the wells will tap the Koolau aquifer alone. However, in a letter from the USGS to the BWS dated December 10, 1979 (page 11-4 through 11-6), the depth of the unconformity is estimated at about 200 feet below sea level, well above the 600-foot depth below sea level shown at the site of the proposed wells in Figure 2-5. If the boundary is at a shallower depth, the potential for withdrawing groundwater from the Waianae aquifer as well as the Koolau aquifer is enhanced.

   We concur with your interpretation of Figures 2-4 and 2-5. Figures 2-4 and 2-5 will be deleted and replaced with a generalized cross-section (attached). The USGS cross-section revealed a fore-shortening of the eastern portion of their section. Our attached cross-section shows the Waianae surface projecting to roughly 550 feet below sea level instead of 200 feet below sea level as indicated on the USGS section. Therefore, it is unlikely for our proposed wells to penetrate through the Koolau aquifer and into the Waianae basal aquifer.

4. *The EIS appropriately indicates the very grave impact that the proposed development would have on the basal groundwater resources of the area if there were not offsetting measures in the form of water exchanges. It also indicates that in spite of the exchanges, there will be some impacts. As stated on page 4-11, these impacts will be selective, insignificant at some existing wells and possibly significant at others. The DEIS further suggests the differences will be in part related to the distances between the*

proposed and existing wells. It does not seem to recognize at all the much greater influence of the separation between the two aquifers.

The distribution of the effects of the draft of the proposed wells will depend, of course, on whether they tap the Koolau aquifer alone or that aquifer and the Waianae aquifer as well. The distribution of the effects of the reductions in draft from existing wells resulting from the proposed water exchanges will depend upon which of two aquifers are tapped by the wells whose draft will be reduced. As we will show later, the water exchanges may affect the quantity and quality of water recharged to either both of the two aquifers. The distribution of the recharge effects will depend on the areas in which the changes in recharge will occur relative to the boundary between the areas recharging the two aquifers.

There is simply no way in which the impacts of the proposed project can be discussed intelligently without reference to the existence and spacial relations of the two aquifers.

As mentioned previously, a discussion on the existence and spacial relationship of the two aquifers will be included in the revised EIS.

Also, as indicated in the attached cross-section, it is unlikely that we will tap into the Waianae aquifer. Should the Waianae aquifer be tapped, an exchange of water must occur to maintain equilibrium conditions.

5. *Discussions on pages 2-17 and A-32 state the potential for enlarging the brackish transition zone in areas lying towards the coast. If the project wells tap the Koolau lavas, such effects may be observed in Kunia I and Hoaeae wells with a consequent increase in dissolved solids levels. Although the water quality reports of Tables 2-3 and 2-4 indicate relatively low chloride concentrations for these wells, total dissolved solids (TDS) levels lie just under the EPA recommended secondary limit of 500 ppm, and may exceed the limit if transition-zone mixing is increased.*

We concur with your interpretation.

6. *The water quality of these and other neighboring wells is a serious cause for concern, particularly in the light of discussions given in Appendix A in which it is stated (pages A-52, 53) that "water from the well field does show a general decline in chloride concentration, owing to the sealing of the deeper wells in the group." No clarification is given as to whether the wells have been sealed because they were originally drilled too deep or because they have gradually experienced increased dissolved solids levels with time.*

The wells were sealed because they were drilled too deep (about 600 feet) and experienced high chloride levels. Most of the wells in the particular area were drilled about 130 feet deep and did not experience excessive chloride levels.

7. *The DEIS (pages 4-11 through 4-14) uses a general approach in discussing potential effects on the quantity and quality characteristics of neighboring wells, stating that (page 4-12) the "new wells have been planned hydro-geologically to have the least effect on other wells in the vicinity." It would be helpful if those wells most likely to be affected by the change in pumpage location could be addressed more specifically. Objective assumptions and procedure used in the hydrogeological planning process, including a single map indicating all well locations with respect to the regional potentiometric surface, would also assist in understanding the impact assessment.*

On page 4-11, the EIS mentions that Kunia Wells I, Kunia Wells II, and Oahu Sugar's Ewa Shaft may be affected by pumpage from the proposed wells. Attached are two potentiometric surface maps that will be adapted for inclusion in the revised EIS.

8. *We encourage the close monitoring of neighboring wells to identify quantity and quality impacts (pages 4-12 and 4-14) so that modifications in well operation can be quickly implemented. The pumping of all project wells at a continuous rate, as opposed to alternating discharges between wells (pages 1-19, 1-20), is also strongly recommended to prevent accelerated mixing in the transition zone.*

We concur with your recommendation. Nearby wells that are monitored on a regular basis include our Kunia Wells I and Kunia Wells II.

9. *Assuming that all groundwater withdrawal occurs in the same volcanic aquifer, the water exchange proposal assures no net increase in pumpage. However, the potential for reduced recharge does exist. If Oahu Sugar elects to use drip irrigation during the application of exchange water provided by BWS, the secondary recharge that has historically occurred under furrow irrigation will be reduced considerably.*

The sustainable yield will have to be re-evaluated and exchange would have to occur on that basis.

10. *From the text given on page A-56, it can be deduced that existing water demands in the PHGWCA closely approach and may already exceed the groundwater supply which includes recharge from furrow irrigation (approximately 50 percent of water applied). If drip irrigation becomes the alternate mode of application, average annual groundwater replenishment will be curtailed accordingly, possibly well below the water demands foreseen for the end of this century. Perhaps a discussion of this possible shortage should be included in the secondary impacts section of Chapter 4.*

As we indicated, should Oahu Sugar Company convert all of their fields to drip irrigation, a re-evaluation of the sustainable yield in the Pearl Harbor Ground Water Control Area would be required. Since exchange would occur on whatever sustainable yield is established by the State, we feel that a discussion of any secondary effects is premature.

11. *The map of Appendix J does not show those areas set aside for drip irrigation and those designated for conventional furrow methods. Economics, and the difficulties associated with the application of effluent through drip irrigation, will likely dictate where each respective form of irrigation can take place.*

Oahu Sugar has plans of converting all of their fields to drip irrigation. Until the use of sewage effluent in drip irrigation is resolved, any discussion with Oahu Sugar Company on the use of sewage effluent would be meaningless.

12. *A reference recommended for citing in the DEIS and useful in determining the most optimum irrigation method for explicit geographical areas is: Ruhe, et, 1965; "Nature of Soil Parent Materials in the Ewa-Waipahu Area, Oahu, Hawaii," Soil Sci. Amer. Proc. 29:282-287.*

We will cite the reference in the revised EIS.

13. *The inference on page A-16 that most recharge from rainfall occurs above the 50-inch isohyet area can be questioned. Recent research by personnel from the Water Resources Research Center (WRRC) suggests that significant recharge occurs primarily in those regions above the 80-inch isohyet and possibly higher. This conclusion is reached from studies of accumulated manganese in soil on the dry side of this rainfall level.*

We will mention WRRC's findings in the revised EIS.

14. *A realistic assessment of the water budget in the PHGWCA should account for a future reduction in the sugar cane industry. If sugar cane production is phased out, irrigation demands will probably be greatly reduced, thus reducing Waiahole Ditch imports and lowering secondary recharge. Similarly, the gradual encroachment of urban areas onto the Ewa Plain will reduce areas of recharge from all agricultural sources, including the areas of pineapple cultivation.*

Since the Sugar Company's future is uncertain, it would be inappropriate to make any assessment at this time. Furthermore, since the Sugar Company pumps over 50 percent of the ground water from the basin, any reduction in the sugar cane industry should be accompanied by a similar reduction in pumpage which, in turn, may cancel any need to adjust for any reduction in recharge.

15. *The discussion on pages 2-31 and 2-32 mentions terrestrial flora and fauna but says nothing about aquatic species. If reduced flows, increased siltation or any other effects on stream life on Waikele Stream or the lower reaches of Honouliuli Stream are possible, then it is worth considering what life forms exist there.*

The proposed wells are sited near to Honouliuli Stream. Honouliuli Stream is an intermittent stream accommodating only storm flows. The USGS only has a crest-stage partial-record station on Honouliuli Stream. The station measures peak stages of floods occurring between inspections.

No consideration was given to life forms in the lower reaches of Honouliuli Stream since the water at the mouth of the stream is attributable to tidal fluctuations and not streamflow.

16. *To reduce siltation over the 2,000 feet of transmission line construction adjacent to Honouliuli Stream, precautionary grading techniques, as mentioned on page 4-2, should be heavily emphasized. In the interest of avoiding deleterious effects on fauna in the lowest reaches of the stream, construction of the transmission line during the dry season is suggested.*

All necessary grading precautions will be taken to minimize erosion and siltation from the construction activities and will conform to pertinent governmental regulations.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

Attach.

cc: Eileen R. Anderson, Mayor
Andrew I. T. Chang, Managing Director

Environment Impact Study Corporation

GEORGE R. ARIYOSHI
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF SOCIAL SERVICES AND HOUSING

FRANKLIN Y. K. SUNN
DIRECTOR

RICHARD PAGLINAWAN
DEPUTY DIRECTOR

ALFRED K. SUGA
DEPUTY DIRECTOR

820195

JAN 20 '82

January 21, 1982

Mayor Eileen Anderson
City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Dear Mayor Anderson:

Subject: Honouliuli Wells, Honouliuli, Oahu
Environmental Impact Statement

The Hawaii Housing Authority has reviewed the subject EIS and has no specific comments to offer relative to the proposed action. The Authority is highly supportive of this action as it will provide much needed water for the Leeward region of Oahu. The construction of these six wells will assist in the future plans of the Authority in providing affordable housing for Hawaii's people.

Thank you for allowing us to comment on this matter.

Sincerely,

Franklin Y K Sunn

FRANKLIN Y. K. SUNN
Director

cc: Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 3, 1982

Mr. Franklin Y. K. Sunn, Director
Department of Social Services and Housing
State of Hawaii
P.O. Box 339
Honolulu, Hawaii 96809

Dear Mr. Sunn:

Subject: Your Letter of January 21, 1982,
On The Environmental Impact Statement
for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement (EIS) for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

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Donnis H. Thompson

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

January 21, 1982

Honorable Eileen Anderson, Mayor
City and County of Honolulu
630 S. King Street
Honolulu, HI 96813

Dear Mayor Anderson:

SUBJECT: Environmental Impact Statement
Honouliuli Wells

The Department of Education has no comments to offer on the subject EIS at this time. We do thank you, however, for the opportunity to review the project.

Sincerely

Lloyd K. Migita
for DONNIS H. THOMPSON
Superintendent

DHT:HL:jl

cc: Mr. James Edington
Board of Water Supply

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 10, 1982

Dr. Donnis H. Thompson
Superintendent
Department of Education
State of Hawaii
P.O. Box 2360
Honolulu, Hawaii 96804

Dear Dr. Thompson:

Subject: Your Letter of January 21, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

L.G. Rathburn
For KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

MAYOR'S OFFICE
CITY & COUNTY
'82 FEB 19

University of Hawaii at Manoa

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

12 February 1982

Honorable Eileen Anderson
Mayor, City & County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Dear Mayor Anderson:

SUBJECT: Environmental Impact Statement for Honouliuli Wells, Waipahu, Oahu, Hawaii, Board of Water Supply, July 1981

We have reviewed the subject EIS and offer the following comments:

1. P. 6-4 Sewage Effluent. The EIS estimates that 33 mgd of sewage effluent will be available for exchange. Is this a projection to the year 2000 or 2020? Current (1981) figures indicate about 16.1 mgd total which consists of 2.1 mgd from Mililani, and 14.0 mgd combined flow (to go into Honouliuli) from Pearl City, Waipahu, Pacific Palisades, Ewa Beach, Barbers Pt. NAS, Makakilo, and Iroquois Pt. The impression is that 33 mgd will be available immediately. The time frame should be clarified.

2. In the water exchange for sewage effluent irrigation, sugarcane is the only crop mentioned. Perhaps the discussion should be broader, particularly considering the present tenuous position of sugarcane production by Oahu Sugar Co. Effluent irrigation of forage crops, which remove a large portion of the nutrients, can be used for ground water recharging.

3. Is it possible to state a definite exchange of water in each development phase I, II, etc.?

Thank you for the opportunity to comment. This material was reviewed by WRRC personnel.

Sincerely,

Edwin T. Murabayashi

Edwin T. Murabayashi
EIS Coordinator

ETM:jm
cc: Y.S. Fok — Env. Center, UH
H. Gee — BWS

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BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 3, 1982

Dr. L. Stephen Lau, Director
Water Resources Research Center
University of Hawaii at Manoa
2540 Dole Street, Holmes Hall 283
Honolulu, Hawaii 96822

Attention: Mr. Edwin T. Murabayashi

Dear Dr. Lau:

Subject: Your Letter of February 12, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement (EIS) for our proposed water development project. Your letter has been referred to us for reply and it will be appended to the revised environmental document.

We have the following response to your comments:

1. *P. 6-4 Sewage Effluent. The EIS estimates that 33 mgd of sewage effluent will be available for exchange. Is this a projection to the year 2000 or 2020? Current (1981) figures indicate about 16.1 mgd total which consists of 2.1 mgd from Mililani, and 14.0 mgd combined flow (to go into Honouliuli) from Pearl City, Waipahu, Pacific Palisades, Ewa Beach, Barbers Pt. NAS, Makakilo, and Iroquois Pt. The impression is that 33 mgd will be available immediately. The time frame should be clarified.*

   We will clarify the time frame as to when the 33 mgd of sewage will be available for exchange. According to the EIS for the Mamala Bay Wastewater Treatment and Disposal System, the Honouliuli Wastewater Treatment Plant is estimated to treat about 25 mgd of sewage by the year 1990. The Mililani Wastewater Treatment Plant is anticipated to treat about 8 mgd at the same time.

2. *In the water exchange for sewage effluent irrigation, sugarcane is the only crop mentioned. Perhaps the discussion should be broader, particularly considering the present tenuous position of sugarcane production by Oahu Sugar Co. Effluent irrigation of forage crops, which remove a large portion of the nutrients, can be used for ground water recharging.*

   We will mention that the treated sewage effluent can also be used to irrigate forage crops.

3. *Is it possible to state a definite exchange of water in each development phase I, II, etc.?*

   We have no commitment on the possible exchange of water with Oahu Sugar Company and therefore cannot state a definite water exchange for each development phase.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

MHS:am
cc: Eileen R. Anderson, Mayor
Andrew I. T. Chang, Managing Director
Environment Impact Study Corporation

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

George Yuen
Director

RECEIVED
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February 22, 1982

Kazu Hayashida
Board of Water Supply
City and County of Honolulu
Honolulu, Hawaii 96813

SUBJECT: Environmental Impact Statement for Honouliuli Wells

Dear Mr. Hayashida:

We have reviewed the subject statement and offer the following comments for your consideration:

1. POPULATION FIGURES

The EIS refers to population figures gathered in 1978. However, the State Department of Planning and Economic Development has published the 1980 Data Book which gives a more recent population figure. We recommend that the population be discussed using the new figures.

2. TABLE 1-1 (page 1-11)

Under the column for operational capacity, the EIS indicates that the total capacity is 20.91 mgd. The discussion on page 1-10 indicates that the actual average pumpage is 16.30 mgd plus five percent. Five percent of the 16.30 mgd is 815,000 mgd which totals to 17.1 mgd. Therefore, we question how 20.91 mgd was derived. A discussion is recommended.

3. AQUATIC WILDLIFE (page 2-31)

The EIS does not discuss the existence of any aquatic wildlife in the Waikele or Honouliuli Streams and what the effect of pumping water would have on the aquatic fauna. A discussion is warranted.

4. SECTION 3

The environmental impact statement should discuss the project in relation to the State Environmental Policy Act, Chapter 344, Hawaii Revised Statutes.

5. SURFACE WATER (page 4-10)

The EIS does not indicate whether any monitoring will be done to detect any changes in stream flows and what impact flow changes will have on the aquatic environment. A discussion is strongly recommended.

6. POPULATION (page 4-15)

The per capita water demand should be given.

7. PAGE 4-26

The EIS indicates that 6 mgd will be used for 12,000 proposed units. However, we note that the Ewa areas has more than the proposed 12,000 units. Therefore, the proposed action will not accommodate the anticipated as indicated by the City and County of Honolulu General Plan. If anything, the proposed action would encourage further development and new sources will be required. Therefore, the EIS should discuss how the 6 mgd will be allocated.

8. PAGE 4-27

The EIS should recognize that the capacity of H-1 for the Ewa area is about 90,000 vehicles. By 1995, your figures indicate that the traffic will exceed this capacity.

9. GROWTH

Since water is a key factor in growth, it becomes one of the best instrument for land use planning. However, there seems to be an implicit assumption that water must be provided to the developments rather than also using water as a method to control growth. Consequently, the dilemma results when developments are approved and the water is not available. Therefore, the Board of Water Supply is placed in the position having to develop more water sources whether there exists any water or not in the area.

10. SURFACE WATER (page 6-21)

The EIS proposes using surface waters from Kahana and Punaluu Streams as alternatives to the action. The EIS should note that both streams are included in the Nationwide Rivers Inventory which recognizes the scenic and historic value of the streams.

11. ALTERNATIVES

Consideration should be given to an active conservation program to reduce the use of water as an alternative.

12. SHORT-TERM USES VS. LONG-TERM PRODUCTIVITY

The EIS should discuss the headline decrease over the long period of time to indicate the long-term effect of pumping from pumping the basal aquifer.

We thank you for the opportunity to review the subject EIS. We look forward to the revised EIS.

Yours truly,

Melvin Koizumi

for George Yuen, Director
Office of Environmental Quality Control

cc: Mayor Eileen Anderson

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 24, 1982

Mr. George A. L. Yuen, Director
State Department of Health
P. O. Box 3378
Honolulu, Hawaii 96801

Attention: Mr. Melvin K. Koizumi

Dear Mr. Yuen:

Subject: Your Letter of February 22, 1982, on the Environmental Impact Statement (EIS) for Honouliuli Wells

Thank you for reviewing the EIS for our proposed water development project. Your letter will be appended to the revised environmental document.

We offer the following in response to your comments:

1. POPULATION FIGURES

We will update the population figures in our revised EIS.

2. TABLE 1-1 (page 1-11)

The discussion on page 1-10 does refer to the 16.30 mgd as the allowable pumpage within the Pearl Harbor Ground Water Control Area. The 20.91 mgd in Table 1-1 is the total operational capacity which includes the 4.61 mgd from Waianae sources located outside the designated area.

We agree that the five percent increase stated as such is unclear. However, the 17.1 mgd is not a part of the present operational capacity. The additional 815,000 gpd cannot be included until a formal application is cleared by the State.

3. AQUATIC WILDLIFE (page 2-31)

As explained on page 4-10, pumping operations would not disrupt the present environmental conditions of the stream. The proposed well is anticipated to have no impact on Waikele Stream. Honouliuli Stream is an intermittent stream used primarily to accommodate flood flows. Any aquatic life would be found at the mouth of the stream and is dependent upon tidal influences.

4. SECTION 3

It was the intent of this EIS to serve the purpose of the State's Environmental Policy. We feel that all pertinent environmental aspects of the policy were addressed.

5. SURFACE WATER (page 4-10)

A gaging station for Honouliuli Stream is maintained by the U. S. Geological Survey (page 2-11). The station is a crest-stage partial record station that measures peak flows between inspections. As mentioned previously, Honouliuli Stream is an intermittent stream that is generally dry except for flood flows.

6. POPULATION (page 4-15)

The per capita water demand will be added to the revision.

7. PAGE 4-26

The EIS indicates that 6 mgd could support approximately 12,000 units to give an example of the capacity of distribution. Honouliuli Wells is only an alternative to meet the projected demands as envisioned by the Development Plan for the area.

8. PAGE 4-27

The H-1 capacity for the Ewa area will be added to the revision.

9. GROWTH

The assumption is rather explicit where water will be provided in concurrence with the General and Development Plans. The Board of Water Supply has continuously operated within its means to provide this service (page 5-6). However, where demand has reached the available supply, we have imposed moratoriums on the issuance of water service in those areas such as in the Leeward district.

10. SURFACE WATER (page 6-21)

The streams will be noted as such in the revised EIS.

11. ALTERNATIVES

In essence, the basic concept of this project is conservation oriented. The proposed arrangements (1-20, 6-3) with Oahu Sugar Company of substituting lower quality water in exchange is a very efficient method of conservation. Since water conservation (4-18 to 4-24) is an on-going activity, it seems inappropriate for it to be listed as an alternative.

12. SHORT-TERM USES VS. LONG-TERM PRODUCTIVITY

The decrease in basal head is due to the cumulative effect of pumpage from all of the wells in the basin. As mentioned earlier, the proposed project will not increase pumpage in the basin; it anticipates exchanging water of a lower quality with water of a higher quality with Oahu Sugar Company on a gallon-for-gallon basis.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

Attach.

cc: Eileen R. Anderson, Mayor
Environment Impact Study Corp.

830333

DEPARTMENT OF GENERAL PLANNING

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

RECEIVED
BOARD OF WATER SUPPLY
FEB 11 10 50 AM '82

WILLARD T. CHOW
CHIEF PLANNING OFFICER

RALPH PORTMORE
DEPUTY CHIEF PLANNING OFFICER

DGP1/82-107

February 10, 1982

MEMORANDUM

TO: Mr. Kazu Hayashida, Manager and Chief Engineer
Board of Water Supply

SUBJECT: Honouliuli Wells Environmental Impact Statement

As presently prepared, the assessment is based on the City's General Plan and the Hawaii State Plan, both of which furnish very broad development guidelines.

The assessment does not reflect provisions contained in the Ewa Development Plan (Ordinance No. 81-80), adopted in November 1981. Nor does it reflect proposed changes to the 1977 Oahu General Plan that will soon be submitted to the Planning Commission.

Public projects, in particular those that involve construction of new potable water sources with potential for opening up of large scale land development projects, may well stimulate or induce immediate and long-term effects. An updated assessment of the project in terms of Development Plan policies and identification of possible conflicts with current and proposed plans may be necessary.

Ralph Kawamoto
RALPH KAWAMOTO
Planner

APPROVED:

W. T. Chow
WILLARD T. CHOW

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 9, 1982

TO : DR. WILLARD T. CHOW
CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM : KAZU HAYASHIDA
BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF FEBRUARY 10, 1982, ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR HONOULIULI WELLS

Thank you for reviewing the draft EIS for our proposed water development project. Your letter will be appended to the revised environmental document.

We offer the following in response to your comments:

1. Provisions contained in the Ewa Development Plan will be reflected in the revised EIS.

2. Proposed changes to the 1977 Oahu General Plan will be appended to the revised EIS.

3. We shall assess the project in terms of Development Plan policies and identify possible conflicts with current and proposed plans.

If you have any questions, please contact Lawrence Whang at 548-5221.

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

RECEIVED
BOARD OF WATER SUPPLY
Jan 19 2 46 PM '82

January 15, 1982

Honorable Eileen Anderson, Mayor
City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Dear Mayor Anderson:

Subject: Honouliuli Wells
Honouliuli, Oahu
TMK: 9-2-01: Portion of Parcel 1

Thank you for the opportunity to review the EIS document for the proposed Honouliuli Wells Water Resource Project.

Your proposed development of additional water resources to meet future needs, especially in the Ewa plains area, will ensure the continuance of adequate health standards for the Leeward residents.

Sincerely,
JOSEPH K. CONANT
Original Signed
JOSEPH K. CONANT

cc: Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

January 22, 1982

TO : MR. JOSEPH K. CONANT, DIRECTOR
DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

FROM : KAZU HAYASHIDA
BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF JANUARY 15, 1982, ON THE ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR HONOULIULI WELLS, HONOULIULI, OAHU, TMK: 9-2-01: POR. 1

Thank you for reviewing the EIS for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corp

DEPARTMENT OF LAND UTILIZATION

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813 ● (808) 523-4432

EILEEN R. ANDERSON
MAYOR

MICHAEL M. McELROY
DIRECTOR

ROBERT B. JONES
DEPUTY DIRECTOR

LU1/82-202( )

February 5, 1982

MEMORANDUM

TO : KAZU HAYASHIDA, MANAGER & CHIEF ENGINEER
BOARD OF WATER SUPPLY

FROM : MICHAEL M. McELROY, DIRECTOR

SUBJECT : ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR
HONOULIULI WELLS, HONOULIULI, OAHU, HAWAII

We have reviewed the subject EIS and find that it adequately addresses the proposed project as to: (1) anticipated environmental impacts, (2) mitigative measures to minimize adverse impacts, and (3) alternatives to the proposed project.

Thank you for the opportunity to review this EIS.

If you have any questions or comments, please call John Machol of our staff at 523-4077.

