BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

RECEIVED
'97 MAY 23 P3:38

Honorable Gary Gill, Director
Office of Environmental Quality Control
235 South Beretania Street, Room 702
Honolulu, HI 96813

May 19, 1997

RE: Finding of No Significant Impact for Iao Treatment Facility and Pipeline
TMK 3-5-01:21; Wailuku, Maui, Hawaii

The Maui County Board of Water Supply has reviewed the comments received during the 30-day public comment period which began on August 8, 1996. The Board has determined that this project will not have significant environmental effect and has issued a "Finding of No Significant Impact". Please publish this notice in the June 8, 1997 OEQC Bulletin.

We have enclosed a completed OEQC Bulletin Publication Form.
Four copies of the final EA were sent previously under seperate cover, but we include four copies of an errata sheet.

Please contact Ms. Ellen Kraftsow at (808) 243-7199 if you have any questions.

Sincerely,

David Craddick
Director

By Water All Things Find Life

66

1997-06-08-MA-FEA-Iao Treatment Facility & Pipeline

FINAL ENVIRONMENTAL ASSESSMENT

IAO TREATMENT FACILITY AND PIPELINE

Prepared pursuant to Chapter 343, HRS
By Maui County Board of Water Supply

"By Water All Things Find Life"

Errata and Supplemental Information Sheet
Iao Treatment Facility and Pipeline

Revised Pages Attached:

Title Sheet - added And Negative Declaration

iii - VIII. reads Determination and Finding of No Significant Impact

10 - Second paragraph on page, IV.A., has been removed, pursuant to correspondence from the Director of Public Works.

14 - V.A. Land Use. Last sentence, "A special use permit will be requried for construction of the filtration facility", has been removed, pursuant to correspondence from the Director of Public Works.

20 - Last sentence in paragraph four, project is known as Waikapu Well Site. In addition, with regard to paragraph 5 the Wailuku Shaft pump and motor are under repair, and plans to increase pump capacity at that location have been abandoned

21 - B.2)c) Wailuku Shaft pump and motor are under repair, and plans to increase capacity in the shaft have since been abandoned.

22 - VIII. Determination and Finding of No Significant Impact

23 - No change in text. Included because additions to previous pages changed beginning of page.

Response Letter to Gary Gill -

Response to item 1) second sentence should have read Cost of water licensing had no bearing on negotiations for use of the water.

Response Letter to Martha Ross -

Paragraph 3, line 5 should read Sodium hydroxide used during clean-in-place operations is not drained to backwash...

Response Letter to HC&S -

Paragraph 1, last sentence. We have added a backwash tank to the project to enable sedimentation of backwash solids before disposal of backwash water to the ditch.

Letter from and Response Letter to NRCS - Maui District Office -

Added. This letter and response were inadvertently omitted in the final EA sent to you on October 22nd. We apologize for the omission, and include them with the errata.

Supplemental Information:

Response letter to HC&S -

Please note that a backwash tank has been added to allow for sedimentation prior to discharge into the ditch.

In a letter dated November 14, 1996, the proposed microfiltration units received approval from

DOH to operate at a flux rate of 0.66 gpm per meter^2. The combined capacity of the units is therefore calculated as follows:

(15 m^2 * 0.666 gpm/m^2) = 9.99 gpm per module.
9.99 gpm/module * 90 modules / 90 M10C unit = 899.1 gpm per 90 M10C unit
=1,294,704 gpd per unit * 2 units = 2,589,408 total capacity at approved flux rate. However, due to backwash and CIP operations, total water production can be expected to be somewhat lower.

Final Environmental Assessment
and
Negative Declaration
for
Proposed 2 MGD Treatment Facility at Iao Tank Site
and Pipeline from Iao Ditch to Iao Tank Site
Wailuku, Maui
3-5-01:21

Prepared pursuant to Chapter 343, HRS

PROPOSING AGENCY: Maui County Board of Water Supply
P.O. Box 1109
Wailuku, Maui, Hawaii 96793

RESPONSIBLE OFFICIAL: _____ May 18, 1997
David R. Craddick, Director Date

PREPARED BY: Maui County Board of Water Supply

Final Environmental Assessment
for
Proposed 2 MGD Treatment Facility at Iao Tank Site
and Pipeline from Iao Ditch to Iao Tank Site
Wailuku, Maui
3-5-01:21

Prepared pursuant to Chapter 343, HRS

PROPOSING AGENCY: Maui County Board of Water Supply
P.O. Box 1109
Wailuku, Maui, Hawaii 96793

RESPONSIBLE OFFICIAL: _____ October 22, 1996
/s/ David R. Craddick, Director Date

PREPARED BY: Maui County Board of Water Supply

Table of Contents

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List of Appendices

I. Introduction

Withdrawals of ground water from the Iao aquifer exceed the sustainable yield as determined by the State Commission on Water Resources Management. The proposed project is designed to mitigate these withdrawals. The project involves taking water from the existing Iao Irrigation Ditch and piping it to the Iao Tank, where it will be treated it with membrane filtration before entering the Central Maui system. The project will increase the potable water capacity of the Central Maui system by roughly 2 MGD for a period of roughly three years, until more permanent source options can be brought on line. This in turn will help to mitigate pumpage from the Iao aquifer.

HRS §343-5 requires preparation of an Environmental Assessment whenever a proposed action involves use of State or County funds. This Environmental Assessment has been prepared to consider the impacts of the proposed action, and to determine whether these impacts are significant enough to warrant an Environmental Impact Statement.

II. Identification of Agencies

A. Proposing Agency

Maui County Board of Water Supply
200 South High Street - Fifth Floor
Wailuku, Maui, HI 96793

B. Approving Agency

Maui County Board of Water Supply
200 South High Street - Fifth Floor
Wailuku, Maui, Hawaii 96793

C. Consulted Agencies & Organizations

The following agencies and organizations have either been consulted, or will receive copies of this consultation draft. Their comments will be included in the Final EA.

U.S. Government
Natural Resource Conservation Service
210 Imi Kala Street Suite 209
Wailuku, HI 96793
244-3729

United States Geological Survey
677 Ala Moana Boulevard, Suite 415
Honolulu, HI 96813
522-8290

State of Hawaii - DOH
Safe Drinking Water Branch
919 Ala Moana Boulevard
Honolulu, HI 96813
586-4258

Safe Drinking Water Branch - Maui Office
54 High Street
Wailuku, HI 96793
808-984-8234

State of Hawaii - DOH (continued)
Clean Water Branch
919 Ala Moana Boulevard
Honolulu, HI 96813
586-4309

Noise & Radiation Branch
591 Ala Moana Boulevard
Honolulu, HI 96813
586-4701

State of Hawaii - DLNR
Commission on Water Resource Management
PO Box 621
Honolulu, HI 96809
587-0214

State Historic Preservation Division
130 Mahalani Street
Wailuku, HI 96793
243-5169

Division of Forestry & Wildlife
54 High Street, Room 101
Wailuku, HI 96793
984-8100

Aquatic Resources Division
70 South High Street, Room 201
Wailuku, HI 96793
243-5294

County of Maui
Department of Planning
250 South High Street
Wailuku, HI 96793
243-7735

Department of Public Works
Kalana O Maui Building
200 South High Street - Third Floor
Wailuku, Hawaii 96793
243-7373 LUCA
243-7745 Engineering

Private Organizations
Wailuku Agribusiness
P.O. Box 520
Wailuku, HI 96793
244-7966

HC&S
PO Box 266
Puunene, HI 96784
877-0081

A&B Hawaii, Inc.
PO Box 3440
Honolulu, HI 96793
735-5788

Maui County Farm Bureau
PO Box 148
Kula, Hawaii 96790
878-2917, 878-3876

Sierra Club Maui Group
PO Box 2000
Kahului, HI 96732
244-9547

Medical Facilities
St. Francis Hemodialysis Unit
Melissa Santos, R.N. - Supervisor
St. Francis Maui Dialysis Unit
255 Mahalani Street
Wailuku, HI 96793
244-9600

Maui Memorial Hospital - Administration
221 Mahalani Street
Wailuku, HI 96793
244-9056

Maui Medical Group
2180 Main Street
Wailuku, Hawaii 96793
242-6464

III. Project Description

A. Need for the Proposed Action

The necessity of the project can be summarized as follows:

1) Withdrawals from existing sources located in the Iao Aquifer currently exceed the regulatory sustainable yield as established by the State Commission on Water Resource Management.
2) The Central Maui system is BWS's largest system, serving the major population centers of Maui, with a growing demand, and
3) The proposed project represents a rapid, temporary solution which can provide good quality water, thereby mitigating Iao aquifer withdrawals within a short time frame.

Aquifer Withdrawals: Existing sources in the Iao Aquifer are shown in **Figure 1**, below. These include the basal Mokuhau, Waihee, Waiehu Heights, Wailuku Shaft, the high level Kepaniwai well fields, and the Iao Tunnel. In addition, Reynolds Foods Well # 1, located in the Kahului aquifer, has been in use since January 1996.

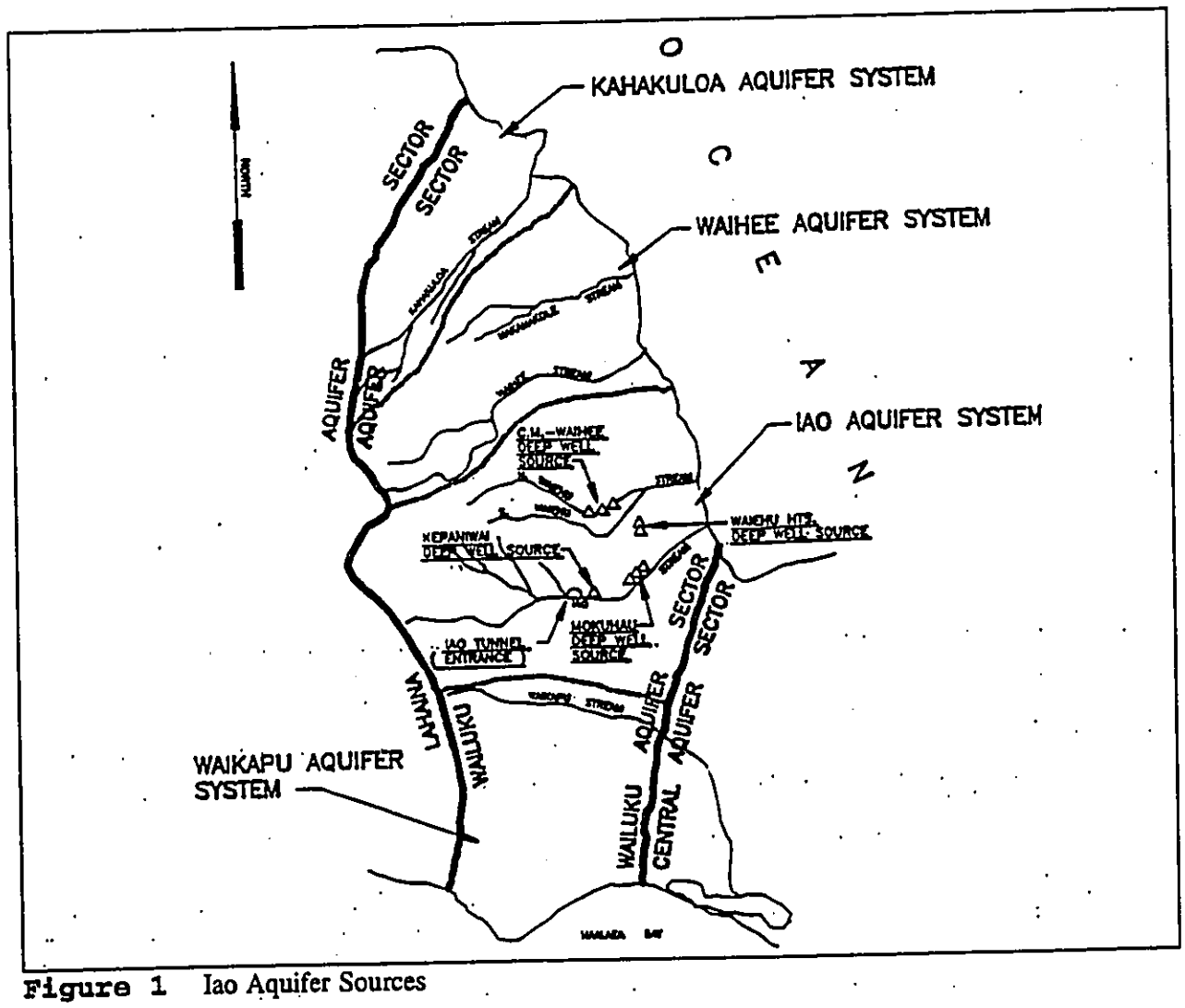

Figure 1 Iao Aquifer Sources

Most recent rolling annual average ground water withdrawals to serve the Central Maui system (as of July 1, 1996) are summarized below:

Iao Aquifer Groundwater Sources:	
Mokuhau Wells	4.580
Waihee Wells	8.450
Waiehu Heights Wells	1.652
Wailuku Shaft	5.430
Kepaniwai	0.370
Subtotal	**20.482**
Iao Tunnel (not counted against sustainable yield by CWRM):	1.580
Kahului Aquifer:	
Reynolds Foods Wells	0.102
Total	**22.164**

BWS groundwater withdrawals from the Iao Aquifer exceeded the regulatory sustainable yield of 20 MGD as of September 1995. Efforts to develop new sources in the Waihee, Paia and Haiku aquifers have experienced delays, causing the Board to look for permanent or temporary source options that could be put on line faster than the North Waihee and East Maui Development projects.

Increased pumpage at the Waihee well fields can cause chloride spikes. The transition zone under these wells seems to be rising at about 8' per year, and the aquifer has not yet reached equilibrium. Chlorides at the Mokuhau well field also exhibit a rapid response to pumpage, with spikes over 400 mg/L at Mokuhau well # 2. There is some evidence that the aquifer could yield more than 20 MGD, but the existing distribution of withdrawal sites will not support these increased yields. Additional data is required to quantify potential yield over 20 MGD. Flexibility to adjust distribution of withdrawals with existing facilities is limited. The capacity of Kepaniwai is only 1.152 MGD. A larger pump in Kepaniwai is contraindicated, as withdrawals could be expected to impact the Mokuhau well field. The Iao Tunnel is a gravity flow source, with varying yields, and the Wailuku Shaft is pumping at the maximum rate for the installed pump and line configuration. In light of this situation, the Board identified measures that could be implemented rapidly to decrease pumpage and distribute withdrawals in the Iao aquifer.

Major, Growing System: The Central Maui System serves water to the communities extending from Waiehu, through Wailuku, Kahului, Spreckelsville and Paia to Kuau on the North, and from Maalaea through Kihei to Makena on the south, as well as across the central isthmus including Puunene. A schematic of the Central Maui System is shown in **Figure 2** below. Historical source withdrawals are shown in **Figure 3**.

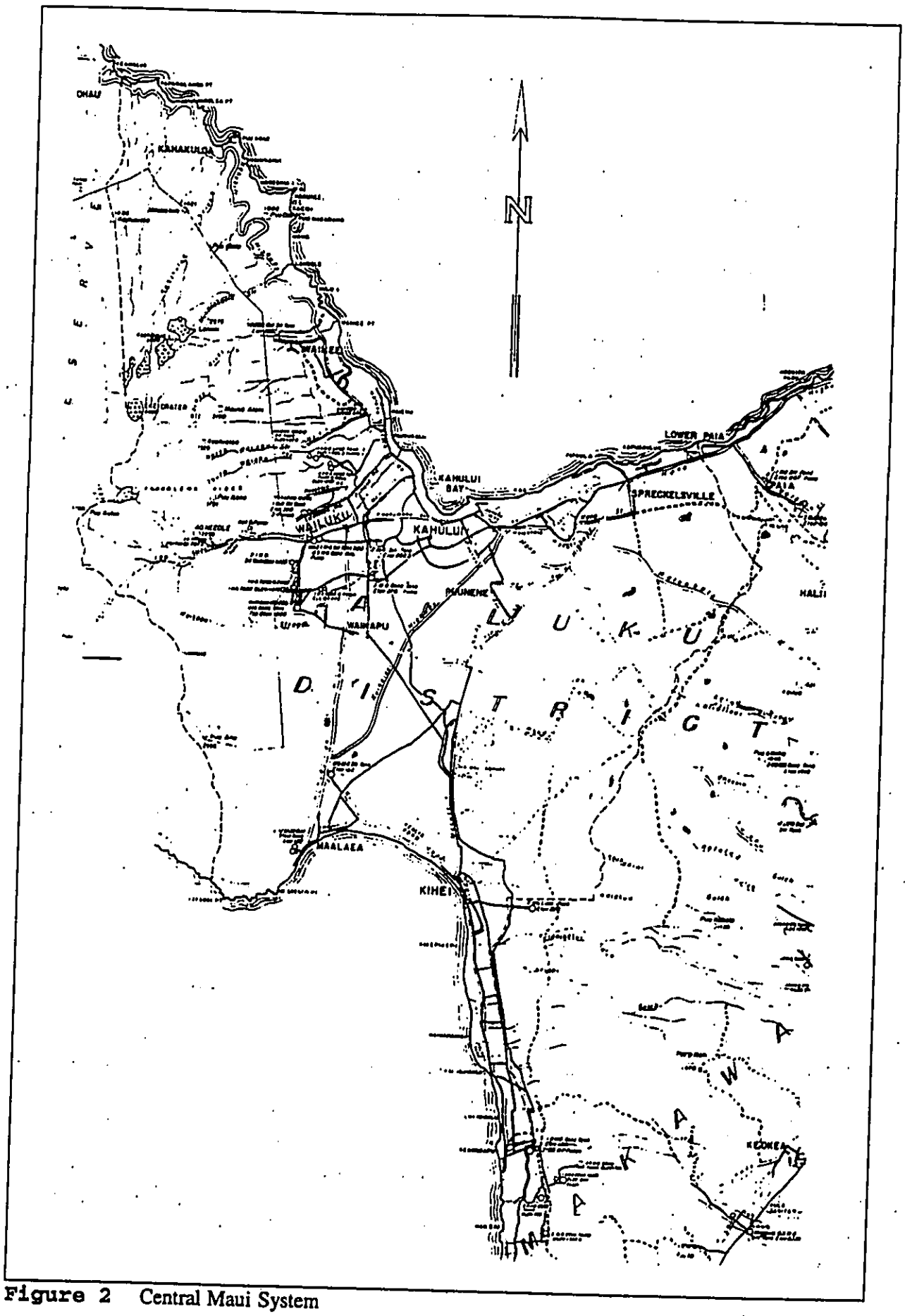

Figure 2 Central Maui System

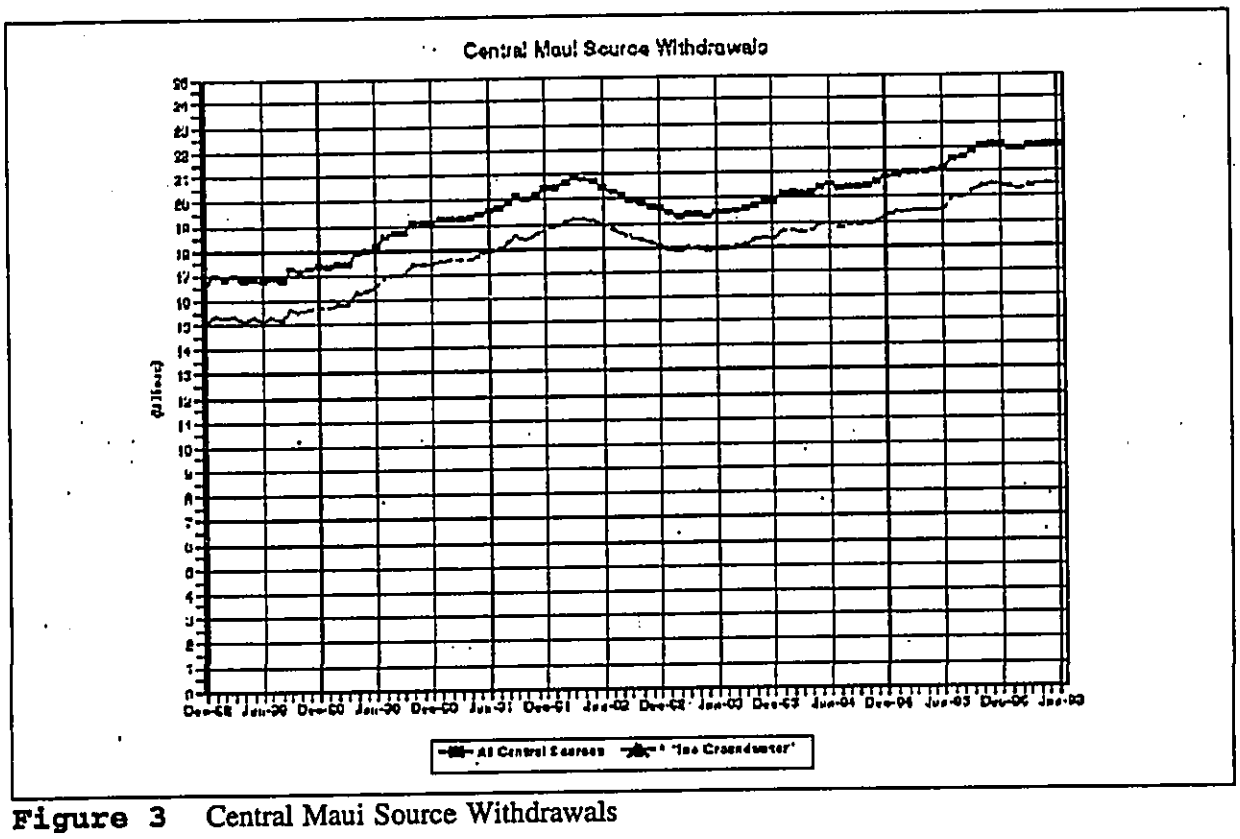

Figure 3 Central Maui Source Withdrawals

Rapid Mitigation Option: The proposed project utilizes an existing water transport facility, existing tank, and pre-fabricated microfiltration modules. It involves little or no site work, and requires minimal construction. it was deemed that this project could be accomplished relatively quickly and with minimal impact. The membrane filtration units have been tested elsewhere on Maui, and performed well in meeting treatment requirements and producing pure water. The proposed water source is the Iao stream. This mountain stream originates in the forest reserve, and is considered relatively pristine.

This 3 year proposal is anticipated to mitigate potential impacts on the Iao aquifer from increased withdrawals, while providing high quality potable water for consumption, and avoiding the socio-economic impacts potentially associated with moratorium.

B. Project Location

The project is located in Wailuku on the island of Maui. The project lies between Wailuku Town and Wailuku Heights on the south side of West Alu Road. A map indicating general project location is presented in **Figure 4** below. In addition, a TMK map, quad map, plot map, schematic of the proposed project and aerial photos are attached in **Figure 5** through **Figure 10**.

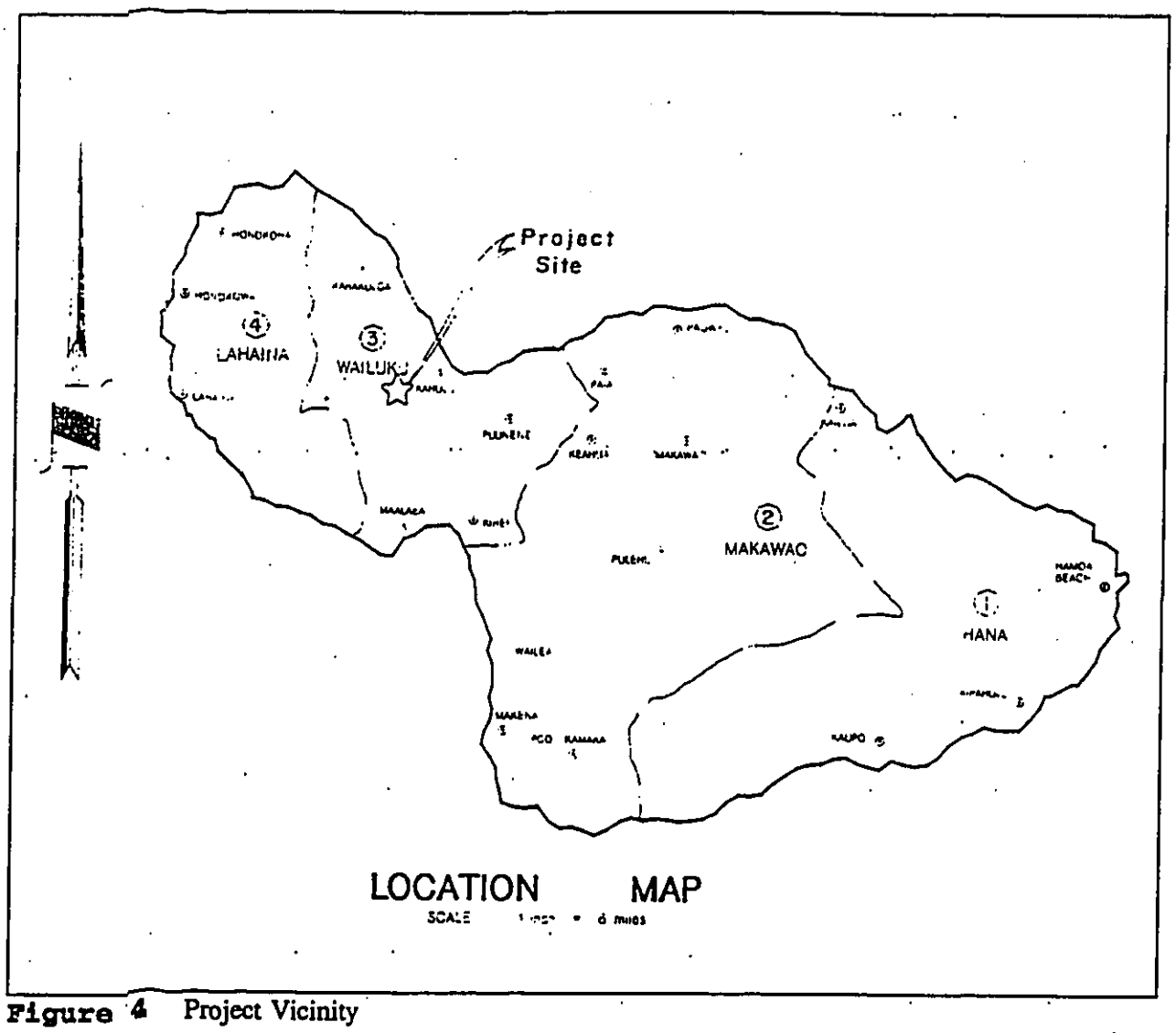

Figure 4 Project Vicinity

Two million gallons per day of water will be withdrawn from the Iao Ditch at TMK 3-5-01:001. The Ditch is owned by Wailuku Agribusiness, but a portion of the water is dedicated under contract to HC&S.

Water from the ditch will be transported along the edge of a pasture at parcel 3-5-01:001, also known as Land Commission Award 387, to the Iao Tank site, located at parcel 3-5-01:021. The tank site is owned by Maui County. The bulk of the project will be conducted at the County Tank site.

The project site is located in the Federal Emergency Management Agency's Zone C, areas of minimal flooding.

C. Overview of the Proposed Facility

The proposed use of the Ditch water is made possible by an agreement between the Maui County Board of Water Supply, A&B-HAWAII, Inc. and Wailuku Agribusiness, executed April 1st, 1996.

This agreement allows for the withdrawal of up to 2 million gallons of water per day from the Iao Waikapu Irrigation Ditch. It expires at the end of March in 1999.

The raw water source for the Iao Ditch is the Iao Stream (**Figure 11**). Existing collection and transport facilities are as follows:

> Water is withdrawn via an intake located at roughly 790' elevation (**Figure 12**). The Intake is of trench with bar-screen construction, and has a capacity of roughly 80 MGD. The intake consists of a "rock-masonry low dam, with a grouted rock spillway behind which is a catchment trench covered by a large bar-screen. [1]
>
> Water from the intake is directed to the north side of the stream and into a diversion tunnel **Figure 13**. A concrete control structure, located several hundred feet below the intake, splits the water and directs it into two separate ditches, the Maniania Ditch and the Iao/Waikapu Ditch. From this control structure, water headed for the Iao/Waikapu Ditch crosses the Iao Stream in a southerly direction via a 30" pipe (**Figure 14**) and then enters a tunnel toward Waikapu. From here the water is transported primarily by tunnel through the mountain, exiting the tunnel near Wailuku Heights **Figure 15**, a few hundred feet North of West Alu Road. The ditch then proceeds in a southerly direction, crossing West Alu Road and continuing on to Waikapu.[2]

BWS plans to withdraw two million gallons per day of water at the sluice gate near West Alu Road, and transport it via roughly 2500' of 12" and 6" lines to membrane filtration units located at the Iao Tank Site. **Figure 16**.

The 3 MG Iao Tank sits on the lower, eastern end of the tank site. The upper, western end is occupied by a vacant, flat area where the old 2 MG tank was demolished. (Refer to photo, **Figure 16**) A 30 x 36'concrete pad will be placed on the old tank site, and the membrane units will be installed on the concrete pad.

The proposed membrane filtration facility will comply with the Surface Water Treatment Rule and provide additional water capacity to the Central system, thereby reducing pumpage from the Iao aquifer for the period of the three year agreement. It is anticipated that the treatment modules will be utilized elsewhere when the three year agreement term has ended. Probable sites are the Awalau or Olinda treatment facilities.

D. Proposed Water Treatment System

The water will be treated with microfiltration. Two 90-M-10-C modular Memcor® Continuous Microfiltration (CMF) units will be placed on a concrete slab (roughly 30' x 36'), adjacent to the existing Iao Tank site. Refer to photo in **Figure 16**, and plot plan in **Figure 6** The CMF units

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1 Hawaiiana Investment Co., Inc.; *Resource Report of Wailuku Sugar Company, Maui Hawaii*; March, 1981; page 13

2 Hawaiiana Investment Co., Inc.; *Resource Report of Wailuku Sugar Company, Maui Hawaii*; March, 1981; page 13

house hollow fiber membranes with 0.2 micron openings. Suspended solids, biomass and microorganisms from the raw water are strained through these openings in the fibers. Performance of these units in contaminant removal is described in the table in **Appendix 1**. The two CMF modules have a combined capacity of 1.6 - 2.4 MGD at a flux rate of 0.5 - 0.75 gpm/meter^2 of membrane.

The CMF hollow fiber filters require periodic physical and chemical cleaning due to the accumulation of solids. The physical cleaning process, commonly referred to as backwashing, consists of flushing solids from the membrane surface via the introduction of reverse flow compressed air and water. The air loosened solids are flushed with raw water and transported by pipe to the Waihee Irrigation Ditch, roughly 80' makai of the tank. This process requires no chemical addition, and backwash effluent stream consists of solids captured from raw water on the membrane during filtration.

Normal Operation and maintenance also includes a chemical filter-cleaning process every four to six weeks. The process consists of washing the filter membranes with a 2% sodium hydroxide solution and a citric acid solution. Following the chemical cleaning process, the chemical solution is drained to a clean-in-place tank, and the filter membranes are washed with water, blown with air and the wash water is transported by pipe to the Waihee Irrigation Ditch below the tank site.

The solution can typically be used several times before fresh solution is required. The membrane units come equipped with a clean in place storage tank to store the solution safely. Spent cleaning solution will be pH neutralized and hauled to the wastewater treatment facility. An emergency eye wash and shower will be located at the Iao Tank site.

E. Cost of the Proposed Action

The proposed action involves the use of Board of Water Supply funds.

The cost for use of the water transport system over the three year period is anticipated to be roughly $763,520.40. Construction and membrane purchase costs will be roughly $1.8 million. Operating costs are estimated at roughly $438,000 for the three year period. The total, three year cost of the project is therefore anticipated to be roughly three million dollars. However, the membrane filtration units will be re-used at another site after the completion of the project. This will effectively reduce project costs by about half.

IV. Summary of Affected Environment

A. Land Use

The parcel where most work will occur is the existing Iao Tank Site, TMK 3-5-1:21. This site is currently zoned and designated for Agricultural use; although the site has long been used for the public-quasi public municipal water tank facility. As described above, the pipe will follow the edge of a pasture, which is zoned Wailuku-Kahului Project District 3.

The Iao Ditch irrigates roughly 6,500 acres of Wailuku Agribusiness and HC&S property, according to Wailuku Agribusiness personnel.

According to a letter dated September 25, 1996 from the Director of Public Works, no personnel, a State Special Use Permit or other permit will be required for the installation of the treatment facility at Iao tank site.

B. Topography

The project site is located between Wailuku and Wailuku heights. The ground elevation of the new 3 MGD Iao Tank is 506'. The tank overflow elevation is 536.5'. The ditch elevation at the site of withdrawal is roughly 740'. Slopes between the ditch and the tank site are roughly 9.4%. No work will occur at the intake, which is at an elevation of about 800' in the stream.

C. Geology & Soils

The area was formed during the Wailuku volcanic series, believed to have occured in the Pliocene or Pleistocene era. Rock from the Wailuku volcanic series is characterized by thin-bedded aa and pahoehoe flows of primitive olivine basalt, scattered cinder cones and thin tuff beds, and numerous dikes. This rock is overlain by older alluvium from the Pleistocene and Holocene eras.

The soils at the proposed project site are in the Wailuku series [3]. The soil types are WvB, Wailuku silty clay with 3-7% slopes, and WvC, Wailuku silty clay with 7-15% slopes. The intake is located in WvC soils (7-15% slopes), and the tank in WvB (3-7% slopes). The pipeline passes through both of these soil classifications. Actual slope between the withdrawal point and the tank is 9.4%.

> The Wailuku series is a well-drained soil series, found on Maui's alluvial fans. These soils developed in alluvium derived from weathered basic igneous rock. The are gently to moderately sloping. Elevations range from 50 to 1000'. Annual rainfall amounts to 20 to 40 inches. The mean annual soil temperature is 73° F. Wailuku soils are geographically associated with Iao and Pulehu soils. The available water capacity is about 1.6 inches per foot in the surface layer and subsoil. In places, roots penetrate to a depth of 5 feet or more. Erosion hazard is slight.
>
> Representative profiles are dark, reddish-brown silty clay about 12" thick. The subsoil is about 48" thick and is dark reddish brown silty clay that has subangular blocky structure. The substratum is gravelly and cobbly alluvium. The soil is slightly acid to medium acid in the surface layer and slightly acid in the subsoil. Permeability is moderate, runoff is slow in WvC and slow to medium in WvB. [4]

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[3] USDA - SCS & University of Hawaii; *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*; August, 1972; page 133

[4] USDA-SCS and University of Hawaii; Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii; August, 1972; page 133

The Iao Ditch irrigates roughly 6,500 acres of Wailuku Agribusiness and HC&S property, according to Wailuku Agribusiness personnel.

According to discussions on 5/7/96 with Planning Department and Public Works Building Permit personnel, a State Special Use Permit and County Building Permit will be required for the installation of the treatment facility at the agriculturally zoned and designated Iao tank site.

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Representative profiles are dark, reddish-brown silty clay about 12" thick. The subsoil is about 48" thick and is dark reddish brown silty clay that has subangular blocky structure. The substratum is gravelly and cobbly alluvium. The soil is slightly acid to medium acid in the surface layer and slightly acid in the subsoil. Permeability is moderate, runoff is slow in WvC and slow to medium in WvB. [4]

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[3] USDA - SCS & University of Hawaii; *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*; August, 1972; page 133

[4] USDA-SCS and University of Hawaii; Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii; August, 1972; page 133

A soils map of the area, showing the location of line from the ditch to the tank site is attached as **Figure 17.**

D. Climate and Air Quality

Median annual rainfall at the site is approximately 30-40 inches. Average annual temperatures are in the 60s to 80s. Winds are north to northeasterly about 10 to 25 mph. Pan evaporation was reported by the Grand Waikapu golf course to be roughly 0.85" per day, but has been reported elsewhere [5] at about 75" per year. Rainfall, pan evaporation maps and climatic data are attached in **Appendix 2.**

Although existing air quality data for Maui is limited, the entire State of Hawaii is classified as an attainment area for State and Federal ambient air quality standards. A summary of available air quality data is provided in **Appendix 3.**

E. Archaeological Resources

The area was inspected by State Historic Preservation Division staff. No historic sites were found. Nor is there any record of historic sites located within the area. A letter from SHPD is attached in **Appendix 4.**

F. Auditory and Visual Conditions

The site is on West Alu Road which runs between Wailuku town and Wailuku Heights residential area. Housing is located on both the north and south sides of the road at the lower, eastern end. From about half way up to the top of the road, the north side is non-native forest, while the south side is pasture. The tank site surrounded by pasture on three sides, with non-native forest across the street. At Wailuku Heights, the road curves to the south and enters a residential area.

Noise conditions are typical of a quiet to moderate urban area. Such locations typically have noise from 40-45 Dba at night, and 40-55 Dba in the day.

G. Biological Resources

The site is a disturbed area, previous used for cane and for the demolished tank. A thorough survey of the vascular plants present in the project area from the ditch to the tank site was conducted on April 4, 1996. This is attached as **Appendix 5.** With the exception of *Waltheria indica*, a questionably indigenous but common plant of no special status, found in dry and often disturbed ares on all Hawaiian islands, every plant in the area is non-native.

A biologist from the Division of Forestry and Wildlife visited the site, and found no evidence of threatened or endangered species, nor critical habitat for native fauna. As a former tank site and former cane field turned pasture, the site vegetation is predominantly non-native, and not likely to host native fauna. Most remaining endangered native bird species are either forest or sea birds. This site would not provide habitat for either. The Hawaiian owl might visit the site,

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[5] Ekern, Paul & Chang, Jen-Hu; *Pan Evaporation: State of Hawaii, 1894-1983: Report R74*; Water Resources Research Center, UH and HSPA; August 1985; pages 78 & 91

but would spend most of its time further upland. The Golden Plover was also considered a potential visitor to the site. A letter from the Division of Forestry and Wildlife is attached as **Appendix 6.**

H. Surface Water Bodies

Iao Ditch water comes from the Iao Stream. The stream originates in the West Maui Mountains. The source is fairly pristine. Little or no chemical contamination is likely in this source. Two potential means of chemical contamination are brush clearing along the ditch banks using pesticides, and road run-off from Iao Park or West Alu Roads. Both are anticipated to be negligible. Wailuku Agribusiness has offered that any clearing from the point of BWS withdrawal back to the stream intake will be done with mechanial means rather than chemical for the term of the contract. Most of the distance from the intake to the BWS withdrawal site is contained in pipe or tunnel, and therefore would not be exposed to clearing. Neither the Iao Park Road nor West Alu Road has heavy traffic, so run-off contribution should be slight. Road run-off potential is also limited by channels, berms and highly vegetated hillsides along the Iao Park Road. Raw water quality data is attached as **Appendix 7.**

The potential for biological contamination and stream sediments is of greater concern. Feral pigs, mongoose, and other animals are found in the woods around the upper reaches of the stream. People swim in the lower reaches of the stream. Potential biological contaminants include the bacteria, viruses and protozoa found in Hawaiian stream waters, including leptospirosis and giardia. Treatment efficacy of the proposed filtration units for these diseases is attached in **Appendix 1.** The proposed microfiltration facility can adapt to varying turbidity conditions or be taken off line during high turbidity spikes if necessary.

Reports of mean and median flows in the Iao Stream vary somewhat. Median flows in the Iao Stream from 1983 to 1990 were estimated at 43 MGD, with an average of 65 MGD[6]. Records obtained from 1910 to 1915 indicated average discharge from the Iao Stream was roughly 50 MGD, with an average of 18 MGD diverted as of 1970[7]. Reported mean monthly flows in the Iao-Waikapu ditch over the 23 year period from 1955-1977 ranged from a low of 7.76 for December to a high of 11.52 in April[8]. Tables of reported ditch flows are attached in **Appendix 8.**

I. Aquifers

The Iao aquifer has a legally defined sustainable yield of 20 MGD, which is currently being exceeded. There is some evidence to indicate that this aquifer may be capable of a higher daily

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6 Hawaii Cooperative Park Service Unit, Western Region Natural Resources and Research Division, National Park Service; *Hawaii Stream Assessment: A Preliminary Appraisal of Hawaii's Stream Resources, Report R84*; Water Resources Research Center & Department of Meteorology, UH; June 1986; page 52

7 USGS and DLNR; *Circular C61, Preliminary Report on the Water Resources of the Wailuku Area, Maui*; 1970; page 21

8 Hawaiiana Investment Co. Inc; *Resource Report of Wailuku Sugar Company, Maui Hawaii*; March 1981; appendix at end of report

yield with increased distribution of withdrawal. However, this evidence is not sufficiently detailed to justify a specific change in the legal sustainable yield number. The commission has allowed withdrawals from the Iao aquifer to go as high as 21.75 MGD for the next two to three years, while new sources are brought on line. The proposed project is intended to mitigate withdrawals from the Iao aquifer during this estimated three year period. BWS plans to stop using the ditch when more permanent well sources become available in the North Waihee, Paia or Haiku aquifers. Data on pumpage and chlorides in for the Central Maui Sources is contained within the CWRM Findings of Fact attached as **Appendix 9.**

J. Water Distribution System

A map of the Central System is attached as **Figure 3.** The Maui Community Plan Infrastructure Update predicts a demand of roughly 23 MGD for the Central Maui System by the year 2000[9]. Regressions on historic withdrawals indicate source withdrawals in the range of 25 MGD by the end of the year 2000. **Figure 18** The former refers to demand, while the latter refers to estimated pumpage, which includes demand plus system losses and other unaccounted-for water. Therefore, the differences are minimal. Built-out estimates for existing and proposed community plans are higher. The 1992 *Draft Water Use & Development Plan* estimates that the 1980 community plan would allow for a demand of 30 MGD if built out[10], and the proposed community plan would allow for a built-out demand of over 60 mgd, if approved. These represent substantial increases over current capacity once legal withdrawal limitations and standards pertaining to system redundancy are accounted for. The Maui County Board of Water Supply is required by County Charter to comport with the County General Plan and Community Plans in planning its water systems.