MICHAEL M. McELROY
Director of Land Utilization

MMM:sl

Board of Water Supply

DEPARTMENT OF PARKS AND RECREATION

CITY AND COUNTY OF HONOLULU L60239

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

ROBERT K. HASUDA
DIRECTOR

RECEIVED
BD OF WATER SUPPLY
FEB 2 3 31 PM '82

January 28, 1982

MEMORANDUM

TO : HONORABLE EILEEN R. ANDERSON, MAYOR

VIA : ANDREW I. T. CHANG, MANAGING DIRECTOR

FROM : ROBERT K. HASUDA, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT FOR HONOULIULI WELLS

We have reviewed the Environmental Impact Statement for Honouliuli Wells and have no comments.

Thank you for the opportunity to comment on this Environmental Impact Statement.

RKM:vc

cc: ʒoard of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 10, 1982

TO : MR. ROBERT K. HASUDA
DIRECTOR
DEPT. OF PARKS AND RECREATION

FROM : KAZU HAYASHIDA
BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF JANUARY 28, 1982, ON THE ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR HONOULIULI WELLS

Thank you for reviewing the EIS for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

EILEEN R. ANDERSON
MAYOR

MICHAEL J. CHUN, Ph.D.
DIRECTOR AND CHIEF ENGINEER

820105

RECEIVED
BD OF WATER SUPPLY
JAN 19 2 47 PM '82

ENV 82-21

January 18, 1982

MEMORANDUM

TO: HONORABLE EILEEN R. ANDERSON, MAYOR

FROM: MICHAEL J. CHUN, DIRECTOR AND CHIEF ENGINEER

SUBJECT: EIS FOR HONOULIULI WELLS, HONOLULU, OAHU, HAWAII

We have reviewed the subject EIS and have the following comments.

1. The Honouliuli wastewater treatment plant (page 2-42) was put into operation in January 1982. It provides preliminary treatment. Primary treatment will be provided at a later date. An exemption from secondary treatment (page 2-55) has been received from EPA but the conditions of the exemption are unsatisfactory and will be appealed.

2. Even if secondary treatment (page 2-55) may not be required, secondary effluent could be made available for irrigation purposes under certain conditions. As stated in the EIS, plans for reclamation for irrigation purposes have not been finalized and are still flexible.

3. The sewer service charge levied against non-residential users is $0.59 per 1,000 gallons of metered water usage as of July 1, 1981. On July 1, 1980 it was $0.45 per 1,000 gallons (page 4-23). The suspended solids surcharge is of very little consequences except for food and fruit processors. The present BWS charge on water consumption is a more prominent factor in motivating water conservation than the sewer service charges since they directly affect residential and non-residential users.

4. We are in favor of the reuse of wastewater effluent especially for irrigation purposes. Any water exchange program between

Honorable Eileen R. Anderson -2- January 18, 1982

Oahu Sugar Company and the Board of Water Supply (page 6-3) involving the use of sewage effluent (page 6-4) will require our formal concurrence.

Michael J. Chun
MICHAEL J. CHUN
Director and Chief Engineer

cc: Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 9, 1982

TO : DR. MICHAEL J. CHUN,
DIRECTOR AND CHIEF ENGINEER
DEPARTMENT OF PUBLIC WORKS

FROM : KAZU HAYASHIDA
BOARD OF WATER SUPPLY

SUBJECT: YOUR MEMORANDUM OF JANUARY 18, 1982, ON THE EIS FOR HONOULIULI WELLS, OAHU

Thank you for reviewing the environmental impact statement for our proposed project. We will append your memorandum to the revised environmental document.

In response to your comments we offer the following:

1. Page 2-42 will be corrected to indicate that the Honouliuli Wastewater Treatment Plant was placed into operation in January 1982 and provides preliminary treatment. Primary treatment will be provided at a later date.

2. Page 2-55 will be corrected to indicate that an exemption from secondary treatment was received from EPA, but the conditions of the exemption will be appealed. We will also note that secondary treated effluent could still be made available for irrigation under certain conditions.

3. Page 4-23 will be revised to indicate that the suspended solids surcharge affects food and fruit processors. We concur that our water rates would have a more motivating impact on water conservation than your sewer service charge.

4. Any water exchange program involving the use of sewage effluent will be coordinated with you for your concurrence.

If you have any questions, please contact Lawrence Whang at 548-5221.

Kazu

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII

RECEIVED
BD OF WATER SUPPLY
FEB 10 3 03 PM '82

EILEEN R. ANDERSON
MAYOR

ROY A. PARKER
DIRECTOR

TE1/82-127

February 8, 1982

MEMORANDUM

TO: HONORABLE EILEEN ANDERSON, MAYOR
CITY AND COUNTY OF HONOLULU

VIA: ANDREW I. T. CHANG, MANAGING DIRECTOR

FROM: ROY A. PARKER, DIRECTOR

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT FOR THE HONOULIULI WELLS PROJECT

We have reviewed the environmental impact statement for the Honouliuli Wells project and have no comments.

ROY A. PARKER

cc: Board of Water Supply

RECEIVED
BD. OF WATER SUPPLY
JAN 25 3 40 PM '82

PB 82-64

January 25, 1982

TO: HONORABLE EILEEN R. ANDERSON, MAYOR

VIA: MR. ANDREW I. T. CHANG, MANAGING DIRECTOR

FROM: ROY H. TANJI
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: HONOULIULI WELL
ENVIRONMENTAL IMPACT STATEMENT

We have reviewed the subject environmental impact statement and have no comments.

Roy H. Tanji
ROY H. TANJI
Director and Building Superintendent

TH:jo
cc: J. Harada
Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 10, 1982

TO : MR. ROY H. TANJI, DIRECTOR AND BUILDING SUPERINTENDENT
BUILDING DEPARTMENT

FROM : KAZU HAYASHIDA
BOARD OF WATER SUPPLY

SUBJECT: YOUR LETTER OF JANUARY 25, 1982, ON THE ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR HONOULIULI WELLS

Thank you for reviewing the EIS for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Kazu Hayashida
KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

003815

HAWAIIAN ELECTRIC COMPANY, INC.
Box 2750 / Honolulu, Hawaii / 96840

February 9, 1982

RICHARD L. O'CONNELL, P.E.
MANAGER, ENVIRONMENTAL DEPARTMENT

ENV 2-1

RECEIVED
BD. OF WATER SUPPLY
FEB 10 9 57 AM '82

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 S. Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Hayashida:

Subject: Environmental Impact Statement
BWS Honouliuli Wells (Proposed)

We have reviewed the EIS for the Honouliuli Wells being proposed by the BWS as a major source of water for the Leeward region of Oahu. The following requires either correction and/or attention:

1. Section 2.IV.D.1 (page 2-57), Electricity - The amount of generating capacity after Kahe #6 facility goes on line is 1,327 megawatts instead of 1,527 megawatts.

2. Section 4.II.B.2.e. (page 4-31), Electricity - It appears that the electricity use rate of 1,400 kilowatt hours (kwh)/month/unit is too high - assuming a unit equals 3.2 persons. Also, the annual energy consumption of 21,600,000 kwh/year for 12,000 units is too low.

3. Section 6.V.A.2. (page 6-5), Pearl Harbor Springs - As one of the alternate water sources for sugar cane irrigation, the BWS proposes to utilize the springs located at Kalauao, Waiau, and Waiawa in exchange for better quality water. The Waiau Springs may be one of the sources of fresh water presently supplying cooling water to HECO's Waiau Power Plant. If it is a source, this exchange will affect the Waiau Power Plant.

Sincerely,

R L O'Connell

Richard L. O'Connell
Manager, Environmental Department

JFB:cm

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 25, 1982

Mr. Richard L. O'Connell
Manager
Environmental Department
Hawaiian Electric Company, Inc.
Box 2750
Honolulu, Hawaii 96840

Dear Mr. O'Connell:

Subject: Your Letter of February 9, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the environmental impact statement for our proposed project. Your letter will be appended to the revised environmental document.

We have the following response to your letter:

1. Section 2.IV.D.1 (pg. 2-57), Electricity - the environmental document will be corrected to reflect that HECO will have a generating capacity of 1,327 megawatts instead of 1,527 megawatts, after the Kahe #6 facility goes on line.

2. Section 4.II.B.2.e. (pg. 4-31), Electricity - We agree that 1,400 kilowatt hours (kwh)/month/unit is too high. In the revised EIS, 700 kilowatt hours (kwh)/month/unit will be used. This will also change the annual consumption for 12,000 units from 21,600,000 kwh/year to 100,800,000 kwh/year.

3. Section 6.V.A.2. (pg. 6-5), Pearl Harbor Springs - We are already working with your company to develop the Waiau tunnel source for incorporation into our system. The use of the source is pending the completion of a feasibility study by your company and subsequent negotiations with Hawaiian Electric Company and Board of Water Supply.

If your have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

RECEIVED
BD OF WATER SUPPLY
JAN 28 1 11 PM '82

HAWAIIAN TELEPHONE COMPANY

P.O. BOX 2200 • HONOLULU, HAWAII 96841 • TELEPHONE (808) 537-7111 • CABLE: TELHAWAII

January 25, 1982

Mayor Eileen Anderson
City and County of Honolulu
630 South King Street
Honolulu, Hawaii 96813

Dear Mayor Anderson:

Environmental Impact Statement (EIS)
Honouliuli Wells, Honouliuli, Oahu

We have reviewed the above EIS and have no further comments to offer. The comments contained therein pertaining to the availability of Hawaiian Telephone Company facilities are satisfactory.

Thank you for the opportunity to review and comment.

Sincerely,

R. Mau
Richard Mau
Engineering and Construction
Staff Manager

cc: Board of Water Supply

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

February 10, 1982

Mr. Richard Mau
Hawaiian Telephone Company
P.O. Box 2200
Honolulu, Hawaii 96841

Dear Mr. Mau:

Subject: Your Letter of January 25, 1982, on the Environmental Impact Statement for Honouliuli Wells

Thank you for reviewing the draft environmental impact statement for our proposed project. Your letter will be appended to the revised environmental document.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

For KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corporation

RECEIVED
BD OF WATER SUPPLY 820435
FEB 23 3 35 PM '82

OAHU SUGAR COMPANY, LIMITED
AN AMFAC COMPANY

P. O. BOX "O"
WAIPAHU, HAWAII 96797
TELEPHONE 677-3577

February 17, 1982

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

RE: COMMENTS ON "ENVIRONMENTAL IMPACT STATEMENT, HONOULIULI WELLS"

Gentlemen:

We have reviewed the above-mentioned Environmental Impact Statement sent under your cover letter of January 12, 1982. The following is a list of our comments:

USE OF SEWAGE EFFLUENT

Oahu Sugar Company currently has an agreement with the City and County to accept sewage effluent on a trial basis from the Mililani Sewage Treatment Plant. The technology of utilizing sewage effluent is not perfected at this time and the supposition that Oahu Sugar Company could accept up to an additional 9 MGD of effluent in exchange for a reduction in the amount of conditionally certified pumping seems premature. Oahu Sugar Company currently does not have adequate furrow irrigated cane land to accept up to 9 MGD of sewage effluent.

EXCHANGE OF DESIGNATIONS WITH OAHU SUGAR COMPANY

On page 1-20 of the E.I.S. it is stated that "The City will compensate Oahu Sugar Company for this reduction in pumpage by offering water of lower quality in exchange, on a gallon-for-gallon basis". This proposition is obviously very unfair.

On one hand, the City receives a gallon of potable water. On the other hand, Oahu Sugar Company is asked to give up a gallon of water relatively free from turbidity problems and very acceptable for use in drip irrigation systems and is then asked to accept in exchange "lower quality water" such as "treated sewage effluent, spring water or surface water". In regards to sewage effluent the report states on page 4-25 that, "Presently, the primary problem is that diluted effluent clogs the holes in drip irrigation tubes over time, limiting its use for drip irrigation".

USE OF POTABLE WATER BY OAHU SUGAR COMPANY

On page 6-3 of the E.I.S. it is stated that "Oahu Sugar Company uses approximately 40 - 50 MGD of domestic quality water for sugar cane irrigation. The B.W.S. would trade water of a lower quality for this potable water on a one-to-one basis". This statement is extremely misleading and, additionally, the amount of domestic quality water is overstated.

The following is a tabulation of chloride concentration in Oahu Sugar Company wells with the amount of daily average conditionally certified pumping.

Well	**Chloride (PPM)	Conditional Certification (Daily Avg. MGD)
WP1	*205	1.641
WP2 & 2B	306	6.360
WP2C & 4C	410	5.420
WP4A & B	595	6.135
WP5	356	13.098
WP6A & B	1,402	6.755
WP7A - C	287	10.730
WP17A	*34	1.699
WP17B	*34	2.129
EP2	*233	1.699
EP3	705	
EP4	561	5.362
EP5	321	
EP6	335	11.696
EP7	602	
EP8	492	8.514
EP10	759	
EP11	831	
EP12 & 13	855	14.612
EP15 & 16	280	19.150
	Total	115.000 MGD

* Domestic quality water (i.e. less than 250 ppm)
** From Oahu Sugar Company's "Water Management Plan for PHGWCA" October 2, 1981

It can be seen from this tabulation that the total amount of domestic quality water (i.e. < 250 ppm chlorides) pumped by Oahu Sugar Company is only 7.168 MGD or about 6.2 per cent of the total. Even if we assume that you added 25 MGD of "potable" Waiahole water, the total "domestic" water is on the order of 32 MGD which is less than the 40 - 50 MGD stated in the report. Waiahole water which meets domestic standards for chlorides probably does not meet other domestic quality standards.

CONSTRUCTION COST ESTIMATE

The construction cost estimate presented in Table 1-5 does not include a number of items which may be applicable to this project. The following list addresses a number of these items:

1. Cost of obtaining land and easements from the Campbell Estate.
2. Reimbursement to Oahu Sugar Company for loss of production of lands taken out of cultivation.
3. Cost of providing facilities to deliver "lower quality water" to Oahu Sugar Company fields.
4. Reimbursement to Oahu Sugar Company for the value of undepreciated facilities it may have to retire to attain the cutback in pumping anticipated by the project.
5. Reimbursement to Oahu Sugar Company for new facilities it may have to install in existing pumping stations to attain the cutback in pumping (throttling valves, smaller pumps, controls, etc.).
6. Reimbursement to Oahu Sugar Company for special filtration systems or special management devices it may have to install to properly manage treated sewage effluent.

EWA PUMPS

The proposed project will almost certainly have a deleterious effect on Oahu Sugar Company's Ewa pumps. The proposed project is located "hydrologically upstream" from the Ewa Pumps. Assuming that the project is built, how does the City and County propose to ameliorate the shadow effect that the proposed wells will have on the Ewa pumps?

USE OF BRACKISH WATER FOR IRRIGATION

On page 4-14 of the E.I.S. it is stated that "....chloride contents well below 1,000 ppm, which is the upper limit tolerated by sugar cane". It should be noted that a chloride content of 1,000 ppm does not represent an absolute demarcation between non-water quality limited growth and dead cane. Reports prepared by industry agriculturalists infer progressive declines in production related to increases in the chloride concentration of the irrigation water.

CANE LAND

The report refers to two acres of cane land being taken for the project. Oahu Sugar Company objects to the taking of any cane land whenever possible and wonders if non-cane land sites were considered for the project.

CERTIFICATION

On page 1-6 of the E.I.S. the report states "Existing wells in this area were certified by July 3, 1980....". It should be added here that the wells were conditionally certified.

Very truly yours,

David W. Ballie

David W. Ballie
President and Senior Manager

CP:mo
cc: J. Loomis, Amfac

.JARD OF WATER SUPPLY
.Y AND COUNTY OF HONOLULU

COPY

March 25, 1982

Mr. David W. Ballie
President and Senior Manager
Oahu Sugar Company, Limited
P. O. Box "O"
Waipahu, Hawaii 96797

Dear Mr. Ballie:

Subject: Your Letter of February 17, 1982, on the Draft Environmental Impact Statement (EIS) for Honouliuli Wells

Thank you for reviewing the draft EIS for our proposed water development project. Your letter will be appended to the revised environmental document.

We offer the following response to your comments:

USE OF SEWAGE EFFLUENT

We will indicate in the EIS that the actual quantity of water to be exchanged will be dependent upon the needs and ability of Oahu Sugar Company (OSC) to utilize lower quality water for irrigation.

EXCHANGE OF DESIGNATIONS WITH OAHU SUGAR COMPANY

Any exchange arrangement would have to be on an agreed basis. We agree that a gallon-for-gallon exchange should consider other factors so that any exchange would be on an equitable basis.

USE OF POTABLE WATER BY OAHU SUGAR COMPANY

The EIS will be corrected to show that about 7 mgd, instead of 40-50 mgd, of the water pumped by OSC meet the acceptable chloride concentration levels for drinking water.

CONSTRUCTION COST ESTIMATE

We will indicate in Table 1-5 that the associated costs to convey lower quality water to OSC's fields are not included.

EWA PUMPS

We concur that the proposed Honouliuli Wells may cause a shadow effect on your Ewa Pumps. Therefore any exchange agreement must include and consider the effects on your Ewa Pumps.

USE OF BRACKISH WATER FOR IRRIGATION

The EIS will note that a chloride content of 1,000 ppm does not represent an absolute demarcation between non-water quality limited growth and dead cane. We will also note the inference from reports by sugar industry agriculturalists that production progressively declines relative to increases in the chloride concentration of the irrigation water.

CANE LAND

We will clarify in the EIS that up to two acres may be needed for the well facility. We are making every effort to site the control station and wells in locations where loss of cane land will be minimized.

CERTIFICATION

We will correct the EIS to indicate that OSC's wells were conditionally certified.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Environment Impact Study Corp.

February 9, 1982

Mr. Francis Tanaka
c/o PRI
P.O. Box 3379
Honolulu, Hawaii 96842

Dear Mr. Tanaka:

Subject: Your Telephone Request Of February 3, 1982, On The Environmental Impact Statement For Honouliuli Wells

We forward a copy of the environmental impact statement for Honouliuli Wells as requested.

If you have any comments on the document, we would appreciate receiving them by February 22, 1982.

If you have any questions, please contact Lawrence Whang at 548-5221.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

Enc.

Appendices

APPENDIX A

THE PEARL HARBOR GROUND WATER CONTROL AREA (PHGWCA)

APPENDIX A

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES, Continued

LIST OF TABLES

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
BEEN REPHOTOGRAPHED TO ASSURE
LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING

LIST OF TABLES

APPENDIX A

THE PEARL HARBOR GROUND WATER CONTROL AREA (PHGWCA)

I. INTRODUCTION

A. The Pearl Harbor Ground Water Control Area

In 1959 the State of Hawaii Legislature passed the Ground Water Use Act (Chapter 177, Hawaii Revised Statutes, amended 1961) which gives the State Board of Land and Natural Resources (Board; BLNR) the authority to regulate the use of ground water in areas designated by the Board as being endangered or likely to become endangered by excessive or improper use. In July 1979 the Department of Land and Natural Resources (DLNR) promulgated Regulation No. 9 which implements the Ground Water Use Act. Finally, on September 28, 1979 the BLNR approved of the first "Designated Ground Water Control Area."

Designation of such an area means that the Board finds that "the ground water must be regulated and protected for best utilization, conservation, and protection in order to prevent threat of exhaustion, depletion, waste, pollution, or deterioration by salt encroachment or an area in which the Board finds that the ground water must be regulated and protected in order to protect the ground water resources from exhaustion, depletion, waste, pollution, or deterioration by salt encroachment" [A.1].

The first such area is termed the Pearl Harbor Ground Water Control Area (PHGWCA). It consists of the Ewa Judicial District and the Wahiawa Judicial District (124,687 acres). Please refer to Figure A-1. The official effective date of the area was 90 days prior to September 28, 1979, or June 30, 1979.

B. <u>DLNR Chapter 166 of Title 13</u> [On May 8, 1981, ~~Regulation 9 was repealed~~ and replaced with Chapter 166 of Title 13.]

The guiding principle of Chapter 166 of Title 13 is to realize the most beneficial uses of the State's ground water resources in regulating, limiting, and apportioning the uses of ground water in the best interest of the people of the State. No person within the ground water control area may make any use of the water within that area, except in compliance with Chapter 166 of Title 13. Individual household uses of ground water are exempt from regulation, but report of such uses must be filed with the Board. Existing ground water uses which are lawful and beneficial may be preserved and continued if such uses are properly declared to and certified by the Board. However, the right to such preserved uses may be completely or partly lost to nonuse. All new ground water withdrawals will be strictly regulated by the issuance

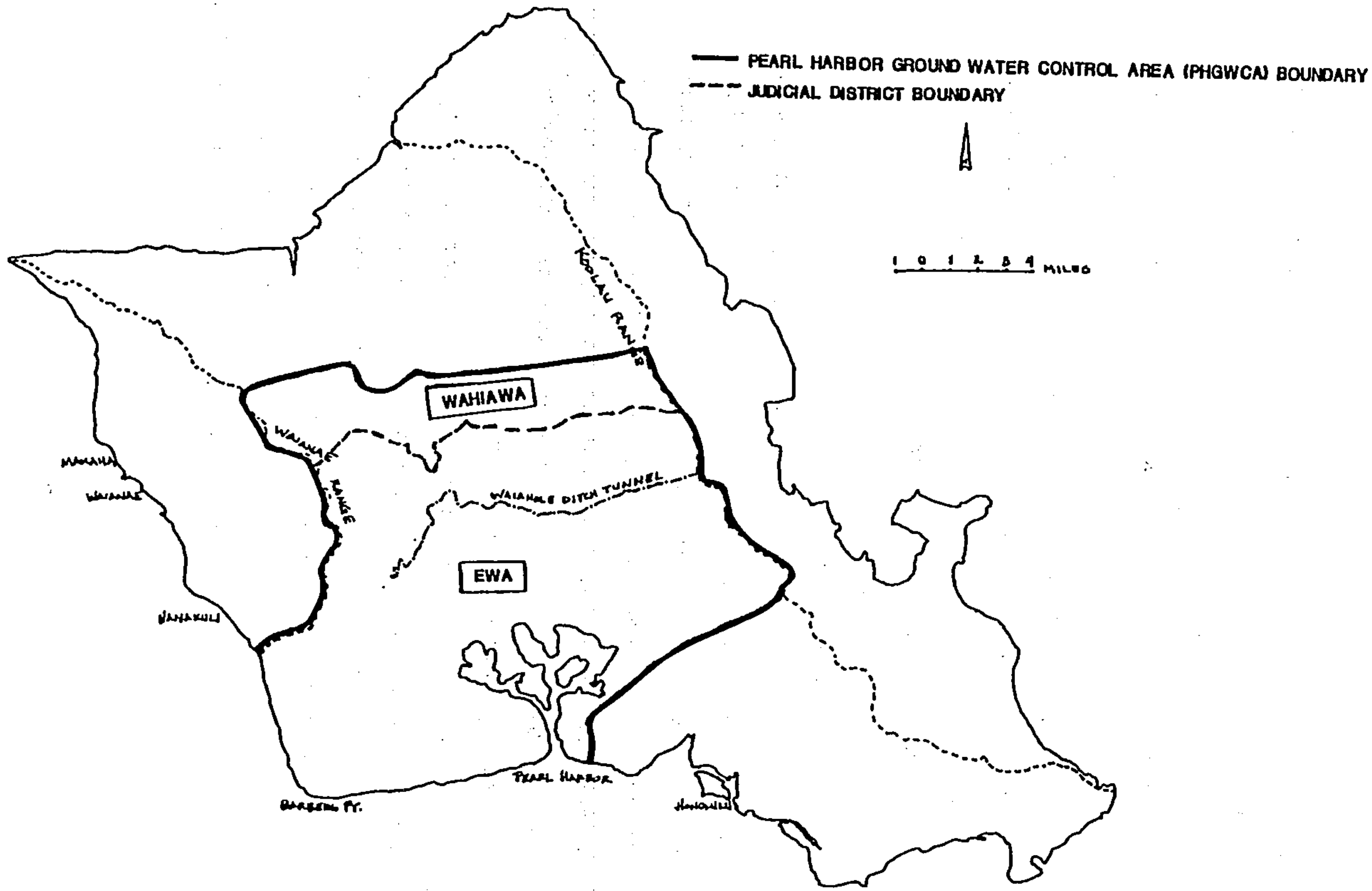


FIGURE A-1

JUDICIAL DISTRICTS
IN PHGWCA

of permits to use ground water and permits to supply ground water.

Between September 28, 1979 and January 2, 1980 existing users were required to declare their pumpage and location of ground water sources to DLNR. Following this declaration period is a certification period which will elapse on July 3, 1980. If certification is to be made, the Board shall issue a certificate which shall include a description of the beneficial uses preserved and a statement of the maximum daily and annual withdrawal preserved for each well.

Within a designated ground water control area, no preserved existing use of water may be modified by increasing the quantity of water used or by substantially changing the purpose or manner of the beneficial use, or the time of taking of water, or by changing the point of diversion of the water, unless authorized by the Board.

However, any municipal corporation or person supplying a municipal corporation may increase its water use from a designated ground water control area by 100,000 gallons per day or 5% of the average per day use during the year immediately prior to the date of ground water control area designation, whichever amount is greater.

Each user who comes under the Chapter 166 of Title 13 will be given a permit to operate at the stated pumpage for a given amount of time, not to exceed 50 years. It is anticipated that most users will be certified for considerably less than 50 years initially [A.2].

C. Relation to Other Study Boundaries

The PHGWCA contains the Wahiawa Water District, Pearl Harbor Water District, and the Ewa portion of the Ewa-Waianae Water District of the Board of Water Supply (BWS), City and County of Honolulu. Refer to Figure A-2. The Manager and Chief Engineer of the BWS may limit the amount of water drawn from any well covered under the BWS Rules and Regulations if there is a reasonable basis to expect that overdraft will occur, except in a designated ground water control area, which is regulated by DLNR.

In various other hydrologic reports and studies the Pearl Harbor aquifer is alternately referred to as the "Pearl Harbor area" or "Pearl Harbor basin." These terms, as well as others in use, are discussed below.

1. In 1964 a study (conducted by F. N. Visher and J. F. Mink) on the basal ground water in southern Oahu was published [A.3]. The authors

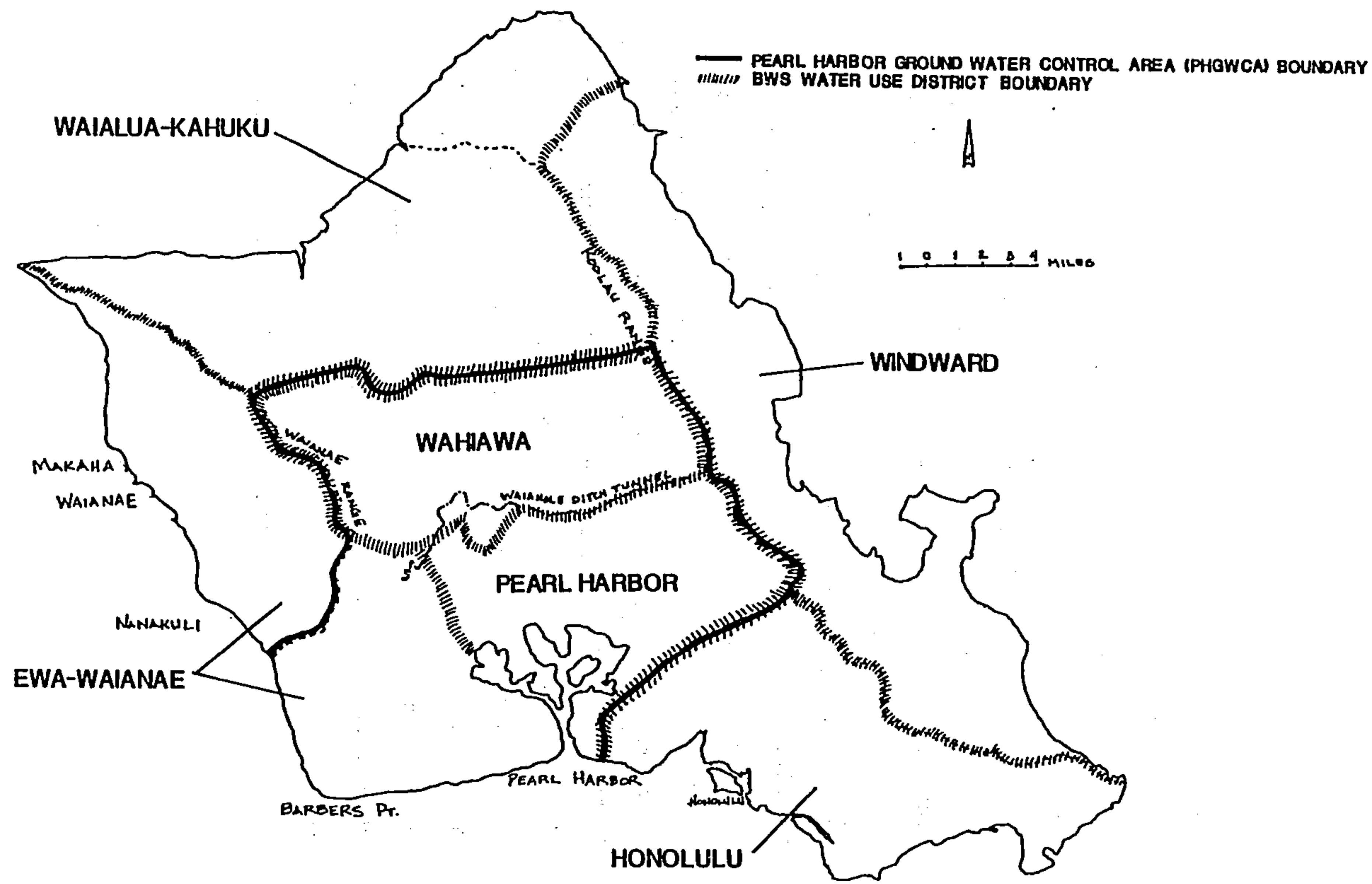


FIGURE A-2
PHGWCA IN RELATION TO
BWS WATER USE DISTRICTS

noted that the basal aquifer underlying southern Oahu was virtually continuous, but could be divided into several "isopiestic areas".

Each such area or compartment is characterized by having an artesian head higher or lower than that in adjacent areas. The head in each area depends on the amount of recharge, the height and depth of the caprock and its ability to prevent seaward escape of the water, and the depth and character of the deep valley fill separating the areas. As can be seen in Figure A-3, two isopiestic areas lie within what was termed the "Pearl Harbor area." These two areas may be said to roughly comprise the Pearl Harbor aquifer. Several other isopiestic areas made up the "Honolulu area". The two isopiestic areas located within the PHGWCA are referred to as the Waianae and Koolau aquifers. The demarcation between these two areas has been approximated as lying along the exposed surface contact of the Koolau and Waianae lavas. This barrier is an erosional unconformity, consisting of weathered zone and accumulations of alluvium, separating the lower, older Waianae volcanic series from the younger Koolau series. The

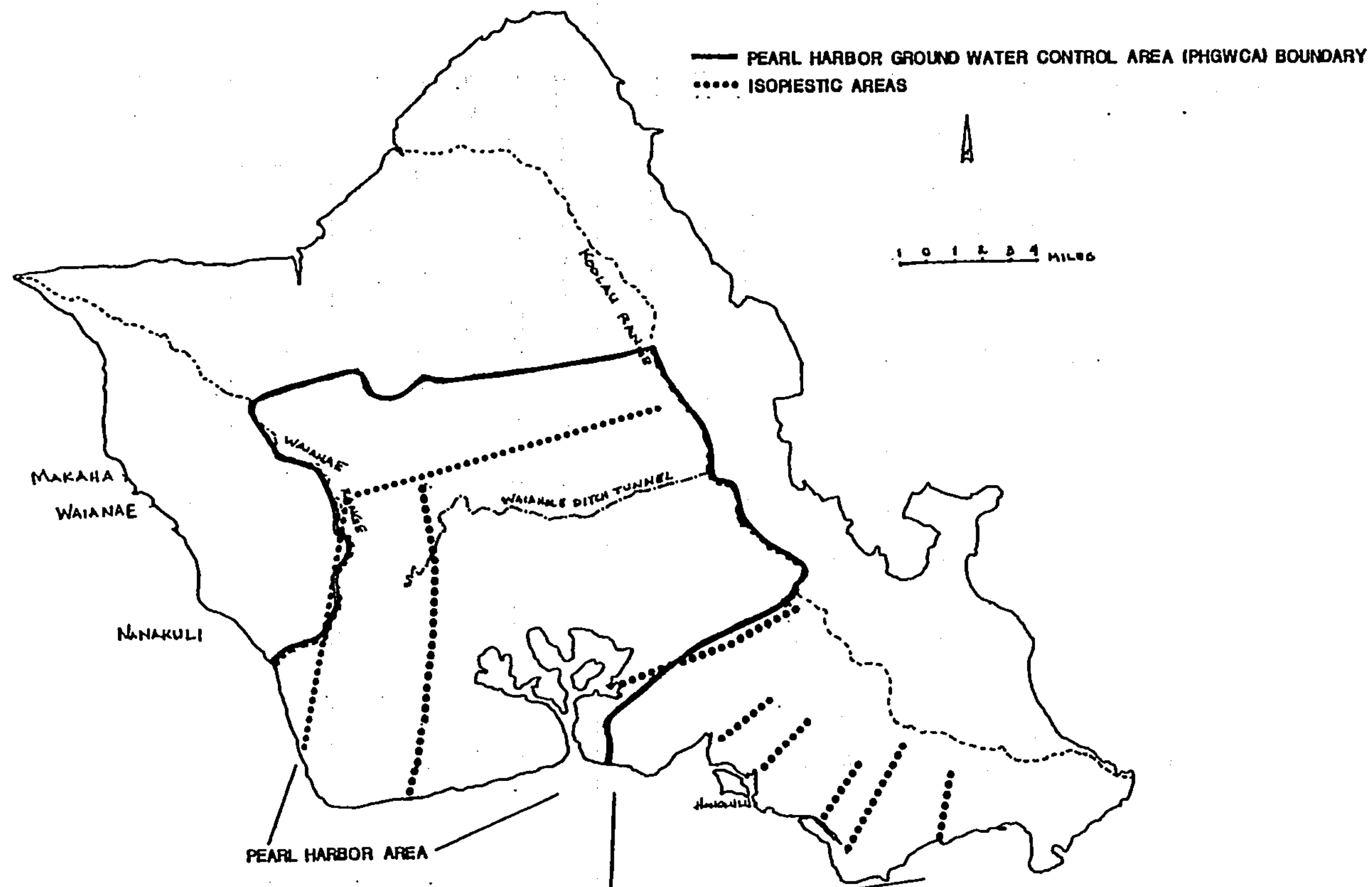


FIGURE A-3
ISOPIESTIC AREAS

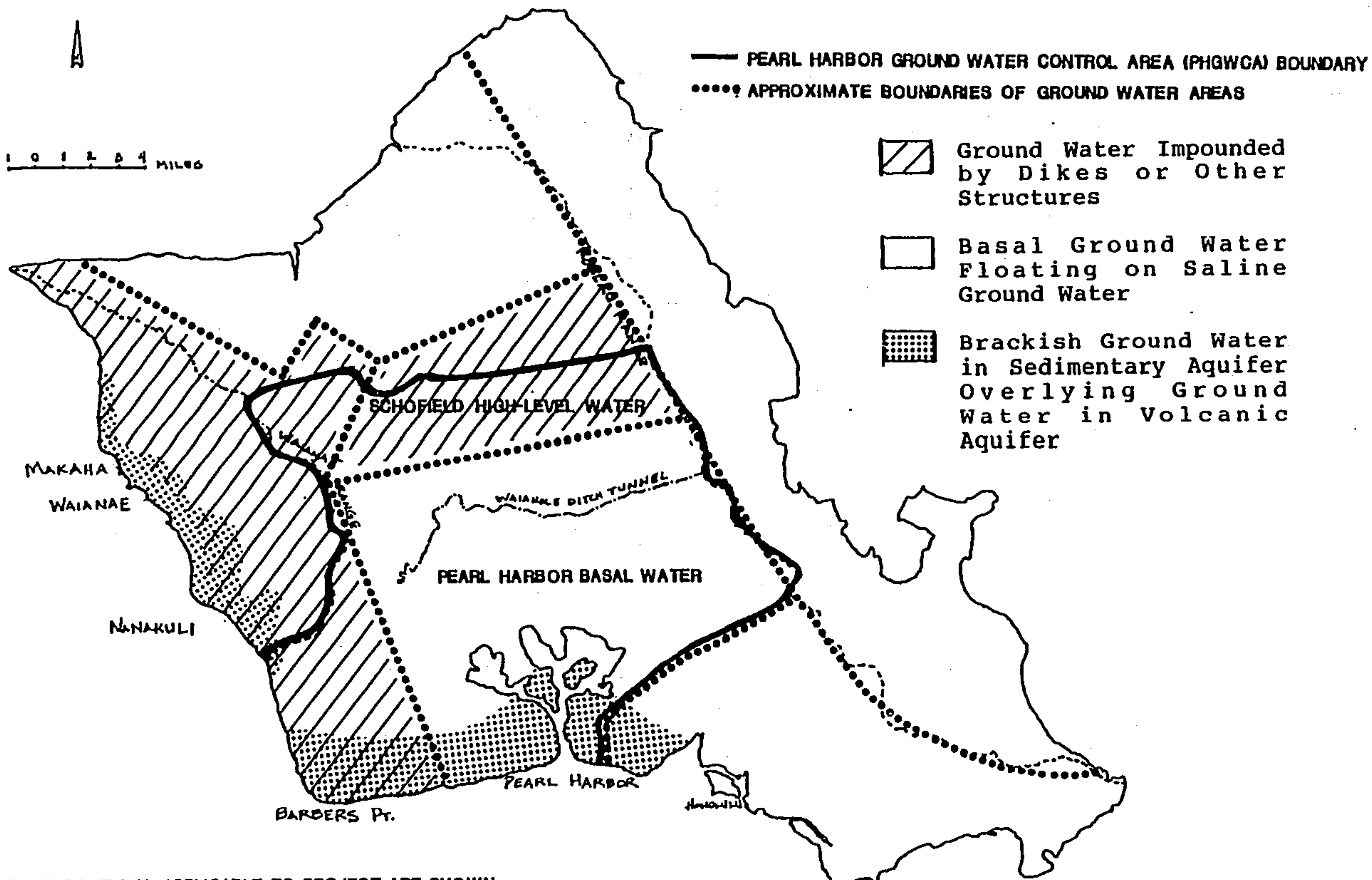
SOURCE: (A.3)

head drop immediately west of the unconformity, in the Waianae aquifer, has been estimated at two to two-and-a-half feet. However, the unconformity is merely an impediment to the hydraulic continuity that exists between these two aquifers.

2. In 1977 another study was published, conducted by K. J. Takasaki in cooperation with the Hawaii State Department of Health [A.4]. This study presented a map of the approximate ground water areas on Oahu, as shown in Figure A-4. As can be seen, the PHGWCA encompasses three major areas according to this study - the Schofield high-level water body, a portion of the basal aquifer, and dike impounded water in the Ewa region. In addition, along the coast there is a sedimentary aquifer containing brackish water.

3. In 1979 another government report was published. This study was conducted by Ronald L. Soroos and Charles J. Ewart [A.5]. The entire study area, "Pearl Harbor Area", lies within the PHGWCA and essentially corresponds with the Pearl Harbor aquifer, as defined on page A-36. Refer to Figure A-5.

4. Finally, in 1980 a new privately-conducted report was prepared [A.6]. Prepared by Sam Hirota, Inc. for Amfac, the study area is made



NOTE: ONLY PORTIONS APPLICABLE TO PROJECT ARE SHOWN

SOURCE: (A.4)

FIGURE A-4

"PEARL HARBOR BASAL WATER"

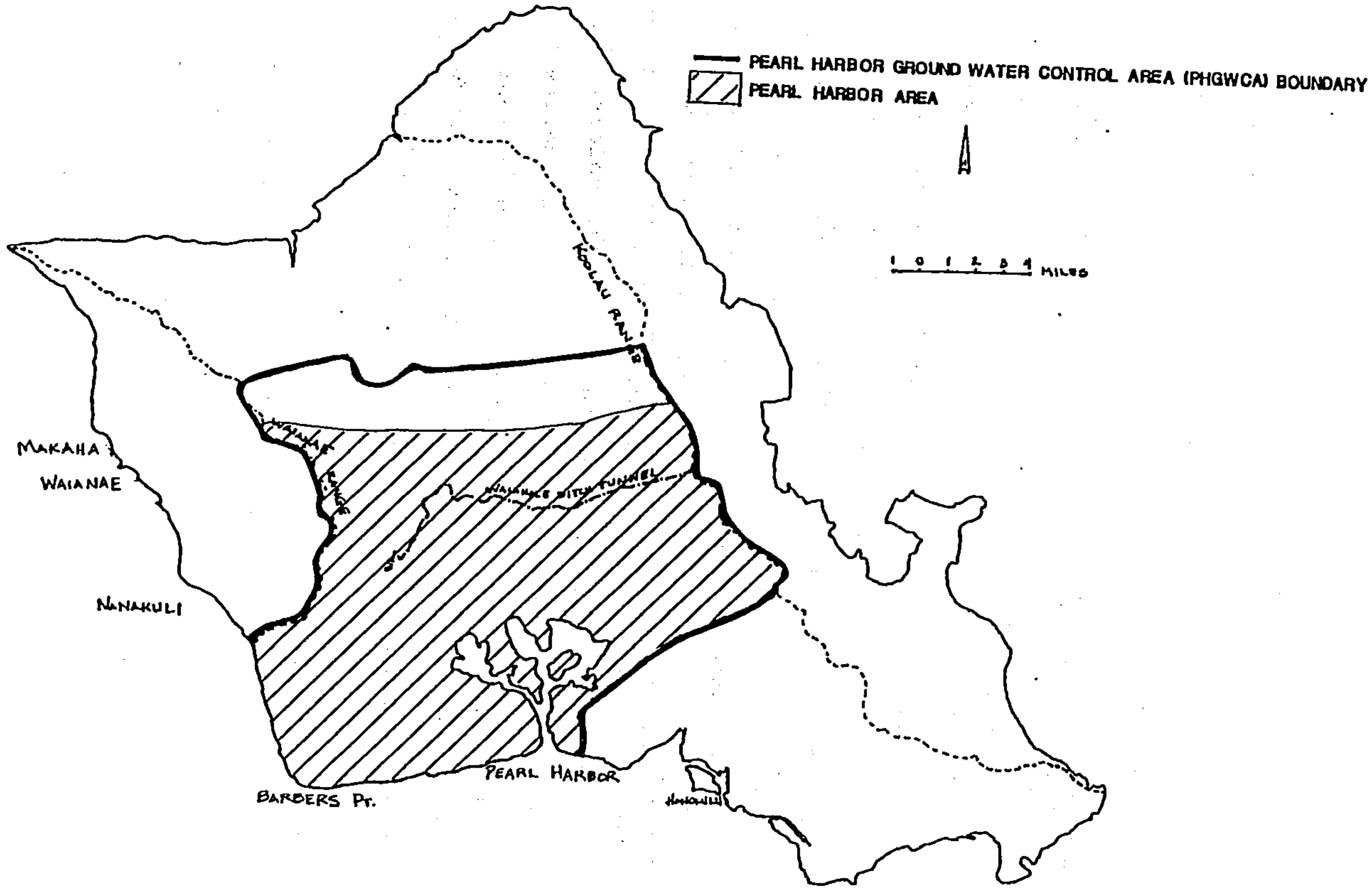


FIGURE A-5
"PEARL HARBOR AREA"

SOURCE: (A.5)

up of the "Pearl Harbor Basin" and, as shown in Figure A-6, essentially contains the Schofield high-level water body and a portion of the basal aquifer.

II. PHYSICAL CHARACTERISTICS OF PEARL HARBOR GROUND WATER CONTROL AREA

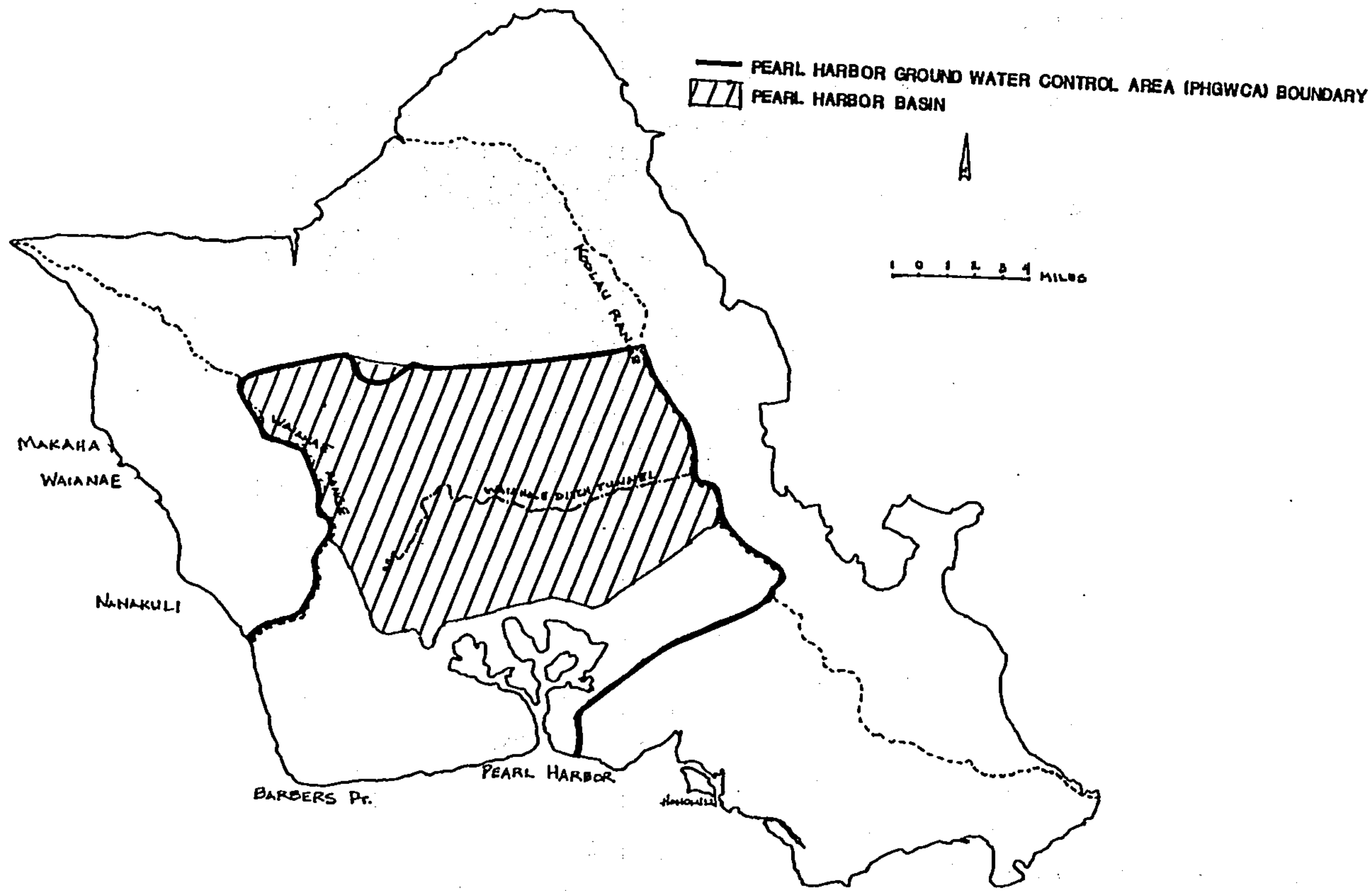
A. Geology [A.7]

The PHGWCA encompasses portions of the Koolau Range, the Waianae Range, and the Schofield Plateau, as well as the entire Ewa Plain. The Koolau Range and the Schofield Plateau consist primarily of lava flows from the Koolau Volcanic Series. The Waianae Range consists of lava flows of the Waianae Volcanic Series. An important characteristic of these lava flow formations is their high permeability.

In the Ewa Plain area both of these volcanic series are covered by cap rock made up of marine sediments and alluvium. This formation is less permeable than the basaltic lavas. The caprock extends seaward from the vicinity of Farrington Highway. Please refer to Figure A-7.