Future demand aside, existing demand requires mitigation measures. Rolling annual average withdrawals from all sources to service the Central Maui water system, as of July 1st 1996 were 22.164 MGD. The proposed project will off-set ground water withdrawals and increase potable water supply up to 2 MGD.

The primary service area of the Iao Tank is currently the Wailuku, Kahului area. However, the system was built for operational flexibility such that water from the Iao Tank could be directed to any part of the Central System east of the Iao Tank. The potential service area affected therefore extends from Wailuku all the way to Kuau in the North and Makena in the South. The total 2 MGD to be derived from this proposed source would be heavily diluted with water from other sources in any case. Dilution factors will vary with operational considerations.

K. Other Infrastructure Considerations - Transportation, Telecommunications, Medical, Police, Fire Safety, Educational

The proposed site is located on the Sourth side of West Alu Road. It is easily accessed via this paved road. Electrical power and telephone lines are available along this road. Approximate

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9 Wilso Okamoto & Associates, Inc.; *Maui Community Plan Update Infrastructure Assessment*; Prepared for Planning Department, County of Maui; September, 1992; pages 12 & 26

10 M&E Pacific, Inc.; *Draft Water Use and Development Plan for the Island of Maui*; Prepared for Maui County Department of Water Supply; December 1991; page 1-16

distances to other facilities are noted below:

Nearest Medical Facility	Maui Medical Group	3,400'
Nearest Dialysis Unit	St. Francis Hemodialysis Unit	11,200'
Nearest School	Wailuku Elementary	2,400'
Nearest Fire Station	Wailuku Fire Station	6,000'
Nearest Police Station	Wailuku Police Station	10,000'

V. Environmental Characteristics and Major Impacts of Proposed Action

A. Land Use

This project is anticipated to impact roughly 200 acres of HC&S cane land. Temporary impacts on land use may include some decreased agricultural production due to loss of irrigation water. HC&S may decide to plant this acreage, but anticipates lower yields with possible stress due to lack of water. The agreed-upon costs of using the water transport system were calculated to include compensation for these potential losses. In addition, if stream flows drop below 11.5 mgd, BWS will either temporarily cease withdrawal or pay liquidated damages to HC&S to offset any additional crop losses caused continuing water withdrawals from the ditch when the stream flow is down. Long term adverse impacts to agriculture are not anticpated. No impacts on scheduled project district development are anticipated. No special use or other county permit will be required for construction of the filtration facility.

B. Air Quality

Short term dust may result from construction. However, such impacts are expected to be minimal because: 1) the construction area is small, 2) grading is not anticipated, and 3) in the event that grading becomes necessary, appropriate control measures such as sprinkling and use of silt fences will be taken to mitigate any dust nuisance.

C. Archaeological Resources

No archaeological sites were found at the project site. The project will not have an adverse impact on archaeological or historic resources.

D. Auditory and Visual Imapcts

Short term noise impacts will be associated with construction, and with backwash. Construction is expected to take less one month. A table of A weighted decibel levels of construction equipment is provided below. Construction equipment typically releases between 70 and 100 dba.

Some noise will also be associated with backwash operations of the treatment unit. The major source of noise is the air compressor, rated at about 80 dBa 6' away. The Memcor microfiltration system normally backwashes on an adjustable timed interval ranging from 20 to 60 minutes. The backwash duration is approximately 2 to 3 minutes. Most of the backwash operation generates only about 30 dBa, however sound levels reach about 90 dBa for a few seconds during each backwash. In addition, a clean in place (CIP) sequence is run once every two to six weeks. These last approximately two hours, and generate roughly 90 dBa, during the backwash proceedures at the beginning and end of each CIP sequence. The project is 340' from

distances to other facilities are noted below:

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the nearest residence, which is downhill of the site. A rock wall boundary is located just above the nearest residence.

Ranges of A-Weighted Sound Levels of Constrcution Equipment at 50' Distance

Equipment	Sound Levels Minimum / Maximum
Backhoe, Trencher	72 / 93
Compactor (roller)	72 / 88
Compressor	68 / 87
Concrete Mixer	72 / 90
Front Loader	72 / 96
Generator	70 /82
Jackhammer, Drill	75 / 98
Paver	82 / 92
Pile Driver (peak levels)	89 / 105
Pump	70 / 80
Saw	68 / 93
Scraper, Grader	76 / 95
Tractor	73 / 95
Truck	70 / 95
Vibrator	70 / 81

Table provided courtesy of Yosh Ebisu, Consultant

E. Biological Resources

The project site supports neither threatened or endangered species, nor critical habitat for such species. No adverse impacts to biological resources are expected at the project site.

The only potential for off-site biological impacts would be from traces of backwash residue in irrigation water on cane fields. Such residue levels will be extremely diluted to the extent of

being non-detectable. No impacts are anticipated.

F. Water Quality and Quantity

Iao Stream: The raw water for the proposed project will be drawn from an existing ditch and intake structure in the Iao Stream. No alteration to stream channel or ditch is anticipated. No impact on stream flow or stream water quality is anticipated, as the entire project will take place well away from the actual stream bed.

The current project neither exacerbates nor mitigates stream withdrawals. The ditch would continue to flow with or without Board action. The withdrawal of this quantity of water undoubtedly has some impact on the Iao stream. In addition various development tunnels withdraw high level water, some portion of which might have ultimately found its way to the stream. These combined withdrawals undoubtedly impact the stream. However, 1) These withdrawals have long been in existence. The age of the Iao-Waikapu Ditch is uncertain, but the Waihee Ditch dates back to 1905[11], and there seems to be reference to the Iao Ditch system as early as 1949.[12] The Iao tunnel, bored into the northern hillside 100' below the intake, was constructed from 1938 to 1945, and realigned in 1956. Three additional tunnels dating back to 1900 and a spring take high level water from Iao according to Circular C61[13]. 2) Even if the intake in question were somehow closed, or the amount of withdrawal reduced, concrete channelization on the lower reaches of the stream would render stream recovery unlikely unless this too were altered.

Iao-Waikapu Ditch: No impact on existing water quality in the Iao-Waikapu ditch is expected. Water quantity in the ditch may be decreased up to 2 million gallons per day.

Waihee Ditch: An estimated 40,000 to 140,000 GPD of backwash water (2% - 7% of treated water) will be discharged into the Waihee Ditch from the treatment facility. Backwash water from the plant will contain materials from the stream which were rejected by the 0.2 um size pores. This will be stream water with a higher concentration of particles, micro-organisms and other debris from the stream. In addition, the clean in place (CIP) sequence runs every 2-6 weeks. The CIP tank holds about 2,500 gallons of 2% by volume sodium hydroxide. The Clean in Place solution is re-usable and is stored in the tank. Each CIP sequence uses only a few hundred gallons of the solution. This is recycled to the tank. Only solution residue in the wash water will reach the ditch. According to data collected over a 23 year period from 1955 to 1977, the mean flows in this ditch range from 13 to 20 mgd, roughly (see **Appendix 8**). Therefore, it is anticipated that chemical residue loading in the Waihee ditch or to the cane and pineapple fields irrigated with Waihee Ditch water will be non-detectable.

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11 *"W.S. Co. One of Hawaii's Oldest, Makes 20,475 T"*; Maui News; October 5, 1940; MCF Section; page 27, column 1

12 Ashdown, Inez; *"Water: Aged-Old Problem On Whole Valley Island"*; Maui News; January 1, 1949; CAVL Sugar Section, page 3.

13 Yamanaga, George & Huxel, C.J. Jr.; *Preliminary Report on the Water Resources of the Wailuku Area, Maui - Circular C61*; USGS & DLNR-DOWALD; December, 1970, pages 21-29

Coastal Waters & Wetlands: Waters from the Waihee ditch are consumed agriculturally in the central isthmus. Any impact to State Waters would result from a possible slight decrease in run-off, or residual cleaning solution. However, run-off is already altered from its natural outlet via the Iao & Waihee streams, and as described above, residual cleaning solution levels are expected to be non-detectable. No discernable difference in water quality is anticipated.

G. Grading & Drainage

The installation of the microfiltration units will occur at the site of the demolished Iao tank. This site is already flat, and will require no modification to existing grades. The 12" line will be installed above ground, just outside the pasture fence. This will tee into dual 6" lines, the existing 6" line under the road and another 6" segment along the pasture fence. Best management practices will be employed for any site work performed. Such measures for site work include the use of temporary erosion control structures such as silt fences or swales, immediate removal of any and all construction debris, proper maintenance of construction equipment, and immediate sodding or planing once final grades are established. Run-off from the site will be completely contained by the Waihee irrigation ditch, only 80' below the tank.

H. Solids Management

Solids in backwash water will be transported to Waihee Ditch with the backwash. These solids consist primarily of dirt, organic silt, algae and other organisms commonly found in surface waters. Chemical addition occurs only once every 4 to six weeks. Chemical cleaning solutions are citric acid and sodium hydroxide at 2% solution. Materials Safety Data Sheets for these are attached as **Appendix 10.** Treatment backwash stream is expected to be relatively benign. Treatment waste water quality, particularly with the dilution achieved in the Waihee Ditch, will be suitable for agricultural use.

I. Energy Consumption

The project will require a three phase, 60 hp service. Energy utilizing facilities include the air compressors, CMF unit, telemetry and possible pump. Energy consumption is expected to be roughly 44.76 kwh, or about 1,075 kwh/day. Energy costs are estimated at roughly $110/day.

J. Other Infrastructure Considerations - Transportation, Telecommunications, Medical, Police, Fire Safety, Educational

No impacts to transportation, telecommunication, police, fire or or educational facilities is expected. No impacts to medical facilities in terms of patient demand is expected. The Saint Francis Hemodialysis Unit, Maui Memorial Hospital and Maui Medical Group will be notified of the proposed use of this source, and sent a copy of the consultation draft.

K. Occupational Health & Safety

No impacts to worker safety are anticipated. The only potential impact would come from an accident in handling the clean in place solution.

MSDS sheets are attached in **Appendix 10.** Sodium hydroxide is a strongly alkaline and basic substance. It is an irritant to the mucous membranes and skin. Excessive exposures can cause esophogeal burns, edema of the epiglottis resulting in respiratory distress, pulmonary edema, pneumonitis and shock. Exposed areas should be irrigated with large quantities of water or milk. Treatment with corticosteroids may be appropriate if esophogeal burns are present. Use of vinegar or lemon juice should be avoided.

A safety shower and eyewash facility will be provided at the site.

VI. Mitigation Measures

A. Auditory and Visual Imapcts

Auditory and visual impacts of the project are expected to be minimal. Construction will be rapid, and construction equipment will be equipped with mufflers. The distance from the site of the proposed filtration units to the nearest residence is 340'. The project is not expected to create a noise nuisance. If necessary, the microfiltration plant can be covered by a simple wooden shed with aluminum roof to mitigate noise from backwash operations.

If a shed is constructed, it can be painted green to match the tank and surrounded with self-sustaining, climate adapted plants to make the site more attractive. The tank site is in Maui County Planting Plan Zone 4, characterized as lower elevations that are wetter due to proximity to mountains. A list of climate adapted native and polynesian plants follows:

Native and Polynesian Climate Adapted Plants Suitable for Use in Tank Site Area

Kamani	(Calophyluum inophylum, 60'ht,poly intro.)
Kukui	(Alerites moluccana, 50'ht., poly. intro.)
Hala	(Pandanus tectorius, 35'ht.)
Hala	(Pandanus odoratissimus, 35'ht.)
'Ōhi'a lehua	(Metrosideros polymorpha, 25'ht.)
Wiliwili	(Erythrina sandwicensis, 20'ht.)
Hao	(Rauvolfia sandwicensis, 20'ht.)
Kou haole	(Cordia sebestena, 20'ht.)
Alahe'e	(Canthium odoratum, 12'ht.)
Lama	(Diospyros sandwicensis, 12'ht.)
Naio	(Myoporum sandwicense, 10'ht.)
Koki'o 'Ula'ula	(Hibiscus kokio, 10'ht.)
Kulu'ī	(Nototrichium sandwicense, 8'ht.)
Wauke	(Broussonetia papyrifera, 8'ht.)
	(Achyranthes splendens, 6'ht.)
'A'ali'i	(Dodonaea viscosa, 6'ht.)
Naupaka kahakai	(Scaevola sericea, 6'ht.)
Kolomona	(Senna gaudichaudii, 5'ht.)
'Ūlei	(Osteomeles anthyllidifolia, 4'ht.)
Nehe	(Lipochaeta lavarum, 3'ht.)
'Ōlena	(Curcuma longa,3'ht.)
Nehe	(Lipochaeta succulenta, 3'ht.)
'Ānapanapa	(Colubrina asiatica, 3'ht.)
'Ākia	(Wikstroemia uva-ursi & W. species, 2'ht.)
'Ala'ala Wai Nui	(Peperomia leptostachya, 1'ht.)
Nehe	(Lipochaeta integrifolia, 1'ht.)
'Ilima papa	(Sida fallax, .5'ht.)

B. NPDES Permit Requirements

The backwash water from the microfiltration units will discharge entirely into the Waihee Ditch. Water in this ditch is consumed for agricultural irrigation, and as such does not impact stream or near shore waters. The backwash water is deemed suitable for irrigation use. The project site is less than 5 acres, and run-off does not influence any state waters. Therefore, it is anticipated that no NPDES permit is required under HRS §342-D, HAR §11-55 or CWA §402. Never the less, inquiries will be made with the State Department of Health, Clean Water Branch.

C. Solids Management

Proper care will be taken to dispose of all construction debris in an appropriate fashion. Treatment solids will consist primarily of organics, silt and debris, from the Iao Stream. These are not expected to adversely impact Waihee ditch irrigation water.

D. Engineering & Construction Measures

The proposed project will involve minimal disturbance to existing topography. The bulk of the project involves the placement of the microfiltration units. This will occur at the site of a demolished tank, which is already flat. The pipe will utilize existing grades to convey water by gravity flow. No grading is anticpated. If any site work or grading is required, construction measures will include silt containment, immediate sodding and removal of debris, and other measures as necessary to maintain a clean construction site. Impacts to the Waihee Ditch have been discussed. No residences or other sensitive receptors are located near the site.

VII. Alternatives to the Proposed Action

A. Alternatives Considered

A large number of potential alternatives were screened to identify the most rapid way to mitigate Iao aquifer withdrawals, while maximizing cost-effectiveness water quality. For this initial screening, timely resolution of the Iao aquifer pumpage situation was the main criteria. A study of well maps on USGS quad sheets identified chlorides, size, pump data and location of every non-BWS well hole in the vicinity of the Central Maui system. A list of all wells identified with either less than 700 mg/L chlorides or no chloride data but other potentially promising features was prepared and mapped. Information on ownership, status, depth, casing depth, location, chlorides, drawdown, elevation, and other pertinent comments was compiled into a spread sheet to assist in considering if any could realistically be obtained, developed and connected to the system in timely fashion. Most of the well holes identified eliminated themselves due to one of several reasons: high chlorides, high drawdown, small size, great distance from the system, long construction and planning time, uncertain status or location, or some combination of the above.

A second screening spreadsheet, of roughly 25 alternatives including the top several well options from the screen described above, considered use of surface water sources, drilling of new sources, conservation, desalination and shifting pumpage at existing wells in use, in addition to use of existing wells with or without pumps. This spreadsheet listed potential yields, development costs, development times, operating costs, community impacts, water quality, dependability,

accessibility, impact on existing Iao sources, funding availability, regulatory requirements, and potential for future use beyond the perceived problem period.

Both of these spreadsheets were screening tools only, and remained in "working draft" format. They served to eliminate options that were clearly less promising. Drafts of these working documents are attached in **Appendix 11.**

The possibility of moratorium was discussed with the Board and the Mayor. It was determined that a moratorium would be an inadequate solution, since existing pumpage exceeds sustainable yield. Potential socio-economic impacts of a moratorium also led Board members and County administration to frown upon this alternative.

The Board found that a combination of actions was warranted. These included expediting existing plans for new source development and distribution of withdrawal, combined with development of temporary, easily constructed solutions and conservation.

Three major sets of plans for new source development were already in progress. These were the East Maui, North Waihee and Iao Aquifer Distribution plans. Expediting the schedule of the East Maui Plan was not possible, due to court action regarding this plan. The North Waihee Plan called for development of three to four million gallons over a three year period. However, it was determined that a smaller amount of water, 1 MGD, could be made to enter the system on a shorter time frame, thus expediting the first million gallons of this plan. Finally, plans had been in progress to develop a new well in the Iao aquifer to distribute withdrawal. It was decided to expedite this well to hasten distribution of withdrawals. This project is known as the Waikapu Well Site and is the subject of another EA.

Also to improve distribution of withdrawal and provide more flexibility in withdrawal distribution, it was decided to increase the pump capacity by repairing a back-up pump at the existing Wailuku Shaft. This was seen as a temporary option, for the purpose of achieving better distribution of withdrawal. The well belongs to Wailuku Agribusiness, and they intend to demolish it when the Wailuku-Kahului Project District proceeds. This option has since been abandoned.

A quarter of a million dollars was budgeted for conservation measures, and BWS is currently pursuing low flow retrofits of shower heads, and of toilets in conjunction with the Public Works Department. In addition, a class on landscaping with native and drought tolerant plants is under discussion and development, since 40% of water consumed on the southeast side of the island goes to landscape.

Three ditch withdrawal sites were identified, of which two were deemed acceptable for water quality reasons. These were The Waihee Ditch by the forest reserve near the CMJV wells, and the Iao ditch, also near the forest reserve and West Alu Road. The Iao Ditch was selected for three reasons: 1) it could be developed more rapidly and was more cost effective, since the existing tank is large enough that the project will not require construction of an additional tank to meet SWTR-mandated CT times, the site requires only very minimal line construction and site work, and; 2) The site has a gravity advantage, in that the natural head from the slope between the ditch and the tank can be used to decrease power requirements; 3) It appeared to have less impact on agriculture. If the Waihee Ditch had been used, a line traversing active Mac Nut orchards would have been required.

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B. Selected Alternatives

The final list of alternatives selected included:

1) Pursuing the North Waihee well development plans, but expediting one of the phases of the ongoing North Waihee project to allow a smaller amount of water to be delivered to the system more rapidly than waiting for construction of the entire project.
2) Improving distribution of withdrawal through:
   a) Shifting existing withdrawal away from basal toward the high level Kepaniwai source to the extent possible.
   b) Drilling a well in the Waikapu area, to further distribute withdrawals within the Iao Aquifer
   c) Upgrading pump capacity at Wailuku Shaft, to provide more flexibility for distribution of withdrawals within the Iao Aquifer, (The pump and motor are under repair, and plans to increase capacity in the shaft have since been abandoned.)
3) Using water from the Iao Irrigation Ditch,
4) Implementing Conservation Measures, and
5) Utilizing the Reynolds Foods Well, an existing well located in the Kahului aquifer, for which BWS already has source approvals, but has kept on hold for emergency use only due to its less than ideal location.

The Board is currently pursuing all of these alternatives, under a schedule mandated by the State Commission on Water Resource Management. This schedule can be found in **Appendix 12.** The combined schedule is expected to provide 3 MGD to supplement Central Maui source over the next 3 years. In addition, the Board continues to pursue the longer term East Maui Development Plan and Waihee Development Plans, which are designed to meet anticipated demands for the next 10 - 15 years.

The proposed action is one of the selected items. Its overall impact is seen as beneficial, both individually and in combination with other related projects. Other projects in progress have been reviewed in separate EAs because they were conceived and started prior to the time when sustainable yield exceedences made emergency measures necessary. However, all related projects have been mentioned above, and EAs can be provided for them upon request.

The Iao Ditch Treatment Facility will make use of existing sources rather than create new stream withdrawals. It will help to mitigate groundwater pumpage in the Iao Aquifer. It will provide a reliable, high quality source of potable water and help to avoid the socio-economic results that a moratorium and halt to construction development could cause.

C. No - Action Alternative

This alternative was deemed unacceptable, as withdrawals from the Iao aquifer already exceed the legal sustainable yield. Although the aquifer appears healthy, it has not yet equilibrated at this time. Historically, increased pumpage at the Waihee well fields can cause chloride spikes. The transition zone under these wells seems to be rising at about 8' per year. Chlorides at the Mokuhau well field also exhibit a rapid response to pumpage, with spikes over 400 mg/L. The capacity of Kepaniwai is only 1.152 MGD. A larger pump at Kepaniwai is contra-indicated by the fact that these withdrawals are expected to effect the Mokuhau well field. Flexibility to distribute withdrawals with existing facilities is limited. The Iao Tunnel is a gravity flow source, with varying yields, and the Wailuku Shaft is pumping at the maximum rate for the installed pump

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2) Improving distribution of withdrawal through:
   a) Shifting existing withdrawal away from basal toward the high level Kepaniwai source to the extent possible.
   b) Drilling a well at the existing Waikapu Tank Site, to further distribute withdrawals within the Iao Aquifer
   c) Upgrading pump capacity at Wailuku Shaft, to provide more flexibility for distribution of withdrawals within the Iao Aquifer,
3) Using water from the Iao Irrigation Ditch,
4) Implementing Conservation Measures, and
5) Utilizing the Reynolds Foods Well, an existing well located in the Kahului aquifer, for which BWS already has source approvals, but has kept on hold for emergency use only due to its less than ideal location.

The Board is currently pursuing all of these alternatives, under a schedule mandated by the State Commission on Water Resource Management. This schedule can be found in **Appendix 12.** The combined schedule is expected to provide 3 MGD to supplement Central Maui source over the next 3 years. In addition, the Board continues to pursue the longer term East Maui Development Plan and Waihee Development Plans, which are designed to meet anticipated demands for the next 10 - 15 years.

The proposed action is one of the selected items. Its overall impact is seen as beneficial, both individually and in combination with other related projects. Other projects in progress have been reviewed in separate EAs because they were conceived and started prior to the time when sustainable yield exceedences made emergency measures necessary. However, all related projects have been mentioned above, and EAs can be provided for them upon request.

The Iao Ditch Treatment Facility will make use of existing sources rather than create new stream withdrawals. It will help to mitigate groundwater pumpage in the Iao Aquifer. It will provide a reliable, high quality source of potable water and help to avoid the socio-economic results that a moratorium and halt to construction development could cause.

C. No - Action Alternative

This alternative was deemed unacceptable, as withdrawals from the Iao aquifer already exceed the legal sustainable yield. Although the aquifer appears healthy, it has not yet equilibrated at this time. Historically, increased pumpage at the Waihee well fields can cause chloride spikes. The transition zone under these wells seems to be rising at about 8' per year. Chlorides at the Mokuhau well field also exhibit a rapid response to pumpage, with spikes over 400 mg/L. The capacity of Kepaniwai is only 1.152 MGD. A larger pump at Kepaniwai is contra-indicated by the fact that these withdrawals are expected to effect the Mokuhau well field. Flexibility to distribute withdrawals with existing facilities is limited. The Iao Tunnel is a gravity flow source, with varying yields, and the Wailuku Shaft is pumping at the maximum rate for the installed

and line configuration. For these reasons, some action had to be taken to reduce Iao aquifer withdrawals.

VIII. Determination & Finding of No Significant Impact

In accordance with Title II, Chapter 200 Environmental Impact Statement Rules, this draft environmental assessment has been prepared to characterize the technical and environmental nature of the proposed project, identify potential impacts, and evaluate the significance of these impacts.

It is anticipated that it will be determined that the proposed Iao Ditch treatment facility and related pipeline project will not significantly impact the environment. Therefore, a negative declaration under HAR §11-20-12 is anticipated.

Specifically, it is anticipated that:

1. The proposed project will not result in an adverse irrevocable commitment, loss or destruction of any natural or cultural resources.

2. The range of beneficial use of the environment will not be curtailed.

3. The project will not conflict with the State's long term environmental policies or goals and guidelines as expressed in Chapter 344 HRS, and any revisions thereof and amendments thereto, court orders or executive orders.

4. The proposed project will not adversely affect the economic or social welfare of the community or state. The project will improve the social and economic welfare of the community by providing drinking water in conformance with the Surface Water Treatment Rule, while helping to avoid the need for a moratorium by mitigating pumpage from the Iao Aquifer.

5. The project will not adversely affect public health.

6. The project will not involve any substantial adverse secondary impacts, such as population changes or effects on public facilities. The proposed project will upgrade public facilities, support existing demand and some small portion of anticipated demand in conformance with existing and proposed community plans.

7. The project will not change any policy concerning the issuing of additional water meters. The project will help to avoid the need for a moratorium, and allow continued issuance of water meters. However, it will not in and of itself solve the problem of the need to meet the growing demand in the Central Maui System.

8. The project will not involve a substantial degradation of environmental quality.

9. The project will not cause considerable effect upon the environment through cumulative actions, nor through commitment to larger actions. The proposed project and other proposed actions related to this project have been discussed. The common theme that ties these together is the Commission's concern and desire to mandate a schedule to mitigate impacts on the Iao aquifer. In most other senses, historic practice would dictate that each

pump and line configuration. For these reasons, some action had to be taken to reduce Iao aquifer withdrawals.

VIII. Anticipated Determination

In accordance with Title II, Chapter 200 Environmental Impact Statement Rules, this draft environmental assessment has been prepared to characterize the technical and environmental nature of the proposed project, identify potential impacts, and evaluate the significance of these impacts.

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8. The project will not involve a substantial degradation of environmental quality.

9. The project will not cause considerable effect upon the environment through cumulative actions, nor through commitment to larger actions. The proposed project and other proposed actions related to this project have been discussed. The common theme that ties

of these actions be evaluated separately. Nevertheless, all actions currently under way to obtain source for Central Maui and mitigate Iao aquifer pumpage have been noted.

10. The project will not substantially affect a rare, threatened or endangered species, or its habitat.

11. The project will not detrimentally affect air or water quality or ambient noise levels. Short term impacts will occur during the construction phase. Treatment of backwash water and solids will be in a manner approved by the Hawaii Department of Health.

12. The project will not affect an environmentally sensitive area such as a flood plain, tsunami zone, erosion prone area, geologically hazardous land, estuary, fresh water or coastal waters.

13. The project will not affect scenic vistas and viewplanes. The microfiltration unit is expected to be placed adjacent to and just mauka of the tank. From below, it will probably not be visible. An unobtrusive shed or tent may be constructed to protect the facility from rain, but this is also not expected to damage scenic views.

14. The project will not require substantial energy consumption.

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14. The project will not require substantial energy consumption.

IX. References

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X. Figures

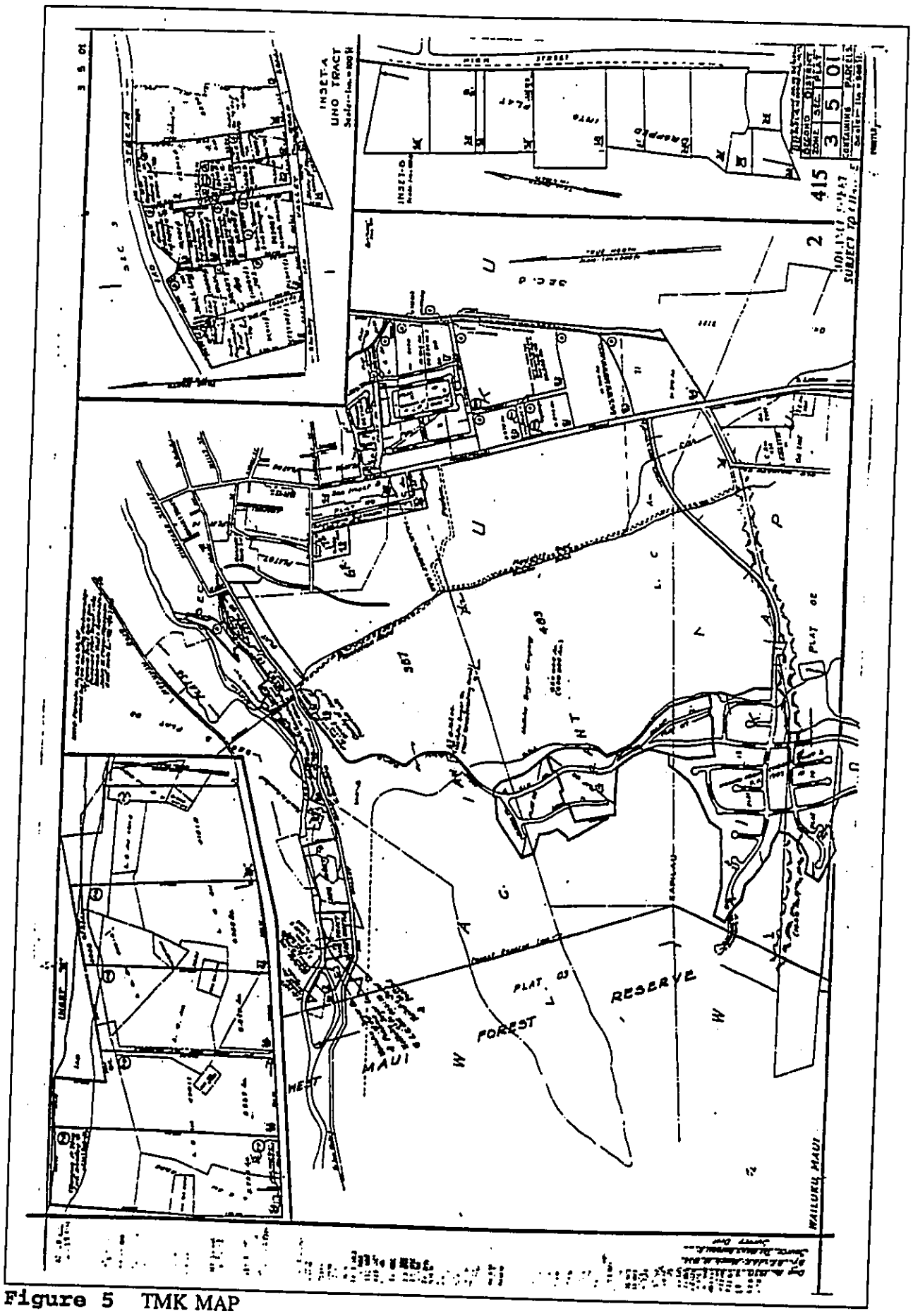


Figure 5 TMK MAP

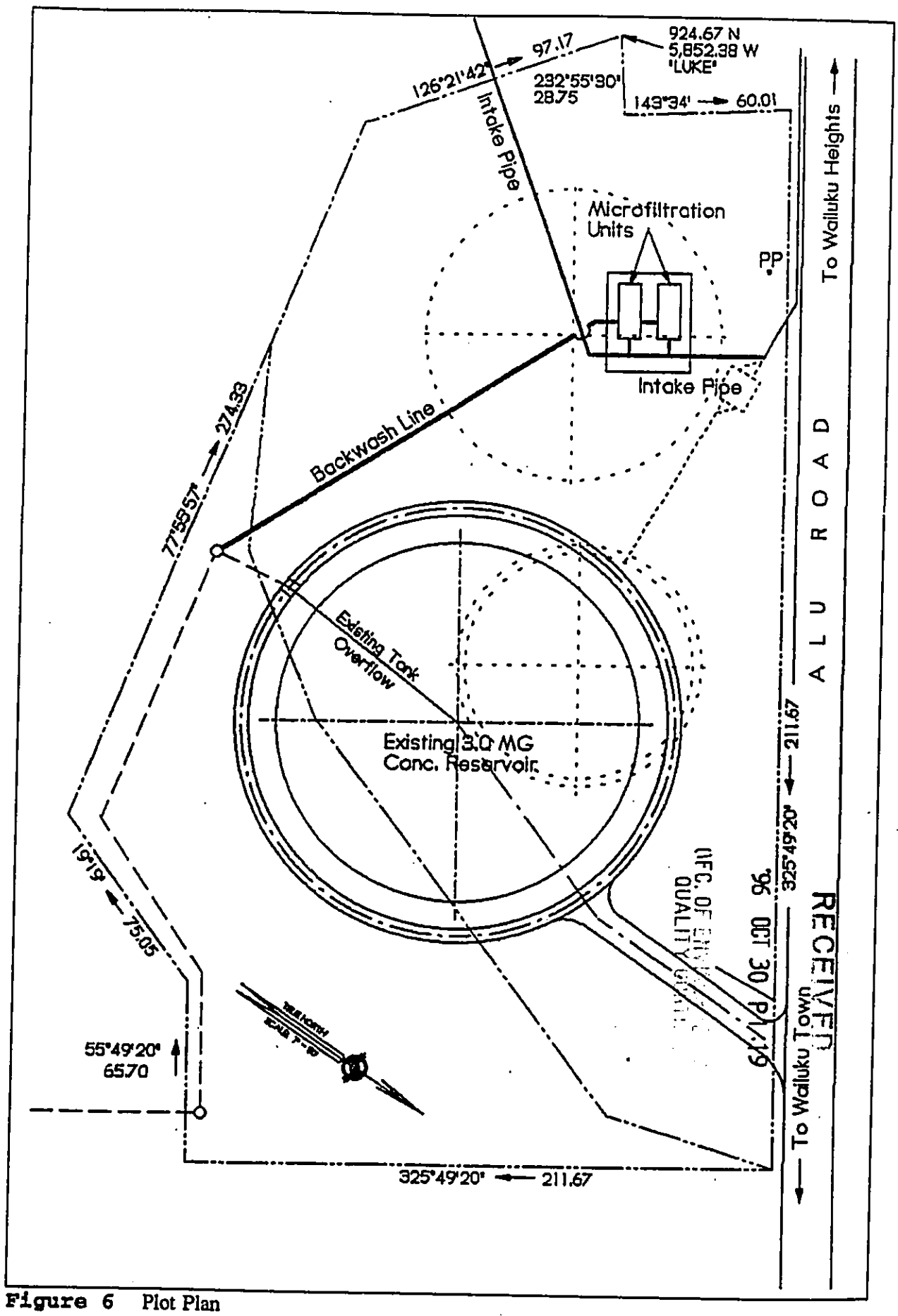


Figure 6 Plot Plan

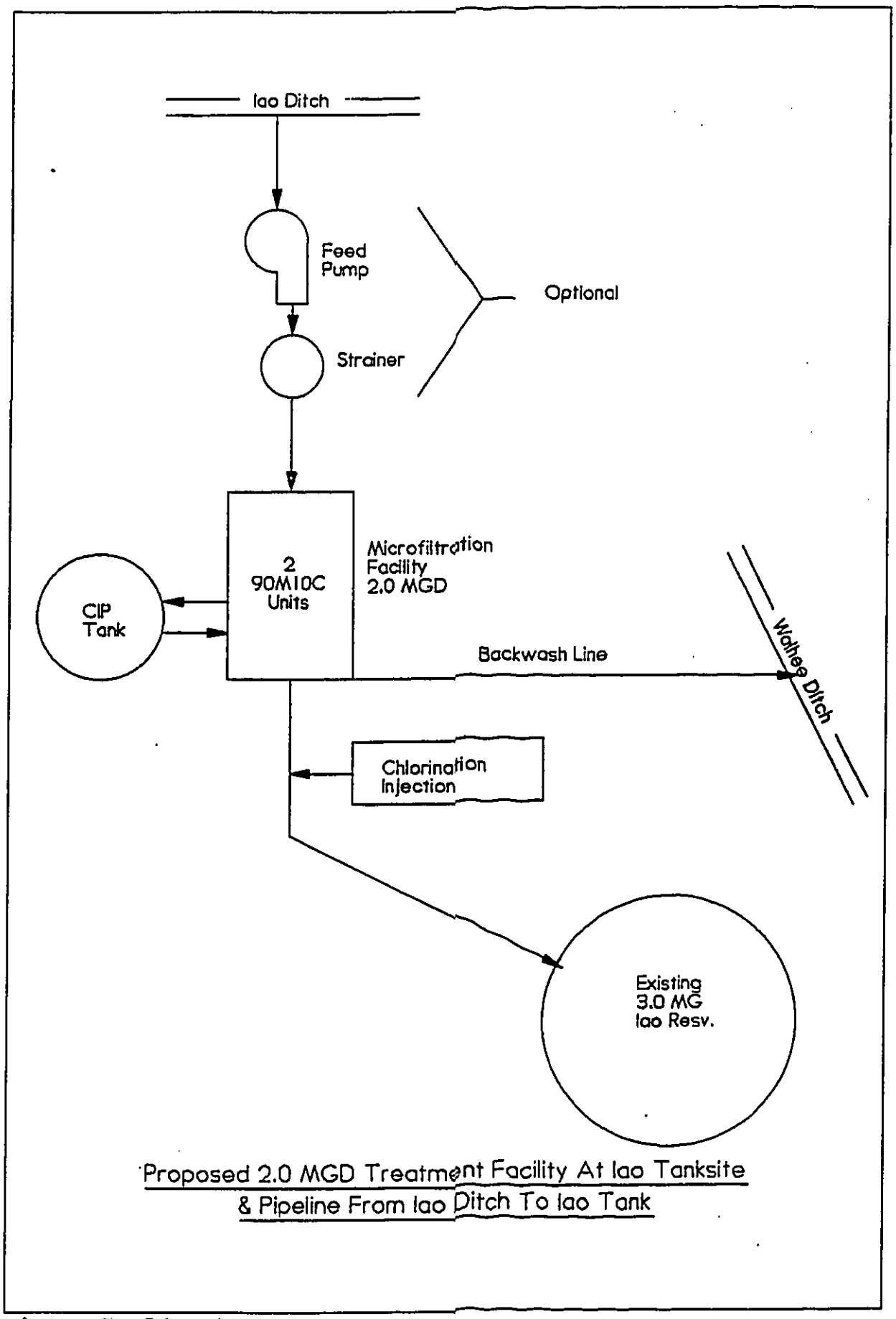
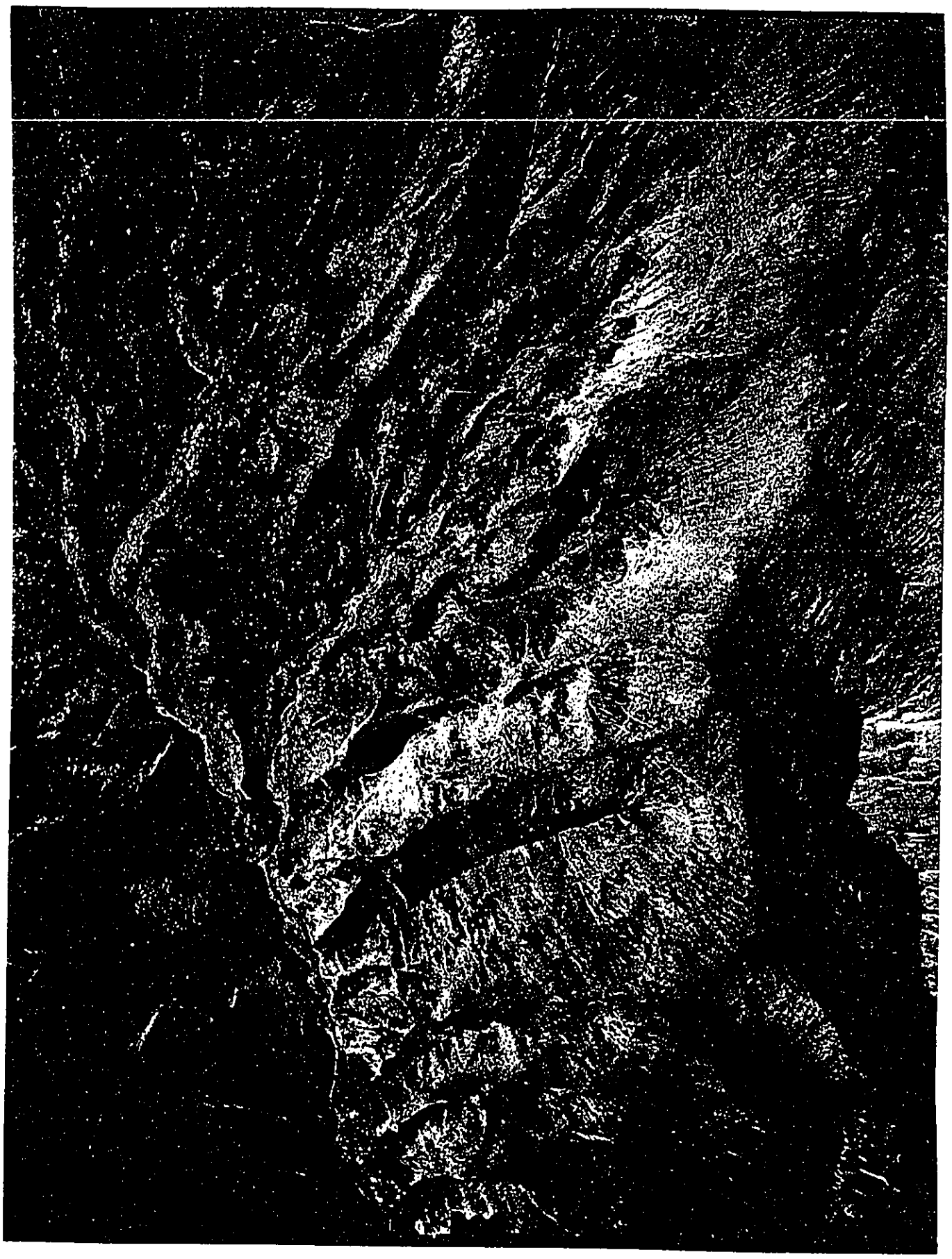