B. Soils [A.8]

There are five main soil associations within the PHGWCA. Refer to Figure A-8. The Ewa Plain and the area immediately surrounding Pearl Harbor



SOURCE: (A.6)

FIGURE A-6
"PEARL HARBOR BASIN"

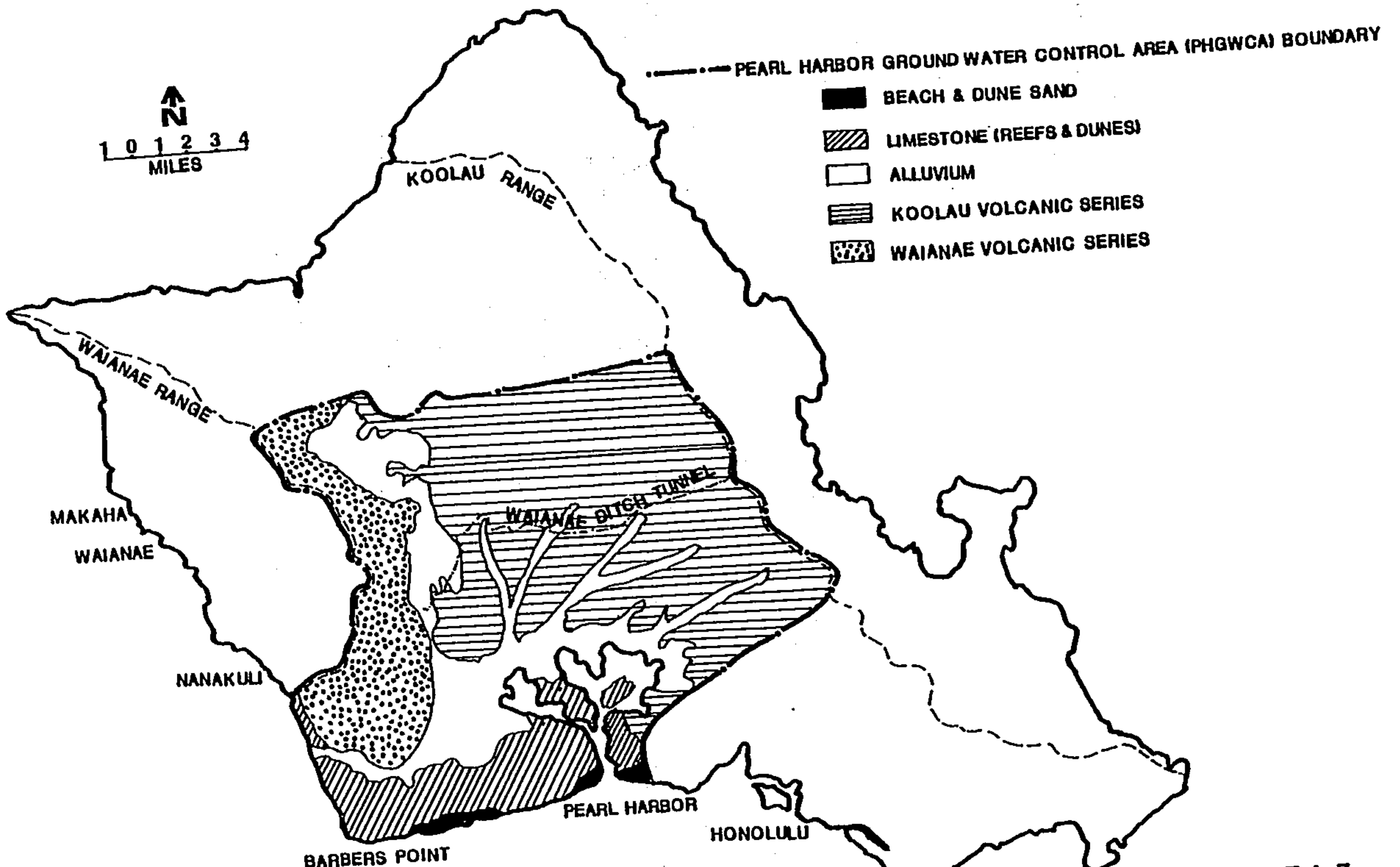


FIGURE A-7

GENERAL GEOLOGIC MAP

SOURCE: (A.7)

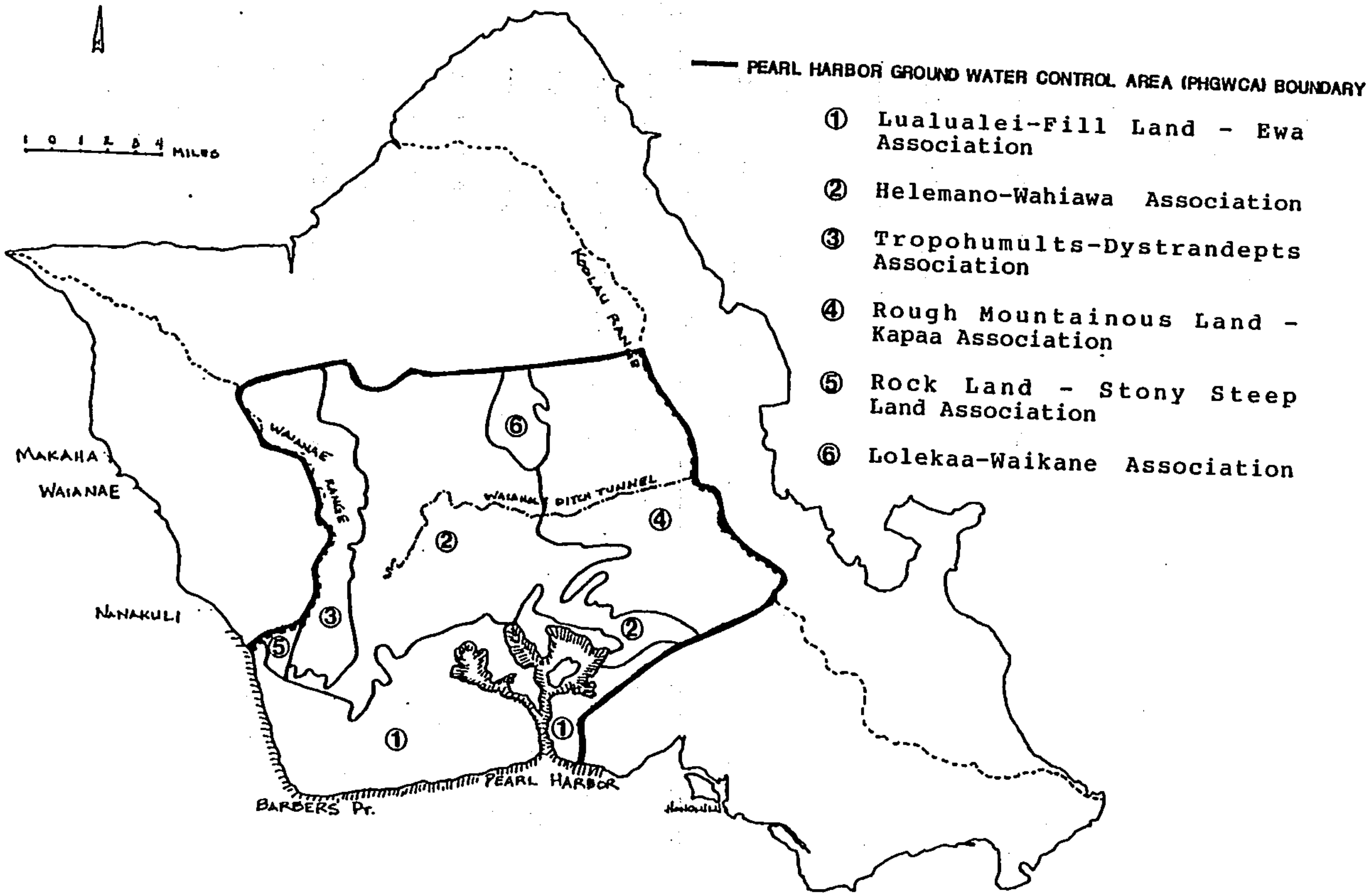


FIGURE A-8

SOIL ASSOCIATIONS

SOURCE : A.8)

consists of the Lualualei-Fill Land - Ewa Association. This association consists of deep, nearly level to moderately sloping, well-drained soils that have a fine textured or moderately fine textured subsoil or underlying material. This association also includes areas of fill land. The Waianae Range soils consist primarily of the Tropohumults-Dystrandepts Association. This association consists of gently sloping to very steep, well-drained soils that are underlain by soft weathered rock, volcanic ash, or colluvium, on narrow ridges and side slopes.

The Schofield Plateau consists of the Helemano-Wahiawa Association. This association consists of deep, nearly level to moderately sloping, well-drained soils that have a fine textured subsoil. The portion of the Koolau Range contained within the PHGWCA consists of the Rough Mountainous Land - Kapaa Association and the Lolekaa - Waikane Association. The Rough Mountainous Land - Kapaa Association consists of very steep land broken by numerous drainageways and deep, well-drained soils that have a fine textured or moderately fine textured subsoil. These soils are found in gulches and on narrow ridges. The Lolekaa-Waikane Association consists of deep, nearly level to very steep, well-drained soils that have a dominantly fine textured subsoil. These soils are found on upland terraces and alluvial fans.

C. Rainfall [A.9]

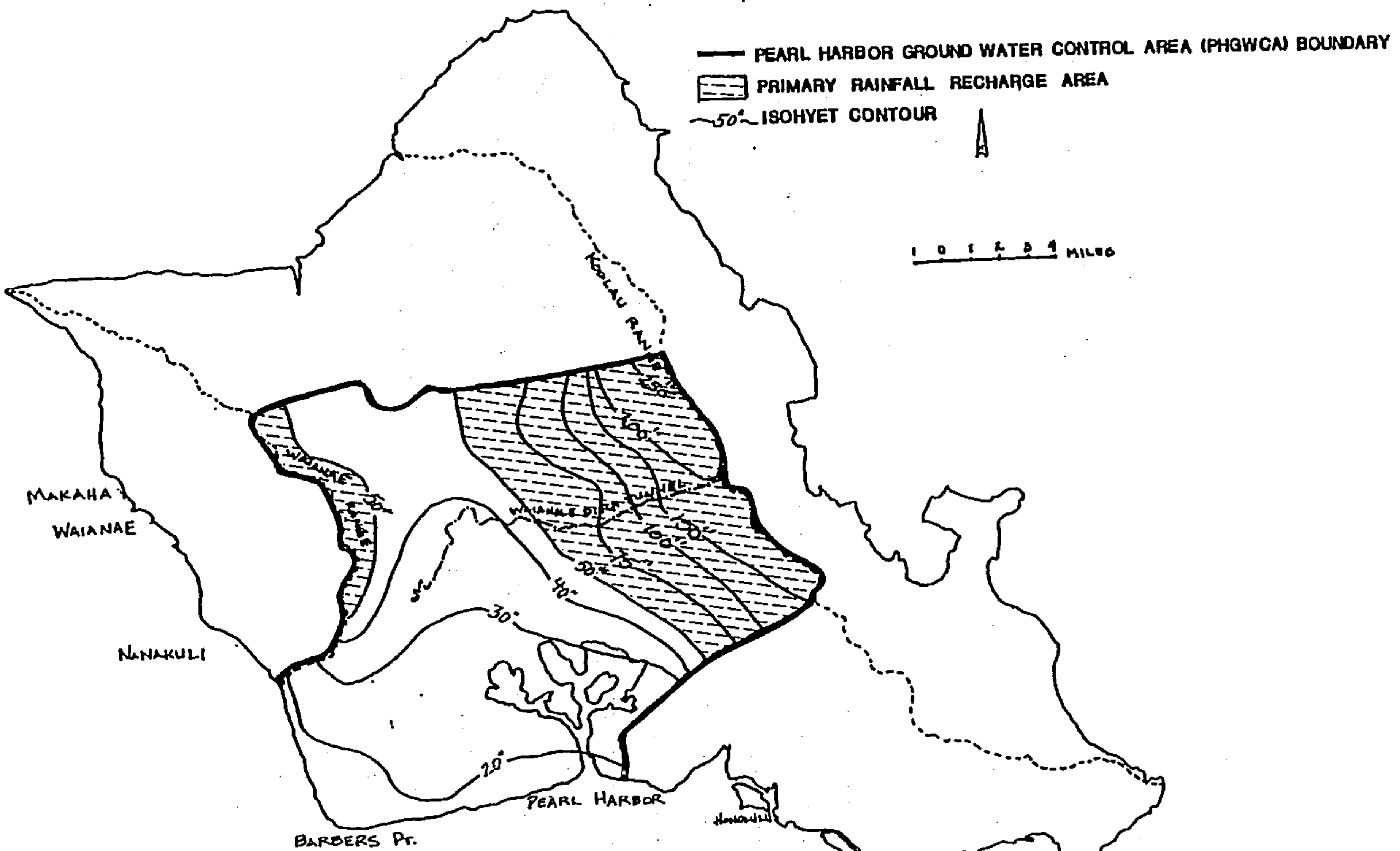
Annual rainfall in the PHGWCA averages 20 inches along the coast but increases to about 40 inches on the Schofield Plateau. Within the PHGWCA, the upper Waianae Range receives 50 inches per year while the Koolau Range receives between 50-250 inches of rainfall per year. Please refer to Figure A-9. Recent research by personnel from the Water Resources Research Center (WRRC) suggests that significant recharge occurs primarily in those regions above the 60-inch isohyst and possibly higher. This conclusion is reached from studies of accumulated manganese in soil on the dry side of this rainfall level.

D. Impermeable Areas

Areas in which virtually no rainfall percolates to the basal ground water aquifer can be found within the PHGWCA. They are primarily urban areas and natural caprock areas along the coastal plain. Please refer to Figure A-10.

E. Aquifers

The lava flows form a virtually continuous aquifer in southern Oahu, although the aquifer is divided into compartments, or isopiestic areas.



Note: Although rainfall recharge areas are shown only within the PHGWCA (Pearl Harbor Ground Water Control Area), recharge occurs throughout the island above the 50-inch rainfall isohyet.

SOURCE: (A-9)

FIGURE A-9
RAINFALL RECHARGE AREAS WITHIN THE PHGWCA

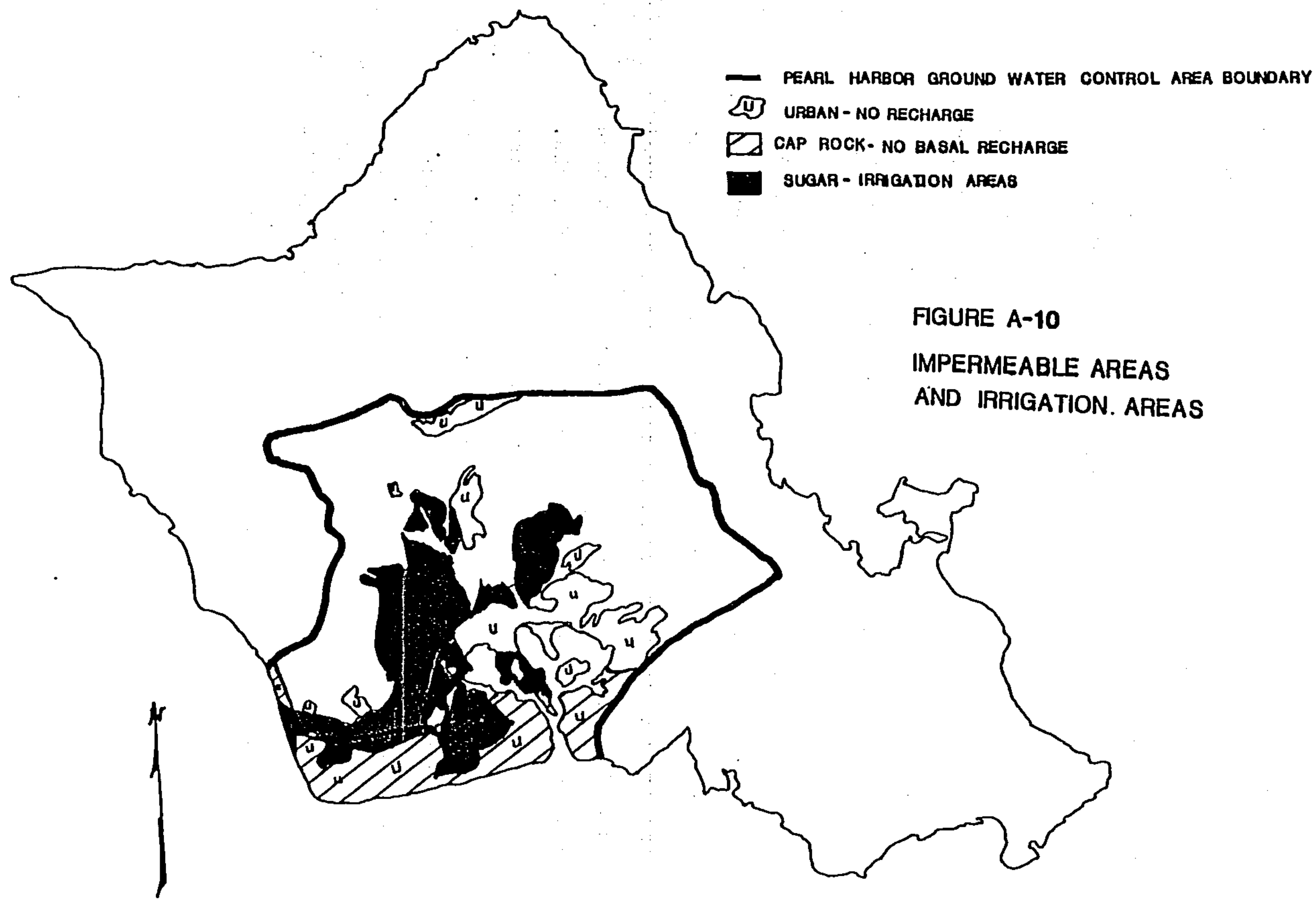


FIGURE A-10

IMPERMEABLE AREAS
AND IRRIGATION. AREAS

Refer to Figure A-3. These are areas defined by the elevations to which water will rise in artesian wells or wells penetrating confined aquifers. They are determined by water pressure and the elevation of the aquifer. There are several isopiestic areas in the Honolulu area and two in the Pearl Harbor area.

One is in the immediate vicinity of Pearl Harbor, north to about Waiakakalaua Stream and west to the contact between the Koolau and Waianae Volcanic Series. Another isopiestic area lies in the area of the Ewa Plain.

Where the Waianae Volcanic Series and the Koolau Volcanic Series meet an erosional unconformity exists, presumably because of the presence of buried soil that had formed from the Waianae rocks. This erosional unconformity acts as a partial barrier to the free flow of ground water between the two sets of rocks.

The PHGWCA also contains most or all of the Schofield high-level water body. This is a zone of high-level water, 2-3 miles wide underlying Schofield Barracks and the town of Wahiawa. The elevation of the water table in the central portion of the Schofield high-level water body varies between 270 and 285 feet above sea level. The water, as far as is presently known, is confined to the region between the valley of Waikakalaua Stream on the south and Poamoho Stream on the north [A.10]. On either side of the high-level water body exists basal ground water. Note Figure A-11. Leakage from the confined zone contributes a substantial portion of the recharge that sustains the basal water lens.

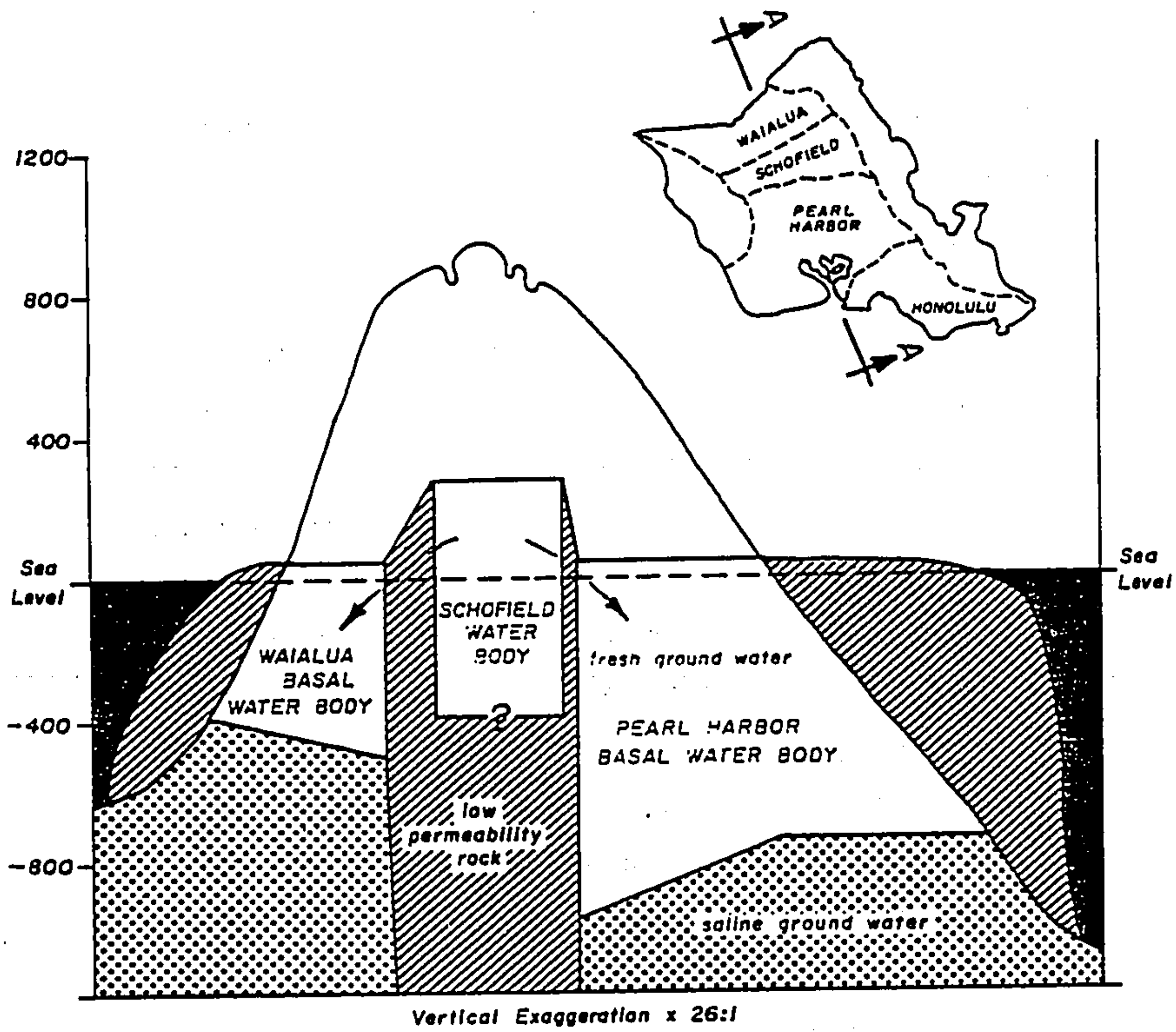
F. Land Use

1. Existing

Existing land use within the PHGWCSA is shown in Figure A-12. The area contains urban uses, military, agriculture, and forest reserve. Refer to Table A-1 for a breakdown of the acreages of existing land use in 1978. Of the total acreage listed for agriculture, approximately 55% (19,000±) acres) were in sugar cane.

2. Proposed

Proposed land use within the PHGWCA may be approximated in a number of different ways. The General Plan of the City and County of Honolulu roughly divides the island into population centers which connote various land uses [A.11]. Figure A-13, from the General Plan, shows part of the Primary Urban Center, the Secondary Urban Center, and three Urban-Fringe areas within the PHGWCA.



SECTION A-A

GROUND WATER OCCURRENCE IN WAIALUA, SCHOFIELD, AND PEARL HARBOR AREAS, OAHU

SOURCE: (A.37)

FIGURE A-11

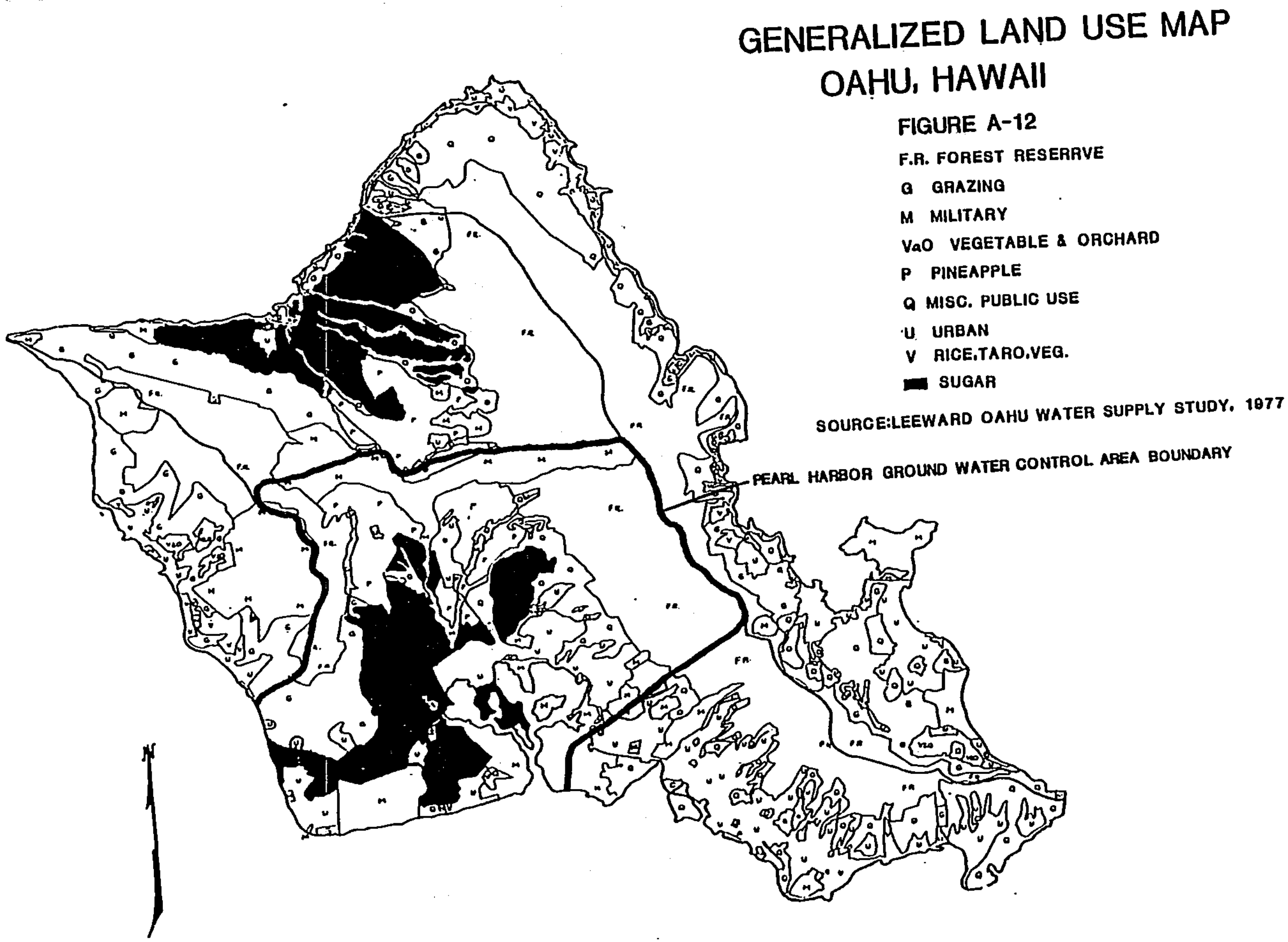

GENERALIZED LAND USE MAP
OAHU, HAWAII
FIGURE A-12
F.R. FOREST RESERRVE
G GRAZING
M MILITARY
VaO VEGETABLE & ORCHARD
P PINEAPPLE
Q MISC. PUBLIC USE
U URBAN
V RICE,TARO,VEG.
SUGAR
SOURCE:LEEWARD OAHU WATER SUPPLY STUDY, 1977
PEARL HARBOR GROUND WATER CONTROL AREA BOUNDARY
N

TABLE A-1

EXISTING LAND USE (ACRES)
PEARL HARBOR GROUND WATER CONTROL AREA
Oahu, 1978

Ewa Judicial District Subtotal (1)

Urban		Agricultural	Vacant Usable	Other (2)	Total Land
Residential	4,449.6	32,853.7	13,187.0	48,808.3	99,209.8
Multifamily	613.0				
Industrial	2,300.9				
Commercial	997.3				
Hotel	0				
	8,360.8				

Wahiawa Judicial District Subtotal (3)

Urban		Agricultural	Vacant Usable	Other	Total Land
Residential	723.8	1,887.8	667.7	22,002.0	25,477.1
Multifamily	36.7				
Industrial	101.5				
Commercial	57.6				
Hotel	0				
	919.6				

Pearl Harbor Ground Water Control Area Total

Urban		Agricultural	Vacant Usable	Other	Total Land
Residential	5,173.4	34,741.5	13,854.7	70,810.3	124,686.9
Multifamily	649.7				
Industrial	2,402.4				
Commercial	1,054.9				
Hotel	0				
	9,280.4				

(1) Cer_us tracts 73.00 through 89.03 inclusive.

(2) Includes government lands (including military), churches, dormitories, and wastelands, for example.

(3) Census tracts 90.00 through 95.05 inclusive.

Source: Department of General Planning, City and County of Honolulu, Table 82.

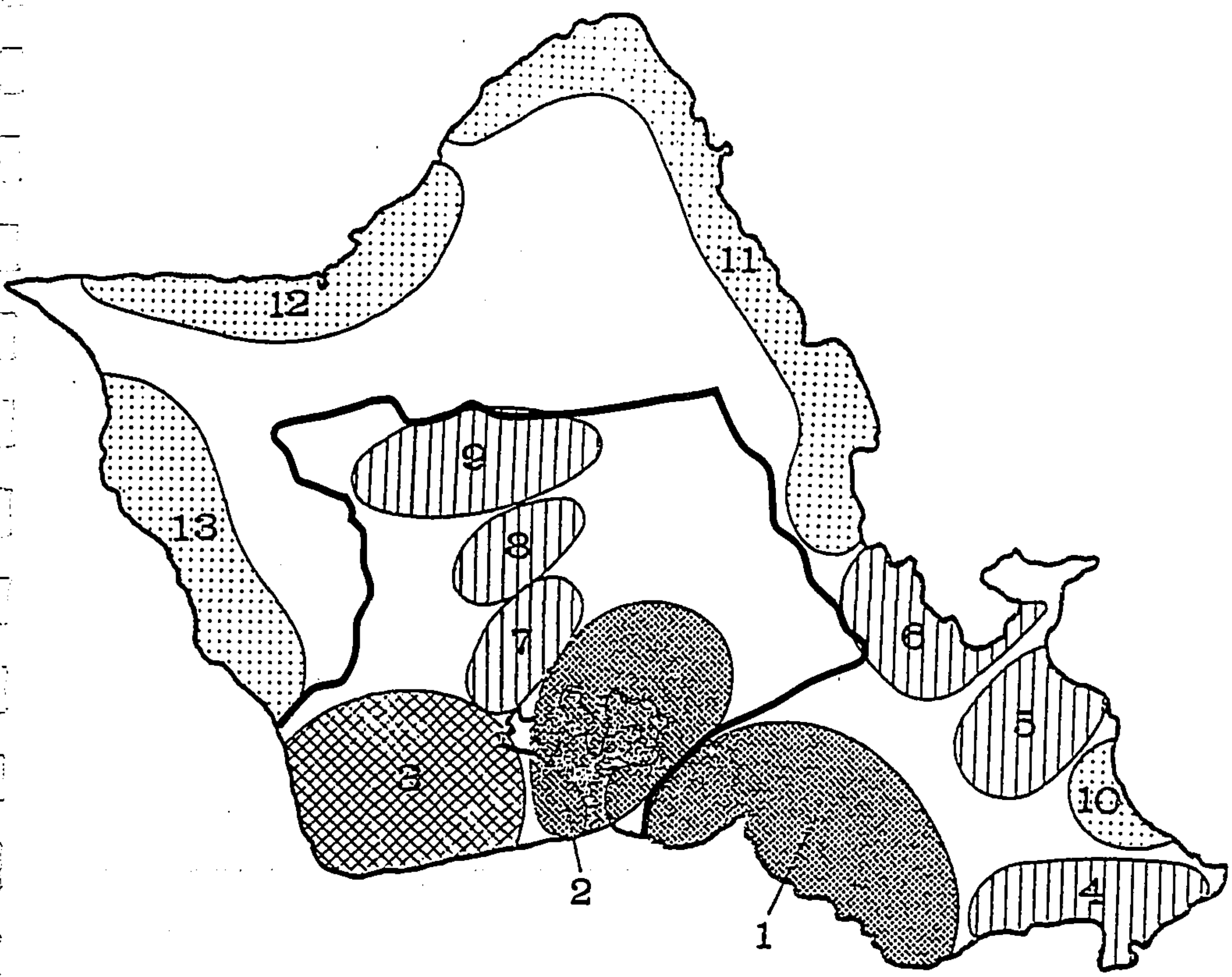


FIGURE A-13

POPULATION AREAS

CITY AND COUNTY OF HONOLULU

SOURCE: (A.11)

LEGEND

PHGWCA BOUNDARY

PRIMARY URBAN CENTER
1. Honolulu (Waialae/Kahala-Halawa)
2. Aiea-Pearl City

SECONDARY URBAN CENTER
3. Ewa - Makakilo

URBAN-FRINGE
4. Aina Koa - Hawaii Kai
5. Kailua
6. Kaneohe - Ahuimanu
7. Waipahu - Crestview
8. Mililani - Waipio
9. Wahiawa

RURAL
10. Waimanalo
11. Kahaluu - Kahuku
12. North Shore
13. Waianae Coast

More specifically, the Land Use Forecast for Oahu, 1975-1985 [A.12] predicted Residential Land (acres) and Hotel Floor Area (square feet) for 1985, based on residential densities and density trends current in 1974. These are presented in Table A-2.

Finally, there are several specific major developments proposed within the PHGWCA. These are presented in Table A-3. In terms of agricultural lands, Oahu Sugar Company estimates that it will decrease its sugar cane acreage in the near future from the present 18,300 acres to 15,000 acres through 1996, when its lease agreements with Campbell Estate elapse [A.13]. Irregardless of the future land use proposed for the area, total pumpage for the PHGWCA cannot exceed 225 mgd.

III. HYDROLOGICAL CHARACTERISTICS OF THE PEARL HARBOR AQUIFER

A. Typical Hawaiian Aquifers

The volcanic rocks of Oahu and their residual soils have a very great capacity to absorb and percolate waters, and consequently, only a relatively small proportion of the rainfall runs off to the sea. Most of it infiltrates into the ground, creating

TABLE A-2

1985 LAND USE FORECAST:
RESIDENTIAL LAND AND HOTEL FLOOR AREA

	Residential Land (Acres)	Hotel Floor Area (square feet)
Ewa Judicial District(1)	5,595	296,500
Wahiawa Judicial District(2)	1,092	19,600
TOTALS	6,687	316,100

(1) Census tracts 73 through 89 inclusive.
(2) Census tracts 90 through 95 inclusive.

Source: Young, Steven C. K. June, 1978. Land Use Forecast for Oahu, 1975-1985. Prepared in association with Alan M. Voorhess and Associates, Inc.

TABLE A-3

MAJOR PROPOSED DEVELOPMENTS
PEARL HARBOR GROUND WATER CONTROL AREA, OAHU, HAWAII

Location/Proposal	Type of Development	Estimated Completion Date	Acreage	Dwelling Units	Estimated Population1/
Waipahu-Crestview					
Village Park	Housing2/	1985	316	1,745	5,600
Ewa-Makakilo					
Makakilo	Housing2/	1995	373	3,693	11,800
West Beach	Housing2/	2000	640	1,680	33,000
West Beach	Resort	1995		7,520	35,3003/
Campbell Industrial Park	Employment	2000	1,486	-	-
Honouliuli WWTP	Utility	1982	51	-	-
Barbers Point Deep Water Harbor	Port Employment	2000	330	-	-
West Oahu College	Education	NA	200	-	-
Ewa Marina Community	Recreation & Housing2/	1990	1,098	7,200	23,040
Ewa Newtown	Housing	NA	200	NA	-
HPOWER	Solid Waste Recovery	NA	NA	-	-
Pearl Harbor-Schofield					
Gentry/Waipio	Housing2/	1985	510	3,700	11,800
	Employment	1985			
Waiawa Ridge	Housing	NA	1,300	NA	-
Waiawa Industrial Park	Employment	NA	63	-	-
Mililani Town	Housing	NA	476	NA	-
Royal Summit	Housing	1985	138	600	1,920

NA Not Available

1/ Population estimates based on: 3.2 persons per dwelling unit and 1.8 persons per hotel room.

2/ Including parks, schools and commercial areas.

3/ According to the West Beach Project Draft EIS, June, 1980.

Note: Refer to Figure A-23 for approximate development locations.

the large ground water bodies on which Oahu depends for its water supply.

Three characteristic types of ground water have been recognized, the most extensive being the basal fresh water that floats on sea water under much of the southern and northern portions of the island. Less wide spread, but of singular importance in some areas, is ground water restrained between impermeable vertical rock structures called dikes.

This water is called "dike water" or "high-level water". Dikes are the remnant conduits through which lava traveled to the earth's surface. They consist of nearly vertical slabs of dense, massive rock, generally a few feet thick, that extend for considerable distances and intrude other lavas. Normal permeable lavas containing water occur between them. This water is of excellent quality and cannot be endangered by saline contamination, because it is sealed off from the sea.

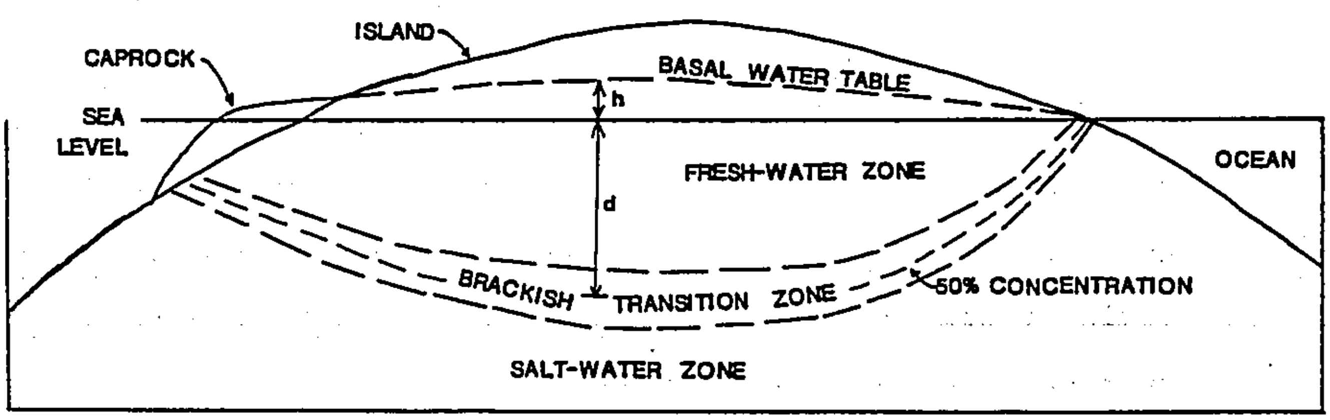
The third type of ground water, which is of minor significance on Oahu, is ground water held up, or "perched", on horizontal impermeable beds such as volcanic ash.

Dikes and other structural features are concealed by lava flows forming the Schofield Plateau. These contain high-level ground water, standing at levels of approximately 275 feet above sea level. The natural discharge from this high-level reservoir is subsurface, as it is concealed by the lava flows overlying the impounding structural features. A part of the discharge moves southward into the Pearl Harbor basal aquifer.

The fresh basal ground water floats on sea water as a lens-shaped body, commonly called a Ghyben Herzberg Lens. The depth of the 50% salt water concentration point below sea level is 40 times the height of the water table above sea level. Refer to Figure A-14.

The lens is a dynamic system through which fresh water moves from an area of recharge to points or zones of discharge, and the energy involved in this movement affects the shape of the lens and the depth of the fresh water. In the practical matter of water supplies in the fresh water lens, the most important factors are the rate of recharge of fresh water, permeability of the rock that contain the water and control its movement, and effects of mixing of the fresh water with the sea water in which the lens floats.

In an aquifer of a given uniform permeability, the thickness of the lens varies with the amount of water moving through it; that is, the thickness increases as the rate of recharge increases. Where a fixed rate of recharge occurs, the lens is thinner in an aquifer having high permeability than in one



GHYBEN-HERZBERG LENS OF FRESH WATER WITHIN AN OCEANIC ISLAND (h:d=1:40)

FIGURE A-14

having low permeability. The thickness of the lens may also be affected by relatively impermeable "caprock" deposits that overlie the aquifer above and below sea level and separated from the sea water. The caprock on the aquifer retards the escape of sea water from the lens and causes the thickness of fresh water to be greater than it would be if the deposits were absent.

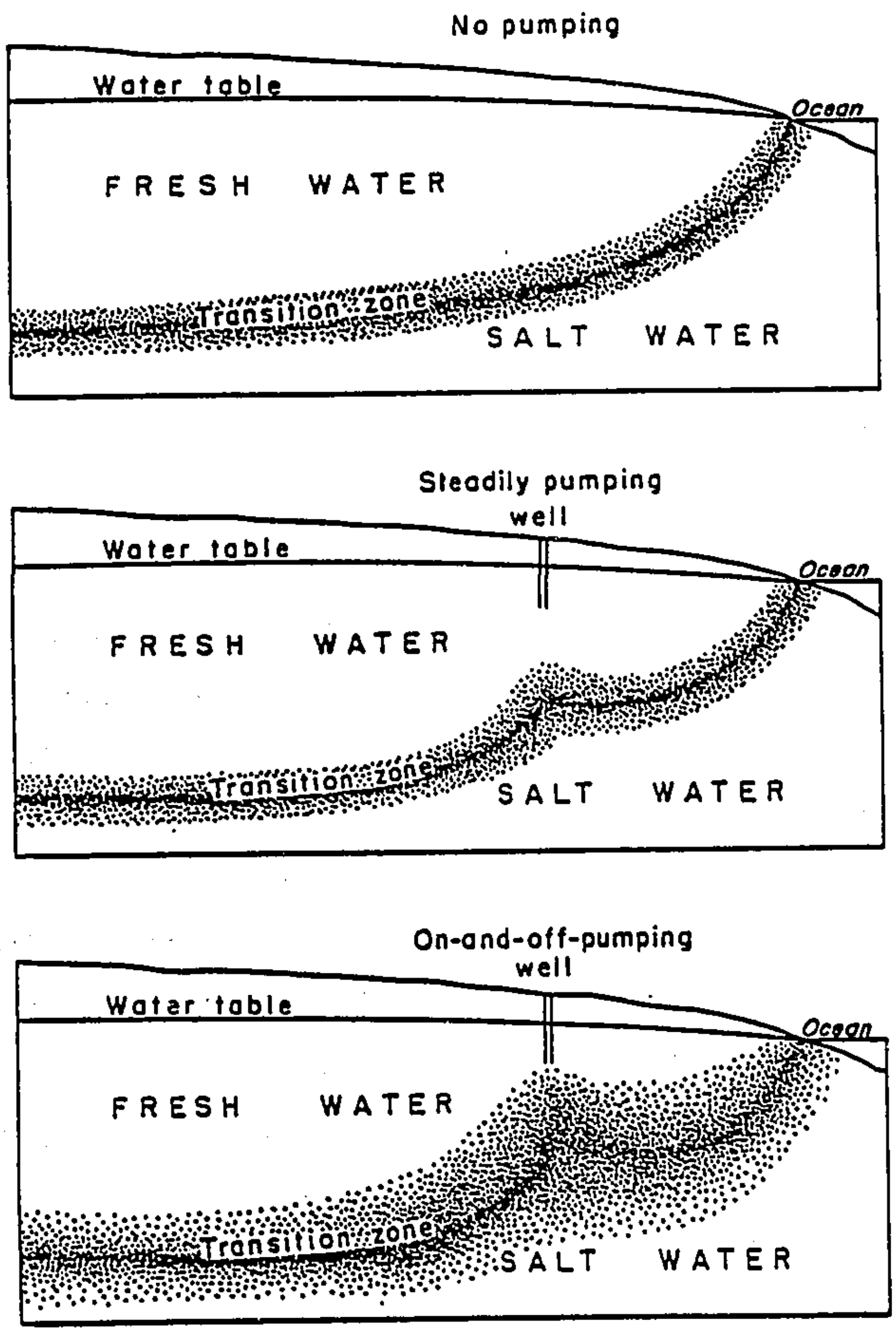
Seasonal changes in the thickness of the lens caused by fluctuations in recharge, pumping, and the action of the tides keeps the fresh water-salt water interface (transition zone) constantly in motion. The thickness of the transition zone is determined by two factors: (1) the rate at which mixing is taking place; and (2) the rate at which the transition zone water is discharged at the shoreline.

Under natural conditions, the most variable factor is likely to be the rate of transition zone water movement to the points of discharge. The rate is determined by seasonal and long-term variation in the rate of recharge to the fresh water lens. A decrease in recharge shrinks the lens and reduces the amount of water moving through it. This causes the transition zone to thicken.

However, under conditions of artificial pumping, the first factor (mixing rate) is likely to be the most variable factor. Artificial discharge from the lens, such as heavy pumping from a well that amounts to a considerable part of the total supply, causes marked changes in the system. The well intercepts water that formerly moved to the shore.

If the rate of withdrawal is constant, the transition zone can be expected to become thicker toward the coast, where velocities are reduced, and to become thinner inland, where velocities are increased. If pumping is intermittent, however, the resultant alternate thickening and thinning of the lens will increase the rate of mixing and cause the transition zone to thicken throughout the area influenced by the well. Refer to Figure A-15.

Rainfall above the 50-inch isohyet is the principal source of recharge to the fresh water aquifers on Oahu. In addition, the basal aquifer is recharged by return irrigation water in areas of sugar cane cultivation, except where irrigation takes place over caprock. Such irrigation water may consist of water from wells drilled within the basal aquifer, surface runoff diverted from streams, or high-level water transported from the Koolau Range via the Waiahole Ditch. Finally, water may flow from one aquifer to another and thus act as a source of recharge.



–Schematic diagram showing effect of pumping on the thickness of the transition zone.

FIGURE A-15

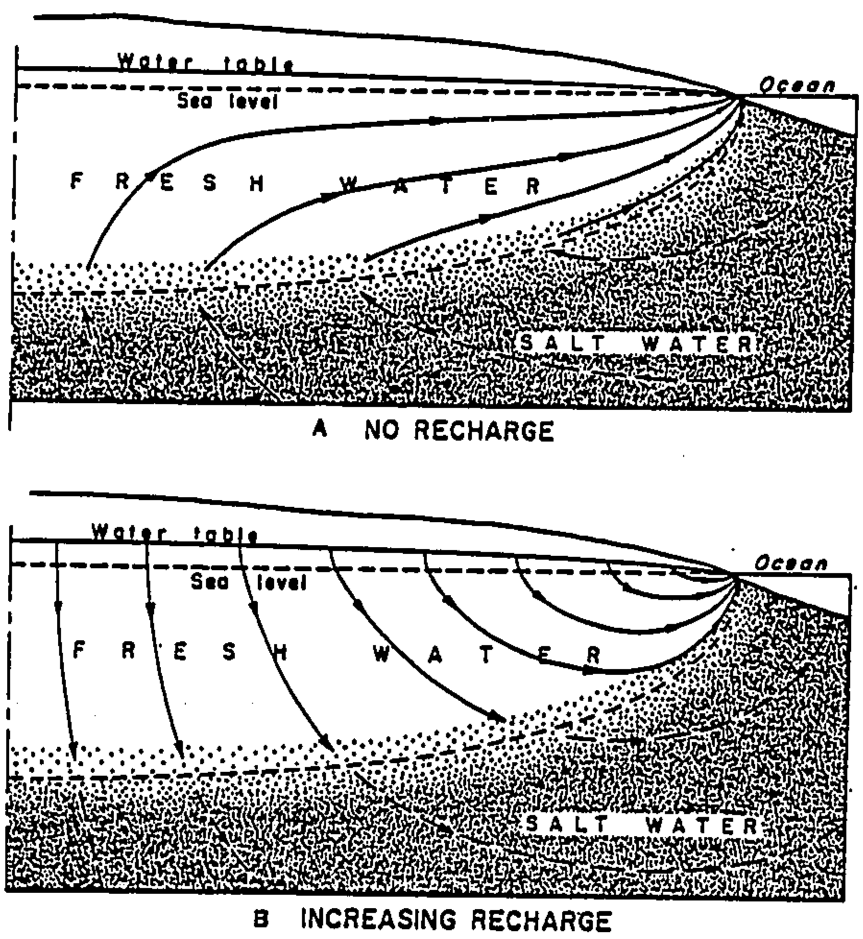
EFFECT OF PUMPING

SOURCE: (A.3)

Not all of the rainfall infiltrates into the ground water aquifers. On Oahu it is estimated that, in general, 36% of the rainfall on the island percolates to recharge the ground water aquifers, about 22% is lost to surface runoff and 41% is lost through evapotranspiration [A.14]. In areas of sugar cane irrigation, approximately one-half of the applied furrow irrigation water infiltrates to recharge the aquifer.

Changes in the rate of recharge greatly affect the height and depth of the fresh water body relative to sea level. Under conditions of no recharge of fresh water, the fresh water lens will decay as shown in Figure A-16a. As the lens decays, every unit decline in head, is accompanied by about a 40-fold upward movement of the transition zone. Conversely, an increase in the rate of recharge will cause a thickening of the fresh water lens and a seaward displacement of the salt water, as shown in Figure A-16b, if all other conditions remain the same.

In addition to the circulation of sea water produced by thickening and thinning of the fresh water lens, sea water also continually moves into the island, thus providing the salt water component of the transition zone that is discharged into the



CROSS-SECTION OF AN IDEALIZED ELONGATE ISLAND IN TWO DIFFERENT CONDITIONS:

A DECAYING LENS

B THICKENING LENS

SOURCE : (A.3)

FIGURE A-16

the island, thus providing the salt water component of the transition zone that is discharged into the fresh water at the margins of the island. Because of these factors, the height of the upper surface of the fresh water body relative to mean sea level is of value in determining the magnitude of changes in the thickness of the fresh water body under equilibrium conditions.

B. Pearl Harbor Aquifer

1. Boundary and Capacity

The Pearl Harbor basal aquifer is bounded on the south by the caprock of the Ewa Plain. The western boundary is abruptly terminated along a line passing up Makaiwa Gulch to the southern Waianae rift zone. Its northern boundary is the structural feature that impounds the Schofield high-level water body. The eastern boundary is delineated by the rift zone of the Koolau range. Refer to Figure 1-8.

It should be noted that in actuality, aquifers of all Southern Oahu from Manoa Valley to the Waianae Mountains and from the caprock wedge to the Koolau and Wahiawa high-level zones are hydraulically connected. In the preparation of hydrologic studies of Southern Oahu, arbitrary delineation of the Pearl Harbor aquifer, resembling the above boundaries has been used. As the boundaries are not standardized, comparisions of computed hydrologic budgets are difficult. Owing to uncertainties regarding the value of the storage coefficient, and the movement of the bottom of the fresh water lens, changes in storage cannot be determined with adequate precision.