Figure 7 Schematic

Courtesy of Natural Resources Conservation Service
Photo by Air Survey, Hawaii

Figure 8 Aerial Photo of Project Site (1991)



Courtesy of Natural Resources Conservation Service
Photo by Air Survey, Hawaii

Figure 9 Aerial Photo of Iao Stream (1991)

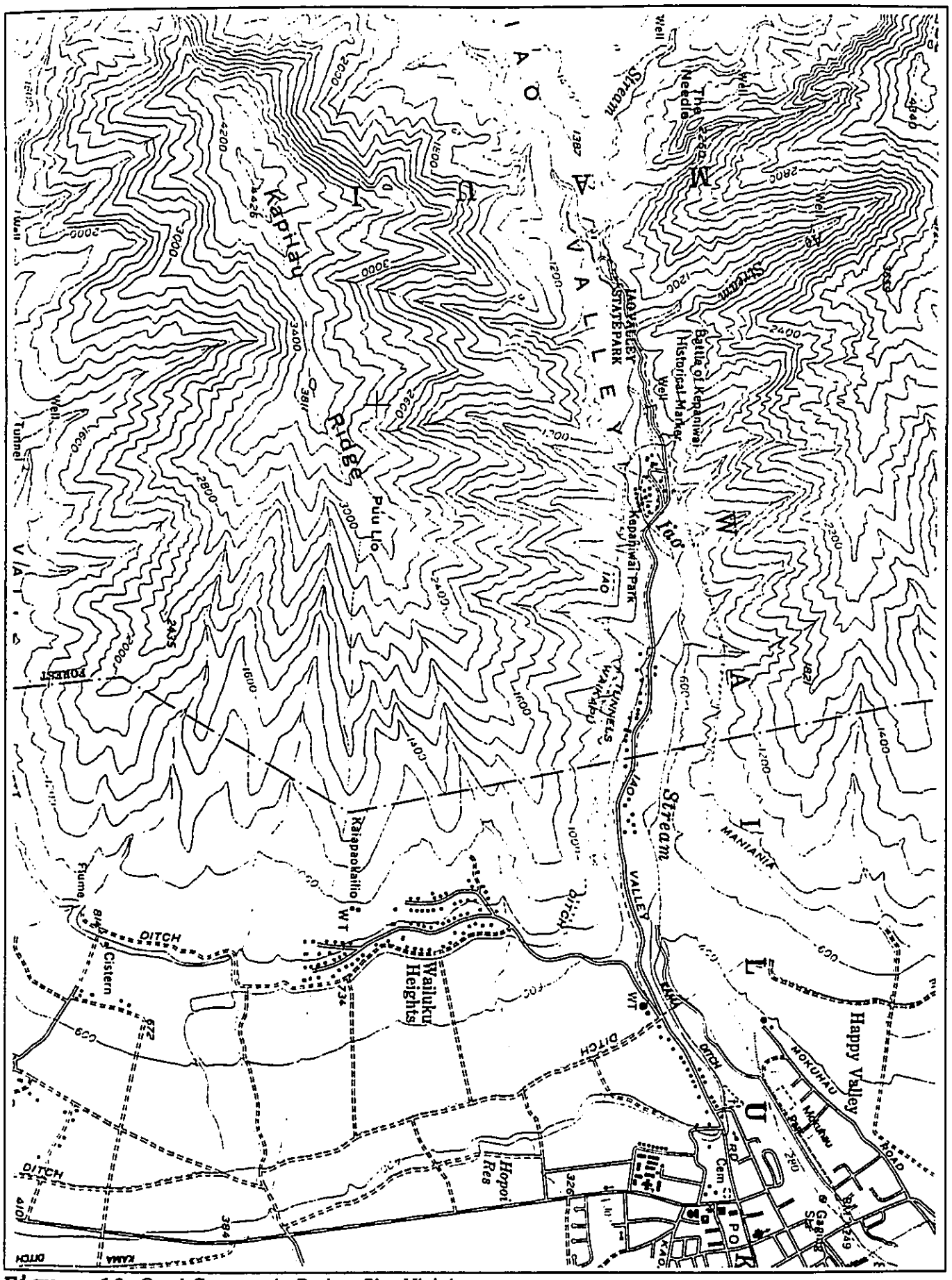


Figure 10 Quad Contours in Project Site Vicinity

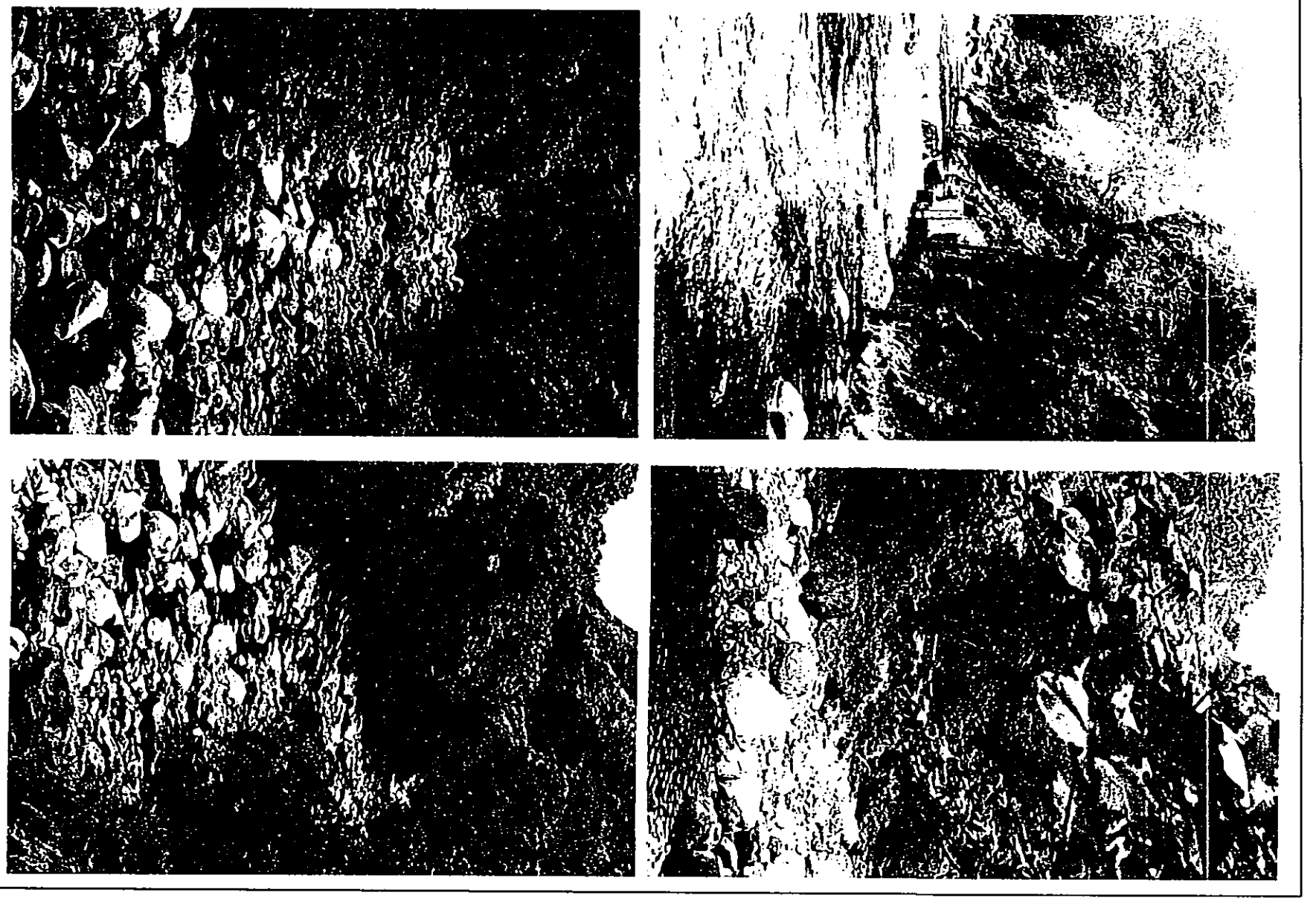


Figure 11 Photos - Views of Iao Stream Above & Below Intake

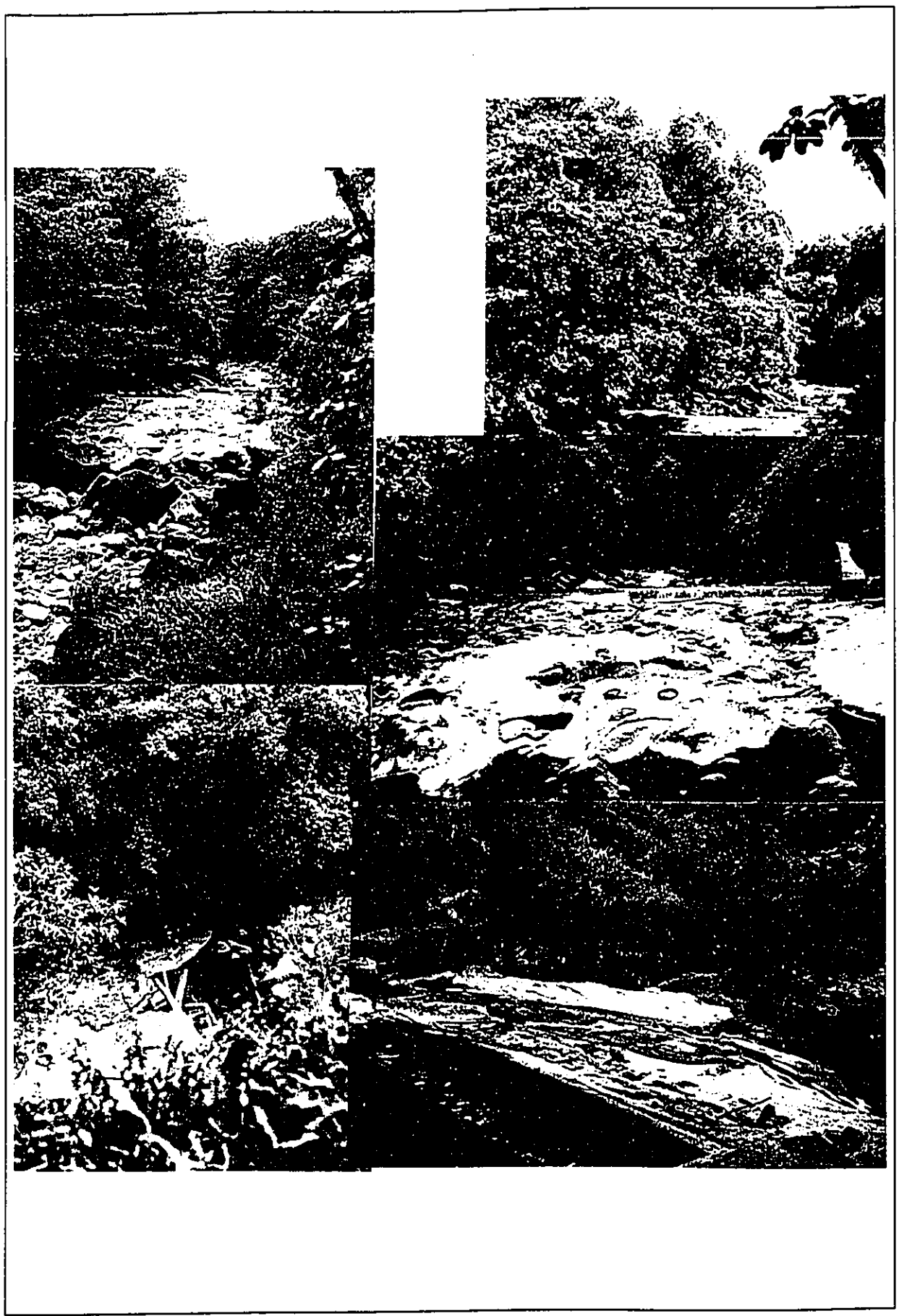


Figure 12 Photos - Views of Intake

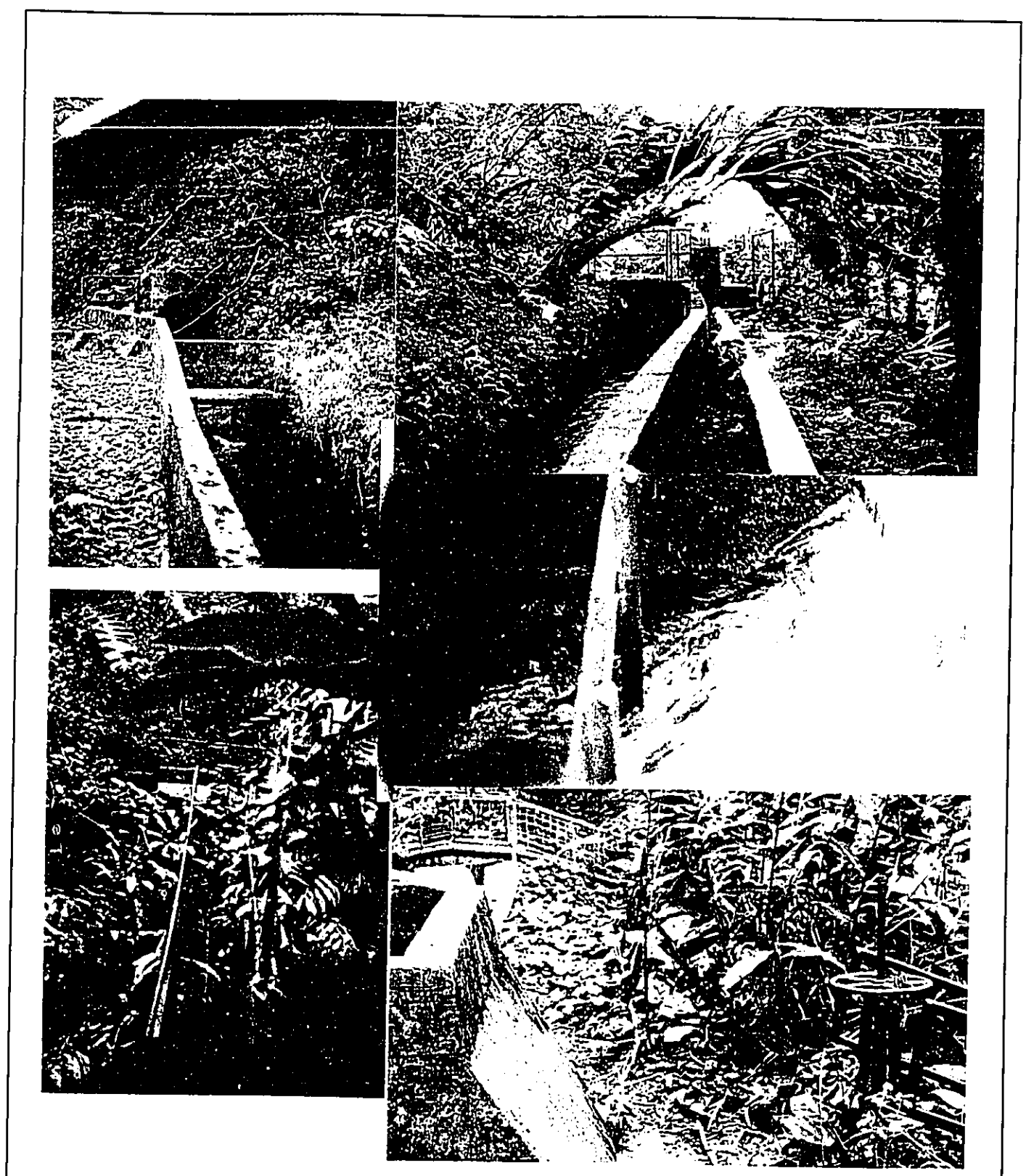


Figure 13 Photos - Views of Tunnel & Split between Iao and Maninia Ditches

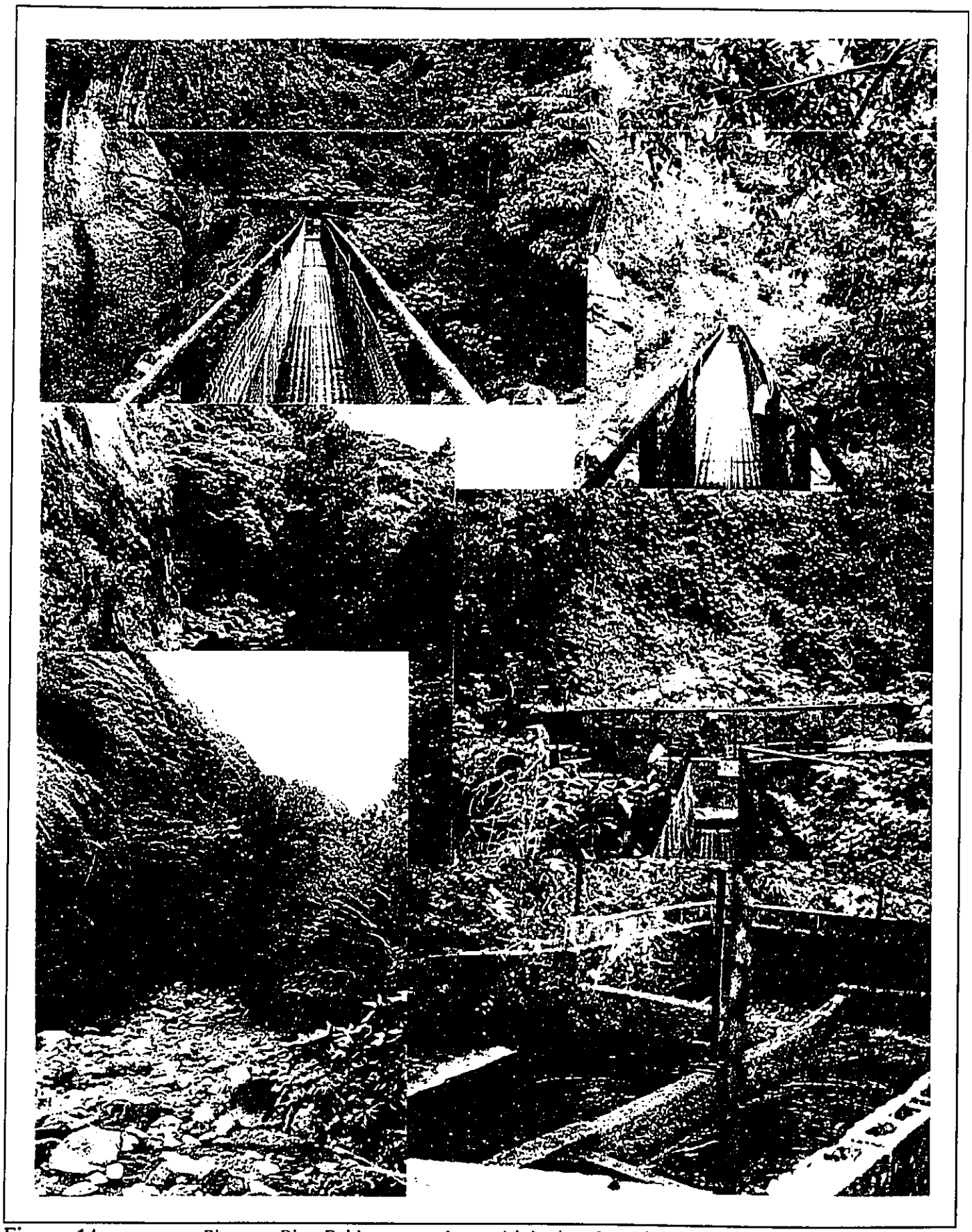


Figure 14 Photos - Pipe Bridge across Iao and inlet into Iao Ditch/Tunnel

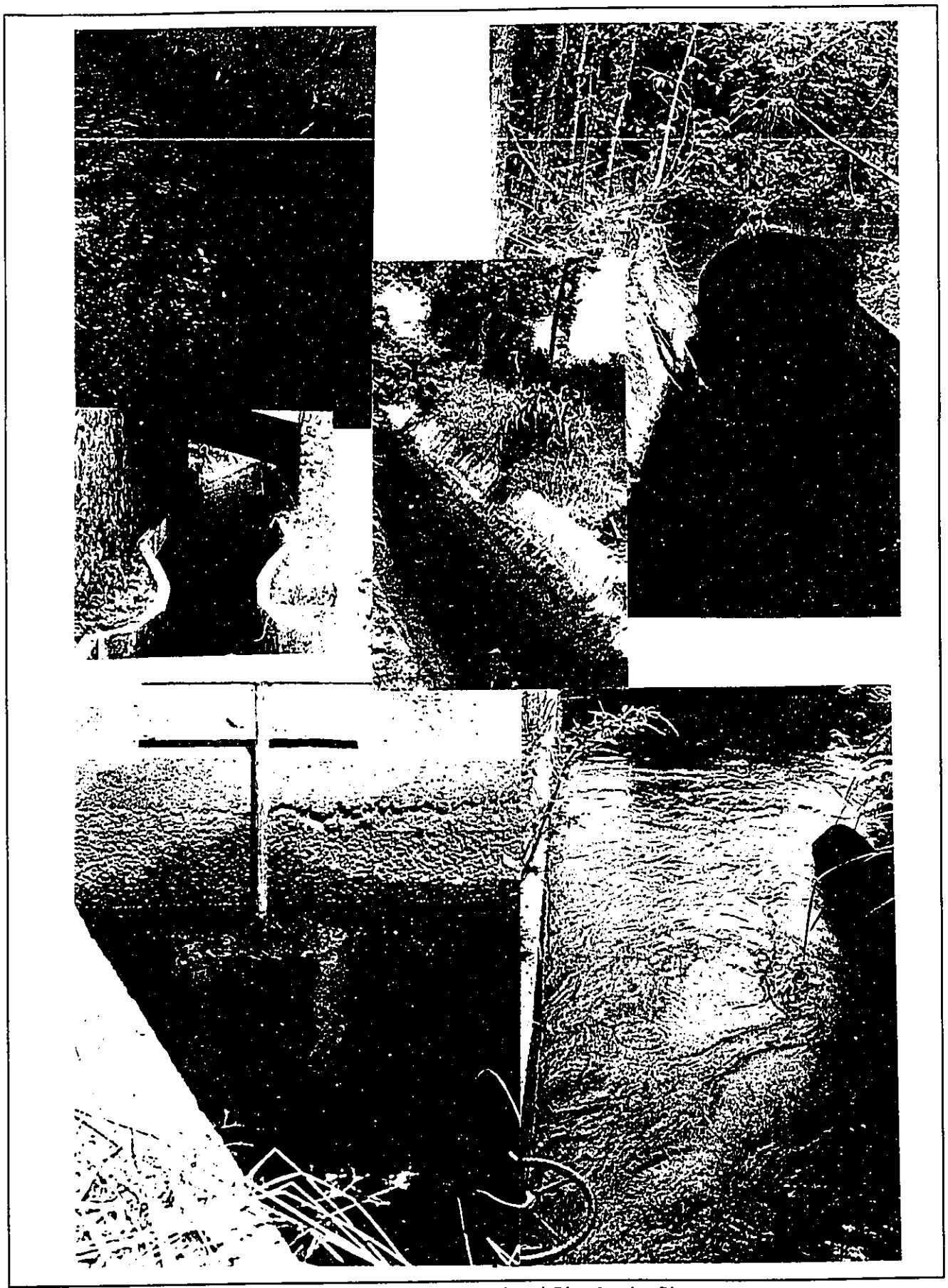


Figure 15 Photos - Iao Ditch Exiting Tunnel and Pipe Intake Site

Figure 16 Photos - Tank Site

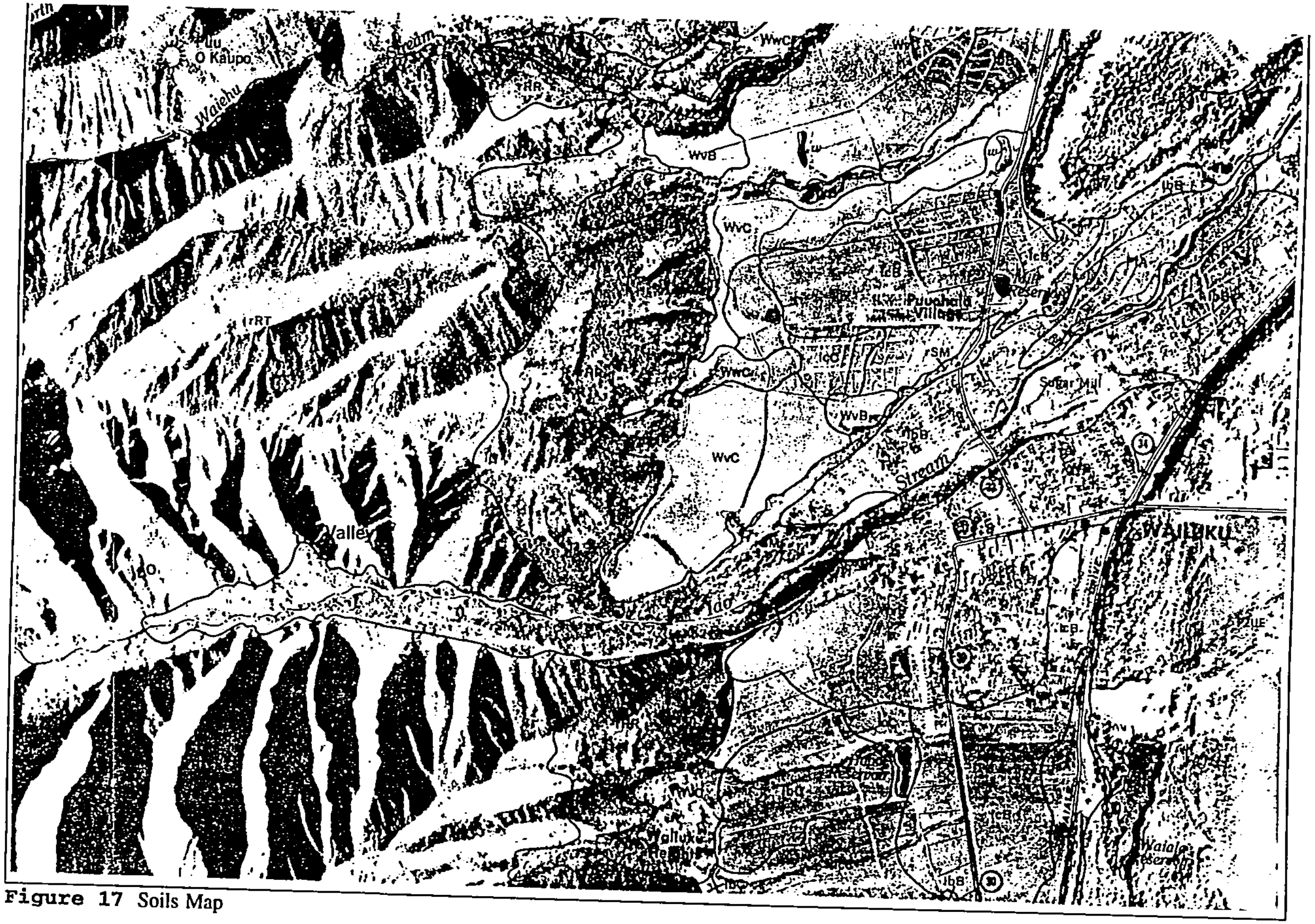


Figure 17 Soils Map

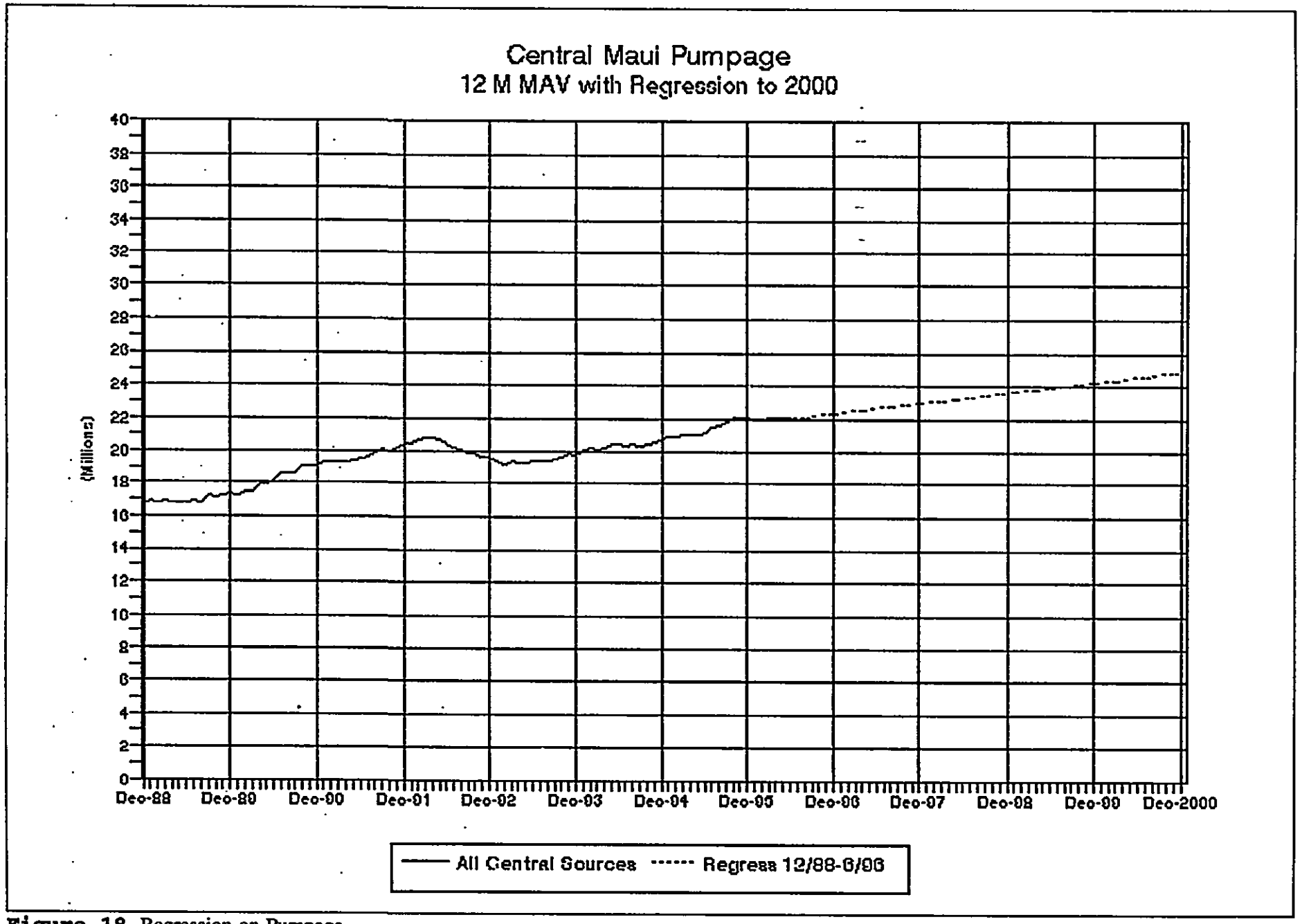


Figure 18 Regression on Pumpage

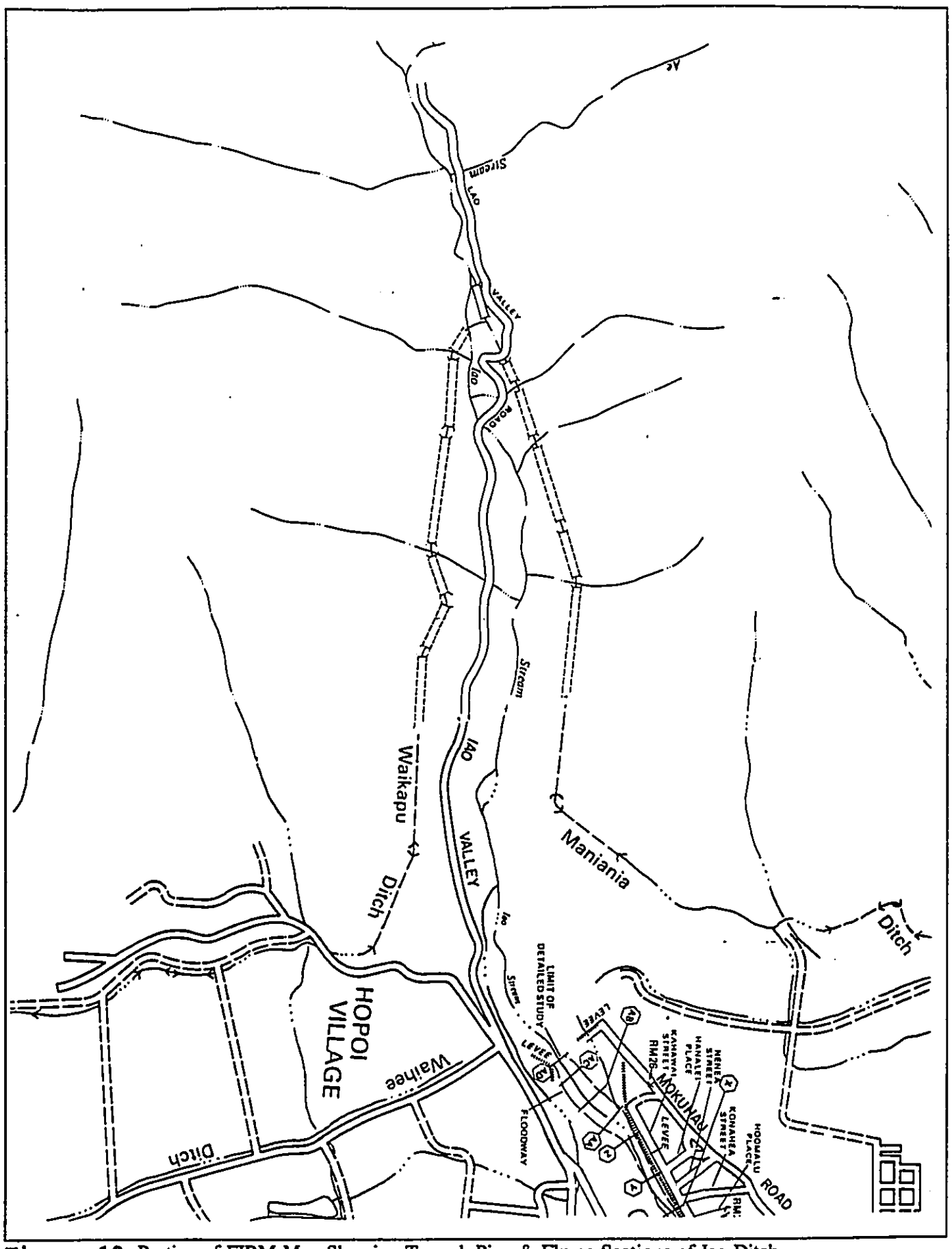


Figure 19 Portion of FIRM Map Showing Tunnel, Pipe & Flume Sections of Iao Ditch

XI. Appendices

MEMTEC AMERICA CORPORATION

MEMCOR®

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5 West Aylesbury Road
Timonium, Maryland 21093 USA
Telephone: (410) 252-0800
Telefax: (410) 561-3017

MEMCOR®CMF Versus Surface Water Treatment Rule			
Contaminate	SWTR Specification for Inactivation	CMF Filtrate Max. Challenge to Date	SWTR Credit
Glardia	99.9% (3 log)	6 log	3 log
Cryptosporidium	99.99% (4log)	6 log	Pending ESWTR Requirements
Viruses	99.99% (4 log)	3 log	1 log
Turbidity	1 ntu (5 ntu max.)	0.02 ntu	Full

Appendix 1 Description of Membrane Filtration & Contaminant Removal

Technical Bulletin T2024-C 1

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MEMCOR® MICROFILTRATION PREFILTRATION REQUIREMENTS

The MEMCOR microfiltration system requires minimal prefiltration to maintain system operation. The M10 and M10C modules can be effectively operated using 500 micron prescreen.

For small systems, a simple strainer is adequate. Larger systems may use gravity operated fine screens or backflushable in-line strainers.

Acceptable Range in Raw Water	
Pretreatment	500 Micron Screen
Suspended Solids	0 - 200 mg/l
Temperature	32 - 110° F
pH	2 - 14
Turbidity	0 - 500 NTU
Microrganisms	0 - 10^7 CFU/ml
Giardia	6 logs
Cryptosporidium	6 logs
S.D.I.	1 - 15

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Virus Removal Capabilities of Microfiltration

The removal and inactivation of Human Viruses from Potable Water and Wastewater is achieved by a combination of physical removal (filtration) and disinfection. Current Federal and State Regulations require a disinfection residual, irrespective of degree of fine filtration, to ensure public safety from treatment process through distribution system to point of use.

Memcor Continuous Microfiltration (CMF) using a 0.2 micron (nominal) membrane has now been accepted as the most appropriate technology from pretreatment of reverse osmosis membranes for wastewater reuse as well as for potable water systems requiring filtration to meet the SWTR and ESWTR.

CMF is credited with complete removal of *Giardia Lamblia* and *Cryptosporidium* and demonstrated similar removal of fecal and total coliforms. The 0.2 micron (nominal) pore size membrane used is obviously too large to retain all single virus of 0.02 - 0.03 (MS2 phage is 0.027 microns), however data from field studies bacteriaphage seeding has established average removal of between 2.2 log and 3.6 log (currently the theory is that natural and seeded virus organisms are attached to particles which are inturn removed by microfiltration).

Virus Removal Factors

1. Viruses associate with particulates (agglomeration)
2. Degree of removal is time dependent. (Adsorption)
3. Viruses associate together in groups and stated as PFU's (plague forming units) rather than a single virus.
4. Virus removal enhanced by cake and gel layer build up on filter media pore size reduced).
5. Virus removal is greater at low pH's.

Virus Log Removal Values by Microfiltration(LRV)

The following general groups characterize the LRV data achieved so far:

1. Removal of naturally occurring Human Viruses in sewage. (Adenovirus, reovirus and enterovirus) — LRV 3.6
2. Removal of naturally occurring bacteriophage in sewage and surface water. — LRV 3.0
3. Removal of spiked samples of MS2 phage in sewage and surface water — LRV 2.2

Summary

The observation that the CMF 0.2 micron membrane achieves a lower LRV for bacteriophage, and in particular MS2 phage, than for naturally occurring human viruses would suggest that the standard model using MS2 phage is always going to underestimate the LRV for Human Viruses by over 1 log.

Respecting the data already established on virus removal as far from complete the CMF capabilities for removal of most pathogens and filtrate usually between 0.03 - 0.08 NTU ensures the disinfection CT's are a minimum.

This is a key factor in meeting the pending ESWTR for *cryptosporidium* while maintaining low THMFP's to meet the D-DBPR.

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MEETING THE PROPOSED ENHANCED SURFACE WATER TREATMENT RULE (ESWTR) BY MEMCOR MICROFILTRATION

During the development of the SWTR, the United States experienced its first recognized waterborne disease outbreak of cryptosporidiosis, caused by the protozoan, *Cryptosporidium*.

Prevalence data for cryptosporidiosis in all age groups ranged from 1 to 2 percent in Europe, 0.6 to 4.3 percent for North America, and 3 to 20 percent for Asia, Australia, Africa and South America (EPA, 1993).

EPA used the data in LeChevallier et al. (1991a,b) to calculate the percentage of systems that use source water containing various densities of *Giardia* cysts. The Agency calculated that about 85% of the source waters in the study contained 10 cysts/100L or more, while about 45% contained 100 cysts/100L or more. Many of these systems currently provide four, five, or even six or more logs of removal/inactivation and therefore are able to achieve EPA's 10^{-4} annual risk goal. However, if such systems were to reduce existing levels of disinfection to more easily meet new D/DBP regulations, and only marginally meet the three-log removal/inactivation requirement for *Giardia* specified in the current SWTR, they could experience significant increases in microbial risk (Regli et al., 1993; Grubbs et al., 1992; EPA, 1994).

Memcor Microfiltration would be able to demonstrate complete removal of *Giardia* and *Cryptosporidium* and allow disinfection levels to be reduced to meet virus and D/DBP regulations without increasing EPA's 10^{-4} annual risk goal.

This situation might result in a substantial increase in waterborne illness for systems using a poor quality source water. For example, according to a model developed by EPA (Regli et al., 1993), a reduction of the MCL for total trihalomethanes (TTHMs) (one of the toxic byproducts) from 100 *u*g/L to 75 *u*g/L could increase the incidence of waterborne giardiasis in some systems by as many as 10,000 per million people per year, if the existing SWTR is not amended to require higher levels of treatment for poor quality source waters.

CMF's ability to filter high turbidity surface water and wastewater to reduce microorganisms and suspended solids to well below SWTR requirements should see microfiltration a candidate for Best Available Technology (BAT), particularly for poor quality source waters.

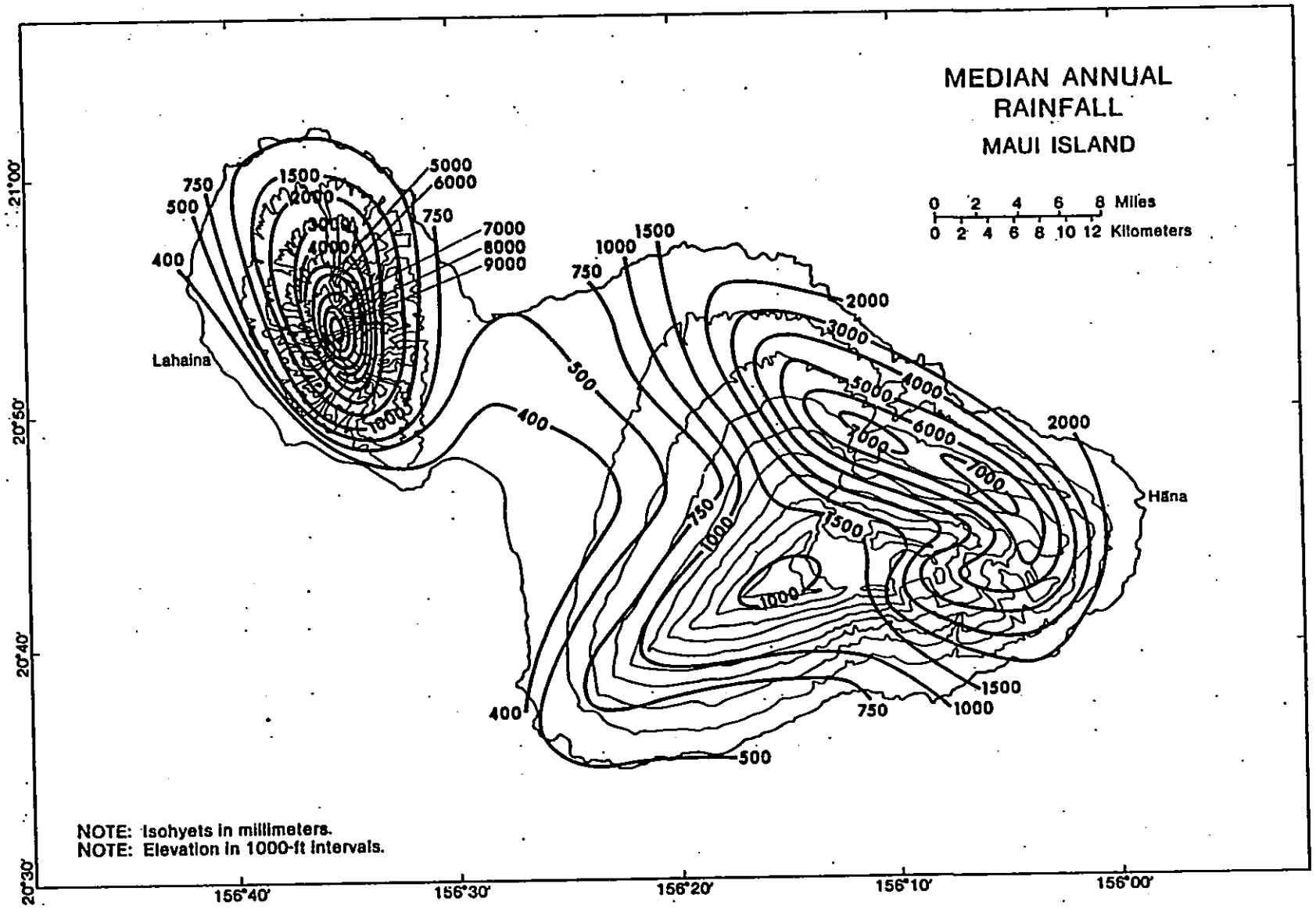
It is estimated that over 162 million people are served by public water systems using surface water, most of which are filtered and disinfected. Of these, as of June 1989, an estimated 21 million people were receiving unfiltered surface water that is only disinfected. EPA anticipates that, as a result of the SWTR, more than 80 percent of the unfiltered systems will install filtration. Nevertheless, in spite of filtration and disinfection, *Cryptosporidium* oocysts have been found in filtered drinking water (LeChevallier et al., 1991b; EPA, 1993) and most waterborne outbreaks of cryptosporidiosis have been associated with filtered surface water systems. Therefore, it appears that surface water systems that filter and disinfect may still be vulnerable to *Cryptosporidium*, depending on source water quality and treatment effectiveness. **In addition, some surface water systems that were able to avoid filtration under the SWTR may need to filter to provide adequate protection against *Cryptosporidium*.**

Also, direct person-to-person spread of infection may readily occur, thus magnifying the significance of the original waterborne infection. Therefore, the presence of this organism at any level in consumed drinking water cannot be considered safe for human consumption. For these reasons and to be consistent with EPA drinking water stanards for *Giardia*, enteric viruses, *Legionella*, *E.coli* and coliform bacteria, EPA proposes that the MCLG for *Cryptosporidium* oocysts in water be zero.

The EPA is proposing a number of alternative MCL's and treatment levels, however, it is assumed that the final regulations will not exceed the following:

No. *Cryptosporidium* (/100L)	Required Treatment Level
<1	99.9% (3-log)
1-9	99.99% (4 - log)
10-99	99.999% (5 log)
>99	99.9999% (6 log)

Memcor microfiltration systems are available to demonstrate that even these levels can be achieved on poor quality source waters.



Appendix Figure A.14. Median annual rainfall, Maui Island, Hawai'i

UNIT CONVERSIONS

mm	in.	mm	in.	in.	mm
5	0.20	1 300	51.18	0.25	6
10	0.39	1 400	55.12	0.50	13
20	0.79	1 500	59.06	0.75	19
25	0.98	1 600	62.99	1.00	25
40	1.57	1 700	66.93	1.50	38
50	1.97	1 800	70.87	2.00	51
70	2.76	1 900	74.80	3.00	76
75	2.95	2 000	78.74	4.00	102
100	3.94	2 500	98.43	5.00	127
125	4.92	3 000	118.11	6.00	152
150	5.91	3 500	137.80	7.00	178
175	6.89	4 000	157.48	8.00	203
200	7.87	4 500	177.17	9.00	229
250	9.84	5 000	196.85	10.00	254
300	11.81	5 500	216.54	15.00	381
400	15.75	6 000	236.22	20.00	508
500	19.69	6 500	255.91	25.00	635
600	23.62	7 000	275.59	50.00	1 270
700	27.56	7 500	295.28	100.00	2 540
750	29.53	8 000	314.96	150.00	3 810
800	31.50	8 500	334.65	200.00	5 080
900	35.43	9 000	354.33	250.00	6 350
1 000	39.37	9 500	374.02	300.00	7 620
1 100	43.31	10 000	393.70	400.00	10 160
1 200	47.24	11 000	433.07	500.00	12 700

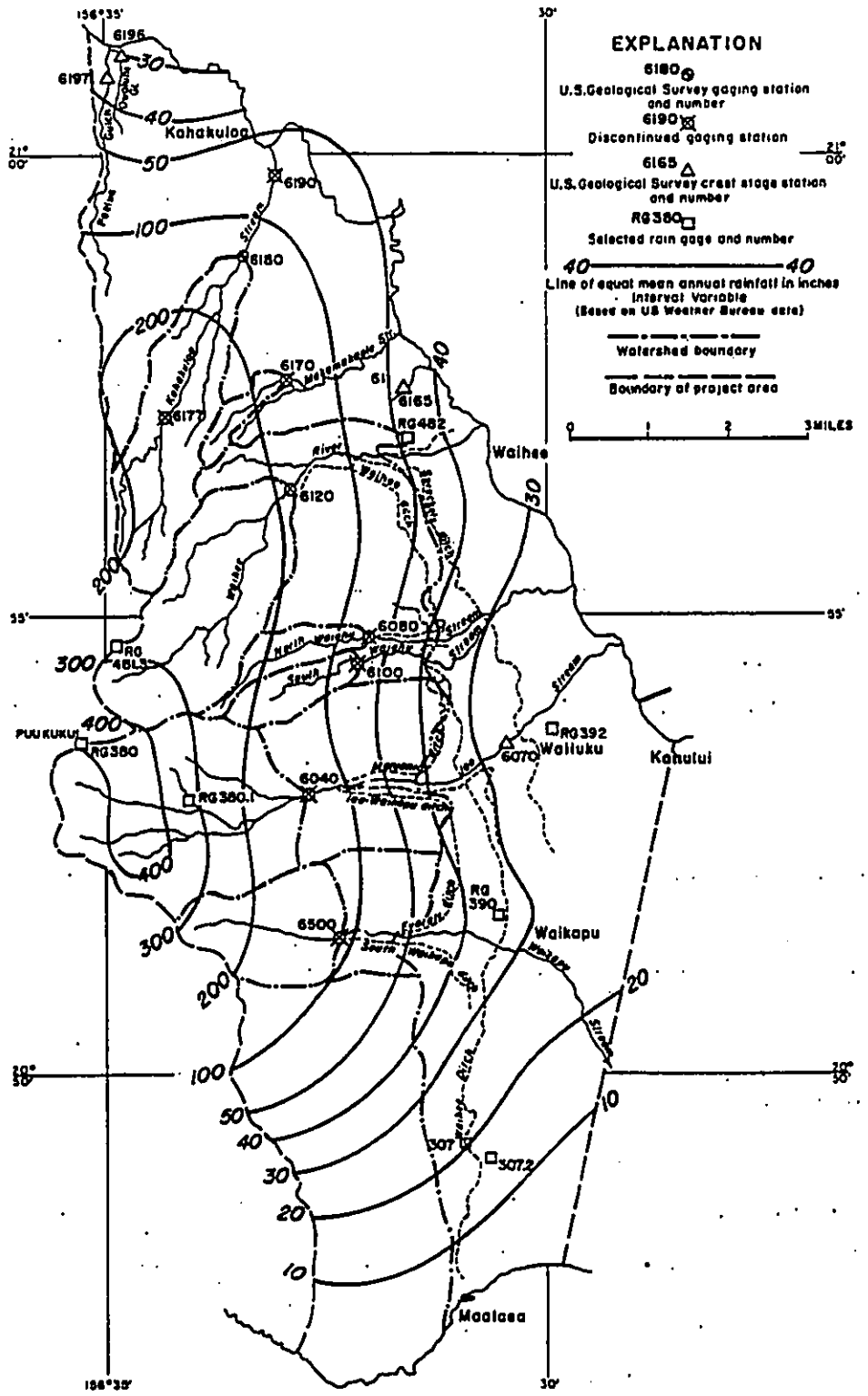


Figure 3. MAP OF AREA SHOWING DISTRIBUTION OF MEAN ANNUAL RAINFALL AND LOCATION OF SELECTED RAINFALL AND STREAMFLOW STATIONS, AND MAJOR DITCHES

From Preliminary Report on the Water Resources of the Wailuku Area, Maui - C61

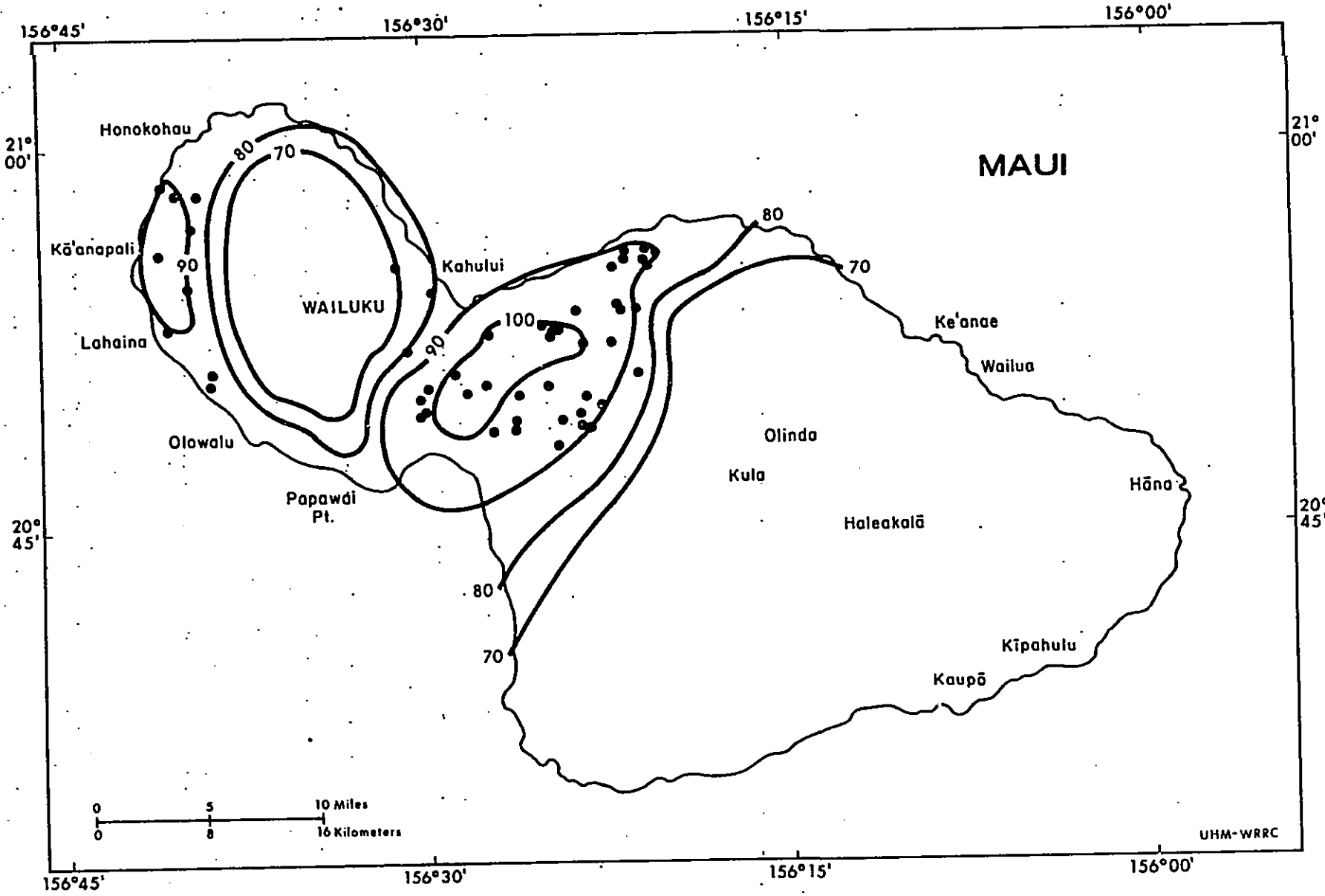
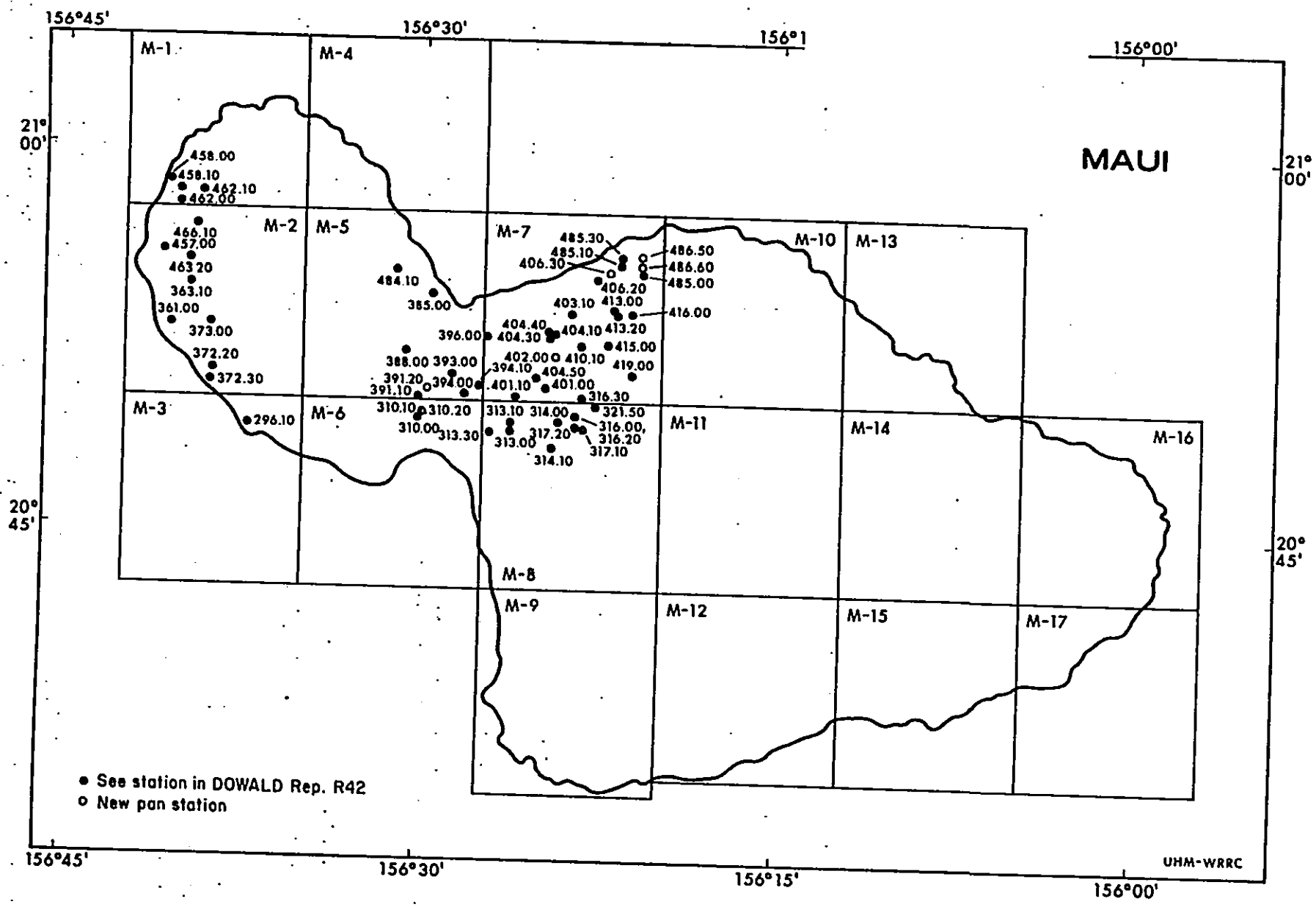


Figure 18. Adjusted annual pan evaporation for Maui



Appendix Figure A.5. Location map of pan evaporation stations, Maui

APPENDIX TABLE B.1—Continued

STATE KEY NO.	YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	ANNUAL (in.)
							(in.)							
385.00	1979	.	.	5.94	5.75	6.18	6.76	8.40	8.49	7.90	6.77	5.24	.	.
385.00	1980	.	5.00	7.08	5.84	6.24	6.95	6.88	7.52	7.46	7.55	6.80	6.64	.
385.00	1981	.	6.60	8.54	8.53	8.92	9.38	9.72	8.60	8.29	6.44	5.66	.	.
385.00	1982	.	5.51	.	6.57	7.48	6.69	7.14	7.15	7.32	7.69	6.90	5.25	.
385.00	1983	5.64	6.13	7.35	7.66	8.09	8.63	7.90	.	.	.	.	.	.
388.00	1976	4.66	5.12	4.60	5.82	6.93	6.99	7.64	8.67	7.14	5.95	5.38	5.45	74.35
388.00	1977	5.30	5.77	7.89	.	7.29	7.13	6.65	8.42	7.67	6.30	6.12	.	.
388.00	1978	5.41	4.74	5.59	7.31	6.84	6.67	6.99	6.90	7.73	5.59	4.78	.	.
388.00	1979	.	.	6.23	5.92	7.14	6.65	6.51	7.33	6.92	5.58	4.04	.	.
388.00	1980	.	3.70	4.99	5.34	5.75	5.98	5.88	6.54	6.24	6.46	5.03	5.32	.
388.00	1981	.	6.54	6.37	6.88	7.79	7.64	7.86	7.44	6.54	5.87	4.29	.	.
388.00	1982	.	4.37	.	.	5.34	5.23	4.96	4.63	5.60	5.68	5.41	4.51	.
388.00	1983	5.22	3.79	5.22	5.57	6.46	6.76	6.13	.	.	.	.	.	.
391.10	1976	7.61	9.05	8.38	10.44	11.55	10.05	10.67	10.50	8.61	7.47	5.23	5.49	105.05
391.10	1977	5.24	6.25	.	.	7.47	8.05	8.08	8.62	8.60	7.44	.	5.25	.
391.10	1978	5.54	6.56	10.03	9.14	9.58	10.26	10.17	10.48	9.40	7.15	.	.	.
391.10	1979	.	.	7.45	6.89	9.12	10.00	8.90	8.68	8.31	6.94	5.31	.	.
391.10	1980	.	4.25	7.25	6.62	10.32	11.13	12.37	12.28	11.07	10.24	6.69	4.82	.
391.10	1981	.	6.75	6.95	9.07	10.22	10.67	11.01	10.04	8.34	8.00	5.78	.	.
391.10	1982	.	4.55	7.20	.	7.36	6.73	.	10.84	10.89	9.87	7.21	4.58	.
391.10	1983	4.41	5.71	6.53	7.44	7.76	8.99	9.25	.	.	.	.	.	.
391.20	1982	.	.	.	.	.	.	5.83	9.66	8.82	8.65	5.65	4.47	.
391.20	1983	5.41	5.31	7.80	9.88	10.76	10.01	11.15	.	.	.	.	.	.
393.00	1974	.	.	.	.	.	10.81	11.52	12.14	9.97	10.17	7.06	8.03	.
393.00	1975	5.56	5.35	7.91	9.13	10.42	11.54	11.89	11.54	10.69	8.91	7.42	5.99	106.35
393.00	1976	5.72	6.25	6.73	9.55	10.98	10.33	13.34	12.80	10.14	9.14	7.61	6.89	109.48
393.00	1977	6.44	7.24	9.94	9.80	9.75	10.93	10.41	10.23	9.77	7.96	6.99	5.47	104.93
393.00	1978	6.62	6.24	7.73	8.28	8.23	10.23	11.52	10.75	10.15	7.31	4.72	5.93	97.71
393.00	1979	5.20	4.18	6.85	6.28	9.08	9.37	9.75	9.15	8.78	7.13	5.58	5.73	87.08
393.00	1980	5.27	4.62	6.76	6.50	8.32	9.10	9.19	8.71	8.42	8.78	7.39	5.18	88.24
393.00	1981	5.25	5.90	8.28	8.51	8.15	10.30	11.04	9.59	9.00	7.99	6.71	5.24	95.96
393.00	1982	5.27	4.18	3.80	6.03	7.56	7.29	8.38	8.49	8.64	6.93	6.71	4.77	78.05
393.00	1983	4.32	5.91	7.48	8.05	7.59	9.48	.	.	.	.	.	.	.
394.00	1964	.	.	.	.	9.84	9.39	10.88	10.23	9.34	7.86	6.34	4.10	.
394.00	1965	4.16	4.41	6.05	6.89	7.46	10.21	9.50	11.37	8.29	8.00	5.70	5.66	87.70
394.00	1966	5.03	3.62	6.40	7.08	7.74	10.06	9.70	8.79	7.94	6.66	.	.	.
394.00	1975	.	.	.	.	.	11.78	13.48	13.11	12.09	10.07	7.67	6.27	.
394.00	1976	6.00	6.36	6.58	9.96	12.14	11.24	13.35	13.28	10.95	9.55	7.99	7.24	114.64
394.00	1977	5.89	7.41	10.70	9.40	10.33	10.76	11.58	10.99	10.50	9.11	7.31	6.25	110.23
394.00	1978	6.79	6.50	8.26	9.20	8.86	11.03	11.88	11.07	10.96	7.87	5.37	6.36	104.15
394.00	1979	6.16	3.95	7.21	6.35	9.21	10.37	11.00	10.63	8.94	7.89	6.45	6.10	94.26
394.00	1980	5.48	4.57	6.97	6.70	8.44	9.58	10.07	10.23	9.42	8.43	7.05	4.63	91.57
394.00	1981	5.71	6.05	8.20	8.27	8.52	10.22	11.81	10.58	10.45	9.41	8.21	5.71	103.14
394.00	1982	4.86	4.80	4.13	6.28	8.09	8.55	9.26	9.89	9.35	7.66	5.17	4.49	82.53
394.00	1983	4.53	5.67	7.25	8.06	8.73	9.33	.	.	.	.	.	.	.
394.10	1966	.	.	.	.	.	.	.	.	.	7.04	6.18	6.05	.

NORMALS, MEANS, AND EXTREMES

KAHULUI, HAWAII

LATITUDE: 20° 54' N LONGITUDE: 156° 26' W ELEVATION: FT. GRND 48 BARO 46 TIME ZONE: BERING WBAN: 22516

	(a)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F														
Normals														
-Daily Maximum		79.9	80.1	81.2	82.2	84.2	85.9	86.8	87.6	87.7	86.4	83.7	81.1	83.9
-Daily Minimum		63.6	63.4	64.6	66.1	67.0	69.0	70.5	70.8	69.8	69.2	67.6	65.1	67.2
-Monthly		71.7	71.8	73.0	74.2	75.7	77.5	78.7	79.5	78.8	77.9	75.7	73.1	75.6
Extremes														
-Record Highest	30	89	85	90	91	92	93	94	97	95	96	93	90	97
-Year		1981	1994	1984	1981	1992	1981	1984	1994	1992	1973	1990	1992	AUG 1994
-Record Lowest	30	48	50	52	54	57	58	58	61	60	58	55	52	48
-Year		1969	1987	1995	1985	1985	1985	1965	1976	1975	1964	1985	1983	JAN 1969
NORMAL DEGREE DAYS:														
Heating (base 65 °F)		0	0	0	0	0	0	0	0	0	0	0	0	0
Cooling (base 65 °F)		208	190	248	276	332	375	425	443	414	400	321	251	3883
% OF POSSIBLE SUNSHINE	32	63	65	64	65	68	72	70	71	72	67	63	63	67
MEAN SKY COVER (tenths)														
Sunrise – Sunset	36	4.8	5.0	5.4	5.9	5.3	4.9	4.8	4.7	4.8	5.2	5.2	4.9	5.1
MEAN NUMBER OF DAYS:														
Sunrise to Sunset														
-Clear	36	12.9	11.5	10.7	7.7	9.6	10.6	10.8	11.9	11.5	10.6	10.9	11.9	130.7
-Partly Cloudy	36	9.8	9.3	11.2	11.8	13.5	13.5	14.8	13.5	12.6	12.5	10.8	11.3	144.5
-Cloudy	36	8.3	7.4	9.1	10.5	7.9	5.9	5.4	5.6	5.9	7.9	8.3	7.8	90.1
Precipitation														
.01 inches or more	36	10.6	9.9	10.9	10.3	6.3	5.2	6.7	6.3	5.6	7.3	10.2	11.1	100.3
Snow,Ice Pellets,Hail														
1.0 inches or more	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Thunderstorms	36	0.8	0.5	0.4	0.5	0.2	0.0	0.1	0.1	0.2	0.3	0.4	0.5	4.2
Heavy Fog Visibility														
1/4 mile or less	36	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Temperature °F														
-Maximum														
90° and above	30	0.0	0.0	0.1	0.1	1.1	2.0	5.3	5.8	7.4	4.7	1.2	0.1	25.6
32° and below	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-Minimum														
32° and below	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0° and below	30	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AV. STATION PRES.(mb)	11	1012.4	1013.6	1014.9	1014.9	1014.7	1014.2	1013.6	1013.2	1013.4	1012.8	1012.9	1013.2	1013.6
RELATIVE HUMIDITY (%)														
Hour 02	10	85	83	81	81	82	80	80	79	80	80	81	82	81
Hour 08 (Local Time)	30	82	81	77	75	71	69	71	71	71	73	76	80	75
Hour 14	30	62	61	59	58	56	55	56	56	55	57	60	61	58
Hour 20	30	77	75	75	74	72	71	72	72	71	73	75	76	74
PRECIPITATION (ins):														
Water Equivalent														
-Normal		4.16	2.87	2.72	1.84	0.77	0.27	0.38	0.49	0.35	1.23	2.59	3.27	20.92
-Maximum Monthly	40	14.46	8.51	10.90	14.29	4.36	2.50	1.65	1.54	1.43	5.66	9.27	10.19	14.46
-Year		1980	1972	1967	1989	1987	1967	1989	1982	1987	1985	1965	1988	JAN 1980
-Minimum Monthly	40	0.12	0.07	0.09	0.06	T	0.00	0.02	0.02	0.02	T	0.14	0.01	0.00
-Year		1977	1983	1957	1990	1972	1957	1973	1973	1972	1984	1980	1975	JUN 1957
-Maximum in 24 hrs	40	7.01	4.98	5.42	4.83	2.41	2.36	1.04	1.21	1.16	4.85	5.48	5.82	7.01
-Year		1980	1972	1967	1989	1987	1967	1989	1982	1965	1985	1965	1955	JAN 1980
Snow,Ice Pellets,Hail														
-Maximum Monthly		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
-Year														
-Maximum in 24 hrs	40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
-Year														
WIND:														
Mean Speed (mph)	23	10.8	11.1	12.3	13.3	13.2	14.7	15.6	14.8	12.9	12.0	11.8	11.3	12.8
Prevailing Direction through 1963		SSW	S	NE	NE	NE	ENE	NE	NE	NE	NE	NE	NE	NE
Fastest Mile														
-Direction (!!)	23	SW	NE	N	E	E	E	NE	NE	E	E	SW	E	SW
-Speed (mph)	23	44	40	43	36	34	33	37	35	33	36	41	36	44
-Year		1980	1971	1968	1976	1986	1986	1978	1975	1977	1975	1982	1971	JAN 1980
Peak Gust														
-Direction (!!)	11	S	NE	E	NE	E	NE	NE	NE	SW	NE	S	E	S
-Speed (mph)	11	54	46	49	45	44	47	46	45	44	46	51	54	54
-Date		1991	1990	1985	1987	1993	1993	1994	1991	1992	1985	1988	1988	JAN 1991

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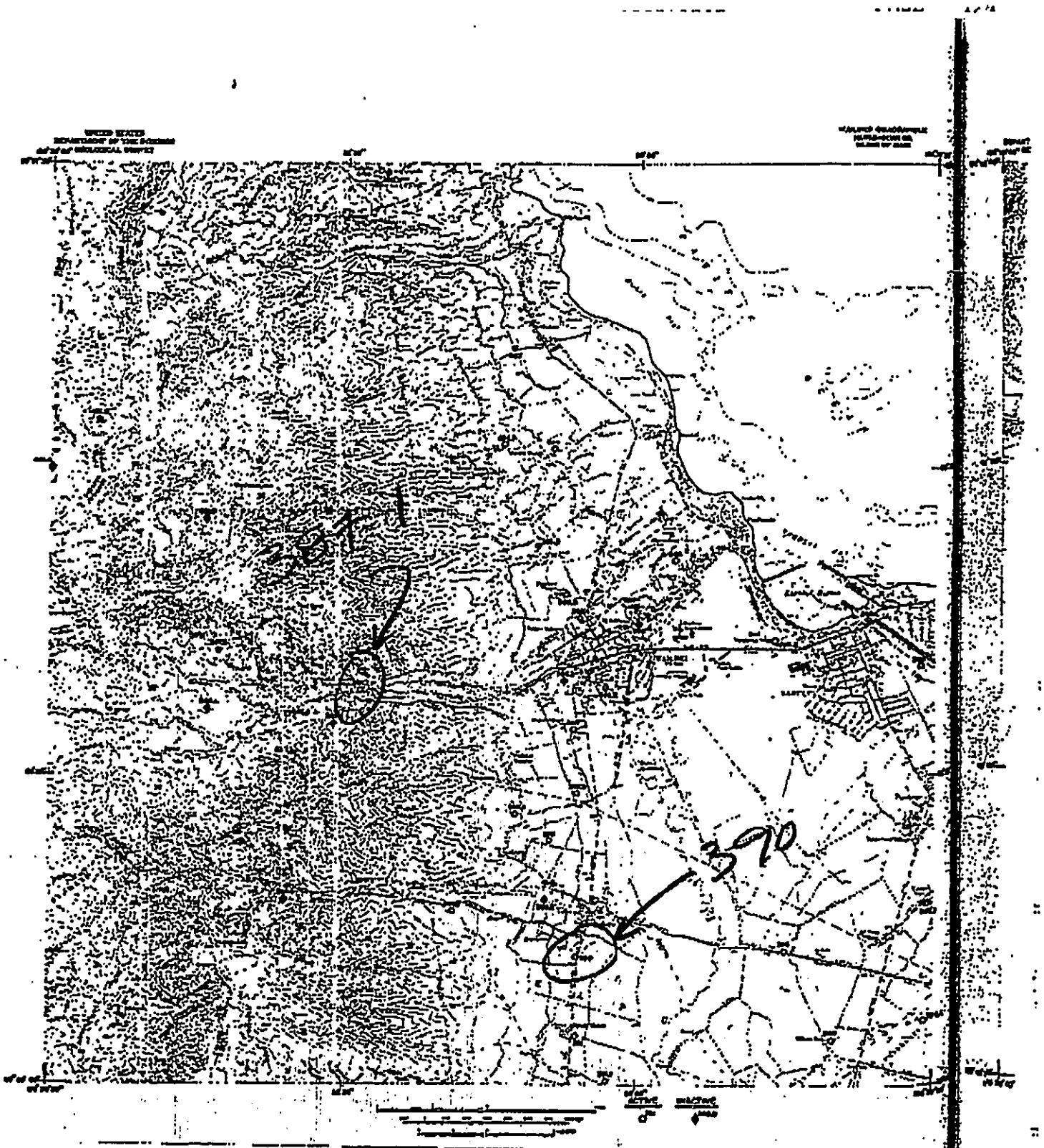

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M-5

CORRECTION

THE PRECEDING DOCUMENT(S) HAS
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LEGIBILITY
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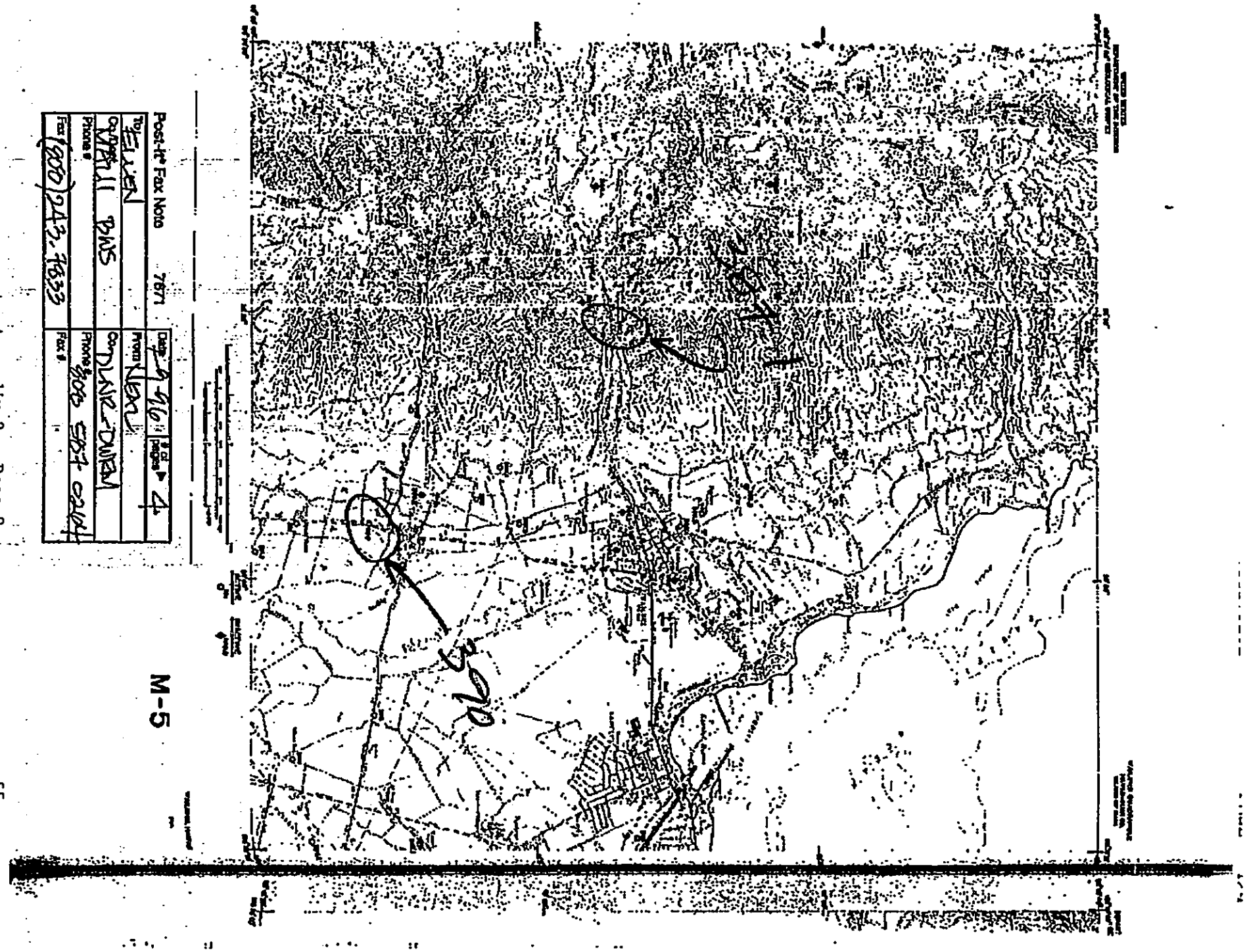

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To ELLEN | From JEAN

Co./Dept. MARIN BWS | Co. DWR-DWEM

Phone # | Phone # 8062

Fax # (800) 243-7832 | Fax # 8062 5267 c2/04

MONTHLY AND ANNUAL RAINFALL SUMMARY, MAUI

SKN: 387.00 NAME: HOPOI RESERVOIR OBSV: WAILUKU SUGAR ELEV(FT): 380
DATA PERIOD: 1933-1983 NYRS: 50 READ:OTHER LAT: 20 52 48 LONG: 156 30 30

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	23.1	13.6	13.7	12.7	6.8	1.7	1.9	3.8	2.1	7.5	15.0	13.8	55.0
75%	7.7	5.6	6.3	3.4	2.0	0.6	0.8	1.1	0.8	2.7	3.6	5.3	34.6
MED	4.2	3.3	3.8	1.8	1.0	0.2	0.5	0.6	0.5	1.5	2.0	2.9	26.7
AVG	5.6	4.1	4.0	2.9	1.4	0.4	0.6	0.9	0.6	1.9	3.1	4.0	29.3
25%	1.6	1.5	1.3	1.0	0.3	0.1	0.2	0.2	0.2	0.8	0.7	1.7	23.1
MIN	0.3	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	10.5

SKN: 387.10 NAME: IAO VALLEY OBSV: WAILUKU SUGAR ELEV(FT): 720
DATA PERIOD: 1949-1983 NYRS: 32 READ:OTHER LAT: 20 53 12 LONG: 156 32 18

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	35.8	25.5	21.4	29.1	10.6	4.1	7.5	14.9	7.6	11.6	28.0	30.4	119.4
75%	17.2	12.0	11.0	9.5	4.7	1.7	2.9	4.4	2.4	6.5	9.9	11.0	82.7
MED	8.6	6.8	6.6	5.8	2.4	1.2	1.9	2.3	1.6	3.7	6.5	6.8	64.6
AVG	11.1	8.6	8.2	7.3	3.5	1.4	2.2	3.3	2.1	4.6	8.4	8.4	69.2
25%	4.6	3.6	3.3	2.6	1.5	0.8	1.1	1.6	1.2	2.1	2.4	4.3	87.1
MIN	0.8	0.6	1.0	0.6	0.2	0.2	0.4	0.5	0.5	0.0	0.9	0.2	31.1