Two recent studies provide an estimate of aquifer capacity. One, a joint effort of the U. S. Geological Survey and the State Division of Water and Land Development (Department of Land and Natural Resources), states that the area underlain by the fresh water lens is estimated to be 120 square miles and the storage coefficient is assumed to be 0.10 [A.15]. Thus, storage capacity is approximately 1500-2000 billion gallons. Another study, privately conducted by Sam Hirota, Inc. for Amfac, estimates the "existing lens volume" of the "Pearl Harbor Basin" at 1400 billion gallons.

The amount of storage is also indicated by the effects of pumping on head levels. The seasonal fluctuation may be as much as a third of the average head, indicating a substantial but apparently safe temporary annual depletion of storage [A.16]. Another indication of the magnitude of storage is the length of time required for water levels to adjust fully to long-term changes in rainfall. For example, the time lag is about 9 months in the main aquifer in southern Oahu [A.17].

2. Recharge

a. Rainfall

Rainfall in the Koolau Range is the principal source of the fresh basal ground water in southern Oahu. The Waianae Range, because of low rainfall, is an area of little recharge. In 1971 Hirashima determined the long-term annual average rainfall over 90 square miles of drainage area (PHGWCA minus the Schofield high-level water body and Ewa Plain) to be 83.3 inches, or 355 mgd [A.18]. Of this, 47 mgd, or 13%, was lost to direct runoff. The exact amount of infiltration or evapotranspiration was not calculated, however.

A recent study conducted by Sam Hirota, Inc. for Amfac concluded that rainfall in the PHGWCA, including the Schofield high level water body but minus Ewa Plain, averages 430 mgd [A.19]. Of this, it is asserted that 212 mgd (49%) is lost to evapotranspiration, 67 mgd (16%) is lost to surface runoff, and 151 mgd (35%) recharges the aquifer.

In summary, the general infiltration figure for Oahu (given on page A-35) is 36% and the Amfac study indicates 35% infiltration. Using the "inflow method" the BWS estimates that up to 20 mgd infiltrates in the Ewa area, 197 mgd infiltrates in the Pearl Harbor area, for a total recharge of 217 mgd from rainfall.

DLNR estimates rainfall recharge of 210 mgd over the entire PHGWCA [A.20]. In comparison, the USGS uses the "outflow method" to estimate rainfall recharge of the Pearl Harbor basal aquifer at 205 mgd [A.21].

b. Irrigation Water

Large amounts of water are applied to sugar cane fields overlying the basal aquifer in the PHGWCA. Because of the generally high permeability of the soils, approximately one-half of the furrow irrigation water applied infiltrates to recharge the aquifer.

Between 1974 and 1978, Oahu Sugar Company pumped an average of 128 mgd. In addition, 27 mgd was taken from Waiahole Ditch, for a total of about 155 mgd.

During this time, Oahu Sugar had 11,400 acres in furrow irrigation and 6,900 acres in drip irrigation [A.22]. Drip irrigation makes a negligible contribution to recharge (less than 20%).

It is generally agreed that of the total water applied, approximately 30 mgd of the pumped water and 15 mgd of the Waiahole Ditch water percolated to recharge the aquifer, for a total of 45 mgd.

c. Water from Adjacent Aquifers

The Pearl Harbor aquifer also receives recharge from adjacent aquifers or isopiestic areas. Two isopiestic areas east of the Pearl Harbor aquifer are considered to be tributary to the Pearl Harbor aquifer [A.23a], as is the Schofield high-level water body.

DLNR estimates that 15 mgd residual subsurface flow enters the Pearl Harbor aquifer from the east [A.20]. In 1976 Dale and Takasaki tentatively estimated that up to 115 mgd flows underground from the Schofield high-level water body to the Pearl Harbor basal aquifer [A.23b]. However, the BWS estimates this figure to be closer to 13 mgd at present.

d. <u>Summary</u>

The BWS estimates total recharge to the Pearl Harbor aquifer to be approximately 275 mgd, shown in Table A-4, and the USGS estimates it at 250 mgd. In comparison, DLNR estimates total recharge of the PHGWCA at 270 mgd.

3. <u>Discharge</u>

Ground water discharge includes withdrawals from wells and shafts, and to a lesser degree, coastal plain leakage. Most of the discharges from wells and shafts have been measured for many years. Where it occurs at distinct springs, leakage in the Pearl Harbor area has been measured, but diffuse seeps that occur in the Pearl Harbor area have not been measured.

TABLE A-4

ESTIMATED BASAL AQUIFER RECHARGE
PEARL HARBOR GROUND WATER CONTROL AREA

Source	Estimated Recharge (mgd)		
	BWS	DLNR*	USGS
Rainfall	217	210	205
Furrow irrigation	45	45	45
Subsurface flow from east	-	15	-
Subsurface flow from north	13	-	-
	275	270	250

* For entire PHGWCA, not just basal aquifer.

a. Withdrawals

Ground water withdrawals from the PHGWCA from 1970 to 1978 are shown in Table A-5. Of the BWS total for 1978, it is estimated that 22.01 mgd served the Pearl Harbor and Ewa areas, 7.1 mgd served the Wahiawa area, 4.0 mgd was exported to Waianae, and 42.41 mgd was exported to Honolulu. Approximately 61% of the water withdrawn from the area was thus exported. Between 1974 and 1978, the BWS estimates that approximately 226 mgd was taken annually from the PHGWCA. Of this, approximately 11 mgd was from the Schofield high-level water body and 215 mgd was taken from the Pearl Harbor aquifer.

b. Spring Flow

Where basal water is not confined by caprock, the normal discharge into the sea is along the shore at or slightly below sea level. This flow is diffuse and cannot be accurately measured in many locations. In southern Oahu the seaward flow of the water is blocked by caprock, but some discharge takes place over the top or into the caprock. Only the discharge above

TABLE A-5

GROUND WATER WITHDRAWAL IN MGD
PEARL HARBOR GROUND WATER CONTROL AREA
1970-1978

	1970	1971	1972	1973	1974	1975	1976	1977	1978
BWS									
Local Use	20.56	21.21	22.00	26.23	24.52	30.25	29.76	29.50	29.11
Export to Waianae	2.00	2.00	3.00	3.00	3.00	3.00	4.00	4.00	4.00
Export to Honolulu	13.46	26.20	31.28	33.60	34.07	31.83	39.68	40.41	42.41
TOTAL	36.02	49.41	56.28	62.83	61.59	65.08	72.47	73.91	75.52
SUGAR PLANTATION									
Oahu Sugar (1)	66.78	62.84	61.01	61.29	39.74	49.93	55.46	61.89	63.18
Ewa Plantation (2)	87.28	84.84	78.21	81.36	71.23	69.39	77.62	81.95	69.36
TOTAL	154.06	147.68	139.22	142.65	110.97	119.32	133.08	143.84	132.54
NAVY									
TOTAL	25.43	19.45	21.39	23.43	21.74	23.11	23.32	17.59	12.24
ARMY									
TOTAL	5.06	4.63	5.50	5.89	5.20	5.58	4.70	4.75	4.37
PRIVATE (3)									
TOTAL	2.00	1.70	1.70	3.50	3.50	4.50	4.50	4.70	3.50
GRAND TOTAL	222.57	222.87	224.09	238.30	203.00	217.59	238.07	244.79	228.17

(1) Exclude Waiahole Tunnel & Ditch and Waikele Stream & Springs.
(2) Exclude Shallow Caprock Wells.
(3) Exclude H.E.Co. Tunnel, Watercress Wells and Spring.

Source: [A.24]

sea level at springs flowing over the top or through openings in the caprock can be readily observed and studied.

Natural discharge from the Pearl Harbor aquifer portion of the PHGWCA is: (1) via springs fringing Pearl Harbor; and (2) in the Ewa portion, west of the Koolau-Waianae unconformity, is unseen and probably seeps through the caprock below sea level [A.25].

The present zone of active discharge includes the five major Pearl Harbor springs at Kalauao, Waiau, Waimano, Waiawa, and Waikele. The largest measurable ground water flow occurs in these areas, but ground water also escapes along the shore in the intervals between the major springs and in the channels of streams that are cut below the basal water level.

Spring discharge estimated by the USGS from 1970 to 1978 is shown in Table A-6.

c. Summary

Artificial withdrawal and natural spring discharge from the Pearl Harbor aquifer total 264-275 mgd, based on estimates shown in Table A-7. (Compare with Table A-4.)

TABLE A-6

ESTIMATED PEARL HARBOR SPRINGS DISCHARGE IN MGD
PEARL HARBOR GROUND WATER CONTROL AREA
1970-1977

Year	Average Amount
1970	67
1971	80
1972	66
1973	52
1974	67
1975	67
1976	56
1977	50

Source: [A.28]

TABLE A-7

BASAL AQUIFER DISCHARGE
PEARL HARBOR GROUND WATER CONTROL AREA

	Estimated Discharge (mgd)		
	BWS	DLNR	USGS
Wells and Shafts	215[1]	214[2]	220[3]
Free flow and leakage	55[4]	50	55[5]
Pearl Harbor Springs	(25)	(25)[6]	
Other	(30)	(25)	
	270	264	275

(1) Average 1974-1978, excluding pumpage from Schofield high-level aquifer [A.24].

(2) Average 1975-1979, excluding pumpage from Schofield high-level aquifer [A.26a]. To facilitate comparison with Table A-4, add 11 mgd pumpage from the Schofield aquifer to this figure to obtain discharge for the entire PHGWCA (275 mgd).

(3) Average 1970-1975, excluding pumpage from Schofield high-level aquifer [A.5] and including 1 mgd pumpage from Pearl Harbor Springs [A.21].

(4) Includes 12 mgd pumpage for cane irrigation.

(5) Average 1970-1975 [A.5].

(6) 1977; includes 1 mgd pumpage from Pearl Harbor Springs [A.20], p. 17.

Using the "inflow method," BWS and DLNR estimate an excess of about 5 mgd and a deficit of about 5 mgd, respectively. Using the "outflow method," USGS estimates a deficit of 25 mgd. Utilizing the more conservative USGS calculations, the DLNR concluded that 225 mgd is the mean maximum yield that may be normally pumped from the PHGWCA without impairing spring discharges. This decision considered the fact that increased conversion from furrow irrigation to drip irrigation would decrease recharge to the aquifer from irrigation return.

4. Long-term Trends in the Aquifer

a. Storage

Based on the aquifer area and storage coefficient given on page A-38, a recent government study suggests that the water volume withdrawn from Pearl Harbor aquifer storage between 1910 and 1977 was approximately 9.3 billion gallons per year, or an average of 25 mgd [A.26b].

Results from the Amfac study, on the other hand, postulate that storage is decreasing by approximately 7 billion gallons per year, or 19 mgd [A.27].

b. Basal Water Head

In general, heads in the Pearl Harbor aquifer have been declining since the 1880's. Of five wells located within one-half mile of the shore of Pearl Harbor and monitored from 1910 to 1979, all exhibited a long-term decline in head [A.29]. Rates of decline varied from 0.06 to 0.14 feet per year and averaged about 0.09 feet per year. This implies that the fresh water lens has thinned at a rate of 3.7 feet per year, or 41 times the average head decline of 0.09 foot [A.30]*.

Basal water head contours represent the surface to which the basal water would rise if tapped by a well. Contours based on measurements taken in 1958, 1967, and

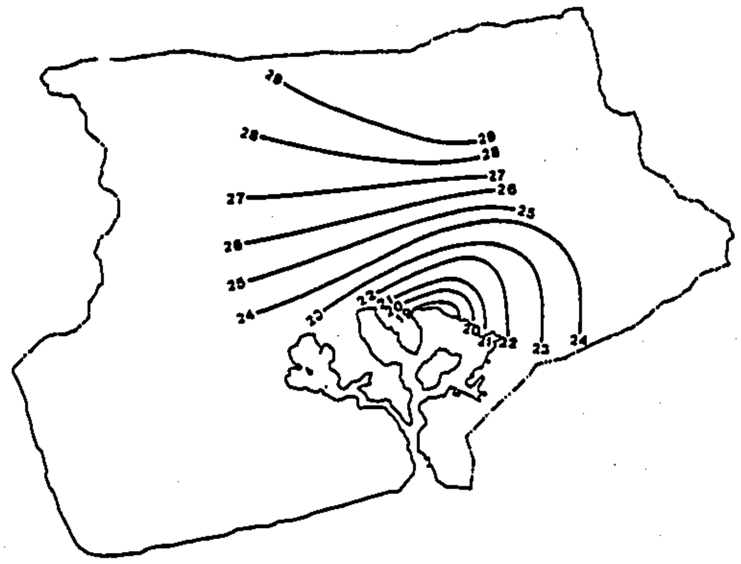
* It should be noted, however, that these data and conclusions largely pertain to operational or drawdown heads, as the monitor wells are influenced by the production wells around them. The May 31, 1958 measurements were taken at the end of a 4-month period when no water was pumped for irrigation (due to a strike) and these data

1978 indicate that head dropped evenly throughout the area, so that the pattern and gradient are generally unchanged [A.31]. Refer to Figures A-17 to A-18.

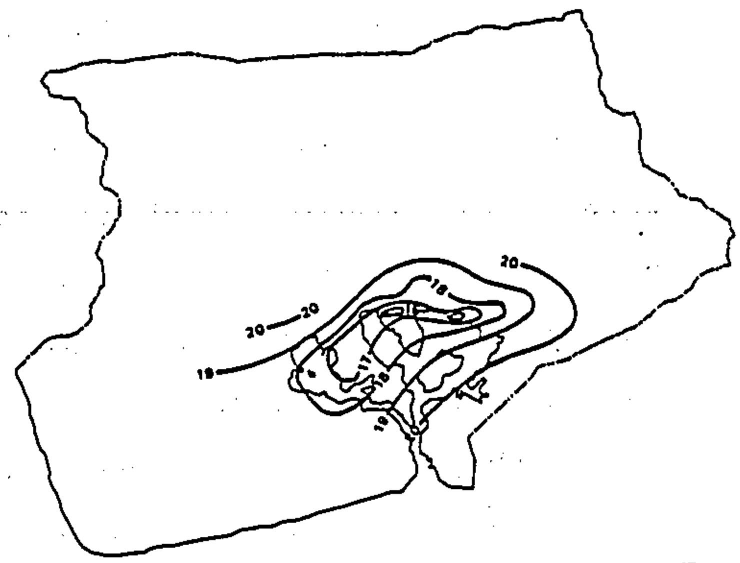
c. <u>Chloride Content</u>

The chloride concentration of the water from any particular well, shaft, or spring in the Pearl Harbor aquifer is often dependent upon: (1) the quality of recharging water; (2) the rate of discharge of the well and nearby wells; and (3) the position and depth of the wells relative to the fresh, brackish transition, and saline zones.

The chloride content of recharging water from Waiahole Ditch is less than 20 ppm, whereas recharge water from the wells ranges from less than 250 ppm to perhaps as much as 800 ppm [A.32]. Annual means of monthly chloride concentrations from long-term records of four wells within one-half mile of Pearl Harbor and one well field near Makakilo have been graphed and results vary [A.33].



BASAL-WATER HEAD CONTOURS BASED ON MEASUREMENTS ON MAY 31, 1958, FROM VISHER AND MINK, 1964.



BASAL-WATER HEAD CONTOURS BASED ON MEASUREMENTS ON MAY 2, 1967, FROM DALE AND EWART, 1971.

EXPLANATION

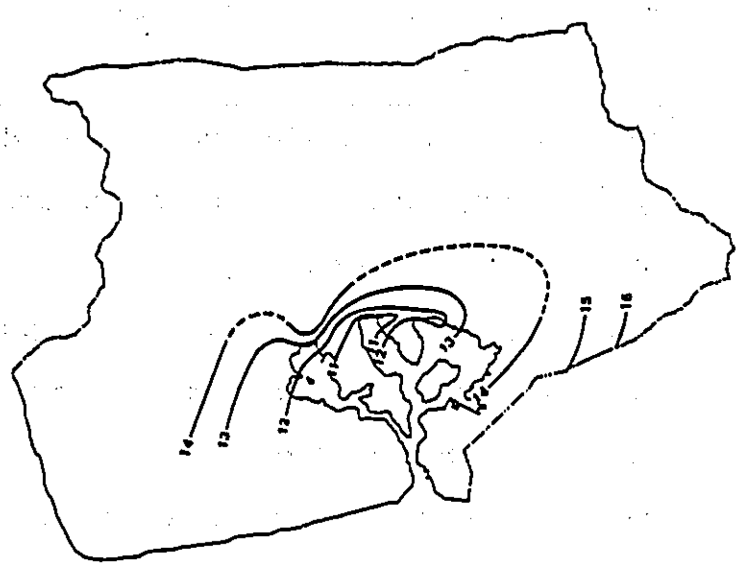
15 Ground-water head contour in feet, above mean sea level, dashed where uncertain.

FIGURE A-17

BASAL WATER HEAD CONTOURS

SOURCE: (A.5)

BASAL-WATER HEAD CONTOURS BASED ON MEASUREMENTS ON JANUARY 11, 1978.



BASAL-WATER HEAD CONTOURS BASED ON MEASUREMENTS ON AUGUST 9, 1978.

EXPLANATION

16 Ground-water head contour in feet, above mean sea level, dashed where uncertain.

SOURCE:(A.5)

FIGURE A-18

BASAL WATER HEAD CONTOURS

Graphs from the wells near Waipahu and Honouliuli indicate no significant trends. However, the long-term chloride record of the wells near Pearl City and Waiau show a general increase since the 1940's. This probably reflects: (1) a thinning of the basal lens; and (2) a thickening or migration inland of the brackish transition zone.

d. <u>Rainfall/Infiltration</u>

Annual and seasonal variations in precipitation will affect the quantity of water available at any time. Extensive rainfall records have been maintained over the years, and while "wet" and "dry" cylces may occur, they cannot be predicted with any useful certainty [A.34]. During a drought, more water will be pumped from ground water sources than would even be normally replenished by rainfall or surface water. This need to rely on ground water not only reduces the amount of accumulated storage, but there also may be long-term effects on the water supply.

e. Discharge

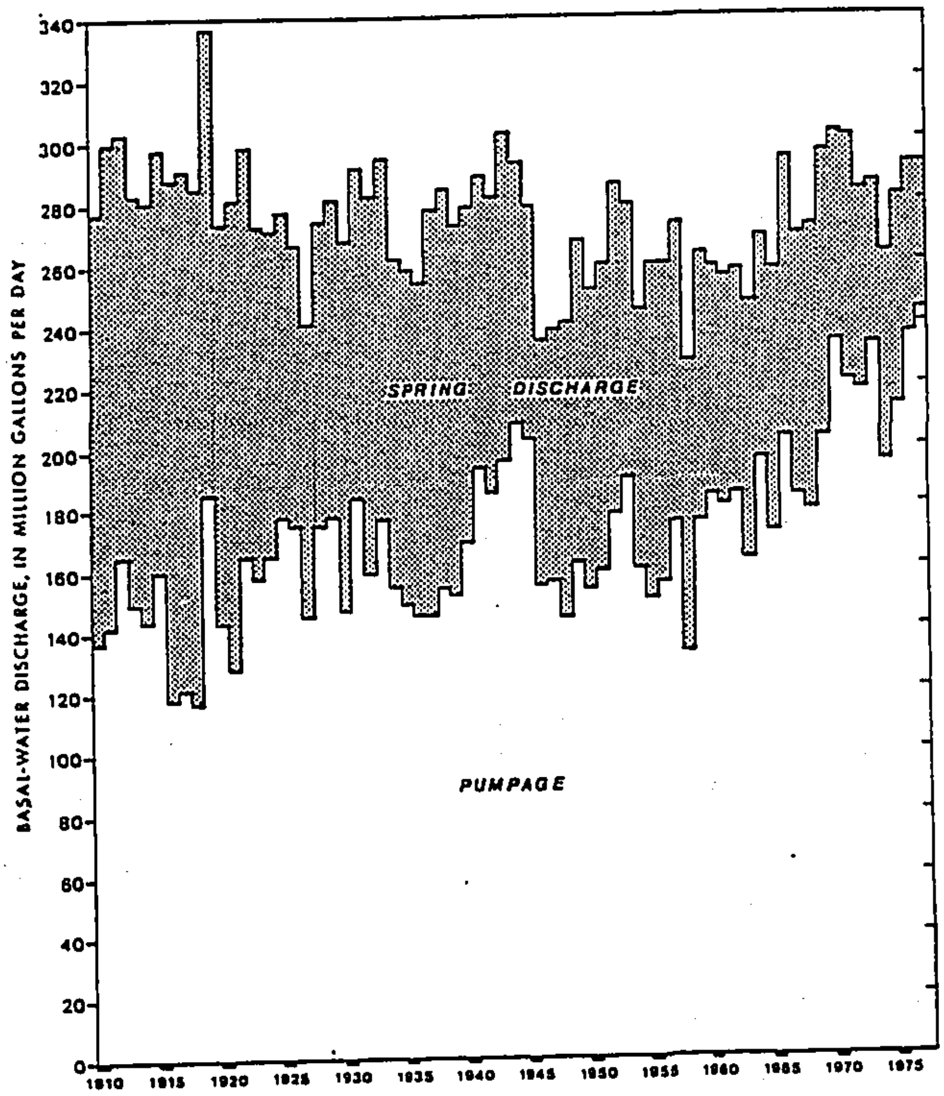
Total annual discharge from the Pearl Harbor aquifer has been steady since 1910, averaging about 275 mgd (per the USGS, Table A-7). However, withdrawals from wells have increased from 140 mgd in 1910 to 240 mgd in 1977, and spring discharge has decreased from 140 mgd in 1910 to 50 mgd in 1977 [A.35]. Refer to Figure A-19. Dividing the Pearl Harbor aquifer into four sub-areas, a government study revealed that pumpage from the Aiea and Waipahu sub-areas has not changed significantly since 1910 [A.36]. Refer to Figure A-20. Pumpage from the Ewa sub-area has shown a slow and steady increase, and pumpage from the Pearl City sub-area has shown a 5-fold increase since about 1950.

IV. DEMAND VERSUS SUPPLY

A. Existing

Within the PHGWCA existing demand may be summarized as follows:

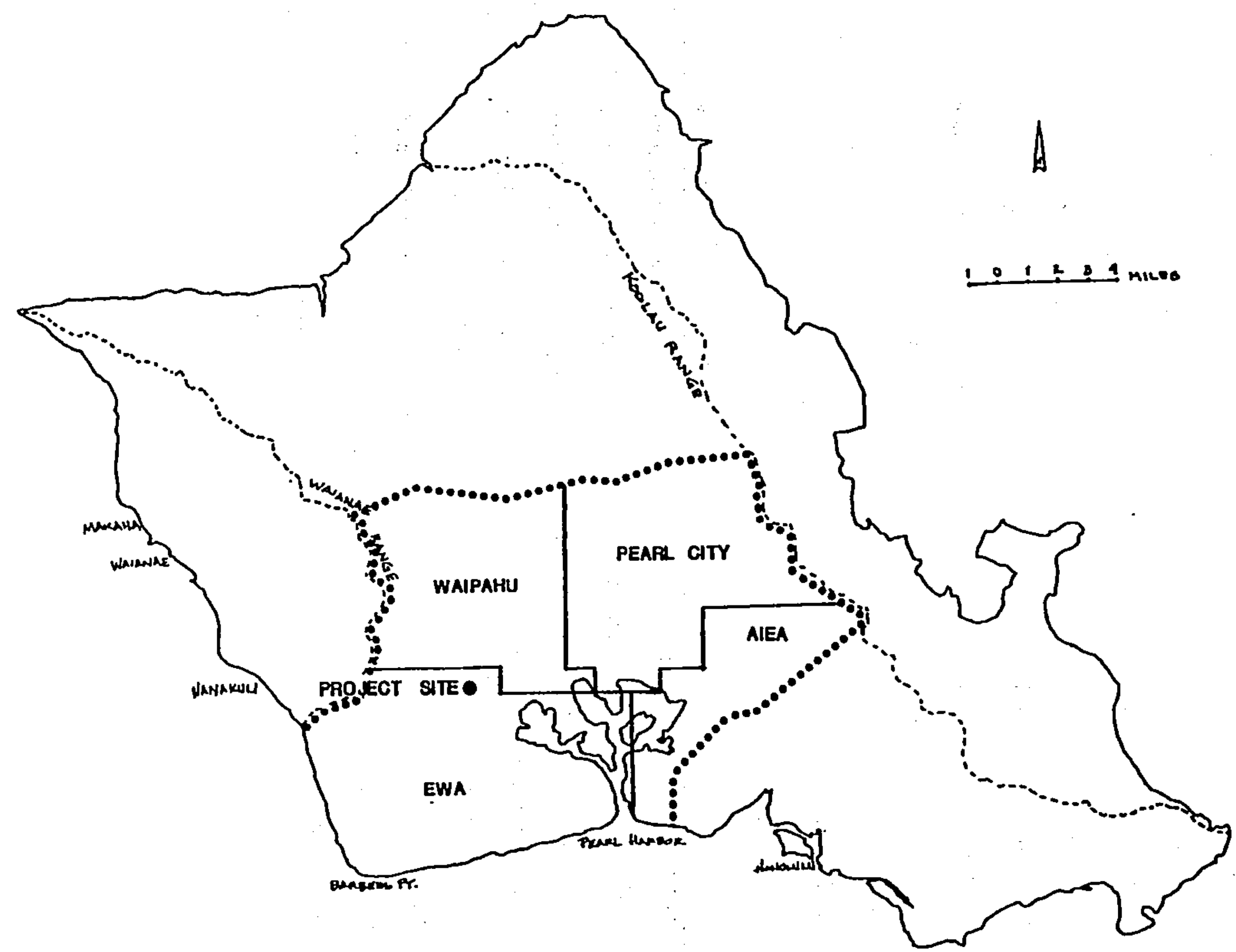
Land Use	1978 Withdrawal (mgd)
Urban (BWS)	75.5
Agriculture (Sugar)	132.5
Military	16.6
Other (Private)	3.5
	228.1



PEARL HARBOR AQUIFER TOTAL DISCHARGE, 1910-1977

FIGURE A-19

SOURCE: (A.5)



SOURCE: (A.5)

FIGURE A-20
PEARL HARBOR AQUIFER SUB-AREAS

(Refer to Table A-5 for a more detailed breakdown.) Major wells within the Pearl Harbor aquifer are shown in Figure A-21.