SKN: 387.20 NAME: IAO NEEDLE OBSV: US CORPS OF ENGR ELEV(FT): 1250
DATA PERIOD: 1949-1977 NYRS: 13 READ:WEEKLY LAT: 20 53 0 LONG: 156 33 0

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	38.9	25.4	21.6	17.8	10.9	2.6	8.2	14.2	6.6	16.0	23.9	25.5	100.2
75%	14.8	13.6	15.0	10.6	5.0	2.0	3.4	5.1	2.8	5.4	11.0	9.4	80.6
MED	8.8	5.5	8.3	6.5	3.7	1.0	2.4	3.1	1.8	3.3	7.7	4.5	70.0
AVG	10.8	8.5	9.3	7.3	4.0	1.3	2.9	4.0	2.1	4.6	9.1	7.0	69.6
25%	4.6	3.2	3.1	3.8	1.9	0.6	1.3	1.8	1.1	2.0	4.2	1.9	62.6
MIN	1.6	0.5	1.5	1.5	0.5	0.3	0.6	0.4	0.4	1.0	1.1	0.4	41.0

FROM WATER RESOURCE MGT ID: e01

SKN: 390.00 NAME: WAIKAPU VILLAGE OBSV: WAILUKU SUGAR ELEV(FT): 470
DATA PERIOD: 1895-1983 NYRS: 81 READ:DAILY LAT: 20 51 0 LONG: 156 30 30

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	25.0	22.9	13.9	17.4	8.1	4.0	3.1	4.0	2.9	6.9	14.6	14.5	57.0
75%	6.6	4.6	4.3	4.3	1.4	0.4	0.6	0.8	0.7	2.3	3.3	6.1	32.1
MED	3.3	2.8	2.7	1.5	0.6	0.1	0.2	0.3	0.3	1.0	1.9	3.0	25.2
AVG	4.7	3.8	3.4	2.9	1.1	0.4	0.4	0.7	0.6	1.4	2.8	4.0	26.1
25%	0.8	1.3	1.4	0.7	0.2	0.0	0.1	0.1	0.1	0.5	0.6	1.4	16.4
MIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	8.0

SKN: 390.10 NAME: RESERVOIR 1 OBSV: WAILUKU SUGAR ELEV(FT): 1100
DATA PERIOD: 1949-1983 NYRS: 33 READ:OTHER LAT: 20 51 18 LONG: 156 31 36

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	26.7	14.0	14.5	19.6	4.8	1.8	3.4	5.5	2.8	7.2	18.1	18.3	72.6
75%	10.2	7.1	7.6	4.4	2.3	0.6	1.0	1.6	1.3	3.2	6.0	8.2	45.8
MED	5.7	3.9	3.6	2.6	0.9	0.3	0.6	0.8	0.6	1.7	3.0	4.4	35.8
AVG	7.6	4.9	4.9	3.6	1.5	0.4	0.8	1.2	0.8	2.2	4.6	5.6	38.2
25%	2.2	2.0	1.6	0.9	0.4	0.0	0.3	0.4	0.3	1.1	1.0	1.9	28.3
MIN	0.8	0.6	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	13.7

SKN: 391.00 NAME: HAYASHI OBSV: WAILUKU SUGAR ELEV(FT): 340
DATA PERIOD: 1932-1983 NYRS: 50 READ:OTHER LAT: 20 51 4 LONG: 156 30 30

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	20.9	11.2	13.2	9.1	3.7	2.4	1.5	3.3	1.8	6.4	15.3	12.7	50.8
75%	5.0	4.5	4.9	2.4	1.1	0.1	0.3	0.7	0.4	2.0	2.9	4.8	25.5
MED	3.2	2.7	2.7	1.1	0.4	0.0	0.1	0.2	0.1	0.8	1.4	2.0	20.6
AVG	5.0	3.1	3.2	2.1	0.9	0.2	0.3	0.6	0.3	1.3	2.3	3.4	22.6
25%	1.1	1.1	1.1	0.5	0.1	0.0	0.0	0.0	0.0	0.4	0.5	0.9	14.9
MIN	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9

SKN: 392.00 NAME: WAILUKU-BOYS SCH OBSV: WAILUKU BOYS SCH ELEV(FT): 200
DATA PERIOD: 1901-1969 NYRS: 64 READ:DAILY LAT: 20 53 42 LONG: 156 30 0

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	24.1	20.5	14.6	12.8	6.7	2.0	2.7	3.4	2.3	7.9	15.1	19.0	55.0
75%	6.9	5.1	4.6	3.8	1.7	0.6	1.0	1.2	1.2	2.0	3.2	6.9	34.3
MED	3.4	3.0	3.1	2.1	0.8	0.3	0.6	0.5	0.5	1.2	1.9	3.4	27.1
AVG	4.7	3.9	3.9	3.0	1.3	0.5	0.7	0.9	0.8	1.6	2.8	4.7	28.6
25%	1.2	1.4	1.6	1.1	0.3	0.1	0.3	0.3	0.2	0.6	1.1	1.7	21.7
MIN	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	10.2

SKN: 393.00 NAME: FIELD 719 OBSV: HCDS ELEV(FT): 150
DATA PERIOD: 1931-1982 NYRS: 36 READ:OTHER LAT: 20 51 0 LONG: 156 28 42

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
MAX	16.8	9.9	10.3	6.4	2.3	3.0	1.1	2.0	1.5	5.0	11.0	10.4	35.5
75%	6.8	4.7	3.7	1.6	0.6	0.1	0.2	0.3	0.3	0.9	2.7	4.2	20.6
MED	3.0	2.1	2.5	0.7	0.2	0.0	0.1	0.1	0.1	0.4	1.4	1.9	15.2
AVG	4.2	2.9	2.7	1.2	0.5	0.2	0.2	0.3	0.2	0.8	2.1	2.8	17.2
25%	0.8	1.0	1.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.8	11.9
MIN	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.9

ISLAND OF MAUI

AVERAGE MINIMUM TEMPERATURE (F)

STATE KEY NO.	STATION NAME	ELEVATION (FT)	YEARS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
360.	PIONEER FLD I-3	225	19	62.6	62.4	63.0	64.0	65.8	67.1	67.5	67.7	67.4	66.9	65.6	63.0	65.2
361.	LAHAINA	45	37	62.5	62.3	62.8	64.0	65.5	66.8	67.8	68.5	68.0	67.4	65.8	63.7	65.4
363.1	PIONEER FLD F-2	980	29	62.1	62.3	62.3	63.2	64.9	66.1	67.0	67.4	67.2	66.5	65.5	62.9	65.0
373.	PIONEER FLD LA-5	1080	29	61.5	61.5	62.2	63.3	64.5	65.5	66.1	66.9	66.6	66.3	65.1	62.6	64.4
386.	WAILUKU OFFICE	180	60	63.5	63.6	64.5	66.0	67.6	69.5	70.6	71.3	70.7	69.7	67.5	65.3	67.5
386.5	WAILUKU FLD 37	460	11	58.7	58.8	59.8	60.5	61.7	63.6	65.1	65.6	66.1	65.7	63.9	61.4	62.5
387.	NOPOI RESERVOIR	400	11	65.0	65.1	66.1	66.9	68.5	70.0	70.4	71.1	71.2	70.5	68.5	358.2	68.3
387.3	WAILUKU FLD 70	445	19	64.2	63.9	64.3	65.8	67.7	69.5	70.2	70.8	70.6	69.9	68.6	65.5	67.6
390.	WAIKAPU	400	10	62.7	62.4	64.4	64.6	66.3	67.9	68.3	69.0	69.0	67.7	65.8	385.1	65.9
392.	WAILUKU BOYS SCH	200	67	63.3	63.2	64.0	65.7	67.5	69.3	70.3	71.1	70.6	69.4	67.3	65.2	67.2
394.	CAMP 6	100	17	61.5	61.8	62.6	63.9	65.5	66.9	68.6	68.9	67.6	66.5	65.3	62.8	65.2
396.	PUUNENE	60	28	61.7	61.8	62.9	64.6	65.6	67.3	68.8	69.4	68.1	67.3	65.7	63.1	65.5
398.	KAHULUI AIRPORT	40	25	63.2	63.1	64.3	66.1	66.9	68.5	70.2	70.9	69.6	68.8	67.1	65.0	66.9
398.2	HANKA	20	3	65.1	64.4	64.8	67.4	68.9	70.3	71.3	71.9	70.9	69.9	68.4	66.4	68.3
402.	PUKALANI	350	25	61.2	61.0	61.6	62.9	64.7	65.9	67.0	67.4	66.5	65.9	64.7	62.6	64.3
404.1	HC&S FLD 603	200	17	61.5	60.8	61.8	63.0	64.2	65.5	67.0	67.7	66.4	66.7	64.8	62.7	64.4
406.	PAIA	165	2	62.1	61.9	62.7	62.8	65.0	67.5	69.3	69.9	69.6	68.4	66.6	63.4	65.8
410.	KEAHUA	510	10	60.1	60.2	61.4	62.1	63.3	64.9	66.2	66.7	66.5	65.9	64.0	61.6	63.6
411.	HC&S FLD 305	650	16	60.9	61.2	61.1	62.5	64.0	65.3	66.3	66.9	66.2	65.6	64.3	62.3	63.9
417.	HC&S FLD 201	715	16	63.3	63.5	63.0	63.9	65.7	67.4	68.2	69.0	68.5	67.8	66.7	64.2	66.0

ISLAND OF MAUI

AVERAGE MAXIMUM TEMPERATURE (F)

STATE KEY NO.	STATION NAME	ELEVATION (FT)	YEARS	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
360.	PIONEER FLD 1-3	225	19	80.5	80.5	81.7	83.4	84.2	85.3	86.2	86.8	87.5	86.6	84.4	81.5	84.1
361.	LAHAINA	45	37	81.2	81.2	81.8	83.1	84.5	86.1	87.2	87.7	87.7	86.9	84.8	82.5	84.6
363.1	PIONEER FLD F-2	900	29	77.7	77.8	79.1	80.0	81.0	82.6	83.9	84.5	84.3	83.3	81.3	78.6	81.2
373.	PIONEER FLD LA-5	1000	29	78.4	78.2	78.4	79.3	80.5	81.6	82.6	83.5	83.6	83.2	81.6	79.6	80.8
386.	WAILUKU OFFICE	180	60	79.4	79.1	79.0	79.8	81.7	83.3	84.0	84.8	85.1	84.4	82.0	80.0	81.8
386.5	WAILUKU FLD 37	460	11	76.1	76.2	76.6	76.9	78.6	79.0	79.4	80.5	80.5	79.7	78.4	77.1	78.2
387.	HOPOI RESERVOIR	400	11	80.5	80.2	81.1	81.5	83.1	84.1	84.4	85.6	86.2	85.0	83.7	81.7	83.2
387.3	WAILUKU FLD 70	445	19	78.5	77.5	78.0	78.9	80.2	81.7	82.3	82.7	83.5	82.7	80.2	78.3	80.1
390.	KAIKAPU	600	10	82.6	83.8	83.9	85.5	87.0	87.1	87.1	88.0	88.4	86.5	85.6	84.0	85.5
392.	WAILUKU BOYS SCH	200	67	78.9	79.0	78.9	79.6	81.7	83.4	84.1	84.9	85.2	84.2	81.8	79.5	81.8
394.	CAMP 6	100	17	78.5	78.2	79.8	81.0	82.8	84.4	85.2	85.9	86.1	84.8	82.2	79.9	82.4
396.	PUUKENE	60	26	78.5	78.6	79.5	81.0	83.1	84.7	85.0	85.7	86.0	84.8	81.9	79.1	82.3
396.	KAHULUI AIRPORT	40	25	79.3	79.4	80.6	81.7	83.3	84.8	85.5	86.4	86.6	85.6	83.1	80.4	83.1
398.2	HASKA	20	5	78.3	78.6	79.8	80.9	82.8	83.6	86.6	85.9	86.1	85.3	82.3	80.1	82.5
402.	PUKALANI	550	25	78.9	78.9	79.6	81.4	83.1	84.8	85.4	86.0	86.2	85.4	82.6	80.0	82.7
404.1	HC&S FLD 6&3	200	17	77.8	78.2	79.3	80.1	82.4	83.8	84.5	85.6	85.1	84.2	81.1	78.5	81.7
406.	PAIA	165	2	75.6	79.0	81.0	81.0	84.1	84.3	84.5	83.5	84.4	83.9	82.1	80.1	81.9
410.	KEANAE	510	10	76.1	77.3	77.2	78.0	80.6	81.9	82.7	83.4	84.6	82.8	79.8	77.3	80.1
411.	HC&S FLD 305	650	10	77.5	76.6	77.8	79.1	81.3	83.7	84.1	84.7	84.7	83.3	80.6	77.9	80.9
417.	HC&S FLD 2&1	715	16	76.8	74.9	76.5	77.5	78.7	81.0	81.5	82.3	83.1	81.7	79.1	76.5	79.1

Table 6a

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS REPORTED BY U.S. ENVIRONMENTAL PROTECTION AGENCY'S AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS), 1992-1994

Parameter / Location	1992	1993	1994
Sulfur Dioxide / Kihei			
No. of 24-Hr Samples	-	47	11
Highest 24-Hr Value (µg/m3)	-	9	3
Second-Highest 24-Hr Value (µg/m3)	-	5	3
Average Daily Value (µg/m3)	-	3	3
PM-10 / Kihei			
No. of 24-Hr Samples	2	42	-
Highest 24-Hr Value (µg/m3)	19	25	-
Second-Highest 24-Hr Value (µg/m3)	18	24	-
Average Daily Value (µg/m3)	19	15	-
PM-10 / Lahaina			
No. of 24-Hr Samples	36	55	-
Highest 24-Hr Value (µg/m3)	22	23	-
Second-Highest 24-Hr Value (µg/m3)	20	22	-
Average Daily Value (µg/m3)	13	14	-
Ozone / Makawao			
No. of 24-Hr Samples	358	353	-
Highest 1-Hr Value (ppm)	0.050	0.052	-
Second-Highest 1-Hr Value (ppm)	0.050	0.050	-

Source: U.S. Environmental Protection Agency

Table 6

ANNUAL SUMMARIES OF AIR QUALITY MEASUREMENTS FOR
DEPARTMENT OF HEALTH MONITORING STATIONS LOCATED ON MAUI ISLAND, 1985-1990

Parameter / Location	1985	1986	1987	1988	1989	1990
Sulfur Dioxide / Kahului						
No. of 24-Hr Samples	32	-	-	-	-	
Range of 24-Hr Values (µg/m3)	<5-31	-	-	-	-	
Average Daily Value (µg/m3)	7	-	-	-	-	
No. of State AAQS Exceedances	0	-	-	-	-	
Sulfur Dioxide / Kihei						
No. of 24-Hr Samples	-	-	36	30	39	8
Range of 24-Hr Values (µg/m3)	-	-	<5-13	<5-5	<5-5	<5-5
Average Daily Value (µg/m3)	-	-	<5	<5	<5	<5
No. of State AAQS Exceedances	-	-	0	0	0	0
PM-10 / Kihei						
No. of 24-Hr Samples	-	-	38	33	37	9
Range of 24-Hr Values (µg/m3)	-	-	11-107	17-46	9-51	6-42
Average Daily Value (µg/m3)	-	-	28	28	24	22
No. of State AAQS Exceedances	-	-	NA	NA	NA	NA
PM-10 / Lahaina						
No. of 24-Hr Samples	-	-	8	22	39	42
Range of 24-Hr Values (µg/m3)	-	-	8-19	9-34	6-25	5-31
Average Daily Value (µg/m3)	-	-	14	19	15	17
No. of State AAQS Exceedances	-	-	NA	NA	NA	NA
TSP / Kahului						
No. of 24-Hr Samples	36	-	-	-	-	-
Range of 24-Hr Values (µg/m3)	26-105	-	-	-	-	-
Average Daily Value (µg/m3)	57	-	-	-	-	-
No. of State AAQS Exceedances	1	-	-	-	-	-

Source: State of Hawaii Department of Health

AMBIENT BACKGROUND AIR QUALITY DATA FOR MAALAEA, MAUI - JUNE 1989 THROUGH DECEMBER 1989

Pollutant	Averaging Period	Concentration (ppb)	Concentration ($\mu g/m^3$)	Percentage of Standard	
				State	National
Sulfur Dioxide	3-hour	13	34	3	3
	24-hour	5	13	4	4
	Annual	1	3	4	4
Nitrogen Dioxide	Annual	3	6	9	6
Ozone	1-hour	44	86	86	37
	Annual	16	31	-	-
Carbon Monoxide	1-hour	12	14	<1	<1
	8-hour	5	6	<1	<1
Particulate Matter	24-hour	-	56	37	37
	Annual	-	14	28	28

Notes:

1. The data given in the table were obtained by Maui Electric Company at Site No. 233 located approximately 1 mile north of Maalaea Power Plant. Concentrations shown in the table for averaging times shorter than annual are the highest concentrations recorded during the period June 10, 1989 through December 31, 1989. Annual average concentrations for all pollutants are based on the 7-month period.

2. Concentrations shown in the table for averaging times shorter than annual do not include periods when the on-shore flow (southerly flow between 130 and 230 degrees) persists, as this would include the Maalaea Generating Station emissions.

Source: Prevention of Significant Deterioration Permit Application for Maalaea Combined Cycle Project, Maui Electric Co., Revised, August 1990.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

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

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

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AQUACULTURE DEVELOPMENT PROGRAM
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CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

June 6, 1996

Ms. Ellen Kraftsow
County of Maui Board of Water Supply
Planning Division
P.O. Box 1109
Wailuku, Hawaii 96793

LOG NO: 17573
DOC NO: 9605KD32

Dear Ms. Kraftsow:

SUBJECT: **Historic Preservation Review of a Proposed Water Treatment Facility and Pipeline, County of Maui Iao Tank Site, Wailuku, Wailuku District, Maui**
TMK: 3-5-01: 21

Thank you for requesting our review of a proposed water treatment facility and pipeline, to be developed by the Maui County Board of Water Supply. The water treatment facility is to be located at the existing Iao water reservoir site along Alu Road, above Wailuku Town. The proposed pipeline will connect the Waikapu (Iao) Ditch with the Iao water treatment facility.

The proposed water treatment facility is to be located on the site of a recently demolished 2 MG water tank, and adjacent to the existing 3 MG tank. The c. .5 km long pipeline will cross a former pineapple field, or follow the boundary of the field along Alu Road.

Our records indicate that no previous archaeological surveys or field inspections have been conducted within or adjacent to the proposed project. We have no records of known historic sites in the project vicinity.

An inspection of the proposed water treatment facility and pipeline routes was conducted by Historic Preservation Division staff on May 9, 1996. The inspection confirmed that the area of the proposed treatment facility has been previously impacted by water tank construction and subsequent demolition. The area of the proposed pipeline has been impacted by pineapple and possibly sugar cane cultivation. No evidence of historic sites was identified within the project area.

We believe that this project will have "no effect" on historic sites.

Please contact Ms. Theresa K. Donham at 243-5269 if you have any questions.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

KD:jen

Appendix 4 Correspondence from State Historic Preservation Division

Vascular Plant List For Environmental Impact Statement
Proposed 2.0. M.G. Treatment Facility and Water Pipeline
April 1996

Prepared for
Maui County Board of Water Supply

Prepared by:
Charles G. Chimera[1]

Summary

On April 4, 1996, a thorough survey of the vascular plants present near the existing Iao water tank and the adjacent fallow cane fields was conducted to assess the impacts of a proposed 2.0 M.G. treatment facility and water pipeline to be constructed by the Maui County Board of Water Supply. The following table contains a list of plants found in the proposed project site. With the exception of *Waltheria indica*, a questionably indigenous but common plant of no special status found in dry and often disturbed areas on all of the Hawaiian islands, the remaining 87 plants found in the area are non-native. Therefore, the proposed project will have no impact on any rare or threatened members of the native Hawaiian flora. Certain plants present along the fence appear to have been planted for their ornamental value, but should not be heavily impacted unless the fence is removed or displaced.

[1]Research Associate, National Biological Service, Haleakala National Park, 1991-present.

Vascular Plant List EIS For Proposed 2.0. M.G. Treatment Facility and Water Pipeline Near Existing Iao Tank

Taxa	Common Name	Family	Status
Cordyline fruticosa	Ti	Agavaceae	Polynesian Introduction
Cyperus rotundus	Nut sedge	Cyperaceae	Non-native
Musa paradisiaca	Banana	Musaceae	Non-native
Cenchrus echinatus	Common sandbur	Poaceae	Non-native
Chloris barbata	Swollen fingergrass	Poaceae	Non-native
Chloris divaricata	Stargrass	Poaceae	Non-native
Cynodon dactylon	Bermuda grass	Poaceae	Non-native
Digitaria ciliaris	Henry's crabgrass	Poaceae	Non-native
Digitaria insularis	Sourgrass	Poaceae	Non-native
Eleusine indica	Wiregrass, Goose grass	Poaceae	Non-native
Eragrostis tenella	Lovegrass	Poaceae	Non-native
Melinis minutiflora	Molasses grass	Poaceae	Non-native
Panicum maximum	Guinea grass	Poaceae	Non-native
Paspalum fimbriatum	Panama paspalum	Poaceae	Non-native
Rhynchelytrum repens	Natal redtop	Poaceae	Non-native
Setaria gracilis	Yellow foxtail	Poaceae	Non-native
Asystasia gangetica	Chinese violet	Acanthaceae	Non-native
Alternanthera pungens	Khaki weed	Amaranthaceae	Non-native
Amaranthus spinosus	Spiny amaranth	Amaranthaceae	Non-native
Schinus terebinthifolius	Christmas berry	Anacardiaceae	Non-native
Ciclospermum leptophyllum	Fir-leaved celery	Apiaceae	Non-native
Nerium oleander	Oleander	Apocynaceae	Non-native
Asclepias physocarpa	Balloon plant	Asclepiadaceae	Non-native
Ageratina riparia	Hamakua pamakani	Asteraceae	Non-native
Ageratum conyzoides	Maile hohono	Asteraceae	Non-native
Bidens pilosa	Spanish needle	Asteraceae	Non-native
Calyptocarpus vialis	No common name	Asteraceae	Non-native
Cirsium vulgare	Bull thistle	Asteraceae	Non-native
Conyza bonariensis	Hairy horseweed	Asteraceae	Non-native
Crassocephalum crepidioides	No common name	Asteraceae	Non-native
Elephantopus mollis	Elephant's foot	Asteraceae	Non-native
Emilia fosbergii	No common name	Asteraceae	Non-native
Gnaphalium japonicum	Cudweed	Asteraceae	Non-native
Pluchea indica	Indian fleabane	Asteraceae	Non-native
Pluchea symphytifolia	Sourbush	Asteraceae	Non-native
Siegesbeckia orientalis	Small yellow crown-beard	Asteraceae	Non-native
Sonchus oleraceus	Sow thistle, Pualele	Asteraceae	Non-native
Synedrella nodiflora	Nodeweed	Asteraceae	Non-native
Tridax procumbens	Coat buttons	Asteraceae	Non-native
Vernonia cinerea	Little ironweed	Asteraceae	Non-native
Youngia japonica	Oriental hawksbeard	Asteraceae	Non-native
Spathodea campanulata	African tulip tree	Bignoniaceae	Non-native
Heliotropium amplexicaule	Heliotrope	Boraginaceae	Non-native
Capsella rubella	Shepherd's purse	Brassicaceae	Non-native
Lepidium virginicum	Virginia pepperweed	Brassicaceae	Non-native
Polycarpon tetraphyllum	No common name	Caryophyllaceae	Non-native
Ipomoea triloba	Little bell	Convolvulaceae	Non-native
Merremia aegyptia	Hairy merremia	Convolvulaceae	Non-native
Momordica charantia	Balsam pear	Cucurbitaceae	Non-native
Chamaesyce hirta	Garden spurge	Euphorbiaceae	Non-native

Filename: PIPEEIS.XLS

Vascular Plant List EIS For Proposed 2.0. M.G. Treatment Facility and Water Pipeline Near Existing Iao Tank

Taxa	Common Name	Family	Status
Chamaesyce hypericifolia	Graceful spurge	Euphorbiaceae	Non-native
Chamaesyce hyssopifolia	No common name	Euphorbiaceae	Non-native
Chamaesyce prostrata	Prostrate spurge	Euphorbiaceae	Non-native
Manihot glaziovii	Ceara rubber tree	Euphorbiaceae	Non-native
Ricinus communis	Castor bean	Euphorbiaceae	Non-native
Albizia lebbeck	Siris tree	Fabaceae	Non-native
Canavalia cathartica	Maunaloa	Fabaceae	Non-native
Chamaecrista nictitans	Partridge pea	Fabaceae	Non-native
Crotolaria assamica	Rattlepod	Fabaceae	Non-native
Crotolaria pallida	Smooth rattlepod	Fabaceae	Non-native
Desmodium incanum	Spanish clover	Fabaceae	Non-native
Desmodium sandwicense	Spanish clover	Fabaceae	Non-native
Indigofera spicata	Creeping indigo	Fabaceae	Non-native
Indigofera suffruticosa	Indigo	Fabaceae	Non-native
Leucaena leucocephala	Koa haole	Fabaceae	Non-native
Melilotus indica	Sweet clover	Fabaceae	Non-native
Pithecelloblum dulce	Manila tamarind, `Opiuma	Fabaceae	Non-native
Abutilon grandifolium	Hairy abutilon	Malvaceae	Non-native
Malva parviflora	Cheese weed	Malvaceae	Non-native
Malvastrum coromandelianum	False mallow	Malvaceae	Non-native
Sida rhombifolia	No common name	Malvaceae	Non-native
Eucalyptus robusta	Swamp mahogany	Myrtaceae	Non-native
Psidium cattleianum	Strawberry guava	Myrtaceae	Non-native
Oxalis comiculata	Yellow wood sorrel	Oxalidaceae	Non-native
Oxalis corymbosa	Pink wood sorrel	Oxalidaceae	Non-native
Passiflora suberosa	Huehue haole	Passifloraceae	Non-native
Portuca pilosa	No common name	Portulacaceae	Non-native
Portulaca oleracea	Pigweed	Portulacaceae	Non-native
Grevillea banksii	Kahili flower	Proteaceae	Non-native
Cotoneaster pannosa	Cotoneaster	Rosaceae	Non-native
Spermacoce mauritiana	No common name	Rubiaceae	Non-native
Lycopersicon esculentum	Tomato	Solanaceae	Non-native
Nicandra physalodes	Apple of Peru	Solanaceae	Non-native
Solanum torvum	No common name	Solanaceae	Non-native
Waltheria indica	`Uhaloa	Sterculiaceae	Indigenous?
Triumfetta semitriloba	Sacramento bur	Tiliaceae	Non-native
Stachytarpheta urticifolia	No common name	Verbenaceae	Non-native
Verbena litoralis	Oi	Verbenaceae	Non-native

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Filename: PIPEEIS.XLS

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
54 SOUTH HIGH ST., ROOM 101
WAILUKU, HAWAII 96793-2198

May 21, 1996

MICHAEL D. WILSON
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY DIRECTOR
GILBERT S. COLOMA-AGARAN

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

Ms. Ellen Kraftsow
Water Resources & Planning Division
Maui County Board of Water Supply
200 S. High Street, 5th Floor
Wailuku, HI 96793

Subject: Development of a waterline attachment at the Iao watertank - concerns for the environmental assessment.

Dear Ms. Kraftsow:

On May 20, 1996 a site visit was made to the proposed project area. The watertank proper, the affected pasture, and the location of where the ditch pipe will be tied into the new line were all inspected.

The affected area is all pastureland, predominated by non-native vegetational communities which often occupy disturbed/pasture areas. No native birds were observed on this date. It is unlikely that native bird or insect/mollusc fauna currently associate with the project's pastureland location (possible exception is the abundant and regular overwintering migrant, the indigenous Pacific Golden Plover). No threatened or endangered faunal species were observed on site, nor is their presence at all likely.

Conclusion: This proposed project at the Iao Watertank in Wailuku Heights, Wailuku, Island of Maui, Hawaii will not negatively impact native or protected native Hawaiian species.

Sincerely,

Dr. Fern P. Duvall II
Wildlife Biologist
cc. Wayne Ching, Honolulu

Appendix 6 Correspondence from Division of Forestry and Wildlife

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109

March 22, 1996

William Wong, P.E., Chief
Drinking Water Branch
Department of Health
Environmental Management Division
919 Ala Moana Boulevard, Room 308
Honolulu, HI 96814

Dear Mr. Wong:
SUBJECT: Iao Surface Source Water Qualification

The Board of Water Supply is submitting the following data taken for the qualification of the Iao surface source water for source water qualification. Included in the data is the MPA summary and the chemical analysis. The Board is requesting for qualification of the Iao surface source for the use of the Memcor unit for additional water for the Iao aquifer to reduce the pumpage from the source wells.

The water treatment division will submit data for the Memcor unit operational testing parameters when the Memcor units are installed and operating. Please contact Paul Seitz for data in this area.

If you need any assistance from the Board of Water please contact Eric Okazaki at 243-7551 or Cari Cerizo at 243-7344.

Sincerely,

David Craddick, Director

cc: George Tengan
Eric Okazaki

Appendix 7 Raw Water Quality Sampling Data

Montgomery Watson Laboratories

EPA RELATIVE SURFACE WATER RISK FACTORS

Client: Maui County Department of Water Supply
Water Source: IAO DITCH RAW (BLUE)
Lab ID#: 960223010
Date Sampled: 2/22/96
Date Analyzed: 2/23/96

Primary Particulates	#/100 Gallon	Relative Frequency	Relative Risk Factor	Comments
Giardia with internal structures	na	na	na	
Coccidia with internal structures	na	na	na	
Diatoms	<1	NS	0	
Other Algae	>300	EH	14	
Insects/larvae	<1	NS	0	
Rotifers	100	H	3	
Plant Debris (with chlorophyll)	26	M	1	
		EPA Relative Risk Factor	18	

Secondary Particulates	#/100 Gallon	Relative Frequency	Comments
Nematodes	91	M	
Crustaceans	<1	NS	
Amoeba	<1	NS	
Flagellates & Ciliates	<1	NS	
Plant Pollen	13	R	
Other: Large Amorphous Debris	>200	EH	no risk factor
Other: Fine Amorphous Debris	>200	EH	no risk factor
Other: Minerals Quant.	>200	EH	no risk factor
Other:			

EH = extremely heavy
H = heavy
M = moderate
R = rare
NS = not significant

COMMENTS: Primary surface water indicators observed: **Other Algae Rotifers Plant Debris (with chlorophyll)**
Based upon microscopic particulate analysis and the proposed EPA risk factors associated with bio-indicators there is moderate risk of surface contamination (EPA risk factors 10 to 19 moderate risk)

REFERENCE: Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA), USEPA Manchester Environmental Laboratory, EPA 910/9-92-[illegible] October 1992.

Reviewed by: Hillard T R Date: [illegible]'96

Montgomery Watson Laboratories

EPA RELATIVE SURFACE WATER RISK FACTORS

Client: Maui County Department of Water Supply
Water Source: IAO DITCH RAW (CLEAR)
Lab ID# 960223009
Date Sampled: 2/22/96
Date Analyzed: 2/23/96

Primary Particulates	#/100 Gallon	Relative Frequency	Relative Risk Factor	Comments
Giardia with internal structures	na	na	na	
Coccidia with internal structures	na	na	na	
Diatoms	<1	NS	0	
Other Algae	>300	EH	14	
Insects/larvae	<1	NS	0	
Rotifers	20	R	1	
Plant Debris (with chlorophyll)	40	M	1	
		EPA Relative Risk Factor	16	

Secondary Particulates	#/100 Gallon	Relative Frequency	Comments
Nematodes	60	M	
Crustaceans	<1	NS	
Amoeba	<1	NS	
Flagellates & Ciliates	<1	NS	
Plant Pollen	<1	NS	
Other: Large Amorphous Debris	>200	EH	no risk factor
Other: Fine Amorphous Debris	>200	EH	no risk factor
Other: Minerals Quant.	>200	EH	no risk factor
Other:			

EH = extremely heavy
H = heavy
M = moderate
R = rare
NS = not significant

COMMENTS: Primary surface water indicators observed: Other Algae Rotifers Plant Debris (with chlorophyll)
Based upon microscopic particulate analysis and the proposed EPA risk factors associated with bio-indicators there is moderate risk of surface contamination (EPA risk factors 10 to 19 moderate risk)

REFERENCE: Consensus Method for Determining Groundwaters Under the Direct Influence of Surface Water Using Microscopic Particulate Analysis (MPA), USEPA Manchester Environmental Laboratory, EPA 910/9-92-092, October 1992.

Reviewed by: Hillary D. T. Date: 3/21/96

MONTGOMERY WATSON LABORATORIES

555 East Walnut Street
Pasadena, California 91101
818 568 6400; Fax: 818 568 6324;
1 800 566 LABS (1 800 566 5227)

Laboratory Report

Maui, County of, Department of Water Supply
614 Palapala Dr

Kahului , HI 96732
ATTN: Cari Cerizo

Sample # 960216004 Sample ID IAO DITCH Project PHASEV
Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

Parameter		Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
Asbestos by TEM	(ML/EPA 100.1)	MFL	< 0.18				0.18			16-feb-1996	cjb
Calcium, Flame AA	(ML/EPA 215.1)	mg/l	4.0				1			21-feb-1996	ola
Cyanide	(ML/SM4500-CN E)	mg/l	ND				0.025			16-feb-1996	huy
Endothall	(ML/EPA 548.1)	ug/l	ND				5	16-feb-1996	wpt	23-feb-1996	crw
Fluoride	(EPA/ML 340.2)	mg/l	ND				0.1			22-feb-1996	amu
Glyphosate	(ML/EPA 547)	ug/l	ND				6			19-feb-1996	cxs
Mercury	(EPA/ML 245.1)	ug/l	ND				0.5	23-feb-1996	gub	01-mar-1996	gub
Nitrite, Nitrogen by IC	(ML/EPA 300.0)	mg/l	ND				0.1			16-feb-1996	eyw
2,3,7,8 - TCDD	(EPA 1613)	Picograms/L	ND				2.7	22-feb-1996	col	23-feb-1996	col

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Laboratory Report

Maui, County of, Department of Water Supply
614 Palapala Dr

Kahului , HI 96732
ATTN: Cari Cerizo

Sample # 96021600- Sample ID IAO DITCH Project PHASEV
Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

Single Determination Analytes
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	Calcium, Flame AA	mg/l	50	52.4	105
LCS2	Calcium, Flame AA	mg/l	50	53.1	106
MBLK	Calcium, Flame AA	mg/l	ND	ND	
MS	Calcium, Flame AA	mg/l	50	51.4	103
MSD	Calcium, Flame AA	mg/l	50	51.4	103
LCS1	Cyanide	mg/l	0.10	0.0974	97
MBLK	Cyanide	mg/l	ND	ND	
MS	Cyanide	mg/l	0.10	0.0847	85
MSD	Cyanide	mg/l	0.10	0.0858	86
LCS1	Endothall	ug/l	25	27.2	109
MBLK	Endothall	ug/l	ND	ND	
MS	Endothall	ug/l	25	26.0	104
LCS1	Fluoride	mg/l	0.87	0.88	101
LCS2	Fluoride	mg/l	0.87	0.88	101
MBLK	Fluoride	mg/l	ND	ND	
MS	Fluoride	mg/l	0.909	0.975	107
MSD	Fluoride	mg/l	0.909	0.986	109
LCS1	Glyphosate	ug/l	50	57.7	115
MBLK	Glyphosate	ug/l	ND	ND	
MS	Glyphosate	ug/l	50	52.1	104
LCS1	Mercury	ug/l	1.50	1.48	99
LCS2	Mercury	ug/l	1.50	1.42	95
MBLK	Mercury	ug/l	ND	ND	
MS	Mercury	ug/l	1.50	1.50	100
MSD	Mercury	ug/l	1.50	1.59	106
LCS1	Nitrite, Nitrogen by IC	mg/l	1.0	0.94	94
LCS2	Nitrite, Nitrogen by IC	mg/l	1.0	0.97	97
MBLK	Nitrite, Nitrogen by IC	mg/l	ND	ND	
MS	Nitrite, Nitrogen by IC	mg/l	1.0	1.00	100
MSD	Nitrite, Nitrogen by IC	mg/l	1.0	1.00	100

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Haui, County of, Department of Water Supply.
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Sample # 960216004 Sample ID IAO DITCH Project PHASEV
Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

Diquat and Paraquat (ML/EPA 549.1)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
Diquat	ug/l	ND				0.4	19-feb-1996	rod	21-feb-1996	cxs
Paraquat	ug/l	ND				2	19-feb-1996	rod	21-feb-1996	cxs

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Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

Diquat and Paraquat (ML/EPA 549.1)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	Diquat	ug/l	10.0	9.83	98
LCS1	Paraquat	ug/l	10.0	9.30	93
MBLK	Diquat	ug/l	ND	ND	
MBLK	Paraquat	ug/l	ND	ND	
MS	Diquat	ug/l	10.0	10.5	105
MS	Paraquat	ug/l	10.0	9.96	100

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Sample # 960216004 Sample ID IAO DITCH Project PHASEV
Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

AB1803 - EDB and DBCP (ML/EPA 504)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
Dibromochloropropane (DBCP)	ug/l	ND				0.01	23-feb-1996	csk	28-feb-1996	mer
Ethylene Dibromide (EDB)	ug/l	ND				0.01	23-feb-1996	csk	28-feb-1996	mer
Data Entry	--	02/28/96				0	23-feb-1996	csk	28-feb-1996	mer

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Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

AB1803 - EDB and DBCP (ML/EPA 504)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
DUP	Dibromochloropropane (DBCP)	ug/l	ND	NA	
DUP	Ethylene Dibromide (EDB)	ug/l	ND	NA	
LCS1	Dibromochloropropane (DBCP)	ug/l	0.10	0.11	110
LCS1	Ethylene Dibromide (EDB)	ug/l	0.10	0.10	100
LCS2	Dibromochloropropane (DBCP)	ug/l	0.10	0.11	110
LCS2	Ethylene Dibromide (EDB)	ug/l	0.10	0.10	100
MBLK	Dibromochloropropane (DBCP)	ug/l	ND	ND	
MBLK	Ethylene Dibromide (EDB)	ug/l	ND	ND	
MS	Dibromochloropropane (DBCP)	ug/l	0.10	NA	
MS	Ethylene Dibromide (EDB)	ug/l	0.10	NA	

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ICPMS Metals (ML 200.8)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
Arsenic, Total, ICAP/MS	ug/l	ND			1	5	23-feb-1996	jps	23-feb-1996	jps
Barium, Total, ICAP/MS	ug/l	ND			1	10	23-feb-1996	jps	23-feb-1996	jps
Beryllium, Total, ICAP/MS	ug/l	ND			1	1	23-feb-1996	jps	23-feb-1996	jps
Cadmium, Total, ICAP/MS	ug/l	ND			1	0.5	23-feb-1996	jps	23-feb-1996	jps
Chromium, Total, ICAP/MS	ug/l	ND			1	5	23-feb-1996	jps	23-feb-1996	jps
Copper, Total, ICAP/MS	ug/l	ND			1	50	23-feb-1996	jps	23-feb-1996	jps
Nickel, Total, ICAP/MS	ug/l	ND			1	5	23-feb-1996	jps	23-feb-1996	jps
Lead, Total, ICAP/MS	ug/l	ND			1	5	23-feb-1996	jps	23-feb-1996	jps
Antimony, Total, ICAP/MS	ug/l	ND			1	2	23-feb-1996	jps	23-feb-1996	jps
Selenium, Total, ICAP/MS	ug/l	ND			1	5	23-feb-1996	jps	23-feb-1996	jps
Thallium, Total, ICAP/MS	ug/l	ND			1	1	23-feb-1996	jps	23-feb-1996	jps

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ICPMS Metals (ML 200.8)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	Arsenic, Total, ICAP/MS	ug/l	20	19.1	96
LCS1	Barium, Total, ICAP/MS	ug/l	100	102	102
LCS1	Beryllium, Total, ICAP/MS	ug/l	5	5.46	109
LCS1	Cadmium, Total, ICAP/MS	ug/l	5	20.0	400
LCS1	Chromium, Total, ICAP/MS	ug/l	50	101	202
LCS1	Copper, Total, ICAP/MS	ug/l	50	104	208
LCS1	Nickel, Total, ICAP/MS	ug/l	50	51.2	102
LCS1	Lead, Total, ICAP/MS	ug/l	4	21.3	532
LCS1	Antimony, Total, ICAP/MS	ug/l	50	49.8	100
LCS1	Selenium, Total, ICAP/MS	ug/l	20	19.2	96
LCS1	Thallium, Total, ICAP/MS	ug/l	4	20.2	505
MBLK	Arsenic, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Barium, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Beryllium, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Cadmium, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Chromium, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Copper, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Nickel, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Lead, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Antimony, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Selenium, Total, ICAP/MS	ug/l	ND	ND	
MBLK	Thallium, Total, ICAP/MS	ug/l	ND	ND	