Sustainable capacity of the aquifers within the PHGWCA is estimated to be 200-245 mgd for the Pearl Harbor aquifer and is not applicable for the Schofield high-level water body. Refer to Figure A-22.

Sustainable capacity for the island of Oahu is estimated at 480-630 mgd [A.37]. Total water use on Oahu (pumpage plus surface water) in 1975 was 470 mgd. Refer to Table A-8. Thus, water use in the PHGWCA and island-wide is approaching sustainable yield of the ground water sources.

B. <u>Future</u>

Based on the BWS Domestic Consumption Guidelines (Table A-9), water demand of major proposed developments in the PHGWCA is shown in Table A-10. The approximate locations of these developments are shown in Figure A-23. Adding this additional future demand of 27± mgd to the 1978 pumpage rate of 228 mgd will result in a total demand of approximately 255 mgd in the PHGWCA by the year 2000. (Demand for sugar operations is anticipated to remain as is.)

Thus, demand will theoretically exceed maximum estimated sustainable yield in the PHGWCA by 10 ±

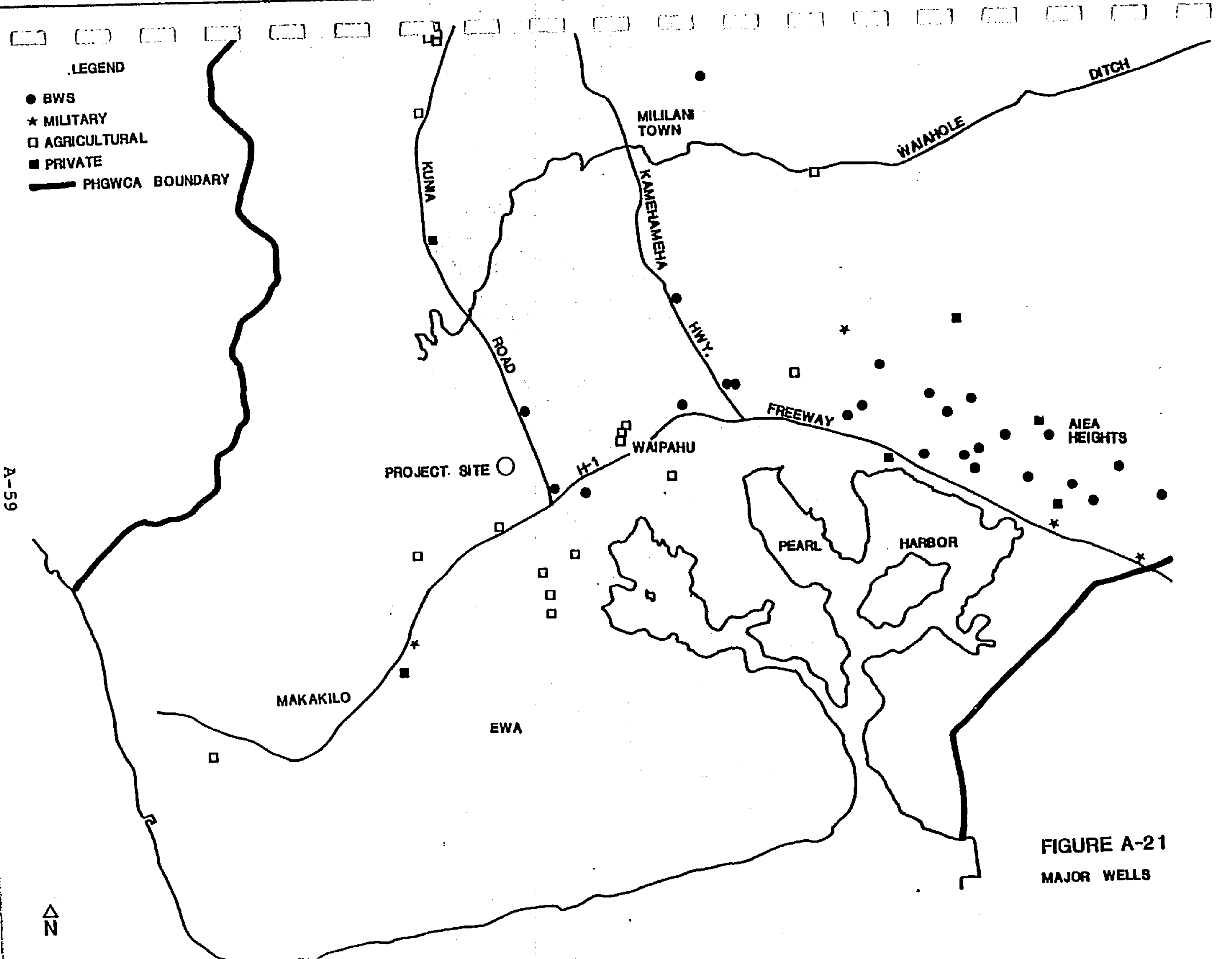
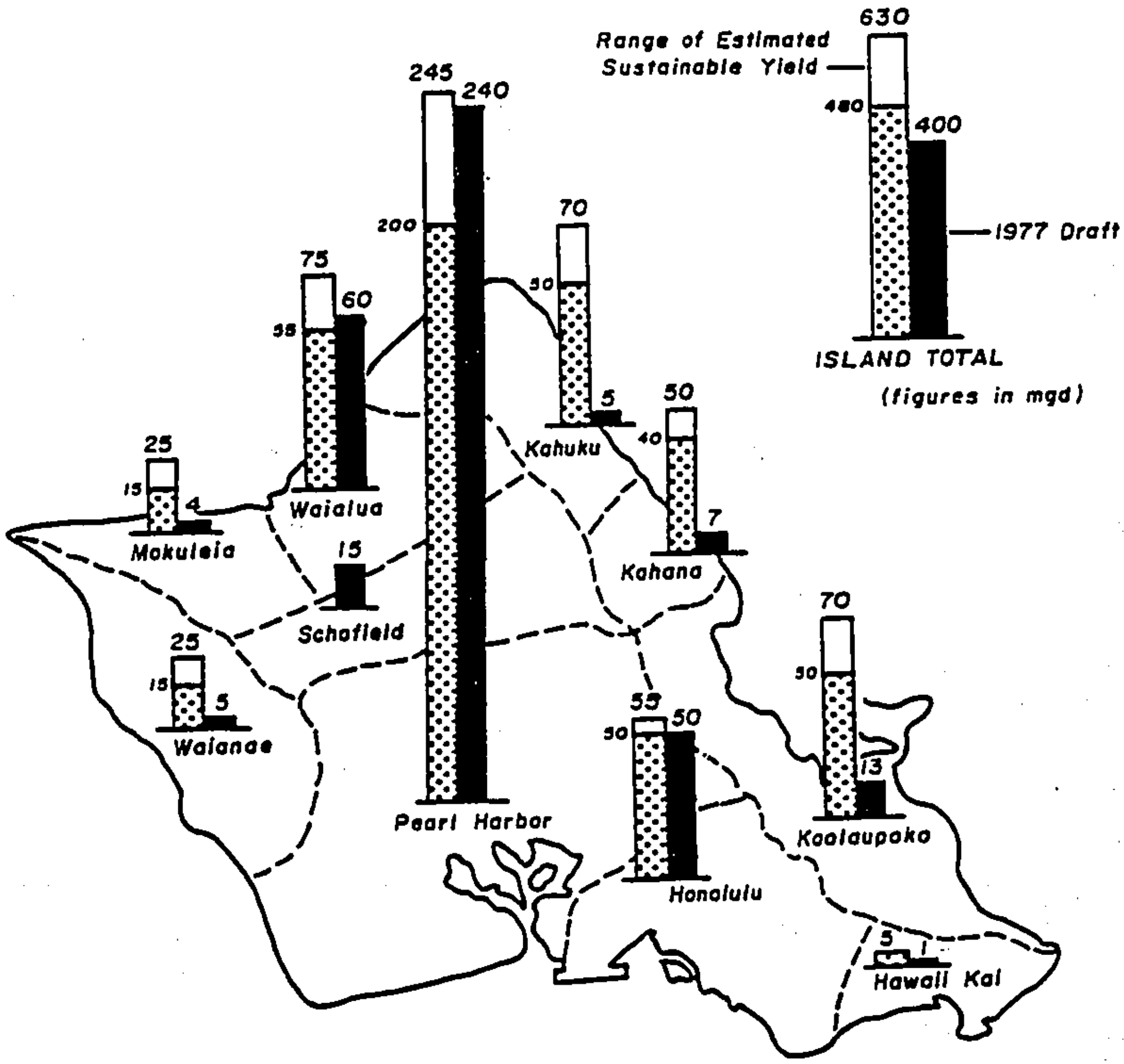


FIGURE A-21
MAJOR WELLS



ESTIMATED SUSTAINABLE YIELD OF GROUND WATER ON OAHU

SOURCE: (A.37)

FIGURE A-22

TABLE A-8

TOTAL WATER DEMAND
OAHU, 1975

Water Use	Amount (mgd)(3)
Municipal	
Board of Water Supply	130
Others	5
Industrial (1)	50
Agricultural	
Sugar cane	240
Diversified crops	5
Military (2)	40
	470

(1) Self-supplied.
(2) Includes municipal use.
(3) Groundwater, surface water, springs, and caprock sources.

Source: [A.38]

TABLE A-9

DOMESTIC CONSUMPTION GUIDELINE

Zoning	Average Daily Demand
Residential	
1. Single Family - or duplex	500 gal/unit 2500 gal/acre
2. Multi-family low rise	400 gal/unit 4000 gal/acre
3. Multi-family high rise	300 gal/unit 3000 gal/acre
Commercial	
Commercial/Industrial mix	100 gal/1000 sq. ft.
Commercial/Residential mix	120 gal/1000 sq. ft.
Resort	350 gal/unit 4000 gal/acre
Light Industry	4000 gal/acre
Schools, Parks	4000 gal/acre 60 gal/student

The guidelines for water consumption may be revised by the Manager based on variable factors that influence water consumption rates to insure an adequate system.

Source: BWS Water System Standards, March 1977.

TABLE A-10

WATER CONSUMPTION OF
MAJOR PROPOSED DEVELOPMENTS[1/]
PHGWCA, OAHU, HAWAII

Location/Proposal	Type of Development	Estimated Completion Date	Acreage	Dwelling Units	Estimated Consumption (mgd)[2/]
Waipahu-Crestview					
Village Park3/	Housing	1985	316	1,745	0.94
Ewa-Makakilo					
Makakilo3/	Housing	1995	373	3,693	1.90
West Beach	Housing	2000	640	1,680	4.5 Potable +
West Beach	Resort	1995		7,520	1.0 Irrigation
Campbell Industrial Park3/	Employment	2000	1,486	-	7.78
Honouliuli WWTP	Utility	1982	51	-	-
Barbers Point Deep Water Harbor	Port Employment	2000	330	-	0.06 (Phase I)
West Oahu College	Education	NA	200	-	0.80
Ewa Marina Community	Recreation & Housing	1990	1,098	7,200	3.65
Ewa Newtown	Housing	NA	200	NA	0.50
HPOWER	Solid Waste Recovery	NA	NA	-	0.20
Pearl Harbor - Wahiawa					
Gentry/Waipio3/	Housing Employment	1985 1985	510	3,700	1.05
Waiawa Ridge	Housing	NA	1,300	NA	3.25
Waiawa Industrial Park	Employment	NA	63	-	0.25
Mililani Town[3/]	Housing	NA	476	NA	1.19
Royal Summit[3/]	Housing	1985	138	600	0.30
				TOTAL	27.37(+)

NA Not Available
1/ Potential projects, not necessarily approved.
2/ Water consumption estimates based on BWS Consumption Guideline (Table A-8) and proposed land use for each development.
3/ Developments that have received full or partial water commitments.

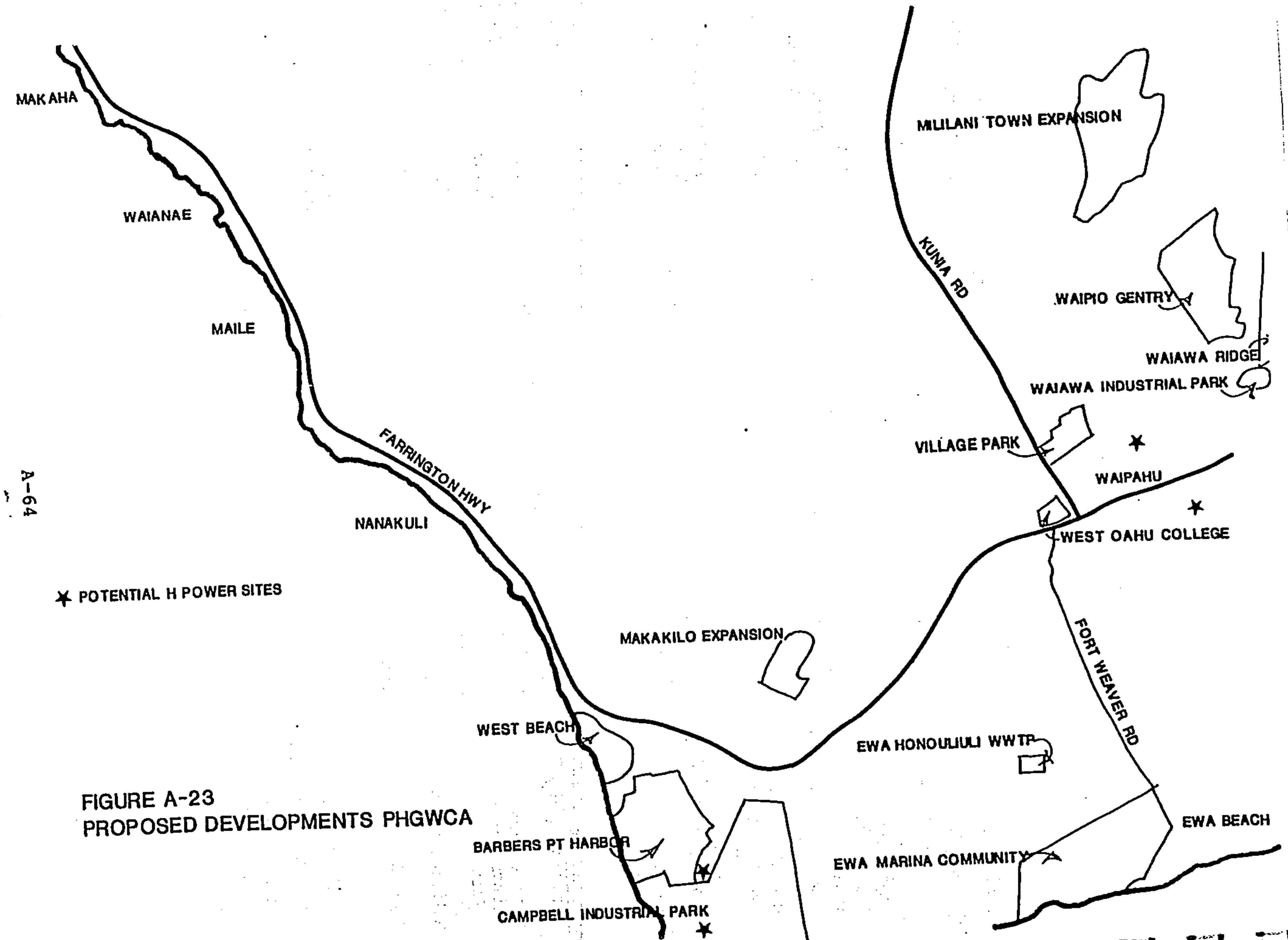


FIGURE A-23
PROPOSED DEVELOPMENTS PHGWCA

mgd. However, since approximately 44 mgd is presently exported to the Honolulu and Waianae areas, demand could be met by the existing supply if alternate water sources could be developed for the areas presently served by export, as well as within the PHGWCA.

A number of alternatives are possible. They include:

1. New Water Sources

Presently, studies are underway to determine the feasibility of developing new water sources in the Waianae region, for example. It is anticipated that 6 mgd of water may be available in Makaha and Waianae valleys. If so, then export from the PHGWCA could be reduced by up to 6 mgd. Other alternative water sources, including water exchange and desalinization, are discussed in Section 6 of this EIS.

2. Conservation

One way in which projected demand could be reduced, rather than "met", would be to enforce across-the-board conservation policies. It has been estimated that potential reduction of about 35 mgd in projected demand on Oahu could be achieved by holding per capita water consumption at 1975 levels [A.39]. If per capita consumption could be reduced by 25% under 1975 levels, most existing domestic water systems would be adequate with minor additions through the year 2000 [A.40]. Methods of achieving conservation are discussed in Section 4 of this EIS.

An example of how a large conservation effort might be carried out is presented below, along with potential impacts on municipal wastewater treatment facilities [A.41]:

> A comprehensive environmental management plan for the San Francisco Bay Area was recently completed by the Association of Bay Area Governments, an association of nine California counties. The plan included a recommendation that a "moderate level" of water conservation be implemented throughout the region.
>
> A moderate conservation program was defined as one that emphasized retrofit of water-saving devices in existing structures, and building in water-saving devices in new structures. Shower flow restrictors and toilet tank volume displacement bottles would be installed in existing homes.

New homes would be fitted with low-flow shower heads, low flush-volume toilets, faucet flow controls with mixers, shower cutoff valves, pressure regulators, and hot water pipe insulation. In California, State legislation already exists requiring the installation of low flush-volume toilets in new construction.

It was estimated that retrofit of water-saving devices in existing homes would save about 9 gallons per capita per day. However, it was expected that if the devices were distributed to homeowners without charge, but installation was voluntary, they would only be installed in 15-30% of the homes. Thus, the actual average saving in existing homes would be 1.7 gallons per capita per day.

It was assumed that all new structures would be fitted with water-saving devices, with an expected water savings of 16.6 gallons per capita per day. In addition to the savings resulting from installation of devices, it was estimated that a further overall saving of 5% would result from informational programs designed to increase public awareness of the need for conservation.

It was anticipated that implementation of the program described above would reduce water demand in the Bay Area by about 160 mgd by the year 2000 (this assumed regional population growth from 4.6 million in 1975 to 6.1 million in the year 2000). It was also realized that if this were true, there would be a decrease in the projected flow of municipal wastewater. This impact of conservation was also studied.

Results of a theoretical analysis of the effects of water conservation on existing wastewater facilities led to the conclusion that, within the expected range of water saving (10-20%), effects would be fairly minor. Conservation-induced flow variations would be relatively small compared to variations caused by other factors. In general, it appears that water conservation programs would not cause any major problems at existing plants and might actually improve performance and extend the time to reach design capacity.

Results also indicated that the capital cost of a new facility designed to treat wastewater for a 10-year period, assuming implementation of a water savings program, would be less than for a similar facility assuming no water saving. Operation costs would also be slightly less. It should be noted, however, that if wet-weather flows far exceed dry-weather flows, the need to provide hydraulic capacity for those large flows would eliminate the opportunity for cost savings.

Conception and implementation of a conservation program of this magnitude on Oahu would probably require an initial decision as to which level of government would have jurisdiction, as well as which agency should become the lead agency.

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[A.17] Op. Cit. [A.3], p. 45.

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[A.21] Ibid. [A.20], p. 13.

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[A.27] Op. Cit. [A.6]

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[A.32] Op. Cit. [A.5], sheet 2.

[A.33] Op. Cit. [A.5], sheet 2.

[A.34] Hawaii Institute for Management and Analysis in Government. January, 1979. Land and Water Resource Management in Hawaii. Prepared for Hawaii State Department of Budget and Finance. p.73.

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APPENDIX B

GLOSSARY

APPENDIX B

GLOSSARY

1. Alkalic Basalt: Lava rock rich in the alkalic elements of sodium and potassium and undersaturated in silica.
2. Aquifer: A saturated underground body of rock or similar material capable of storing water and transmitting it to wells or springs.
3. Caprock: Relatively impermeable soil and alluvial deposits with some marine sediment, including poorly sorted gravel, sand and silt washed down from the mountains.
4. Class 2 Waters: Waters which are used for recreational purposes, propagation of fish and other aquatic life, and agricultural and industrial water supplies.
5. Cone of Depression: The area in the aquifer around a well from which water has been removed by pumping.
6. Discharge: This term refers to both pumpage of ground water and natural free flow of ground water from the aquifer (springs, tunnels, and seepage).
7. Draft: Discharge or pumpage from a well or shaft.
8. Drawdown: The distance from the original water surface to the lowered surface of water in a well, due to pumping.
9. Ground Water: Water that occurs beneath the land surface and completely fills all pore spaces of the rock material in which it occurs.

10. <u>Head</u>: The elevation of the water table above sea level.

11. <u>Inflow Method</u>: A method used to derive ground water recharge whereby <u>natural</u> recharge is computed by subtracting direct surface runoff and evapotranspiration from inflow (rainfall and subsurface flows). This method is also known as a hydrologic budget. Adding irrigation return to the computed natural recharge yields total recharge.

12. <u>Isopiestic Area</u>: An area characterized as having an artesian head higher or lower than that in adjacent areas. In the vicinity of Honolulu, such areas are separated by relatively impermeable natural fill extending far below sea level in ancient valleys.

13. <u>Maximum Capacity</u>: This refers to the maximum capacity of the well pumps. A maximum capacity of 12 mgd means that if the pump were to be operated for 24 hours, the maximum water that could be withdrawn would be 12 mg.

14. <u>Outflow Method</u>: A method used to derive ground water recharge whereby <u>total</u> recharge (the sum of natural and artificial recharge) is equal to the total discharge less the amount of water taken from storage. Subtracting irrigation return from the computed total recharge yields natural recharge.

15. Pumpage: Forcible outflow pumped from a water source; artificial discharge.

16. Recharge: Rainfall or other water which infiltrates the earth and replenishes ground water bodies.

17. Sustainable Capacity (Sustainable Yield): This refers to the rate at which water may be withdrawn from a well without causing any degradation of water quality or quantity within the aquifer. This term is also used to refer to the combined impact of several wells or water sources on the entire aquifer of an area.

18. Tholeiitic Basalt: Lava rock saturated in silica and relatively low in the alkalic elements (of sodium and potassium).

19. Unconformity: A surface of separation between two rock outcrops or groups of rocks, marking a period of nondeposition and/or erosion.

20. Water Table: The upper limit of the fresh water basal lens.

APPENDIX C

SURFACE FLOW RECHARGE

APPENDIX C

SURFACE FLOW RECHARGE

A recent study suggests that surface flow from the streams into the Pearl Harbor area could be diverted through recharge areas [C.1]. The following discussion is taken from that study:

Average annual direct runoff from the 90-square mile Pearl Harbor area is 47.27 mgd. Natural recharge is greatest in the uplands, where average direct annual runoff in streams in the 800 and 400 foot altitudes is 29 and 38 mgd, respectively. Because streams are flashy and have a wide range of recharge, only 60% of the average annual runoff can be economically diverted through ditches to recharge areas, or 28.36 mgd. The diversion may be increased slightly if reservoirs are used in conjunction with ditches to temporarily detain flows in excess of ditch capacity. Practical tests are needed to determine the advantages and disadvantages of different types of recharge structures, such as a reservoir or basin, large diameter deep shafts, deep wells, or combinations of all these structures.

One problem with this scheme is the sediment load carried by the surface waters. High flows must be used if recharge is to be effective, but flows must not be so high as to cause clogging of recharge facilities with sediment or woodland debris.

Another problem involves water quality. Diversion of water from a stream may prevent the water quality in the stream from meeting State water quality standards. Application of minimum flow standards to streams, which would effectively restrict diversion of stream waters, may be necessary and desirable to protect water quality [C.2].