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ATTN: Cari Cerizo

Sample # 960216004 Sample ID 1AO DITCH Project PHASEV
Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

Volatile Organic Compounds (ML/EPA 502.2)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
1,1,1,2-Tetrachloroethane	ug/l	ND				0.5			22-feb-1996	gto
1,1,1-Trichloroethane	ug/l	ND				0.5			22-feb-1996	gto
1,1,2,2-Tetrachloroethane	ug/l	ND				0.5			22-feb-1996	gto
1,1,2-Trichloroethane	ug/l	ND				0.5			22-feb-1996	gto
1,1-Dichloroethane	ug/l	ND				0.5			22-feb-1996	gto
1,1-Dichloroethene	ug/l	ND				0.5			22-feb-1996	gto
1,1-Dichloropropene	ug/l	ND				0.5			22-feb-1996	gto
1,2,3-Trichloropropane	ug/l	ND				0.5			22-feb-1996	gto
1,2,3-Trichlorobenzene	ug/l	ND				0.5			22-feb-1996	gto
1,2,4-Trichlorobenzene	ug/l	ND				0.5			22-feb-1996	gto
1,2,4-Trimethylbenzene	ug/l	ND				0.5			22-feb-1996	gto
1,2-Dichloroethane	ug/l	ND				0.5			22-feb-1996	gto
1,2-Dichlorobenzene	ug/l	ND				0.5			22-feb-1996	gto
1,2-Dichloropropane	ug/l	ND				0.5			22-feb-1996	gto
1,3,5-Trimethylbenzene	ug/l	ND				0.5			22-feb-1996	gto
1,3-Dichlorobenzene	ug/l	ND				0.5			22-feb-1996	gto
1,3-Dichloropropane	ug/l	ND				0.5			22-feb-1996	gto
1,4-Dichlorobenzene	ug/l	ND				0.5			22-feb-1996	gto
2,2-Dichloropropane	ug/l	ND				0.5			22-feb-1996	gto
2-Chlorotoluene	ug/l	ND				0.5			22-feb-1996	gto
4-Chlorotoluene	ug/l	ND				0.5			22-feb-1996	gto
Bromodichloromethane	ug/l	ND				0.5			22-feb-1996	gto
Benzene	ug/l	ND				0.5			22-feb-1996	gto
Bromobenzene	ug/l	ND				0.5			22-feb-1996	gto
Bromochloromethane	ug/l	ND				0.5			22-feb-1996	gto
Bromomethane	ug/l	ND				0.5			22-feb-1996	gto
cis-1,2-Dichloroethene	ug/l	ND				0.5			22-feb-1996	gto
Chlorobenzene	ug/l	ND				0.5			22-feb-1996	gto
Carbon tetrachloride	ug/l	ND				0.5			22-feb-1996	gto

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Sample # 960216004 Sample ID IAO DITCH Project PHASEV
Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

Volatile Organic Compounds (ML/EPA 502.2)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
cis-1,3-Dichloropropene	ug/l	ND				0.5			22-feb-1996	gto
Bromoform	ug/l	ND				0.5			22-feb-1996	gto
Chloroform	ug/l	ND				0.5			22-feb-1996	gto
Chloroethane	ug/l	ND				0.5			22-feb-1996	gto
Chloromethane	ug/l	ND				0.5			22-feb-1996	gto
Dibromochloromethane	ug/l	ND				0.5			22-feb-1996	gto
1,2-Dibromo-3-chloropropane	ug/l	ND				1			22-feb-1996	gto
Dibromomethane	ug/l	ND				0.5			22-feb-1996	gto
Dichlorodifluoromethane	ug/l	ND				0.5			22-feb-1996	gto
1,2-Dibromoethane	ug/l	ND				0.5			22-feb-1996	gto
Ethylbenzene	ug/l	ND				0.5			22-feb-1996	gto
Hexachlorobutadiene	ug/l	ND				0.5			22-feb-1996	gto
Isopropylbenzene	ug/l	ND				0.5			22-feb-1996	gto
Methylene chloride	ug/l	ND				0.5			22-feb-1996	gto
m&p-Xylenes	ug/l	ND				0.5			22-feb-1996	gto
Naphthalene	ug/l	ND				0.5			22-feb-1996	gto
n-Butylbenzene	ug/l	ND				0.5			22-feb-1996	gto
n-Propylbenzene	ug/l	ND				0.5			22-feb-1996	gto
o-Xylene	ug/l	ND				0.5			22-feb-1996	gto
Tetrachloroethene	ug/l	ND				0.5			22-feb-1996	gto
p-Isopropyltoluene	ug/l	ND				0.5			22-feb-1996	gto
sec-Butylbenzene	ug/l	ND				0.5			22-feb-1996	gto
Styrene	ug/l	ND				0.5			22-feb-1996	gto
trans-1,2-Dichloroethene	ug/l	ND				0.5			22-feb-1996	gto
tert-Butylbenzene	ug/l	ND				0.5			22-feb-1996	gto
Trichloroethene	ug/l	ND				0.5			22-feb-1996	gto
Trichlorotrifluoroethane(Freon	ug/l	ND				0.5			22-feb-1996	gto
trans-1,3-Dichloropropene	ug/l	ND				0.5			22-feb-1996	gto
Toluene	ug/l	ND				0.5			22-feb-1996	gto

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Laboratory Report

Maui, County of, Department of Water Supply
614 Palapala Dr

Kahului , HI 96732
ATTN: Cari Cerizo

Sample # 960216004 Sample ID IAO DITCH Project PHASEV
Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

Volatile Organic Compounds (ML/EPA 502.2)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
Trichlorofluoromethane	ug/l	ND				0.5			22-feb-1996	gto
Vinyl chloride	ug/l	ND				0.4			22-feb-1996	gto
Data Entry	---	02/23/96				0			22-feb-1996	gto

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Volatile Organic Compounds (ML/EPA 502.2)
Surrogate Summary

Parameter	Percent Recovery	Acceptable Range
Bromofluorobenzene-ELCD	95	80 - 120
Chlorofluorobenzene-ELCD	100	80 - 120
Bromofluorobenzene-PID	93	80 - 120
Chlorofluorobenzene-PID	99	80 - 120

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Volatile Organic Compounds (ML/EPA 502.2)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	1,1,1-Trichloroethane	ug/l	10.0	9.4	94
LCS1	1,2,3-Trichlorobenzene	ug/l	10.0	9.9	99
LCS1	Bromodichloromethane	ug/l	10.0	10.1	101
LCS1	Benzene	ug/l	10.0	9.9	99
LCS1	Carbon tetrachloride	ug/l	10.0	9.6	96
LCS1	Bromoform	ug/l	10.0	9.4	94
LCS1	Chloroform	ug/l	10.0	9.1	91
LCS1	Dibromochloromethane	ug/l	10.0	9.2	92
LCS1	Isopropylbenzene	ug/l	10.0	9.8	98
LCS1	Tetrachloroethene	ug/l	10.0	9.5	95
LCS1	sec-Butylbenzene	ug/l	10.0	9.8	98
LCS1	trans-1,2-Dichloroethene	ug/l	10.0	10.0	100
LCS1	Trichloroethene	ug/l	10.0	9.8	98
LCS2	1,1,1-Trichloroethane	ug/l	10.0	9.8	98
LCS2	1,2,3-Trichlorobenzene	ug/l	10.0	10.7	107
LCS2	Bromodichloromethane	ug/l	10.0	10.8	108
LCS2	Benzene	ug/l	10.0	10.0	100
LCS2	Carbon tetrachloride	ug/l	10.0	9.7	97
LCS2	Bromoform	ug/l	10.0	9.9	99
LCS2	Chloroform	ug/l	10.0	9.6	96
LCS2	Dibromochloromethane	ug/l	10.0	10.0	100
LCS2	Isopropylbenzene	ug/l	10.0	9.9	99
LCS2	Tetrachloroethene	ug/l	10.0	9.5	95
LCS2	sec-Butylbenzene	ug/l	10.0	9.9	99
LCS2	trans-1,2-Dichloroethene	ug/l	10.0	9.3	93
LCS2	Trichloroethene	ug/l	10.0	9.7	97
MBLK	1,1,1,2-Tetrachloroethane	ug/l	ND	ND	
MBLK	1,1,1-Trichloroethane	ug/l	ND	ND	
MBLK	1,1,2,2-Tetrachloroethane	ug/l	ND	ND	
MBLK	1,1,2-Trichloroethane	ug/l	ND	ND	
MBLK	1,1-Dichloroethane	ug/l	ND	ND	

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Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

Volatile Organic Compounds (ML/EPA 502.2)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
MBLK	1,1-Dichloroethene	ug/l	ND	ND	
MBLK	1,1-Dichloropropene	ug/l	ND	ND	
MBLK	1,2,3-Trichloropropane	ug/l	ND	ND	
MBLK	1,2,3-Trichlorobenzene	ug/l	ND	ND	
MBLK	1,2,4-Trichlorobenzene	ug/l	ND	ND	
MBLK	1,2,4-Trimethylbenzene	ug/l	ND	ND	
MBLK	1,2-Dichloroethane	ug/l	ND	ND	
MBLK	1,2-Dichlorobenzene	ug/l	ND	ND	
MBLK	1,2-Dichloropropane	ug/l	ND	ND	
MBLK	1,3,5-Trimethylbenzene	ug/l	ND	ND	
MBLK	1,3-Dichlorobenzene	ug/l	ND	ND	
MBLK	1,3-Dichloropropane	ug/l	ND	ND	
MBLK	1,4-Dichlorobenzene	ug/l	ND	ND	
MBLK	2,2-Dichloropropane	ug/l	ND	ND	
MBLK	2-Chlorotoluene	ug/l	ND	ND	
MBLK	4-Chlorotoluene	ug/l	ND	ND	
MBLK	Bromodichloromethane	ug/l	ND	ND	
MBLK	Benzene	ug/l	ND	ND	
MBLK	Bromobenzene	ug/l	ND	ND	
MBLK	Bromochloromethane	ug/l	ND	ND	
MBLK	Bromomethane	ug/l	ND	ND	
MBLK	cis-1,2-Dichloroethene	ug/l	ND	ND	
MBLK	Chlorobenzene	ug/l	ND	ND	
MBLK	Carbon tetrachloride	ug/l	ND	ND	
MBLK	cis-1,3-Dichloropropene	ug/l	ND	ND	
MBLK	Bromoform	ug/l	ND	ND	
MBLK	Chloroform	ug/l	ND	ND	
MBLK	Chloroethane	ug/l	ND	ND	
MBLK	Chloromethane	ug/l	ND	ND	
MBLK	Dibromochloromethane	ug/l	ND	ND	
MBLK	Dibromomethane	ug/l	ND	ND	

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Volatile Organic Compounds (ML/EPA 502.2)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
MBLK	Dichlorodifluoromethane	ug/l	ND	ND	
MBLK	Ethylbenzene	ug/l	ND	ND	
MBLK	Hexachlorobutadiene	ug/l	ND	ND	
MBLK	Isopropylbenzene	ug/l	ND	ND	
MBLK	Methylene chloride	ug/l	ND	ND	
MBLK	m+p-Xylenes	ug/l	ND	ND	
MBLK	Naphthalene	ug/l	ND	ND	
MBLK	n-Butylbenzene	ug/l	ND	ND	
MBLK	n-Propylbenzene	ug/l	ND	ND	
MBLK	o-Xylene	ug/l	ND	ND	
MBLK	Tetrachloroethene	ug/l	ND	ND	
MBLK	p-Isopropyltoluene	ug/l	ND	ND	
MBLK	sec-Butylbenzene	ug/l	ND	ND	
MBLK	Styrene	ug/l	ND	ND	
MBLK	trans-1,2-Dichloroethene	ug/l	ND	ND	
MBLK	tert-Butylbenzene	ug/l	ND	ND	
MBLK	Trichloroethene	ug/l	ND	ND	
MBLK	Trichlorotrifluoroethane (Freon	ug/l	ND	ND	
MBLK	trans-1,3-Dichloropropene	ug/l	ND	ND	
MBLK	Toluene	ug/l	ND	ND	
MBLK	Trichlorofluoromethane	ug/l	ND	ND	
MBLK	Vinyl chloride	ug/l	ND	ND	

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525 Semivolatiles by GC/MS (ML/EPA 525.2)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
2,4-Dinitrotoluene	ug/l	ND				0.1	21-feb-1996	rod	27-feb-1996	crw
alpha-Chlordane	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Acenaphthylene	ug/l	ND				0.1	21-feb-1996	rod	27-feb-1996	crw
Alachlor	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Aldrin	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Anthracene	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Atrazine	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Benz(a)Anthracene	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Benzo(a)pyrene	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Benzo(b)Fluoranthene	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Benzo(g,h,i)Perylene	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Benzo(k)Fluoranthene	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Bis(2-Ethylhexyl)phthalate	ug/l	ND				0.6	21-feb-1996	rod	27-feb-1996	crw
Butylbenzylphthalate	ug/l	ND				0.5	21-feb-1996	rod	27-feb-1996	crw
Bromacil	ug/l	ND				2	21-feb-1996	rod	27-feb-1996	crw
Butachlor	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Caffeine	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Chrysene	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Dibenz(a,h)Anthracene	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Di-(2-Ethylhexyl)adipate	ug/l	ND				0.6	21-feb-1996	rod	27-feb-1996	crw
Diethylphthalate	ug/l	ND				0.5	21-feb-1996	rod	27-feb-1996	crw
Dieldrin	ug/l	ND				0.2	21-feb-1996	rod	27-feb-1996	crw
Dimethylphthalate	ug/l	ND				0.5	21-feb-1996	rod	27-feb-1996	crw
Dimethoate	ug/l	ND				10	21-feb-1996	rod	27-feb-1996	crw
Di-n-Butylphthalate	ug/l	ND				0.5	21-feb-1996	rod	27-feb-1996	crw
Endrin	ug/l	ND				0.1	21-feb-1996	rod	27-feb-1996	crw
Fluorene	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
gamma-Chlordane	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Hexachlorobenzene	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw

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Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

525 Semivolatiles by GC/MS (ML/EPA 525.2)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
Hexachlorocyclopentadiene	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Heptachlor	ug/l	ND				0.04	21-feb-1996	rod	27-feb-1996	crw
Heptachlor Epoxide	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Indeno(1,2,3,c,d)Pyrene	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Isophorone	ug/l	ND				0.5	21-feb-1996	rod	27-feb-1996	crw
Lindane	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Methoxychlor	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Metribuzin	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Molinate	ug/l	ND				0.2	21-feb-1996	rod	27-feb-1996	crw
Metolachlor	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
trans-Nonachlor	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Pentachlorophenol	ug/l	ND				1	21-feb-1996	rod	27-feb-1996	crw
Phenanthrene	ug/l	ND				0.02	21-feb-1996	rod	27-feb-1996	crw
Prometryn	ug/l	ND				0.5	21-feb-1996	rod	27-feb-1996	crw
Propachlor	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Pyrene	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Simazine	ug/l	ND				0.05	21-feb-1996	rod	27-feb-1996	crw
Thiobencarb	ug/l	ND				0.2	21-feb-1996	rod	27-feb-1996	crw
Trifluralin	ug/l	ND				0.1	21-feb-1996	rod	27-feb-1996	crw

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525 Semivolatiles by GC/MS (ML/EPA 525.2)
Surrogate Summary

Parameter	Percent Recovery	Acceptable Range
Perylene-d12	110	70 - 130

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525 Semivolatiles by GC/MS (ML/EPA 525.2)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	alpha-Chlordane	ug/l	2	2.28	114
LCS1	Acenaphthylene	ug/l	2	1.94	97
LCS1	Alachlor	ug/l	2	2.29	114
LCS1	Aldrin	ug/l	2	2.09	104
LCS1	Anthracene	ug/l	2	2.02	101
LCS1	Atrazine	ug/l	2	2.06	103
LCS1	Benz(a)Anthracene	ug/l	2	2.08	104
LCS1	Benzo(a)pyrene	ug/l	2	2.22	111
LCS1	Benzo(b)Fluoranthene	ug/l	2	2.22	111
LCS1	Benzo(g,h,i)Perylene	ug/l	2	2.54	127
LCS1	Benzo(k)Fluoranthene	ug/l	2	2.23	112
LCS1	Di(2-Ethylhexyl)phthalate	ug/l	2	2.17	108
LCS1	Butylbenzylphthalate	ug/l	2	2.37	118
LCS1	Caffeine	ug/l	2	1.90	95
LCS1	Chrysene	ug/l	2	2.06	103
LCS1	Dibenz(a,h)Anthracene	ug/l	2	2.55	128
LCS1	Di-(2-Ethylhexyl)adipate	ug/l	2	1.85	92
LCS1	Diethylphthalate	ug/l	2	2.14	107
LCS1	Dimethylphthalate	ug/l	2	1.96	98
LCS1	Di-n-Butylphthalate	ug/l	2	2.33	116
LCS1	Endrin	ug/l	2	2.04	102
LCS1	Fluorene	ug/l	2	2.07	104
LCS1	gamma-Chlordane	ug/l	2	2.21	110
LCS1	Hexachlorobenzene	ug/l	2	1.96	98
LCS1	Hexachlorocyclopentadiene	ug/l	2	1.68	84
LCS1	Heptachlor	ug/l	2	2.15	108
LCS1	Heptachlor Epoxide	ug/l	2	2.28	114
LCS1	Indeno(1,2,3,c,d)Pyrene	ug/l	2	2.44	122
LCS1	Lindane	ug/l	2	2.11	106
LCS1	Methoxychlor	ug/l	2	2.16	108
LCS1	Molinate	ug/l	2	1.99	100

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525 Semivolatiles by GC/MS (ML/EPA 525.2)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	trans-Nonachlor	ug/l	2	2.25	112
LCS1	Pentachlorophenol	ug/l	8	6.91	86
LCS1	Phenanthrene	ug/l	2	2.12	106
LCS1	Pyrene	ug/l	2	2.22	111
LCS1	Simazine	ug/l	2	2.12	106
LCS1	Thiobencarb	ug/l	2	2.19	110
MBLK	alpha-Chlordane	ug/l	ND	ND	
MBLK	Diazinon	ug/l	ND	ND	
MBLK	Acenaphthylene	ug/l	ND	ND	
MBLK	Alachlor	ug/l	ND	ND	
MBLK	Aldrin	ug/l	ND	ND	
MBLK	Anthracene	ug/l	ND	ND	
MBLK	Atrazine	ug/l	ND	ND	
MBLK	Benz(a)Anthracene	ug/l	ND	ND	
MBLK	Benzo(a)pyrene	ug/l	ND	ND	
MBLK	Benzo(b)Fluoranthene	ug/l	ND	ND	
MBLK	Benzo(g,h,i)Perylene	ug/l	ND	ND	
MBLK	Benzo(k)Fluoranthene	ug/l	ND	ND	
MBLK	Di(2-Ethylhexyl)phthalate	ug/l	ND	ND	
MBLK	Butylbenzylphthalate	ug/l	ND	ND	
MBLK	Bromacil	ug/l	ND	ND	
MBLK	Butachlor	ug/l	ND	ND	
MBLK	Caffeine	ug/l	ND	ND	
MBLK	Chrysene	ug/l	ND	ND	
MBLK	Dibenz(a,h)Anthracene	ug/l	ND	ND	
MBLK	Di-(2-Ethylhexyl)adipate	ug/l	ND	ND	
MBLK	Diethylphthalate	ug/l	ND	ND	
MBLK	Diazinon	ug/l	ND	ND	
MBLK	Dieldrin	ug/l	ND	ND	
MBLK	Dimethylphthalate	ug/l	ND	ND	
MBLK	Dimethoate	ug/l	ND	ND	

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525 Semivolatiles by GC/MS (ML/EPA 525.2)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
MBLK	Di-n-Butylphthalate	ug/l	ND	ND	
MBLK	Endrin	ug/l	ND	ND	
MBLK	Fluorene	ug/l	ND	ND	
MBLK	gamma-Chlordane	ug/l	ND	ND	
MBLK	Hexachlorobenzene	ug/l	ND	ND	
MBLK	Hexachlorocyclopentadiene	ug/l	ND	ND	
MBLK	Heptachlor	ug/l	ND	ND	
MBLK	Heptachlor Epoxide	ug/l	ND	ND	
MBLK	Indeno(1,2,3,c,d)Pyrene	ug/l	ND	ND	
MBLK	Isophorone	ug/l	ND	ND	
MBLK	Lindane	ug/l	ND	ND	
MBLK	Methoxychlor	ug/l	ND	ND	
MBLK	Metribuzin	ug/l	ND	ND	
MBLK	Molinate	ug/l	ND	ND	
MBLK	Metolachlor	ug/l	ND	ND	
MBLK	trans-Nonachlor	ug/l	ND	ND	
MBLK	Pentachlorophenol	ug/l	ND	ND	
MBLK	Phenanthrene	ug/l	ND	ND	
MBLK	Prometryn	ug/l	ND	ND	
MBLK	Propachlor	ug/l	ND	ND	
MBLK	Pyrene	ug/l	ND	ND	
MBLK	Simazine	ug/l	ND	ND	
MBLK	Thiobencarb	ug/l	ND	ND	
MBLK	Trifluralin	ug/l	ND	ND	
MS	alpha-Chlordane	ug/l	2	2.14	107
MS	Acenaphthylene	ug/l	2	1.84	92
MS	Alachlor	ug/l	2	2.38	119
MS	Aldrin	ug/l	2	2.03	102
MS	Anthracene	ug/l	2	1.45	72
MS	Atrazine	ug/l	2	2.02	101
MS	Benz(a)Anthracene	ug/l	2	1.93	96

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Laboratory Report

Maui, County of, Department of Water Supply
614 Palapala Dr

Kahului , HI 96732
ATTN: Cari Cerizo

Sample # 960216004 Sample ID IAO DITCH Project PHASEV
Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

525 Semivolatiles by GC/MS (ML/EPA 525.2)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
MS	Benzo(a)pyrene	ug/l	2	1.94	97
MS	Benzo(b)Fluoranthene	ug/l	2	2.03	102
MS	Benzo(g,h,i)Perylene	ug/l	2	2.21	110
MS	Benzo(k)Fluoranthene	ug/l	2	2.08	104
MS	Di(2-Ethylhexyl)phthalate	ug/l	2	2.18	109
MS	Butylbenzylphthalate	ug/l	2	2.57	128
MS	Caffeine	ug/l	2	1.92	96
MS	Chrysene	ug/l	2	2.01	100
MS	Dibenz(a,h)Anthracene	ug/l	2	2.24	112
MS	Di-(2-Ethylhexyl)adipate	ug/l	2	1.78	89
MS	Diethylphthalate	ug/l	2	2.09	104
MS	Dimethylphthalate	ug/l	2	1.84	92
MS	Di-n-Butylphthalate	ug/l	2	2.23	112
MS	Endrin	ug/l	2	2.41	120
MS	Fluorene	ug/l	2	1.97	98
MS	gamma-Chlordane	ug/l	2	2.11	106
MS	Hexachlorobenzene	ug/l	2	1.86	93
MS	Hexachlorocyclopentadiene	ug/l	2	1.68	84
MS	Heptachlor	ug/l	2	1.87	94
MS	Heptachlor Epoxide	ug/l	2	2.25	112
MS	Indeno(1,2,3,c,d)Pyrene	ug/l	2	2.24	112
MS	Lindane	ug/l	2	1.96	98
MS	Methoxychlor	ug/l	2	2.11	106
MS	Molinate	ug/l	2.	1.99	100
MS	trans-Nonachlor	ug/l	2	1.99	100
MS	Pentachlorophenol	ug/l	8	8.74	109
MS	Phenanthrene	ug/l	2	1.94	97
MS	Pyrene	ug/l	2	2.06	103
MS	Simazine	ug/l	2	2.08	104
MS	Thiobencarb	ug/l	2	2.13	106

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Aldicarbs (ML/EPA 531.1)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
1-Hydroxycarbofuran	ug/l	ND				2			04-mar-1996	yks
Aldicarb (Temik)	ug/l	ND				0.5			04-mar-1996	yks
Aldicarb sulfone	ug/l	ND				0.8			04-mar-1996	yks
Aldicarb sulfoxide	ug/l	ND				0.5			04-mar-1996	yks
Baygon	ug/l	ND				2			04-mar-1996	yks
Carbofuran (Furadan)	ug/l	ND				0.9			04-mar-1996	yks
Carbaryl	ug/l	ND				2			04-mar-1996	yks
Methiocarb	ug/l	ND				2			04-mar-1996	yks
Methomyl	ug/l	ND				1			04-mar-1996	yks
Oxamyl (Vydate)	ug/l	ND				2			04-mar-1996	yks

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Aldicarbs (ML/EPA 531.1)

Surrogate Summary

Parameter	Percent Recovery	Acceptable Range
8DNC	97	80 - 120

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Aldicarbs (ML/EPA 531.1)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	3-Hydroxycarbofuran	ug/l	20.0	18.5	92
LCS1	Aldicarb (Temik)	ug/l	20.0	22.5	112
LCS1	Aldicarb sulfone	ug/l	20.0	19.0	95
LCS1	Aldicarb sulfoxide	ug/l	20.0	18.3	92
LCS1	Baygon	ug/l	20.0	20.4	102
LCS1	Carbofuran (Furadan)	ug/l	20.0	19.5	98
LCS1	Carbaryl	ug/l	20.0	17.5	88
LCS1	Methiocarb	ug/l	20.0	17.6	88
LCS1	Methomyl	ug/l	20.0	19.0	95
LCS1	Oxamyl (Vydate)	ug/l	20.0	17.4	87
MBLK	3-Hydroxycarbofuran	ug/l	ND	ND	
MBLK	Aldicarb (Temik)	ug/l	ND	ND	
MBLK	Aldicarb sulfone	ug/l	ND	ND	
MBLK	Aldicarb sulfoxide	ug/l	ND	ND	
MBLK	Baygon	ug/l	ND	ND	
MBLK	Carbofuran (Furadan)	ug/l	ND	ND	
MBLK	Carbaryl	ug/l	ND	ND	
MBLK	Methiocarb	ug/l	ND	ND	
MBLK	Methomyl	ug/l	ND	ND	
MBLK	Oxamyl (Vydate)	ug/l	ND	ND	
MS	3-Hydroxycarbofuran	ug/l	20.0	23.2	116
MS	Aldicarb (Temik)	ug/l	20.0	22.4	112
MS	Aldicarb sulfone	ug/l	20.0	22.1	110
MS	Aldicarb sulfoxide	ug/l	20.0	21.3	106
MS	Baygon	ug/l	20.0	22.7	114
MS	Carbofuran (Furadan)	ug/l	20.0	22.3	112
MS	Carbaryl	ug/l	20.0	22.5	112
MS	Methiocarb	ug/l	20.0	22.5	112
MS	Methomyl	ug/l	20.0	21.3	106
MS	Oxamyl (Vydate)	ug/l	20.0	22.0	110

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Nitrate by IC as NO3 & N (ML/EPA 300)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
Nitrate-N by IC	mg/l	ND				0.1			16-feb-1996	eyw
Nitrate	mg/l	ND				0.44			16-feb-1996	eyw

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Nitrate by IC as NO3 & N (ML/EPA 300)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	Nitrate-N	mg/l	2.5	2.51	100
LCS2	Nitrate-N	mg/l	2.5	2.51	100
MBLK	Nitrate	mg/l	ND	ND	
MS	Nitrate-N	mg/l	2.5	2.57	103
MSD	Nitrate-N	mg/l	2.5	2.56	102

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Herbicides by 515.1 (ML/EPA 515.1)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
2,4,5-T	ug/l	ND				0.2	21-feb-1996	wpt	20-feb-1996	dst
2,4,5-TP (Silvex)	ug/l	ND				0.2	21-feb-1996	wpt	20-feb-1996	dst
2,4-D	ug/l	ND				0.1	21-feb-1996	wpt	20-feb-1996	dst
2,4-DB	ug/l	ND				2	21-feb-1996	wpt	20-feb-1996	dst
Dichlorprop	ug/l	ND				0.5	21-feb-1996	wpt	20-feb-1996	dst
Acifluorfen (qualitative)	ug/l	ND				0.2	21-feb-1996	wpt	20-feb-1996	dst
Bentazon	ug/l	ND				0.5	21-feb-1996	wpt	20-feb-1996	dst
Dalapon (qualitative)	ug/l	ND				1	21-feb-1996	wpt	20-feb-1996	dst
3,5-Dichlorobenzoic acid	ug/l	ND				0.6	21-feb-1996	wpt	20-feb-1996	dst
DCPA	ug/l	ND				0.2	21-feb-1996	wpt	20-feb-1996	dst
Dicamba	ug/l	ND				0.08	21-feb-1996	wpt	20-feb-1996	dst
Dinoseb	ug/l	ND				0.2	21-feb-1996	wpt	20-feb-1996	dst
Pentachlorophenol	ug/l	ND				0.04	21-feb-1996	wpt	20-feb-1996	dst
Picloram	ug/l	ND				0.1	21-feb-1996	wpt	20-feb-1996	dst
4-Nitrophenol (qualitative)	ug/l	ND				5	21-feb-1996	wpt	20-feb-1996	dst
Data Entry	--	02/23/96				0	21-feb-1996	wpt	20-feb-1996	dst

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Herbicides by 515.1 (ML/EPA 515.1)
Surrogate Summary

Parameter	Percent Recovery	Acceptable Range
2,4-Dichlorophenylacetic Acid	95	70 - 130

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Herbicides by 515.1 (ML/EPA 515.1)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	2,4,5-TP (Silvex)	ug/l	0.500	0.51	102
LCS1	2,4-D	ug/l	1.00	0.90	90
LCS1	Bentazon	ug/l	1.00	1.01	101
LCS2	2,4,5-TP (Silvex)	ug/l	0.500	NA	
LCS2	2,4-D	ug/l	1.00	NA	
LCS2	Bentazon	ug/l	1.00	NA	
MBLK	2,4,5-T	ug/l	ND	ND	
MBLK	2,4,5-TP (Silvex)	ug/l	ND	ND	
MBLK	2,4-D	ug/l	ND	ND	
MBLK	2,4-DB	ug/l	ND	ND	
MBLK	Dichlorprop	ug/l	ND	ND	
MBLK	5-Hydroxydicamba	ug/l	ND	ND	
MBLK	Acifluorfen (qualitative)	ug/l	ND	ND	
MBLK	Bentazon	ug/l	ND	ND	
MBLK	Chloramben (qualitative)	ug/l	ND	ND	
MBLK	Dalapon (qualitative)	ug/l	ND	ND	
MBLK	3,5-Dichlorobenzoic acid	ug/l	ND	ND	
MBLK	DCPA	ug/l	ND	ND	
MBLK	Dicamba	ug/l	ND	ND	
MBLK	Dinoseb	ug/l	ND	ND	
MBLK	Pentachlorophenol	ug/l	ND	ND	
MBLK	Picloram	ug/l	ND	ND	
MBLK	4-Nitrophenol (qualitative)	ug/l	ND	ND	
MS	2,4,5-TP (Silvex)	ug/l	0.500	0.55	110
MS	2,4-D	ug/l	1.00	0.95	95
MS	Bentazon	ug/l	1.00	1.03	103

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Sample Type Water Sampled 15-feb-1996 Received 16-feb-1996 Reported 05-mar-1996

SDWA Pesticides (ML/EPA 508)

Parameter	Units	Result	Conc.	%Rec	Dilution	Det.Limit	Prepared	By	Analyzed	By
PCB 1016 Aroclor	ug/l	ND				0.1	20-feb-1996	dcm	23-feb-1996	rok
PCB 1221 Aroclor	ug/l	ND				0.1	20-feb-1996	dcm	23-feb-1996	rok
PCB 1232 Aroclor	ug/l	ND				0.1	20-feb-1996	dcm	23-feb-1996	rok
PCB 1242 Aroclor	ug/l	ND				0.1	20-feb-1996	dcm	23-feb-1996	rok
PCB 1248 Aroclor	ug/l	ND				0.1	20-feb-1996	dcm	23-feb-1996	rok
PCB 1254 Aroclor	ug/l	ND				0.1	20-feb-1996	dcm	23-feb-1996	rok
PCB 1260 Aroclor	ug/l	ND				0.1	20-feb-1996	dcm	23-feb-1996	rok
Alpha-BHC	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Alachlor (Alanex)	ug/l	ND				0.05	20-feb-1996	dcm	23-feb-1996	rok
Aldrin	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Beta-BHC	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Chlordane	ug/l	ND				0.1	20-feb-1996	dcm	23-feb-1996	rok
Chlorthalonil (Drconil, Bravo)	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Delta-BHC	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
p,p' DDD	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
p,p' DDE	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
p,p' DDT	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Dieldrin	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Endrin Aldehyde	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Endrin	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Endosulfan I (alpha)	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Endosulfan II (beta)	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Endosulfan sulfate	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Heptachlor	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Heptachlor Epoxide	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Lindane (gamma-BHC)	ug/l	ND				0.01	20-feb-1996	dcm	23-feb-1996	rok
Methoxychlor	ug/l	ND				0.05	20-feb-1996	dcm	23-feb-1996	rok
Toxaphene	ug/l	ND				0.5	20-feb-1996	dcm	23-feb-1996	rok
Data Entry	--	02/26/96				0	20-feb-1996	dcm	23-feb-1996	rok

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SDWA Pesticides (ML/EPA 508)
Surrogate Summary

Parameter	Percent Recovery	Acceptable Range
Dibutyl Chlorendate	128	70 - 130
Tetrachlorometaxylene	132	70 - 130

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SDWA Pesticides (ML/EPA 508)
Quality Control

Control	Parameter	Units	Actual	Found	%Recv
LCS1	Aldrin	ug/l	0.050	0.065	130
LCS1	p,p' DDT	ug/l	0.100	0.123	123
LCS1	Dieldrin	ug/l	0.100	0.128	128
LCS1	Endrin	ug/l	0.100	0.124	124
LCS1	Gamma-BHC (Lindane)	ug/l	0.050	0.066	132
LCS1	Heptachlor	ug/l	0.050	0.065	130
LCS2	Aldrin	ug/l	0.050	NA	
LCS2	p,p' DDT	ug/l	0.100	NA	
LCS2	Dieldrin	ug/l	0.100	NA	
LCS2	Endrin	ug/l	0.100	NA	
LCS2	Gamma-BHC (Lindane)	ug/l	0.050	NA	
LCS2	Heptachlor	ug/l	0.050	NA	
MBLK	PCB 1016 Aroclor	ug/l	ND	ND	
MBLK	PCB 1221 Aroclor	ug/l	ND	ND	
MBLK	PCB 1232 Aroclor	ug/l	ND	ND	
MBLK	PCB 1242 Aroclor	ug/l	ND	ND	
MBLK	PCB 1248 Aroclor	ug/l	ND	ND	
MBLK	PCB 1254 Aroclor	ug/l	ND	ND	
MBLK	PCB 1260 Aroclor	ug/l	ND	ND	
MBLK	Alpha-BHC	ug/l	ND	ND	
MBLK	Alachlor (Alanex)	ug/l	ND	ND	
MBLK	Aldrin	ug/l	ND	ND	
MBLK	Chlordane	ug/l	ND	ND	
MBLK	Chlorthalonil (Drconil, Bravo)	ug/l	ND	ND	
MBLK	Delta-BHC	ug/l	ND	ND	
MBLK	p,p' DDD	ug/l	ND	ND	
MBLK	p,p' DDE	ug/l	ND	ND	
MBLK	p,p' DDT	ug/l	ND	ND	
MBLK	Dieldrin	ug/l	ND	ND	
MBLK	Endrin Aldehyde	ug/l	ND	ND	
MBLK	Endrin	ug/l	ND	ND	

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Quality Control

Control	Parameter	Units	Actual	Found	%Recv
MBLK	Endosulfan I (alpha)	ug/l	ND	ND	
MBLK	Endosulfan II (beta)	ug/l	ND	ND	
MBLK	Endosulfan sulfate	ug/l	ND	ND	
MBLK	Gamma-BHC (Lindane)	ug/l	ND	ND	
MBLK	Heptachlor	ug/l	ND	ND	
MBLK	Heptachlor Epoxide	ug/l	ND	ND	
MBLK	Methoxychlor	ug/l	ND	ND	
MBLK	Toxaphene	ug/l	ND	ND	
MS	Aldrin	ug/l	0.050	0.066	132
MS	p,p' DDT	ug/l	0.100	0.124	124
MS	Dieldrin	ug/l	0.100	0.128	128
MS	Endrin	ug/l	0.100	0.124	124
MS	Gamma-BHC (Lindane)	ug/l	0.050	0.069	138
MS	Heptachlor	ug/l	0.050	0.066	132

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Appendix 8 Ditch Flow Data

23 Year 1955-1977 Month	Period	WAIHEE DITCH (14Hrs. P.Fl.) 23 ± Year Mean	MGD Std. Deviation	Mean - Std. Deviat'n	SPRECKELS DITCH (12Hrs 4' P.Fl.) 23 ± Year Mean	MGD Std. Deviation	Mean - Std. Deviat'n	MANIANIA DITCH (12' P.Fl.) 23 ± Year Mean	MGD Std. Deviation	Mean - Std. Deviat'n	IAO WAIKAPU DITCH (3' P.Fl.) 23 ± Year Mean	MGD Std. Deviation	Mean - Std. Deviat'n
January		13.88	5.43	8.45	4.67	1.27	3.40	8.53	3.37	5.16	8.06	4.01	4.05
February		15.45	4.68	10.77	4.68	1.60	3.08	10.12	3.32	6.80	8.23	4.05	4.18
March		16.50	6.11	10.33	5.30	1.45	3.85	10.95	3.68	7.27	9.21	4.17	5.04
April		19.15	3.44	15.71	5.89	1.19	4.70	13.24	3.38	9.85	11.52	3.77	7.75
May		16.65	4.95	11.70	5.46	.97	4.49	12.23	3.31	8.92	10.87	3.74	7.13
June		15.18	5.39	9.79	4.98	1.12	3.86	10.21	3.98	6.23	8.44	4.15	4.29
July		16.21	5.52	10.69	5.51	1.40	4.11	12.13	4.04	8.09	10.65	4.09	6.56
August		16.92	6.34	10.58	5.69	1.14	4.55	11.90	3.51	8.39	10.75	4.34	6.41
September		14.17	5.13	9.04	5.06	.79	4.27	8.77	2.92	5.85	7.98	3.82	4.16
October		14.25	4.70	9.55	4.80	1.04	3.76	9.23	3.29	5.94	8.27	3.50	4.77
November		15.27	4.23	11.04	4.96	.92	4.04	10.02	3.58	6.44	9.04	3.19	5.85
December		13.17	3.79	9.38	5.04	1.51	3.53	8.40	3.82	4.58	7.76	2.94	4.82
		NO.WAIEHU DITCH (2' P.Fl.			SO.WAIKAPU DITCH (2' P.Fl.)			EVERETT DITCH (2' P.Fl.)			WAILUKU PUMP		
January		2.74	.60	2.14	2.88	.79	2.09	1.69	.87	.82	11.06	4.24	6.82
February		2.91	.78	2.13	3.00	1.22	1.78	1.82	1.08	.74	10.67	3.09	7.58
March		2.95	.87	2.08	3.10	1.06	2.04	1.94	1.20	.74	9.32	2.28	7.04
April		3.12	.74	2.38	3.27	.78	2.49	2.04	1.06	.98	10.70	3.35	7.35
May		3.28	.77	2.51	3.97	1.08	2.89	1.62	.94	.68	11.64	2.66	8.98
June		3.25	.71	2.54	3.13	.92	2.21	1.50	.89	.61	12.95	4.04	8.91
July		3.26	.77	2.49	3.13	.88	2.25	1.44	.95	.49	11.36	3.84	7.52
August		3.10	1.19	1.91	3.24	.97	2.27	1.49	.83	.66	11.77	4.50	7.27
September		2.96	.80	2.16	2.98	.89	2.09	1.33	.59	.74	13.58	3.55	10.03
October		2.83	.69	2.14	2.76	.69	2.07	1.44	.86	.58	13.44	3.97	9.47
November		2.73	.74	1.99	2.76	.63	2.13	1.48	.77	.71	11.81	3.97	7.84
December		2.71	.62	2.09	2.71	.73	1.98	1.49	.81	.68	12.85	3.83	9.02

APPENDIX "C"

SUBJECT Water Resources COMPANY Wailuku Sugar Company COST CENTER
SOURCE Wailuku Sugar Co. "Report of Irrigation Water and Discharge in Million Gallons"
PROJ. NO. B/55697, Wai-641 DATE June 2, 1978 BY CB Land Dept. (lh) PERIOD COVERED FROM 1955 TO 1977

WAILUKU SUGAR COMPANY - WATER RESOURCES (By Ditch Systems & Wailuku Pump)

EXHIBIT 1

MILLION GALLONS PER DAY/GROSS WATER

23 Year Period 1955-1977 Month	WAIHEE VALLEY Waihee/Spreckels Ditches 23 + Year Mean	Std. Deviation	Mean - Std. Deviat'n	IAO VALLEY Nanianiau/Iao Waikapu Dtchs. 23 + Year Mean	Std. Deviation	Mean - Std. Deviat'n	No. Waihehu Ditch 23 + Year Mean	Std. Deviation	Mean - Std. Deviat'n
January	18.55	6.70	11.85	16.59	7.38	9.21	2.74	.60	2.14
February	20.13	6.28	13.85	18.35	7.37	10.98	2.91	.78	2.13
March	21.80	7.56	14.24	20.16	7.85	12.31	2.95	.87	2.08
April	25.04	4.63	20.41	24.76	7.15	17.61	3.12	.74	2.38
May	22.11	5.92	16.19	23.10	7.05	16.05	3.28	.77	2.51
June	20.16	6.51	13.65	18.65	8.13	10.52	3.25	.71	2.54
July	21.72	6.92	14.80	22.78	8.13	14.65	3.26	.77	2.49
August	22.61	7.48	15.13	22.65	7.85	14.80	3.10	1.19	1.91
September	19.23	5.92	13.31	16.75	6.74	10.01	2.96	.80	2.16
October	19.05	5.74	13.31	17.50	6.79	10.71	2.83	.69	2.14
November	20.23	5.15	15.08	19.06	6.77	12.29	2.73	.74	1.99
December	18.21	5.30	12.91	16.16	6.76	9.40	2.71	.62	2.09

	WAIKAPU VALLEY So.Waikapu/Everett Ditchs			Wailuku Pump			All Systems		
January	4.57	1.66	2.91	11.06	4.24	6.82	53.51	20.58	32.93
February	4.82	2.30	2.52	10.67	3.09	7.58	56.88	19.82	37.06
March	5.04	2.26	2.78	9.32	2.28	7.04	59.27	20.82	38.45
April	5.31	1.84	3.47	10.70	3.35	7.35	68.93	17.71	51.22
May	5.39	2.02	3.37	11.34	2.66	8.98	65.72	18.42	47.30
June	4.83	1.81	2.82	12.95	4.04	8.91	59.64	21.20	38.44
July	4.57	1.83	2.74	11.36	3.84	7.52	63.69	21.49	42.40
August	4.73	1.80	2.93	11.77	4.50	7.27	64.86	22.82	42.04
September	4.31	1.48	2.83	13.58	3.55	10.03	56.83	18.49	38.34
October	4.20	1.55	2.65	13.44	3.97	9.47	57.02	18.74	38.28
November	4.24	1.40	2.84	11.81	3.97	7.84	58.07	18.03	40.04
December	4.20	1.54	2.66	12.85	3.83	9.02	54.13	18.05	36.08

APPENDIX "C"

SUBJECT Water Resources COMPANY Wailuku Sugar Company COST CENTER

SOURCE Wailuku Sugar Co. "Report of Irrigation Water and Discharge in Million Gallons"

REQ. NO. B/S5697, Wai-641 DATE June 2, 1978 TO CR Land Dept. (1b)

07-03-96 10:22AM P01

Form 8510-2

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER RESOURCE MANAGEMENT

REGISTRATION OF STREAM DIVERSION WORKS AND DECLARATION OF WATER USE

INSTRUCTIONS: Please type or print. If information is not available or not applicable, indicate as N/A. Fill out as completely as possible, sign, and mail form to the Division of Water Resource Management, P.O. Box 373, Honolulu, Hawaii 96809. Phone 548-3648 or 548-7543 for assistance.

MULTI-SOURCE SYSTEMS: For a system of two or more diversion structures, submit a single package to describe the complete system. Include a single location map (or a set of maps if required) showing all diversion structures and measurement points, and a separate copy of this form for each structure and measurement point. On forms describing diversion structures, complete parts A, B, D, and E. On forms describing measurement points, complete parts A, B, and F.

STREAM NAME: Iao Stream ISLAND: Maui (Iao Valley)
DIVERSION STRUCTURE NAME: Maniania Ditch and Iao Waikapu Ditch Intake (Intake)
DIVERSION SYSTEM NAME: Maniania Ditch and Iao-Waikapu Ditch

A. DIVERSION WORKS OPERATOR
Firm name: Wailuku Agribusiness
Contact person: Clayton S. Suzuki
Address: P. O. Box 520
Wailuku, Hawaii
Zip 96793 Phone: 244-9567

B. OWNER OF DIVERSION WORKS SITE
Firm name: Wailuku Agribusiness
Contact person: Clayton S. Suzuki
Address: P.O. Box 520
Wailuku, Hawaii
Zip 96793 Phone: 244-9567

C. STREAM DIVERSION LOCATION
Tax Map Key: 3-3-03-3 Town, Place, District: Wailuku, Maui
Attach USGS "Quad" map (scale 1:24,000), tax map, or other map showing the diversion location.

D. STREAM DATA
Streamflow at diversion site is: ☒ Perennial (Water is always flowing) ☐ Intermittent (Channel is sometimes dry)
Is streamflow gaged? ☒ Yes ☐ No
If yes, provide gage name, and show location on map. Name: Iao Stream 16604500 (USGS)
Average flow before diversion: 86.8 (1986) ☐ mgd ☐ gpm ☒ cfs

E. DIVERSION STRUCTURE DATA
Year constructed: Unknown Elevation (Above mean sea level): 800'
Diversion structure is: ☒ Concrete ☐ Wood ☐ Pipe ☐ Other (Describe):
Diverted flow is: ☒ Controlled ☐ Uncontrolled
Diversion capacity is: 55 ☒ mgd ☐ gpm ☐ cfs

Submit an "as-built" drawing and dated photograph of the diversion works, if available.

. . . (continued over)

For Official Use Only:
Date received: *Date accepted:*
Field checked by: *Date:* *Latitude:* *Hydrologic Unit:*
Comments: *Longitude:* *State Diversion No.:*

References: Hawaii Revised Statutes, Chapter 174C.
Hawaii Administrative Rules, Chapters 13-167 to 13-171.

F. DECLARATION OF WATER USE

NOTE: The purpose of the Declaration of Water Use is to obtain information necessary for the management of the State's water resources. The Declaration does not confer a legal right to water or its use.

Location and name of measurement point (Show on location map): Iao Valley, Maui

Water use data are recorded: ☐ Continuously ☒ Daily ☐ Other: _____

Method of measurement (Check box and describe below): ☒ Weir ☐ Rating flume ☐ Other

Description: 12' Weir and 2.5' Weir

Quantity of Use (Report gaged or estimated monthly water use from the diversion described on the reverse side of this form, for the calendar years 1983 through 1987):

WATER USE, IN Mgd (unit of measurement)

	1983	1984	1985	1986	1987
January	488.3	769.9	397.0	634.9	936.7
February	242.2	809.6	353.0	314.8	667.2
March	335.4	457.5	1,002.9	650.6	476.1
April	508.7	597.2	765.9	794.5	735.9
May	873.3	401.2	949.2	849.5	565.9
June	666.7	315.1	368.3	911.2	727.0
July	620.7	315.4	674.4	838.7	694.9
August	614.1	332.1	818.3	744.5	510.3
September	748.1	210.8	567.2	966.5	485.2
October	1,068.1	182.0	910.5	746.8	718.6
November	892.6	336.0	827.9	1,023.1	952.3
December	567.0	319.2	750.0	853.7	845.9
ANNUAL	7,565.2	5,046.0	8,384.6	8,766.4	8,316.4

Typical times of usage: Continuous

Type of Use (Check all category boxes that apply and provide additional information as indicated.):

Category	Additional Information
☐ Municipal (including nurses, hotels, businesses)	
☐ Domestic (systems serving 25 people or less)	Number of service connections:
☒ Irrigation	Acres irrigated: Crop(s): ☒ Sugar ☒ Pineapple ☒ Other (specify): Macadamia Nut Non-Crop: ☐ Landscape ☐ Golf Course ☐ Other (specify): Method: ☐ Drip ☐ Furrow ☐ Sprinkler
☐ Industrial	☐ Cooling ☐ Manufacturing ☐ Mill ☐ Other (specify):
☐ Military	
☐ Other	Specify (livestock, hydroelectric, aquaculture, etc.):

Location of Use (Describe the location of water use, relative to the diversion, and indicate on location map. If water is used by others, submit a list of their names and addresses.):

Kamamoto, Nakaema, H. Ohki, Shimabukuro, R. Kishaba, J. Tom Sun, K. Kiyan, M. Takamiya, Okamura, K. Asato, U. Sakugawa, K. Matsuda, S. Okuhama all Wailuku

I declare that the contents of the above Declaration of Water Use are, to the best of my knowledge and belief, true, correct, and complete.

Water User's Signature: Clayton S. Suzuki Date: APR 24 1989

Printed Name: Clayton S. Suzuki

Firm or Title (Diversion Operator, etc.): Wailuku Agribusiness Co., Inc.

IAO AQUIFER SYSTEM
STATE AQUIFER CODE 60102
GROUND WATER MANAGEMENT AREA DESIGNATION
FINDINGS OF FACT

State of Hawaii
Commission on Water Resource Management
January 24, 1996

Appendix 9 CWRM Findings of Fact, Information on Aquifer Pumpage & Chlorides

PREFACE

This FINDINGS OF FACT has been prepared for the Commission on Water Resource Management (CWRM) for its consideration in designating the Iao Aquifer System, State Aquifer Code 60102, on the island of Maui as a ground water management area under the authority of Chapter 174C, HRS.

During the later part of 1990, CWRM staff review of existing water use, head level, and chloride concentration data revealed that the utility of the Iao Aquifer System on the island of Maui was potentially threatened and staff immediately informed the Chairperson of the CWRM of the situation.

On December 19, 1990, the Chairperson of the CWRM initiated the "Recommendation to Continue the Process Regarding Designation of the Wailuku (Iao) Aquifer as a Water Management Area".

On June 19, 1991, the CWRM approved the "Continuance of Designation Process, Proposed Wailuku (Iao) Water Management Area, Maui".

On September 10, 1991, the CWRM held a public hearing on Maui to receive public testimony and comments regarding the proposed designation of the aquifer. Written testimony was accepted until September 25, 1991.

On October 2, 1991 the CWRM held a workshop with the United States Geological Survey to assess the ground water conditions in the Iao Aquifer System.

These FINDINGS OF FACT summarize the CWRM staff investigations and research, comments from consultation with the County of Maui, the public's written and oral comments received at the public hearing, and other existing information on file with the Department of Land and Natural Resources.

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SUMMARY

The CWRM directed its staff to investigate the Iao Aquifer System, State Aquifer Code 60102, for possible designation as a ground water management area under the authority of Chapter 174C, HRS. Under a ground water management area the CWRM would regulate water withdrawals from the Iao Aquifer System through water use permits. This document reviews the system's ground water resource situation and makes FINDINGS OF FACT based upon information on file in the CWRM offices, the research of independent investigators, the written and oral comments submitted to the CWRM at the public hearing, and other planning and scientific literature.

Iao Aquifer System's Current Ground Water Resource Conditions

The Iao Aquifer System, State Aquifer Code 60102, is located in western Maui and includes high-level dike, basal, and caprock ground water bodies. Most of the wells withdraw water from the basal ground water source except for two sources tapping the high-level dike portion of the aquifer system. The current established sustainable yield of the dike and basal system is 20 million gallons per day (mgd). No estimate of sustainable yield has been made for the caprock portion of the aquifer system.

Presently, water level and chloride analyses reveal that the midpoint and the upper portion of the transition zone is rising. The basal lens is approximately 730 feet thick at the Waiehu Deep Monitor Well. It is estimated that the transition zone is rising at the rate of about 8 feet per year. Current information indicates that the basal lens is reacting to pumpage on its way toward establishing a new state of equilibrium. Further, a well field has experienced substantial increases in chloride concentration. However, this is more due to local upconing than regional increases in chlorides.

The Iao Aquifer System is the major ground water source for the MBWS Central Maui Water System. MBWS existing water use presently accounts for 100% of the aquifer's sustainable yield. Alternate well sources in other aquifer systems have been specified by the MBWS to satisfy future demand, but it is not clear how quickly these new sources could be brought on-line.

Findings of Fact

Given the existing hydrologic data, analyses, and current withdrawals from the Iao Aquifer System, this report makes the following conclusions:

1. Evidence does not exist to justify changing the current sustainable yield estimate of the Iao Aquifer System, which is 20 mgd.

2. The transition zone has been rising at a steady rate and new equilibrium levels have not yet been achieved.

3. Increased chloride concentrations in some of the wells are the result of localized upconing, and chloride concentrations in one of the wells has exceeded the Department of Health's guideline concentrations;

4. Water use from the Iao Aquifer System is largely municipal for the MBWS;

5. Current 1995 ground water withdrawals from the Iao Aquifer System average 20.5 mgd (12 month moving average) or more than 100% of sustainable yield; and

6. Present available data and information support a finding that the following two ground water criteria for designation under HRS §174C-44 have been met:

   [§174C-44(1)] Whether an increase in water use or authorized planned use may cause the maximum rate of withdrawal from the ground water source to reach ninety percent of the sustainable yield of the proposed water management area; and

   [§174C-44(4)] Whether rates, times, spatial patterns, or depths of existing withdrawals of ground water are endangering the stability or optimum development of the ground water body due to upconing or encroachment of salt water.

STATE OF HAWAII
COMMISSION ON WATER RESOURCE MANAGEMENT

IAO AQUIFER SYSTEM
GROUND WATER MANAGEMENT AREA DESIGNATION
FINDINGS OF FACT

I. PURPOSE

This Findings of Fact Report has been prepared for the Commission on Water Resource Management (CWRM) to consider designating the Iao Aquifer System as the IAO AQUIFER SYSTEM GROUND WATER MANAGEMENT AREA.

II. DESIGNATION BACKGROUND

2.1 Chairperson Initiation/Recommendation

On December 19, 1990, the Chairperson of the CWRM initiated designation proceedings by recommending continuation of the process of designation for the Wailuku (Iao) Aquifer as a ground water management area. This recommendation was a result of CWRM staff analysis of existing ground water conditions within the aquifer system. Preliminary staff investigations highlighted applicable ground water designation criteria from HRS §174C-44 requiring designation, as follows:

1. Future authorized planned development would or may cause the water withdrawal to exceed 90% of the aquifer's sustainable yield;

2. Current basal ground water levels are excessively declining;

3. Existing withdrawals are endangering the stability of the basal ground water body due to upconing and salt water encroachment;

4. Commitments as specified by the Maui Board of Water Supply (MBWS) may result in any of the eight (8) ground water criteria for designation as provided by 174C.

The CWRM deferred action on the recommendation pending further consultation with the Mayor and MBWS. There are no deadlines specified in HRS 174C regarding Chairperson initiated designation proceedings. The Chairperson's recommendation can be found in Appendix A.

2.2 Consultation

Consultation with the Maui County Mayor and Maui Board of Water Supply was initiated on October 29, 1990. Responses were returned on March 1, and January 19, 1991 respectively. County responses may be found in Appendix B.

During this response period the CWRM held a public informational meeting on November 11, 1990 at the Kahului Library regarding actual 80% sustainable yield water usage in accordance with HRS §174C-44(8).

2.3 Recommendation for Continuance

The CWRM entertained two additional recommendations at CWRM meetings on May 15 and June 19, 1991 before approving continuance of the designation process. At its May 15, 1991 meeting the CWRM deferred action for continuance to review additional studies on the aquifer by the United States Geological Survey (USGS) and C. Brewer Co. After preliminary review of the new data the Commission approved continuance of the designation process at its June 19, 1991 meeting. The CWRM approved action may be found in Appendix C.

2.4 Public Hearing

On September 10, 1991 the CWRM held a public hearing on the island of Maui at the Kahului Library to receive public testimony concerning designation of the Iao Aquifer System.

Pro-designation testimony, orally stated by West Maui Soil and Water Conservation District and the West Maui-Moloka'i Taro Farmers Association is summarized as follows:

1. MBWS lacks the expertise to protect the aquifer system;

2. MBWS has their hands tied in light of necessary approvals from the county administration that will lead to ineffective protection of the aquifer;

3. MBWS has never financed larger water developments. Money has always come from the State or private (Central Maui Source Development Joint Venture) sectors;

4. Private enterprise alone has intended to withdraw 19.5 mgd (98%) from the Iao Aquifer System;

5. There are at least eight valley areas in the West Maui Mountain Range where taro revitalization is occurring. The taro market demand has increased and, thus, there is a future need for more water for taro farming;

6. MBWS intends to pump up to the 20 mgd limit or (100%) of sustainable yield; and

7. Shifting water from East Maui to Central or West Maui may not be viable in the long-term as some water may be coming from areas that underlie previous agricultural land and may have water quality problems. This may place greater demands on West Maui ground water.

Non-designation testimony, both written and oral, originated from the Maui County Mayor's office, Maui County Board of Water Supply, C. Brewer Co., and Wailuku Agribusiness Co., are summarized as follows:

1. Through analysis by the United States Geological Survey (USGS), the Iao Aquifer System may be safely pumped up to the present sustainable yield of 20 mgd through re-distributed pumping;

2. Unlike the Pearl Harbor Water Management Area (PHWMA), there is only a single water user and use authority in the Iao Aquifer System; MBWS. In fact, the only parties with the practical potential to withdraw ground water from the Iao Aquifer System are Wailuku Agribusiness Co. and MBWS. The major land owner in the area, C. Brewer Properties, has worked responsibly with MBWS since 1975 through the Central Maui Source

Development Joint Venture and would take no action on withdrawals that would be objectionable to the MBWS. Therefore, no water use disputes exist or will exist in the future. Because of this unique situation ground water designation criteria, in general, do not apply;

3. Current (1991) withdrawals from the aquifer (16.9 mgd) constitute 84% of the present sustainable yield and the MBWS will not commit any water in excess of 20 mgd on an annual average basis from the Iao Aquifer System;

4. The MBWS has shown it can manage the aquifer system based on its present measures to reduce water consumption and waste through a leak detection program and to increase future water supplies;

5. The MBWS is the only user and has clear authority to control pumping from the aquifer and may control other new ground water users (on their system) through the issuance of water meters;

6. The CWRM's present well drilling and pump installation permitting process, in conjunction with MBWS, can limit withdrawals by other parties and provides sufficient authority and control over the aquifer; and

7. Given the above statements, designation would go far beyond the needs of the situation.

Written public hearing testimony can be found in Appendix D.

2.5 Investigation and Findings of Fact

The CWRM conducted investigations on the Iao Aquifer System, which are described in Section III of this report. A letter was received from the MBWS dated January 5, 1996, in response to a number of questions posed by the CWRM regarding the status of the MBWS water development plans. Section IV presents the findings relative to the eight (8) ground water designation criteria specified in HRS 174C-44.

III. PROPOSED IAO AQUIFER SYSTEM GROUND WATER MANAGEMENT AREA

3.1 Areal Extent

The Iao Aquifer System is one of four aquifer systems located within the Wailuku Aquifer Sector, Maui. The Iao Aquifer System area is 17.81 mi^2 (11,400 acres) or 33 percent of the total Wailuku Aquifer Sector area of 53.43 mi^2 (Yuen and Assoc., 1990, p. B-7). The system's boundaries are shown in Figure 1 and follow the boundaries as defined in the State's Water Resources Protection Plan. The County of Maui uses the same boundaries in its Maui County Water Use and Development Plan.

Ground water in the Iao Aquifer System occurs in three areas: 1) high-level dike confined water, 2) basal water, and 3) caprock water (see Figure 2, modified from Mink, 1977). Potable ground water in the Iao Aquifer System is found in the high-level and basal portions of the system. The areal boundaries show that the basal source is relatively narrow as imposed by the constraints of the subsurface geology and the location of the high-level dike water boundary. Mink (1977) computed the basal aquifer's initial pre-development volume at 220 billion gallons.

3.2. Sustainable Yield

A sustainable yield of 20 mgd for the dike and basal portions of the aquifer has been adopted by the CWRM in the 1990 Water Resources and Protection Plan. No estimate of sustainable yield has been adopted for the caprock portion of the Iao aquifer. Sustainable yield is defined in HRS §174C-3 as follows:

> *"Sustainable yield" means the maximum rate at which water may be withdrawn from a water source without impairing the*

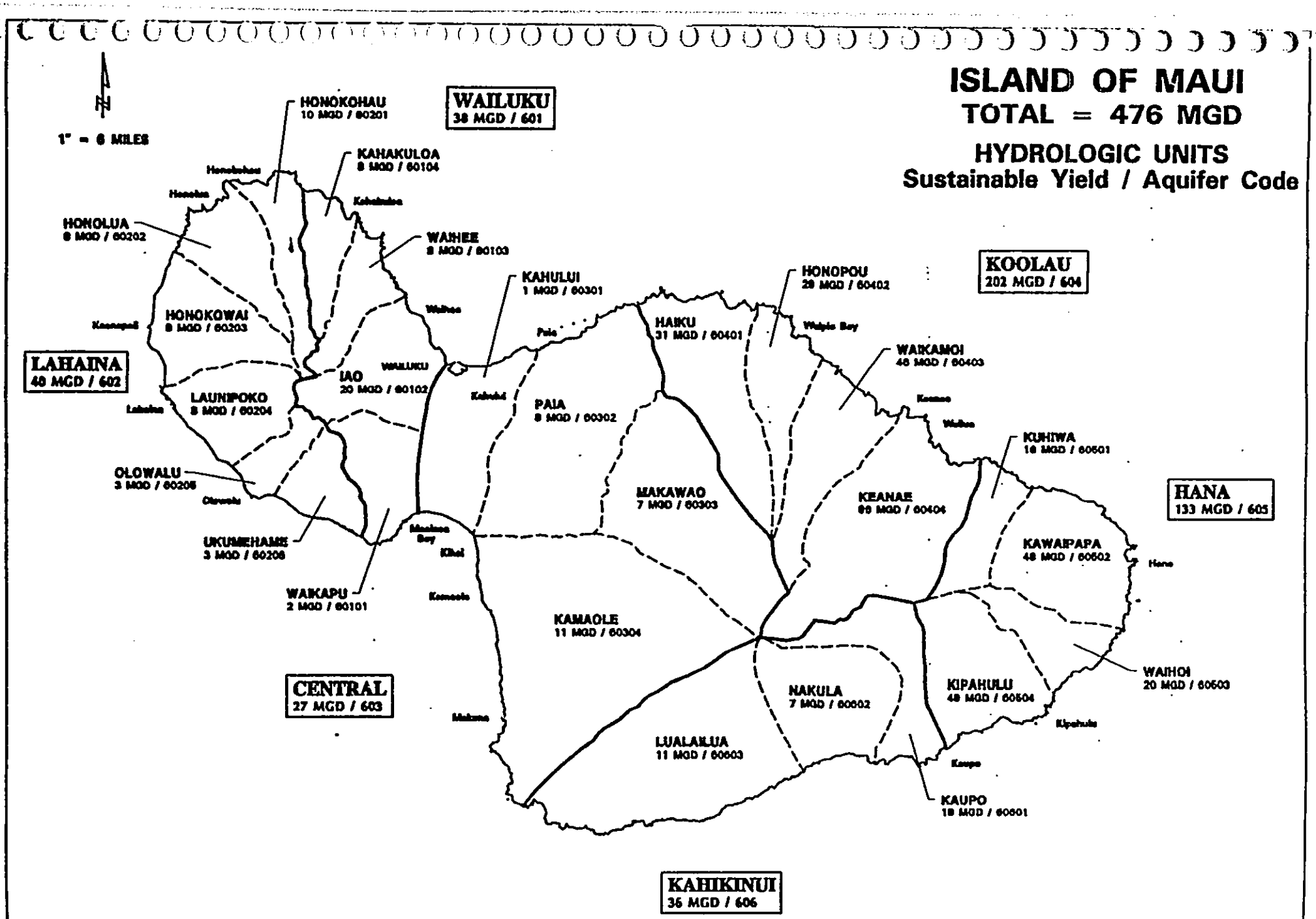
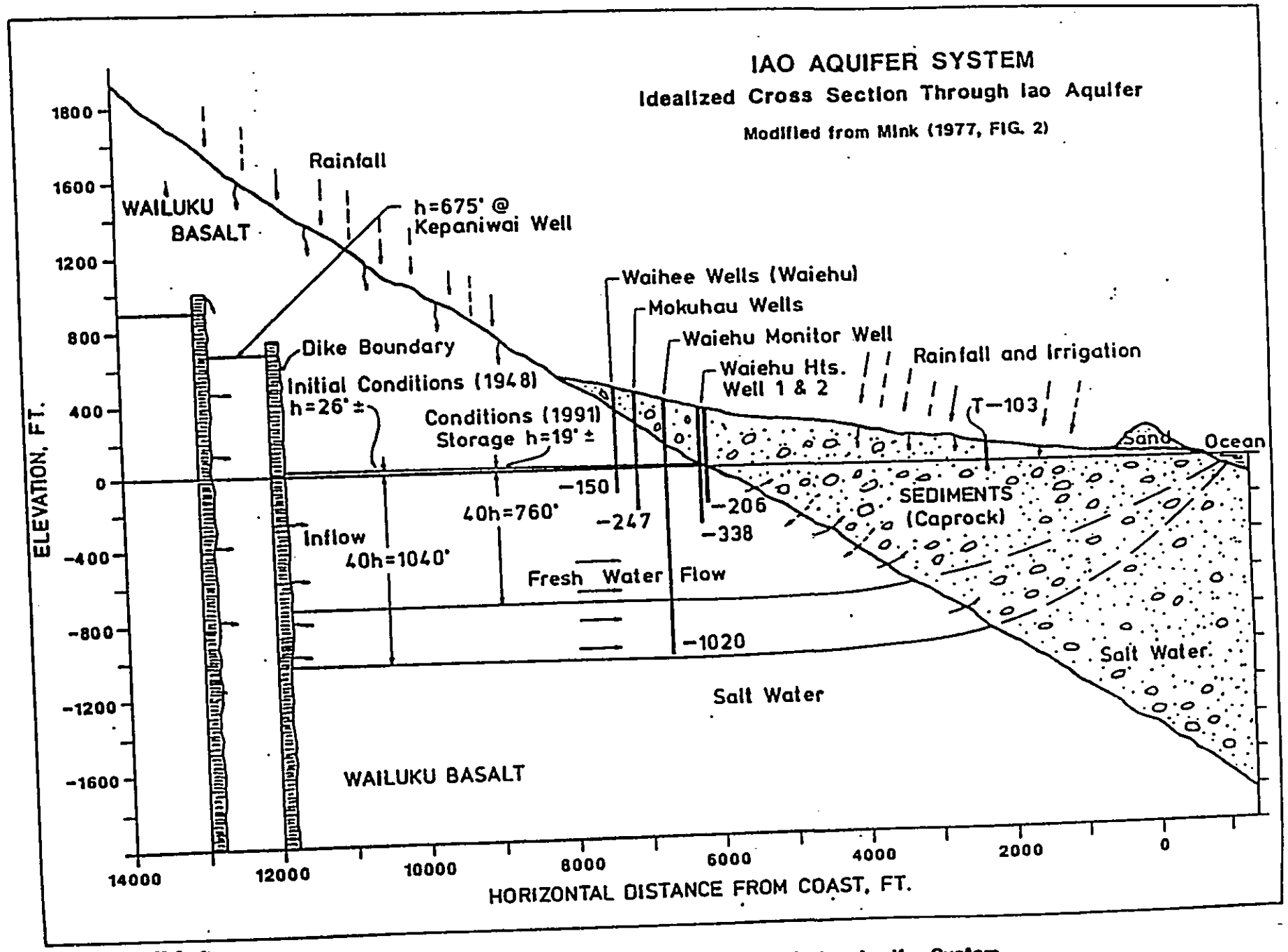


FIGURE 1. Aquifer Boundaries

Map Projection: Universal Transverse Mercator



(Source: Mink, 1977, Fig. 2)

FIGURE 2. Profile of Ground-Water Occurance in Iao Aquifer System

utility or quality of the water source as determined by the commission.

The Iao Aquifer System's sustainable yield can be estimated by an analytic ground water model similar to that used to estimate sustainable yield in the Pearl Harbor Ground Water Management Area. The derivation of this model requires a steady-state relationship between the initial head, recharge, and the current storage head (Mink, 1980; Yuen and Assoc., 1990). The model employs mass-balance, Darcy's Law, and dimensional analysis relationships to formulate the fundamental model that accounts for unknown parameters such as leakage and global permeability. It should be noted that return irrigation affects recharge in this model and changes in plantation practices should affect the estimate.

The sustainable yield estimate of 20 mgd is the best estimate available at this time. There is inadequate evidence to change the estimate either upward or downward at this time.

3.3 Current Ground Water Use

Currently, there are 44 wells listed on the State of Hawaii's Ground water Index (1996) within the Iao Aquifer System boundaries (see Appendix F). Average pumpage from 4 caprock wells totals about 0.3 mgd. Pumpage from the 10 wells in the basal and dike aquifers totals about 20.5 mgd (12 month moving average). In addition, the Iao Tunnel, which is a gravity fed source operated by the MBWS, provides about 1.6 mgd. Thus, current ground water use from the Iao Aquifer System is 22.1 mgd and largely municipal as MBWS is the major user of ground water at this time. The portion that is forcibly withdrawn and therefore would be compared to sustainable yield is 20.5 mgd.

TABLE 1. Well Capacity and Pumpage
(mgd; excludes tunnel and caprock sources)

Well Name	Year Drilled	Pump Capacity	Pumpage as of 12/95 12-MAV
Wailuku Shaft	1946	21.750	5.463
Mokuhau 1	1953	4.000	0.706
Mokuhau 2	1953	4.000	0.078
Mokuhau 3	1967	6.070	4.133
Waiehu Hts. 1	1975	1.790	0.528
Waiehu Hts. 2	1975	1.790	1.150
Waihee 1	1976	4.000	1.624
Waihee 2	1976	4.000	2.909
Waihee 3	1981	4.970	3.390
Kepaniwai	1974	1.000	0.491
	Total Pumpage	53.37	20.472
Iao Tunnel		NA	1.6
	Total Use		22.1

As described in the Maui County Water Use and Development Plan (WUDP), MBWS wells in Iao are the main source for the Central Maui Water System which services the Wailuku-Kahului, Paia-Haiku, and Kihei-Makena community regions. The only other currently available sources for the Central Maui Water System are the Iao Tunnel and Reynolds Foods Wells. Since they are not in the Iao Aquifer the Reynolds Foods Wells could reduce reliance on the Iao Aquifer, albeit temporarily. Figure 3 shows the areal location of MBWS wells within the Iao Aquifer System. Correspondingly, Figure 4 shows the depths of these wells.

Development of the basal aquifer began in 1948 with pumpage from Shaft 33 (Wailuku Shaft). Prior to the use of basal water in the Wailuku Area, stream and tunnel water were developed for potable use (Stearns and Macdonald, 1942, p. 209). Since 1980, annual mean pumpage increased from 9.60 mgd to 20.5 mgd. Total annual average water withdrawals from active wells in Iao Aquifer are summarized in Figure 5 for the period of record from 1948 to 1995.

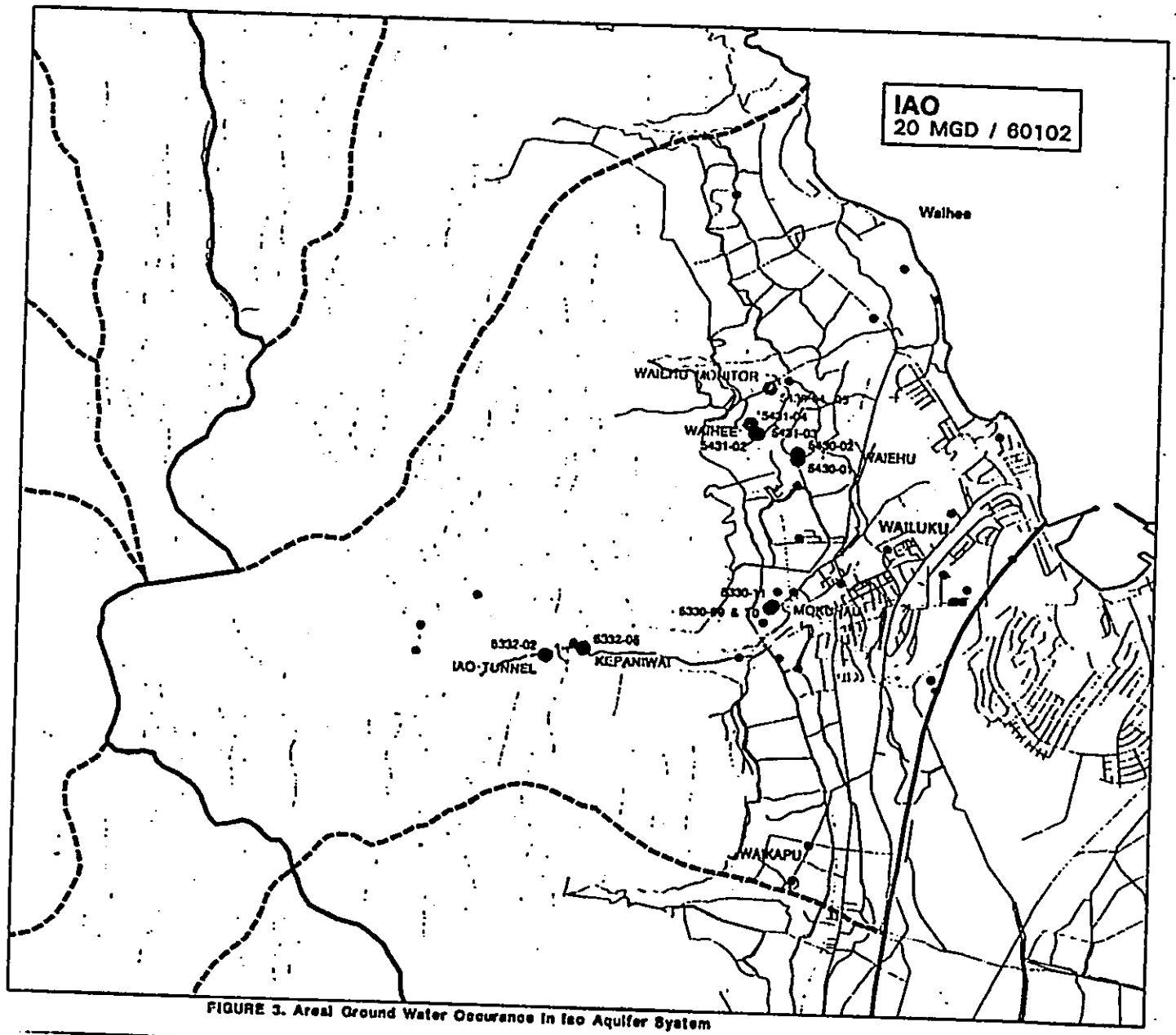


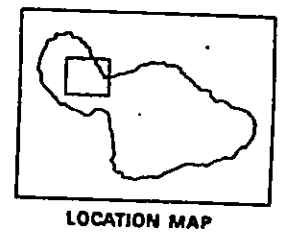
FIGURE 3. Areal Ground Water Occurance in Iao Aquifer System

State of Hawaii
Department of Land and Natural Resources
Division of Water Resource Management

IAO AQUIFER

SCALE 1:50,000

- AQUIFER SECTOR BOUNDARY
- AQUIFER SYSTEM BOUNDARY
- OTHER WELLS
- MAUI DWS WELL
- MONITOR WELL
- PERENNIAL STREAM
- DITCH
- MAJOR ROAD
- ROAD
- CONTOUR (500 FT INT.)



LOCATION MAP

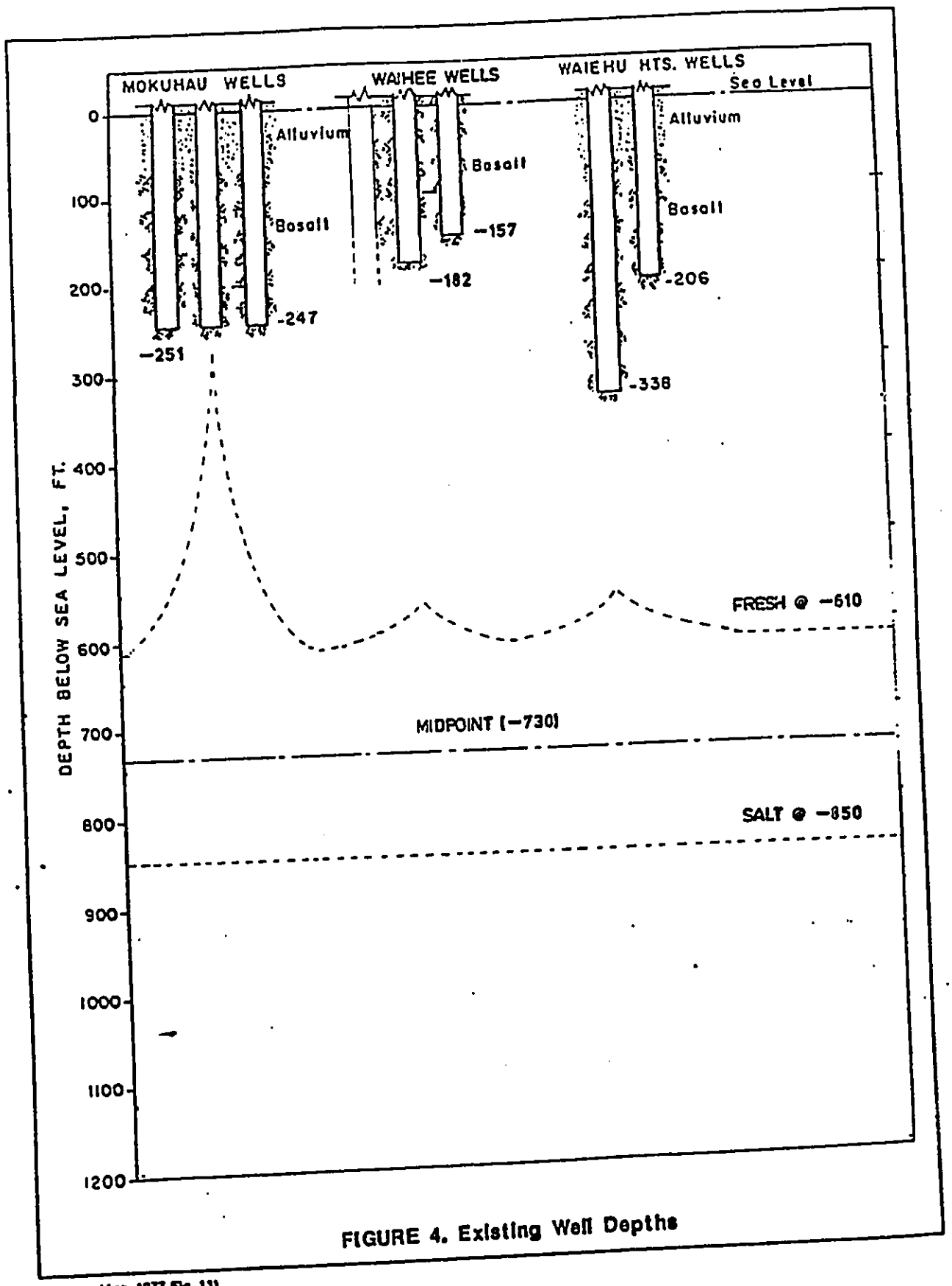


FIGURE 4. Existing Well Depths

(Source: Mink, 1977 Fig. 11)

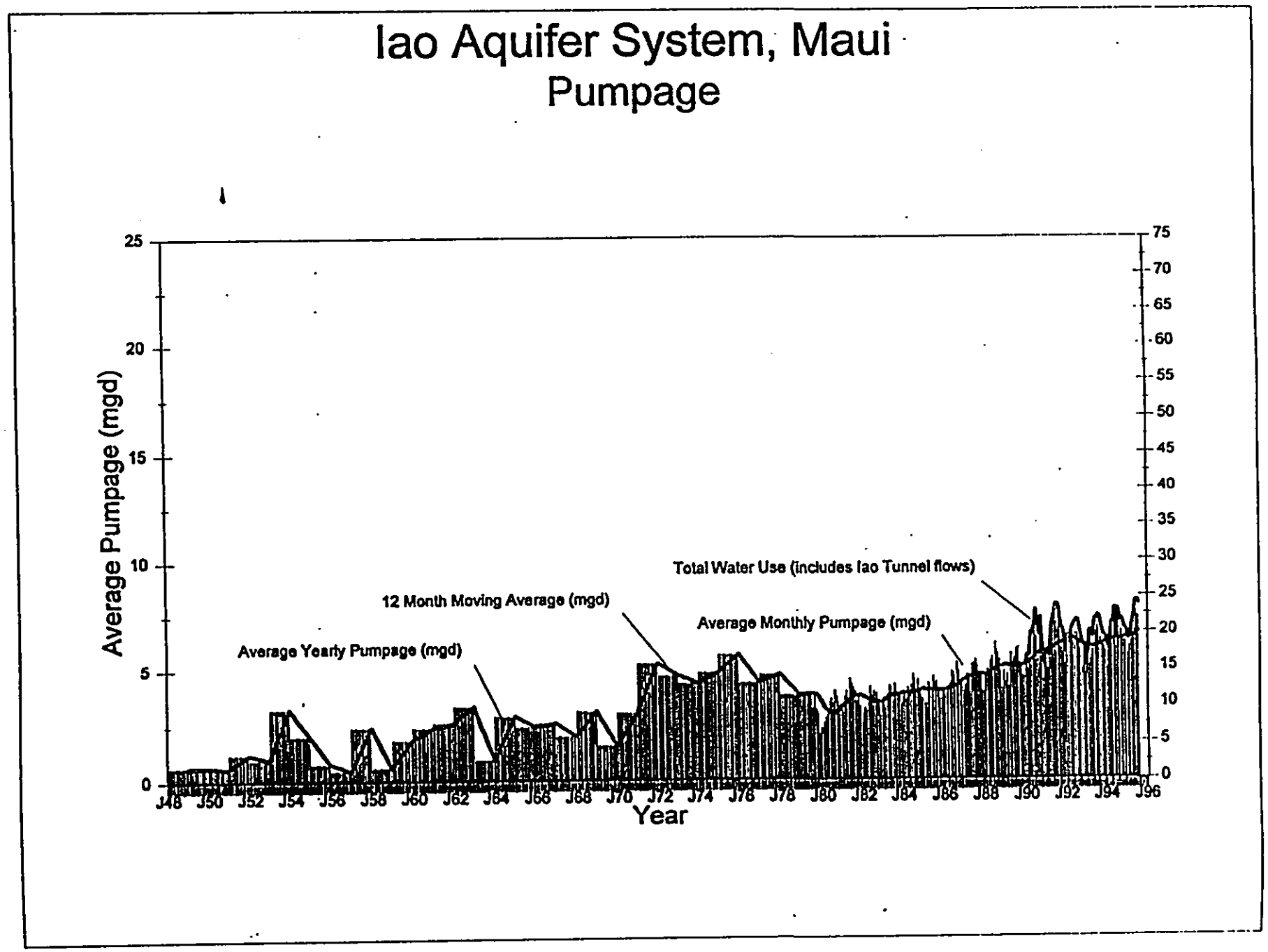


FIGURE 5. Average Annual Withdrawals For MBWS Wells 1948–1995

3.4 Chloride Levels

The chloride ion concentration is a measure of salinity used as one indicator of the potability of the resource. The American Water Works Association (AWWA) guideline limit of chloride concentrations for potable uses is 250 ppm. Geology, well depth, and pumpage influence chloride trends.