REFERENCES

[C.1] Hirashima, G. T. 1971. Availability of Stream Flow for Recharge of the Basal Aquifer in the Pearl Harbor Area, Hawaii. U.S.G.S. Water - Supply Paper 1999-B. Prepared in cooperation with the Board of Water Supply, City and County of Honolulu. U.S. Government Printing Office, Washington, D.C.

[C.2] Department of Health. 1978. Water Quality Management Plan for the City and County of Honolulu, Volume 1. State of Hawaii, Department of Health, Honolulu, Hawaii.

APPENDIX D

WATER QUALITY STANDARDS

APPENDIX D

WATER QUALITY STANDARDS*

"4. Basic Water Quality Criteria Applicable to All Waters

All water shall be free of substances attributable to domestic, industrial, or other controllable sources of pollutants and subject to verification by monitoring as may be prescribed by the Director of Health, as follows:

(A) Materials that will settle to form objectionable sludge or bottom deposits.

(B) Floating debris, oil, grease, scum, or other floating materials.

(C) Substances in amounts sufficient to produce taste or odor in the water or detectable off flavor in the flesh of fish, or in amounts sufficient to produce objectionable color, turbidity, or other conditions in the receiving waters.

(D) High temperatures; biocides; pathogenic organisms; toxic, radioactive, corrosive, or other deleterious substances at levels or in combinations sufficient to be toxic or harmful to human, animal, plant, or aquatic life, or in amounts sufficient to interfere with any beneficial use of the water. To identify the actual or potential effects of a discharge, as a minimum, a phytoplankton bioassay test or a 96-hour bioassay or both shall be required. The methods and test parameters shall be specified by the Director according to established procedures in Section 9 of this Chapter, provided that modifications may be prescribed to meet conditions specific to the disposal situation. Survival of test organisms shall not be less than that in controls which utilize appropriate experimental

* Public Health Regulations 37-A, Department of Health, State of Hawaii. These are the new water quality standards, which went into effect on December 7, 1979.

water. Field monitoring may be further required to insure conformance with this standard as long as a discharge or a suspected discharge is occurring.

(E) Substances or conditions or combinations thereof in concentrations which produce undesirable aquatic life.

(F) Soil particles resulting from erosion on land involved in earthwork, such as the construction of public works; highways; subdivisions; recreational, commercial or industrial developments; or the cultivation and management of agricultural lands. This standard shall be deemed met upon a showing that the land on which the erosion occurred or is occurring is being managed in accordance with soil and water conservation district and the Director of Health, and that a comprehensive conservation program is being actively pursued, or that the discharge has received the best degree of treatment or control, and that the severity of impact of the residual soil reaching the recieving body of water is deemed to be acceptable."

"5.3 Criteria

(B.) Streams

(1) Water Column Criteria for Streams

Parameter	Geometric mean not to exceed the given value	Not to exceed the given value more than 10% of the time	Not to exceed the given value
Total Kjedahl Nitrogen (ug N/l)	250.0*	520.0*	800.0*
	180.0**	380.0**	600.0**
Nitrate + Nitrate Nitrogen (ug (NO_3 + NO_2-N/l)	70.0*	180.0*	300.0*
	30.0**	90.0**	170.0**
Total Phosphorus (ug P/l)	50.0*	100.0*	150.0*
	30.0**	60.0**	80.0**

Total Non-filterable Residue (ug/l)	20,000.0*	50,000.0*	80,000.0*
	10,000.0**	30,000.0**	55,000.0**
Turbidity (Nephelometric Turbidity Units)	5.0*	15.0*	25.0*
	2.0**	5.5**	10.0**

* Wet Season - November 1 through April 30.

** Dry Season - May 1 through October 31.

pH Units shall not deviate more than 0.5 units from ambient conditions and shall not be lower than 5.5 nor higher than 8.0.

Dissolved Oxygen - Not less than 80% saturation.

Temperature - Shall not vary more than 1°C from ambient conditions.

Specific Conductance - Not more than 300 micromhos/cm.

(2) Bottom Criteria For Streams

(a) Episodic deposits of flood-borne soil sediment shall not occur in quantities exceeding an equivalent thickness of 5 mm. (0.20 inch) over hard bottoms 24 hours after a heavy rainstorm.

(b) Episodic deposits of flood-borne soil sediment shall not occur in quantities exceeding an equivalent thickness of 10 mm. (0.40 inch) over soft bottoms 24 hours after a heavy rainstorm.

(c) In soft bottom material in pool sections of streams, oxidation-reduction potential (E_H) in the top 10 cm (4 inches) shall not be less than +100 mv.

(d) In soft bottom material in pool sections of streams, no more than 50% of the grain size distribution of sediment shall be smaller than 0.125 mm (0.005 inch) in diameter.

(e) The Director of Health shall prescribe the appropriate parameters, measures and criteria for monitoring stream bottom biological communities including their habitat, which may be affected by proposed actions. Permanent benchmark stations may be required where necessary for monitoring purposes. The water quality criteria for this subsection shall be deemed to be met if time series surveys of benchmark stations indicate no relative changes in the relevant biological communities, as noted by biological community indicators or by indicator organisms which may be applicable to the specific site."

Note: The abbreviation "ug" refers to "microgram". One miligram ("mg") equals 1,000 micrograms.

APPENDIX E

SAFE DRINKING WATER ACT, 1974

STATE DEPARTMENT OF HEALTH, CHAPTER 49, POTABLE WATER SYSTEMS

All references to Chapter 49, Public Health Regulations (PHR) are amended to read Chapter 20, Title 11, Administrative Rules which is the current state regulation for potable water systems. Chapter 49, PHR was revised as Chapter 20, Title 11, Administrative Rules on December 26, 1981.

APPENDIX E

SAFE DRINKING WATER ACT, 1974

The Safe Drinking Water Act of 1974 (P.L. 93-523) designates the Federal Government (Environmental Protection Agency or EPA) with the primary responsibility of establishing national standards. The states are responsible for enforcing the standards and otherwise supervising public water supply systems and sources of drinking water. A public water system is defined as providing piped water for human consumption and as having at least 15 service connections or regularly serving at least 25 people.

This Act provides for:

- Establishment of primary regulations for the protection of the public health;
- Establishment of secondary regulations relating to the taste, odor, and appearance of drinking water;
- Measures to protect underground drinking water sources;
- Research and studies regarding health; economic, and technological problems of drinking water supplies. Specifically required are studies of viruses in drinking water and contamination by cancer-causing chemicals;
- A survey of the quality and availability of rural water supplies;
- Aid to the States to improve drinking water programs through technical assistance, training of personnel, and grant support;
- Citizen suits against any party believed to be in violation of the Act;

- Record-keeping, inspection, issuance of regulations, and judicial review;
- A 15-member National Drinking Water Advisory Council to advise the EPA Administrator on scientific and other responsiblilities under the Act;
- A requirement that the Secretary of Health, Education, and Welfare ensure that standards for bottled drinking water conform to the primary regulations established under the Act - or to publish reasons for not doing so;
- Authorization of appropriations totaling $156 million for fiscal year 1975, 1976, and 1977.

Primary standards were designed to provide maximum feasible protection of the public health, utilizing the best treatment methods generally available, with cost as a consideration. The standards are ultimately to include maximum contaminant levels, treatment techniques, and criteria for operation, maintenance, siting, and intake of public water supply systems.

Secondary standards will also be prescribed for taste, odor, and appearance of drinking water, including sodium and total dissolved solids in the water. Secondary standards are to be enforced at the discretion of the individual states.

STATE DEPARTMENT OF HEALTH, CHAPTER 49, POTABLE WATER SYSTEMS

These regulations were adopted by virtue of Chapter 340E, Hawaii Revised Statutes, the purpose being to establish drinking water quality standards. These standards are based on standards and guidelines developed due to enactment of the Safe Drinking Water Act (P.L. 93-523). It sets the parameters for inorganic and organic chemicals and for such factors as turbidity and coliforms. Inorganic and organic chemicals and coliforms are monitored by the State Department of Health and turbidity is monitored by the County.

APPENDIX F

SPECIES CHECKLISTS

APPENDIX F

SPECIES CHECKLISTS

CHECKLIST OF FLORA

The following is a checklist of flora observed in the vicinity of the proposed Honouliuli Wells and transmission line in May, 1979. All species are considered exotic; that is, species introduced after the western discovery of the islands. No rare or endangered species of plants were seen at the site, or are believed to exist on or near the site.

The site is presently dominated by shrub species, with cultivated sugar cane in the surrounding areas. Species in the checklist are presented in alphabetical order according to families and subcategorized beneath each family are the genus and species classifications.

Status symbols are as follows:

X exotic; i.e., species of accidental or deliberate introduction after the western discovery of the islands.

CHECKLIST OF FLORA

PROPOSED HONOULIULI WELLS

KUNIA, OAHU, HAWAII

SCIENTIFIC NAME	COMMON NAME	STATUS	RELATIVE ABUNDANCE
AMARANTHACEAE			
Amaranthus spinosus L.	Spiny Amaranth	X	C
CONVOLVULACEAE			
Ipomoea arborescens (Humb. & Bon pl. ex Willd.) G. Don	Palo blanco	X	O
Ipomoea forsteri	Morning glory	X	O
GRAMINEAE			
Brachiaria mutica (Forsk.) Stapf	California grass	X	O
Chloris inflata Link.	Swollen finger grass	X	C
Paspalum dilatatum (Poir.	Dallis grass	X	O
Saccharum officinarum L.	Sugar cane	X	A
LEGUMINOSAE			
Leucaena leucocephala (Lam.) de Wit.	Koa-haole	X	C
Prosopis pallida (Humb. & Bonpl. ex Willd.) HBK.	Kiawe	X	C

SCIENTIFIC NAME	COMMON NAME	STATUS	RELATIVE ABUNDANCE
PASSIFLORACEAE			
<u>Passiflora mollissima</u> (HBK.) Bailey	Banana poka	X	O
PLANTAGINACEAE			
<u>Plantago major</u> L.	Broad-leaved plaintain	X	U

Where: A - abundant, C- common, O - occasional,
U - uncommon, R - rare

CHECKLIST OF FAUNA

The following is a checklist of fauna seen or believed probable at the site. The only endemic species that probably frequents the site is the Hawaiian owl, or pueo. No rare or endangered species of avifauna were seen or are believed to be present at the site or adjacent areas.

Avifauna seen or believed present and mammalian species believed present are common and found throughout the State. Significant impacts to fauna communities and species' populations are not expected.

Species in the checklist are presented in alphabetical order according to families, and subcategorized beneath each family are the genus and species classifications.

Status symbols are as follows:

X exotic; i.e., species of accidental or deliberate introduction after the western discovery of the islands

E endemic to the Hawaiian Islands; i.e., occurring naturally nowhere else in the world

CHECKLIST OF FAUNA

PROPOSED HONOULIULI WELLS

KUNIA, OAHU, HAWAII

SCIENTIFIC NAME	COMMON NAME	STATUS
A. CLASS AVES		
COLUMBIDAE		
* *Geopelia striata*	Barred dove	X
Streptopelia chinensis chinensis	Lace-necked dove	X
FRINGILLIDAE		
Cardinalis cardinalis	Cardinal	X
Carpodacus mexicanus frontalis	House finch	X
* *Paroaria coronata*	Red-crested cardinal	X
Passer domesticus	House sparrow	X
MIMIDAE		
* *Mimus polyglottus*	Mockingbird	X
STRIGIDAE		
Asio flammeus sandwichensis	Hawaiian short-eared owl; pueo	E

SCIENTIFIC NAME	COMMON NAME	STATUS
STURNIDAE		
Acridotheres tristis	Common mynah	X
B. _CLASS MAMMALIA_		
MURIDAE		
Mus musculus domesticus	House mouse	X
Rattus exulans	Polynesian rat	X
Rattus norvegicus	Brown rat	X
Rattus rattus	Black rat	X
VIVERRIDAE		
Herpestes auropunctatus	Mongoose	X

* Species observed during site reconnaissance

APPENDIX G

BOARD OF WATER SUPPLY, CITY AND COUNTY OF HONOLULU

RULES AND REGULATIONS

APPENDIX G

BOARD OF WATER SUPPLY, CITY AND COUNTY OF HONOLULU

RULES AND REGULATIONS

Section 3-313: Utilization of Well Water.

1. All water wells shall be operated in a manner that will readily and effectively prevent wastage and pollution of water. The Manager may exclude high-level tunnels from the provisions of this section if it is specifically determined in each case that wastage of water therefrom cannot be reasonably corrected.

2. The Manager may limit the amount of water drawn from any well covered under these Rules and Regulations if there is a reasonable basis to expect that the overdraft will:

   a. Cause or bring about overdraft conditions; or

   b. Excessively lower the ambient groundwater table; or

   c. Cause or bring about excessive salt water intrusion, excessive mineralization, or other degradation of water quality, which may render a domestic water source unfit for such purposes; or

   d. Interfere with the operations of existing established water sources.

3. If the Manager proposes to limit draft from any well, he shall inform the Owner of sufficient facts

and reasons upon which his limitation is based, and afford the Owner an opportunity for informal hearing before taking action.

4. This rule shall apply to all areas of the City except in "designated groundwater areas" established by the State of Hawaii, Department of Land and Natural Resources, pursuant to Chapter 177, Hawaii Revised Statutes, as amended.

APPENDIX H

PRIORITY RECOMMENDATIONS OF THE STATE WATER COMMISSION

APPENDIX H

PRIORITY RECOMMENDATIONS OF THE STATE WATER COMMISSION

1. CONTINUE AND INTENSIFY CONSERVATION PROGRAMS UNDERTAKEN BY THE COUNTY WATER DEPARTMENTS AND THE MILITARY TO STABILIZE OR REDUCE PER CAPITA CONSUMPTION OF MUNICIPAL WATER.

2. CONTROL FURTHER DEVELOPMENT OF GROUND WATER FROM THE PEARL HARBOR BASIN AND TRIBUTARY SOURCES BY APPLICATION OF THE GROUND WATER USE ACT (CHAPTER 177, HRS). AS AN IMMEDIATE INTERIM MEASURE, IMPOSE A MORATORIUM ON INCREASED EXPORT OF WATER FROM THE PEARL HARBOR AREA.

3. TO MEET PROJECTED MUNICIPAL WATER DEMANDS ON OAHU, EMPHASIZE THE DEVELOPMENT OF NEW SURFACE AND GROUND WATER SOURCES AND ALTERNATIVE SOURCES, TOGETHER WITH RESEARCH TO IMPROVE DEVELOPMENT METHODS.

4. STATE AND COUNTY GOVERNMENTS TAKE INTO ACCOUNT THE FINITE LIMITATIONS OF OAHU'S WATER RESOURCES IN ESTABLISHING POLICIES THAT INFLUENCE THE RATE OF POPULATION INCREASE AND RELATED URBAN DEVELOPMENT.

5. THE STATE LEGISLATURE ADOPT A PERMIT SYSTEM TO CONTROL THE DEVELOPMENT AND USE OF HAWAII'S SURFACE AND GROUND WATER RESOURCES IN ORDER TO PREVENT DEPLETION AND QUALITY DETERIORATION, AND PROVIDE FOR AN INDEPENDENT "WATER USE CONTROL BOARD" TO ADMINISTER THE PROGRAM.

6. THE LEGISLATURE AUTHORIZE THE FORMULATION OF A COMPREHENSIVE WATER CODE BY A DESIGNATED AGENCY TO DEFINE EXPLICITLY WATER RIGHTS IN HAWAII AND TO DELINEATE THE ROLE OF GOVERNMENT IN WATER MANAGEMENT.

7. ACCELERATE AND IMPROVE PROGRAMS FOR GATHERING AND UTILIZING INFORMATION ON WATER RESOURCES, INCLUDING SUSTAINABLE YIELDS, WATER DEMANDS, WATER CONSERVATION OPPORTUNITIES, METHODS AND COSTS OF WATER DEVELOPMENT, AND ASSESSMENT OF ENVIRONMENTAL IMPACTS OF DEVELOPMENT.

8. UPGRADE MUNICIPAL WATER SERVICES IN RURAL COMMUNITIES TO MINIMUM DELIVERY, QUANTITY, AND QUALITY STANDARDS.

9. PROVIDE IRRIGATION WATER FOR DIVERSIFIED AGRICULTURE WHEREVER PRACTICABLE, AND ASSURE THE CONTINUING AVAILABILITY OF WATER FOR AGRICULTURE IN GENERAL.

10. ESTABLISH A COMPREHENSIVE STATEWIDE PROGRAM FOR MINIMUM STREAMFLOW CONTROL TO PROVIDE AND PROTECT WATER RESOURCES FOR ECOLOGICAL, AESTHETIC, AND RECREATIONAL USES.

11. UTILIZE THE STATE FUNCTIONAL PLAN ON WATER RESOURCES (WHEN FORMULATED) TO GUIDE STATE FUNDING OF WATER PROGRAMS AND PROJECTS, CONSIDERING STATE COST-SHARING IN AND SUPPORT OF BOND FINANCING FOR COUNTY PROJECTS, COORDINATION OF FEDERAL FUNDING OF STATE AND COUNTY PROGRAMS AND PROJECTS, PROMOTION OF CONSERVATION PROGRAMS, AND SUPPORT OF RESEARCH PROGRAMS BY AGENCIES BENEFITTING FROM THE RESULTS.

12. BALANCE THE RATE OF URBAN DEVELOPMENT WITH THE RATE OF MUNICIPAL WATER DEVELOPMENT.

13. OPTIMIZE ISLAND-WIDE WATER DEVELOPMENT ON OAHU, CONSIDERING THE ISLAND'S FULL RANGE OF HYDROLOGIC POTENTIALS AND LIMITATIONS AND REASONABLE COSTS.

14. OPTIMIZE ISLAND-WIDE WATER DEVELOPMENT ON MAUI, CONSIDERING THE ISLAND'S FULL RANGE OF HYDROLOGIC POTENTIALS AND LIMITATIONS AND REASONABLE COSTS.

Source: State Water Commission. 1979. Hawaii's Water Resources: Directions for the Future. State Water Commission, Honolulu, Hawaii.

APPENDIX I

SUMMARY OF HOUSEHOLD WATER-SAVING DEVICES

AND

CITY AND COUNTY ORDINANCE No. 79-27

APPENDIX I

SUMMARY OF HOUSEHOLD WATER-SAVING DEVICES

Device	Water Use Reduction gpd	per cent
Toilet improvements	7.5-17.5	12-27
Faucet aerators	0-0.5	0-1
Flow limit valves, all fittings	0-0.5	0-1
Shower flow limiting	0-7.5	0-12
Pressure-reducing valves	0-16	0-20
Metering	0	0
Septic tanks	35	15
Improved clothes washers	0-8	0-5
Improved dishwashers	0-6	0-4
Hot water pipe insulation	0-6	1-4
TOTAL	70	52

Source: Stone, Brian G. 1978. Supression of Water Use by Physical Methods. American Water Works Association Journal, Vol. 9, No. 9, September 1978. American Water Works Assn., Denver Colorado.

ORDINANCE NO. (PC) 79-27

BILL NO. 2 (1979)
(Draft No. 2)

A BILL FOR AN ORDINANCE TO AMEND CHAPTER 19, R.O. 1969, AS AMENDED, ENTITLED "PLUMBING CODE", BY ADDING A NEW ITEM (46a) RELATING TO WATER CONSERVATION.

BE IT ORDAINED by the People of the City and County of Honolulu:

SECTION 1. Section 19-4.1, Chapter 19 thereof is hereby amended by adding a new item (46a) to read as follows:

(46a) Adding Section 1010.

Section 1010 is added to read:

Section 1010. Water Conservation.

(a) Water supply faucets or valves shall be provided with approved flow control devices which limit flow to a maximum three (3) gallons per minute.

Exceptions:

(1) Hose bibbs or valves not used for a designated fixture or equipment.

(2) Hose bibbs, faucets or valves serving fixed demand, timing or water level control appliances, equipment or holding structures such as water closets, pools, automatic washers and other similar equipment.

(3) Emergency showers.

(b) Tank-type water closets discharging more than 3.5 gallons per flush shall be provided with approved volume limiting devices or methods which will limit the discharge to 3.5 gallons per flush. When a satisfactory performance of the water closet cannot be obtained with 3.5 gallons or less per flush, the Administrative Authority may approve a larger discharge.

(c) Any new installation using potable water for cooling equipment at a rate exceeding one (1) gallon per minute, or operating more than ten (10) hours in a twenty-four (24) hour period, shall be designed to recirculate or reuse the cooling water.

(OCS/041779/LC)

79-27

Any existing installation using potable water for cooling equipment shall be exempt except where an expansion to the system requires additional water usage.

SECTION 2. Effective Date. This ordinance shall take effect six (6) months after its approval.

INTRODUCED BY:

Daniel Clement

Councilmembers

DATE OF INTRODUCTION:

January 10, 1979
Honolulu, Hawaii

APPROVED AS TO FORM & LEGALITY:

George I. Hiuda
Deputy Corporation Counsel

APPROVED this 9th day of May, 1979.

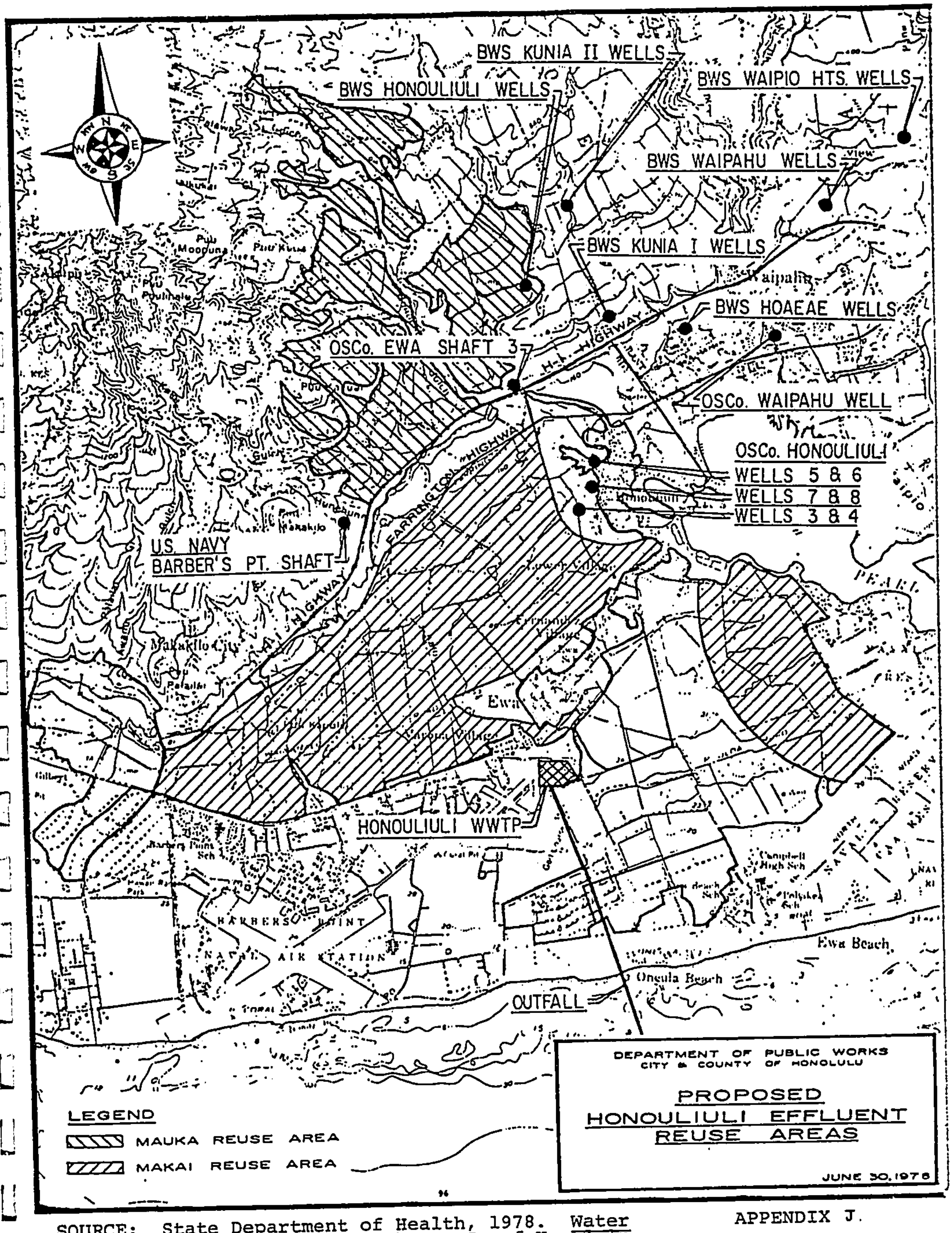
Frank F. Fasi
FRANK F. FASI, Mayor
City and County of Honolulu

(OCS/041779/LC)

APPENDIX J

PROPOSED HONOULIULI EFFLUENT

REUSE AREAS



SOURCE: State Department of Health, 1978. Water Quality Management Plan for the C.&C. of Honolulu.

APPENDIX J.