Dike sources, such as the Kepaniwai Well or Iao Tunnel, have high water levels and stable low chloride concentrations which are only slightly greater than rainwater. On the other hand, basal sources are more susceptible to changes in chloride concentrations than dike sources due to lower water levels and susceptibility to salt water intrusion near the ocean shore or from the transition zone which underlies the entire basal aquifer. Localized increases in chlorides are due to upconing effects from high pumpage rates of individual wells in basal aquifers. Regional basal chloride increases are due to overall shrinking of the basal lens and may affect all wells within the aquifer.

Table 2 compares current chloride levels to the initial chloride concentrations when MBWS wells in Iao Aquifer were first drilled and tested.

TABLE 2. Initial and Current Chloride Concentrations (mg/l)

Well Name	Initial Cl	Year	Current Monthly Chlorides		
			Max	Min	Date
Wailuku Shaft	NA	1946	38	34	12/95
Mokuhau 1	16	1953	120	120	9/95
Mokuhau 2	16	1953	420	400	7/95
Mokuhau 3	30	1967	130	120	12/95
Waiehu Hts. 1	52	1975	130	130	11/95
Waiehu Hts. 2	20	1975	61	58	12/95
Waihee 1	15	1976	19	19	12/95
Waihee 2	NA	1976	32	27	12/95
Waihee 3	13	1981	22	14	12/95
Kepaniwai	25	1974	17	10	12/95

Chloride concentrations are well below the EPA potable water guideline of 250 ppm, except for Mokuhau Well No. 2. To evaluate

the cause for the chloride changes over time, a comparison of chloride concentrations to pumpage was made for each well field (Mokuhau, Waiehu, and Waihee). These comparisons are shown in Figures 6 to 9. Figures 10 and 11 show pumpage and chlorides for Kepaniwai and Wailuku Shaft.

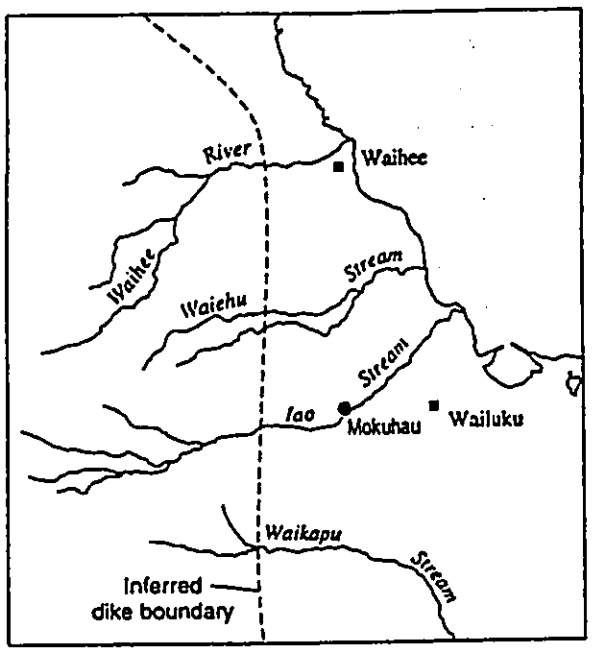
Figure 6 shows that the chloride levels in Mokuhau Well No. 2 are very responsive to well field pumpage compared to Mokuhau 1 and 3. Figure 7 is an expanded version of the comparison. Mokuhau Well No. 2 exhibits chloride concentrations greater than 250 ppm for sustained well field pumpage of approximately 5 to 6 mgd or greater. When Mokuhau well field pumpage was reduced to 4 mgd in 1991, a decrease in chloride concentration was immediately achieved. When pumpage increased to 10 mgd in 1994, chloride concentration immediately increased to 400 ppm. This data shows that Mokuhau well field is experiencing local upconing and indicates that 5 mgd may be the maximum production from the field to avoid Mokuhau No. 2 chloride levels that exceed the EPA guidelines.

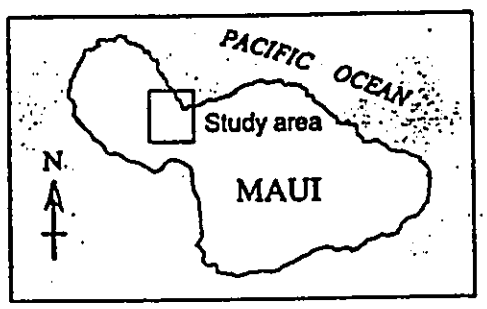
Waiehu Heights Wells show an increase in chlorides in response to increased pumpage (Figure 8), as do Waihee Wells (Figure 9). However, the chloride levels are much lower and the percentage increase in chloride levels are smaller than were seen at Mokuhau Well No. 2.

3.5 Water Levels

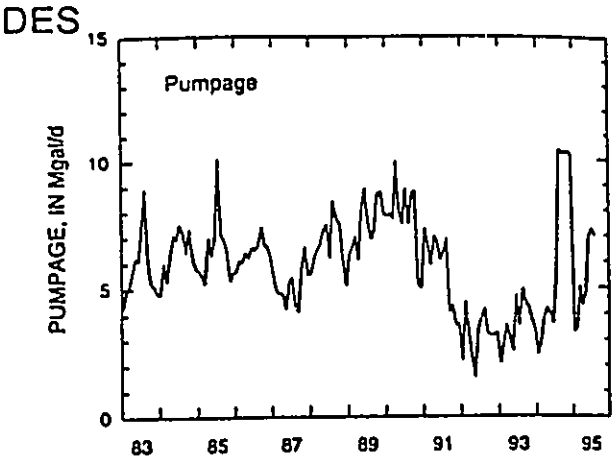
Water levels within a basal aquifer are governed by the Ghyben-Herzberg principle under steady-state conditions. This principle is the equilibrium relationship between fresh water floating on salt water. For every foot of water above mean sea level (msl), fresh water extends 40 feet below msl under steady-state conditions. Under natural conditions, an aquifer's initial equilibrium water level is governed by geological boundaries, aquifer properties, recharge, and leakage. For example, caprock formations retard leakage to the sea and, thus, generate relatively high basal water levels. Also, during periods of high rainfall there will be relatively more recharge to an aquifer and water levels will tend to be higher. These conditions affect the aquifer globally or regionally. Thus, the static equilibrium water levels are a measure of the aquifer on a regional level.

MOKUHAU PUMPAGE AND CHLORIDES





LOCATION OF STUDY AREA



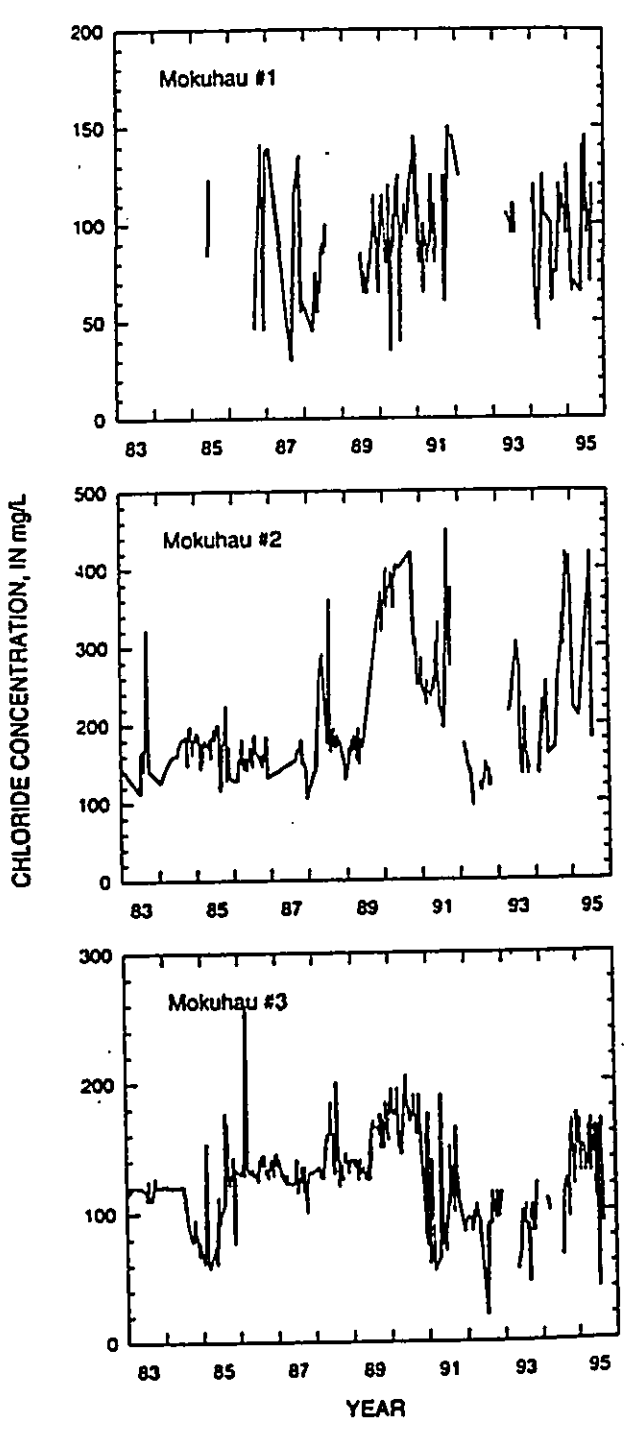


FIGURE 6. Mokuhau Well Field Chlorides & Pumpage Over Time

MOKUHAU WELL FIELD PUMPAGE AND MOKUHAU #2 CHLORIDES

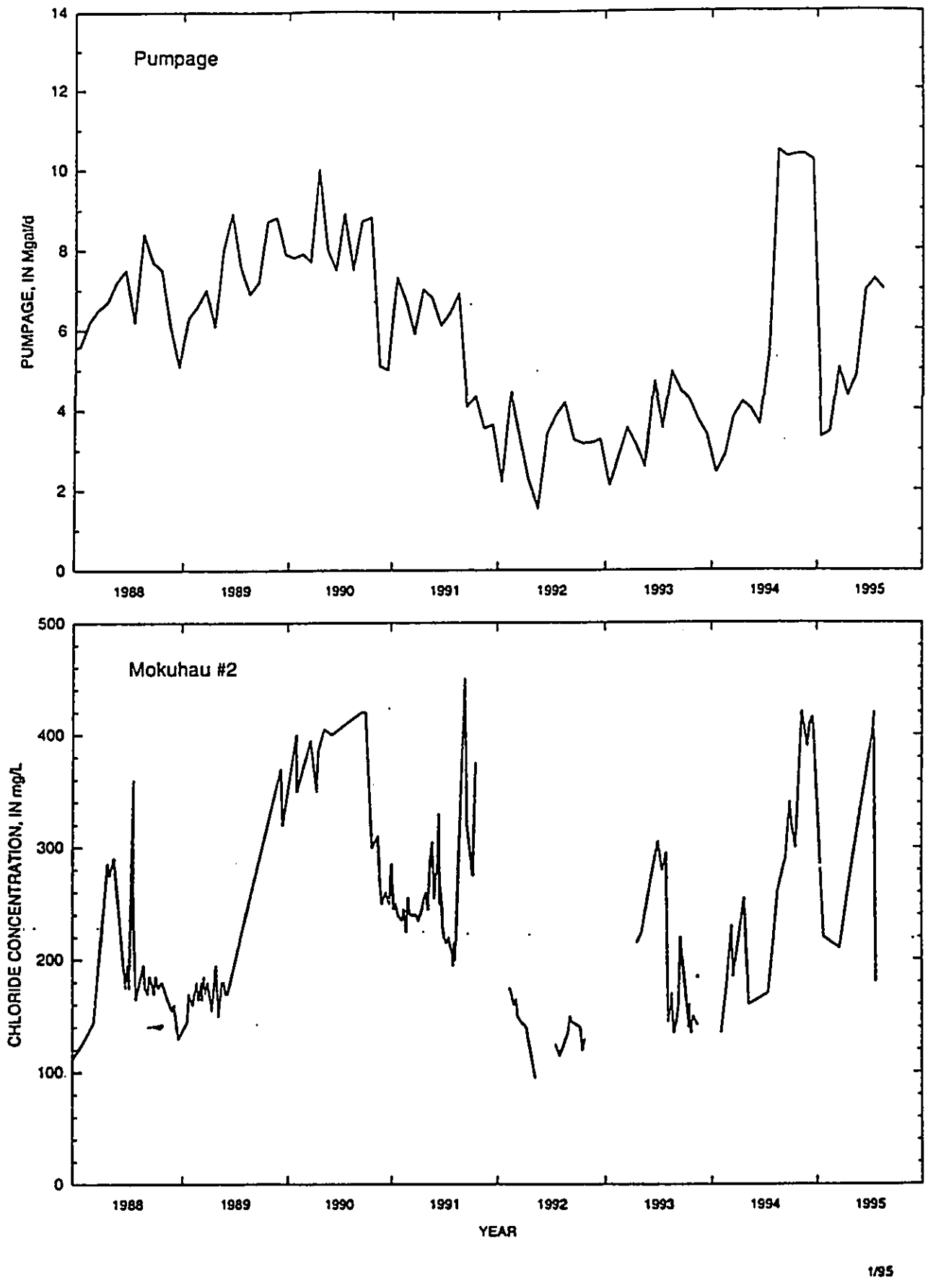
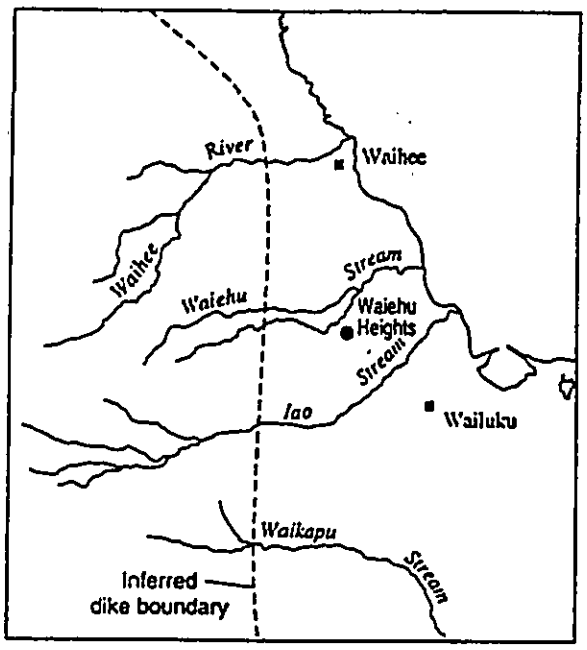
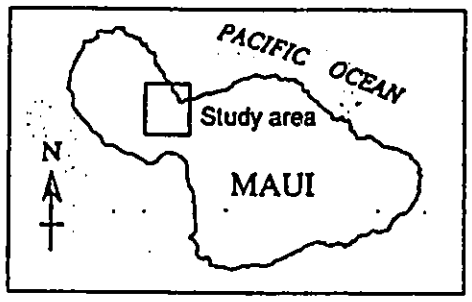


FIGURE 7. Mokuhau Well Field Pumpage & Mokuhau #2 Chlorides Over Time

WAIEHU HEIGHTS PUMPAGE AND CHLORIDES





LOCATION OF STUDY AREA

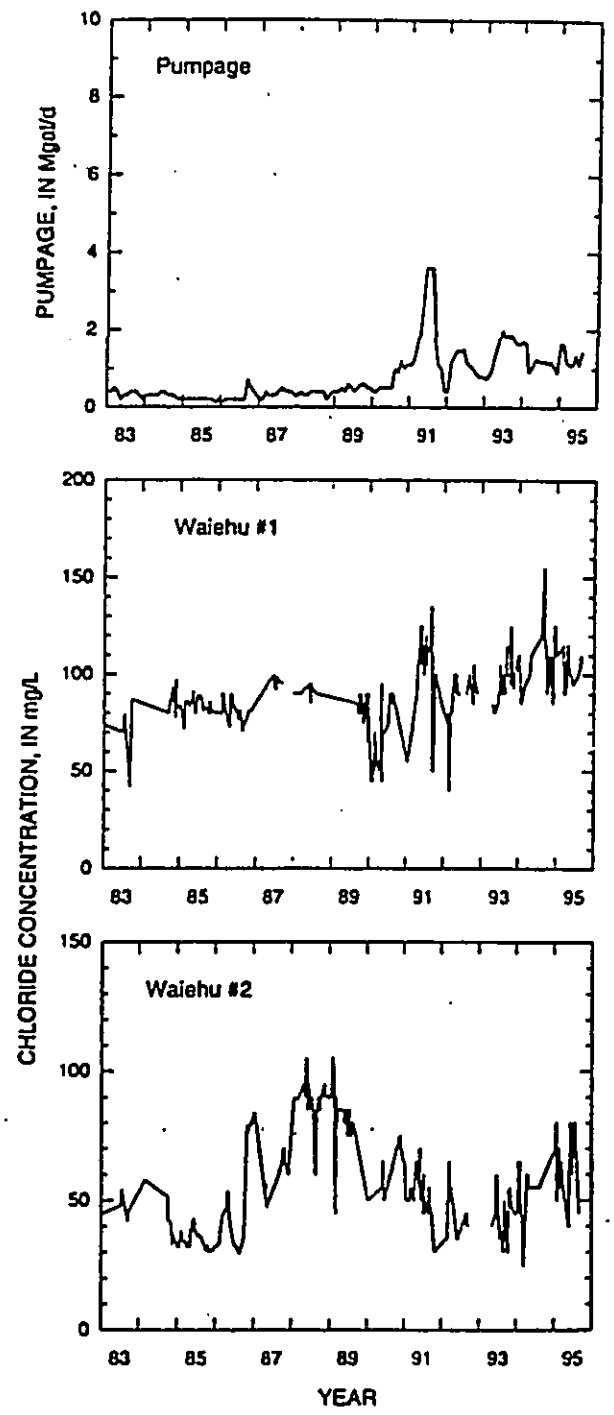
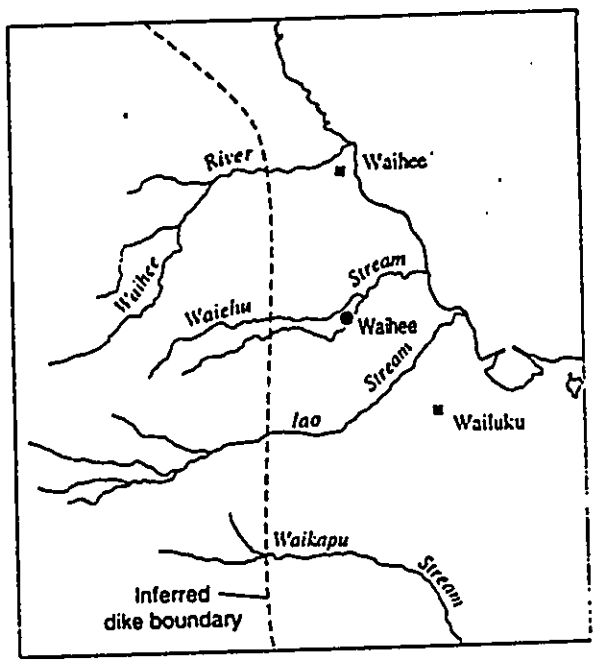
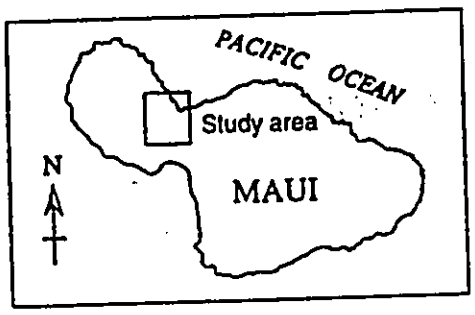


FIGURE 8. Waiehu Well Field Chloride & Pumpage Over Time

WAIHEE PUMPAGE AND CHLORIDES





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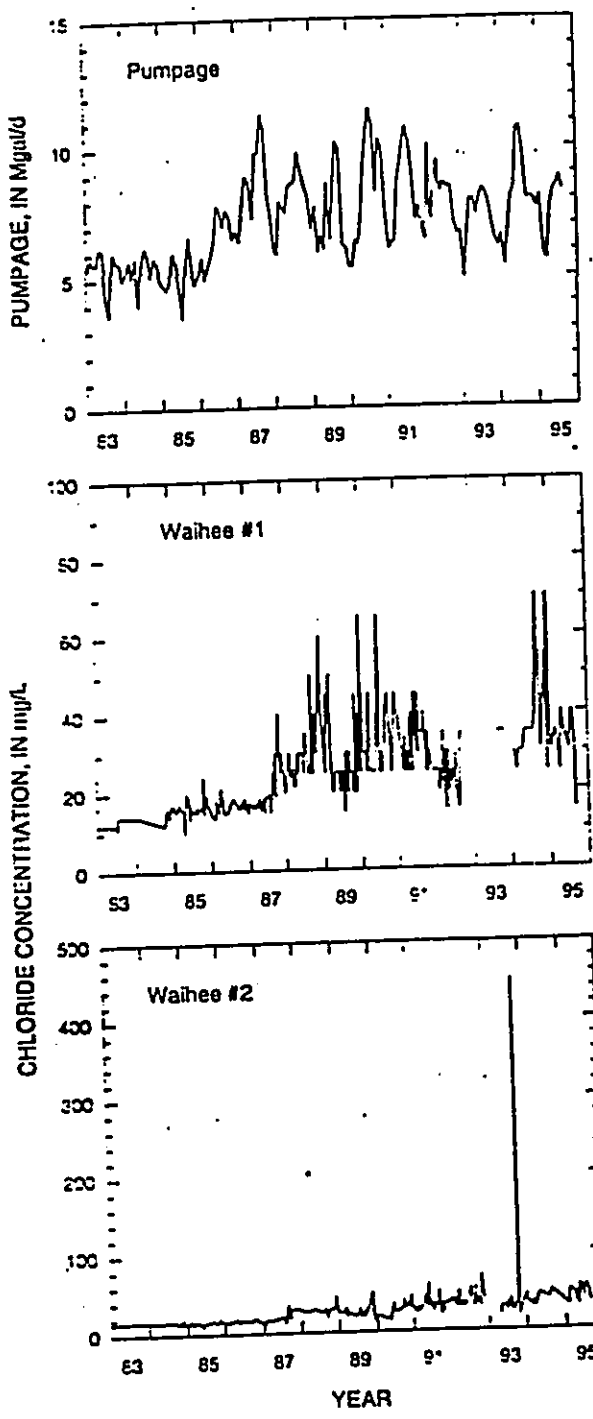
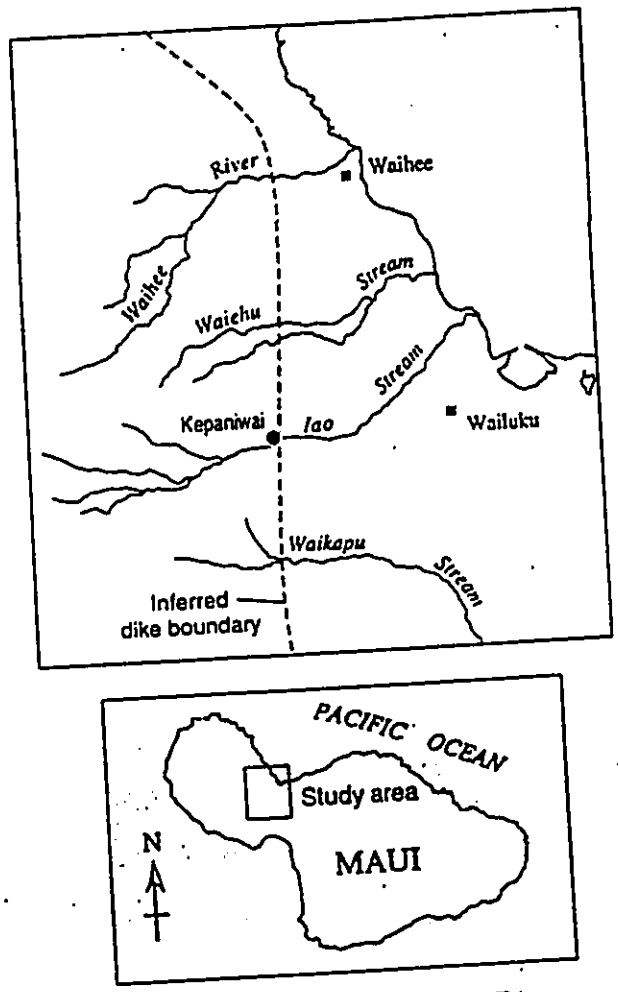


FIGURE 9. Waihee Well Field Chlorides & Pumpage Over Time

KEPANIWAI PUMPAGE AND CHLORIDES



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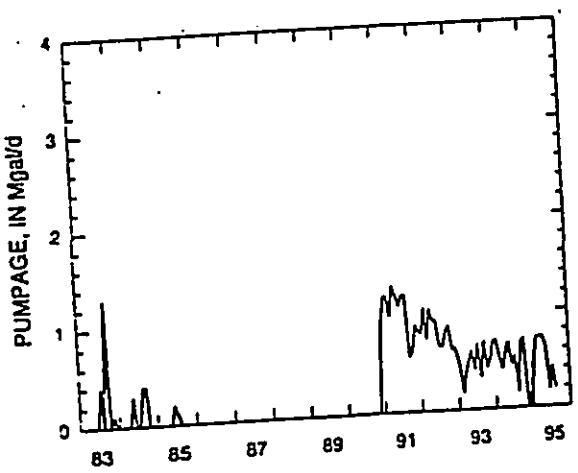


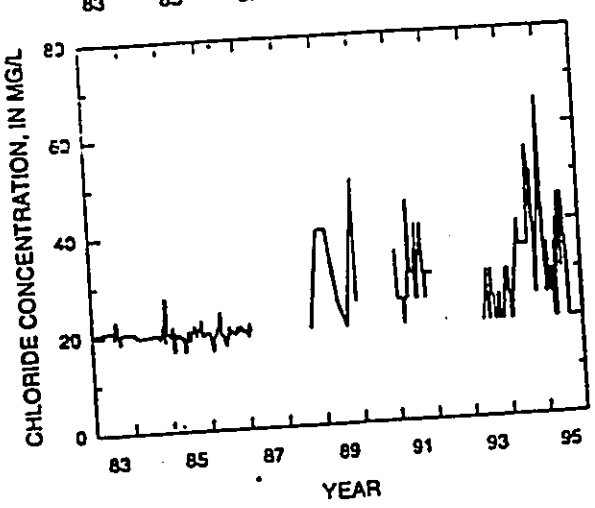


FIGURE 10. Kepaniwai Well Chloride & Pumpage Over Time

SHAFT 33 PUMPAGE AND CHLORIDES

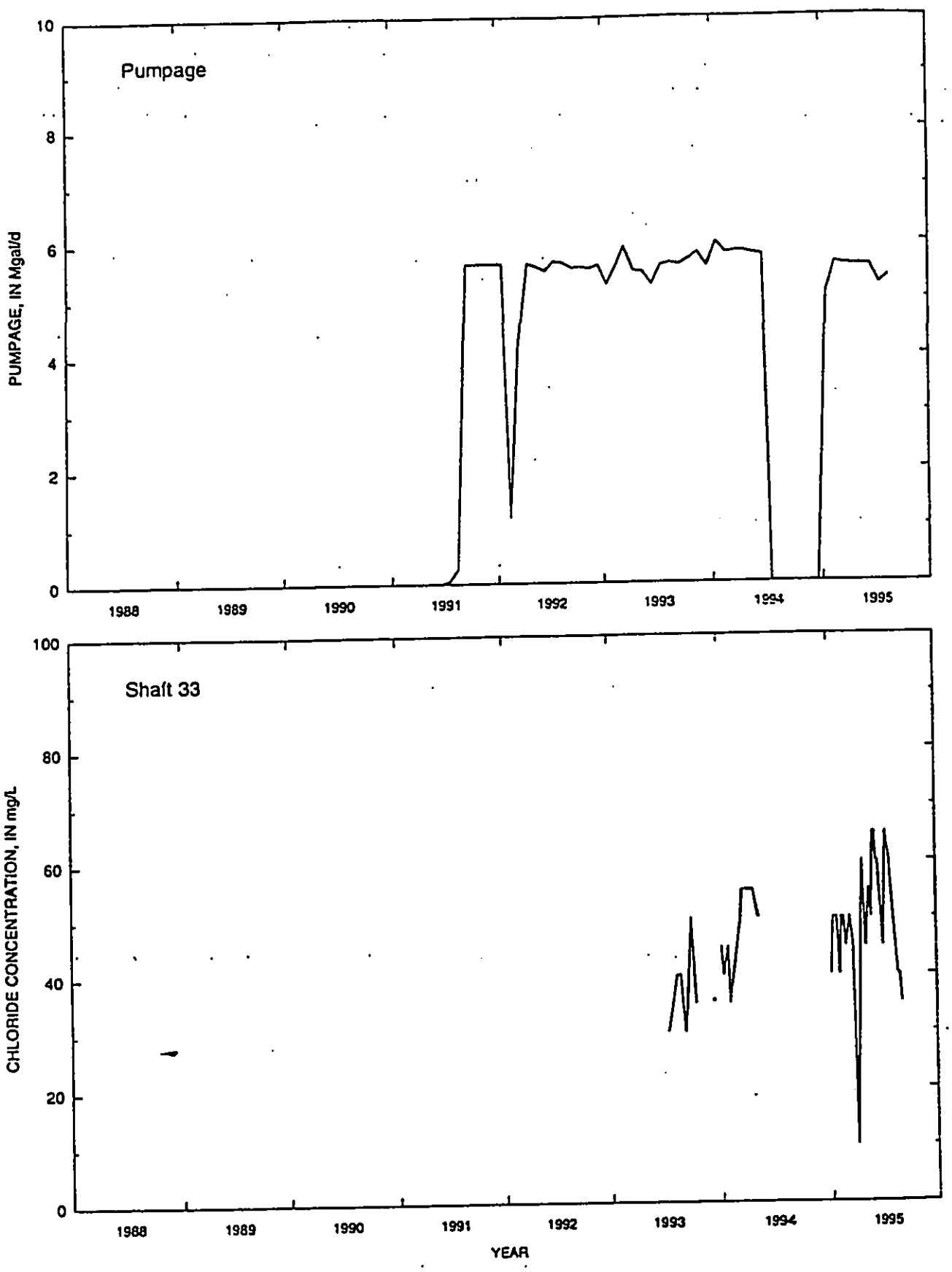


FIGURE 11. Shaft 33 Chloride & Pumpage Over Time

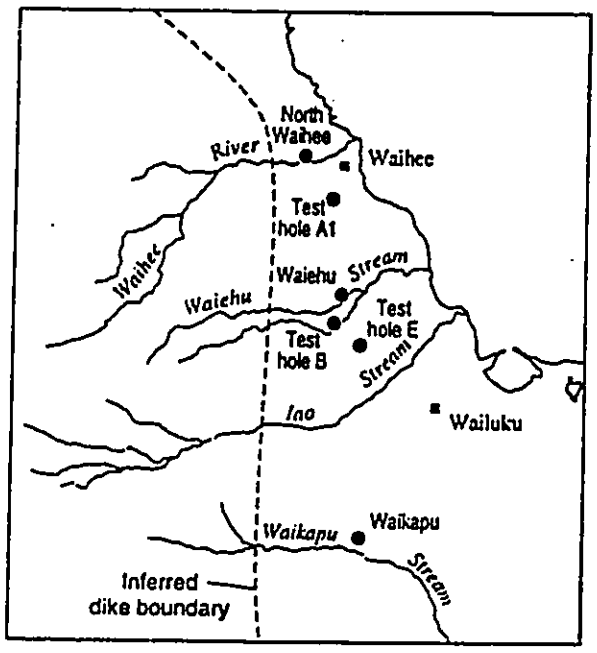
Besides steady-state equilibrium water levels, operating, or dynamic, water levels reflect localized effects of active pumping. A "cone of depression" is created that extends outward from an active well. When pumping ceases, localized pumping stresses dissipate and the operating water level will rise to a quasi-equilibrium water level of the aquifer. This rise will occur within a few hours to a few days depending on hydrogeologic conditions. Normally, operating water levels precede the global reaction shown by equilibrium water levels.

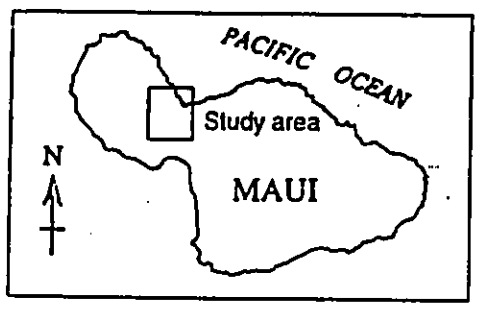
In 1940, the first measured basal water level in the Iao Aquifer was 35± feet msl at T-112 near Wailuku Shaft 33. This pre-development measurement represents the initial static equilibrium water level. Under this initial condition the thickness of the lens was 1400± feet taken to the mid-point of the transition zone (chloride concentration of 9,500 ppm or 50% isochlor).

Development of the Iao Aquifer basal ground water changed the equilibrium conditions within the aquifer as pumpage induced an outflow greater than natural leakage. Pumpage has reduced the volume of the basal lens and lowered the initial static equilibrium head as the aquifer tries to reestablish equilibrium conditions of balancing total inflow (recharge) with total outflow (pumpage plus leakage). Therefore, in order to evaluate the reaction of the aquifer to development, it is important to study the water levels at locations across the extent of the aquifer. Further, it is important to try to distinguish localized effects (due to nearby wells) from regional effects (due to changes in recharge or aquifer-wide development).

There are three test holes (A1, B, and E), two observation wells in Waikapu and one deep monitor well in the Iao Aquifer System. In addition, there is one observation well in the Waihee aquifer adjacent to the Iao Aquifer. Data is continuously collected by the USGS from these wells. Figure 12 shows water levels at five of these wells for the last ten years.

MONITOR WELLS AND WATER LEVELS





LOCATION OF STUDY AREA

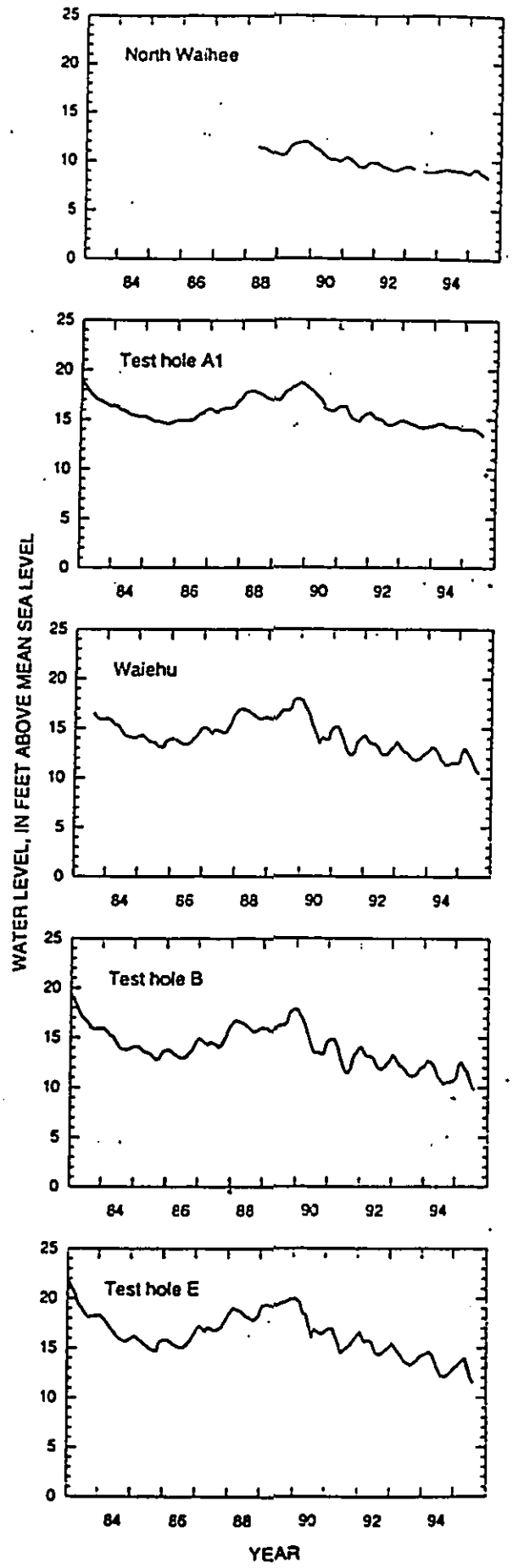


FIGURE 12. Water Levels at Monitor Wells

The water level information presented in Figure 12 is compared to monthly averages of total basal aquifer pumpage in Figures 13 to 17. From 1989 to 1995, total average draft increased from 14 mgd to over 20 mgd. During this period, it can be seen that the maximum measured operating water levels at the Waiehu Monitor Well decreased from 17 feet to 11 feet above mean sea level (Figure 15).

It would be useful to determine how much each of the following three factors affected the change in water levels: pumpage, rainfall, and return irrigation. When the decline in water levels across the aquifer is plotted (Figure 18), we see a cone of depression where highest declines center around the Waiehu and Waihee Wells and the declines gradually decrease toward the coast. This shows that the predominant impact is pumpage. A decline in water levels is an expected reaction of an aquifer to pumpage. However, to determine whether this is an unacceptable decline in water levels, the changes in the transition zone must be evaluated.

The Ghyben-Herzberg principle is a theoretical relationship which is supposed to govern the depth of the lens to its midpoint, the 9,500 ppm (50% isochlor) chloride concentration. Although it assumes a sharp interface between fresh and salt water, in reality there is a zone of mixing that occurs (transition zone) What is more critical to pumping wells is the depth of the wells compared to the location of the transition zone. The Waiehu Deep Monitor Well, since it provides data on the aquifer through the entire transition zone, can provide information necessary to judge whether the transition zone is getting unacceptably close to the bottom of the wells.

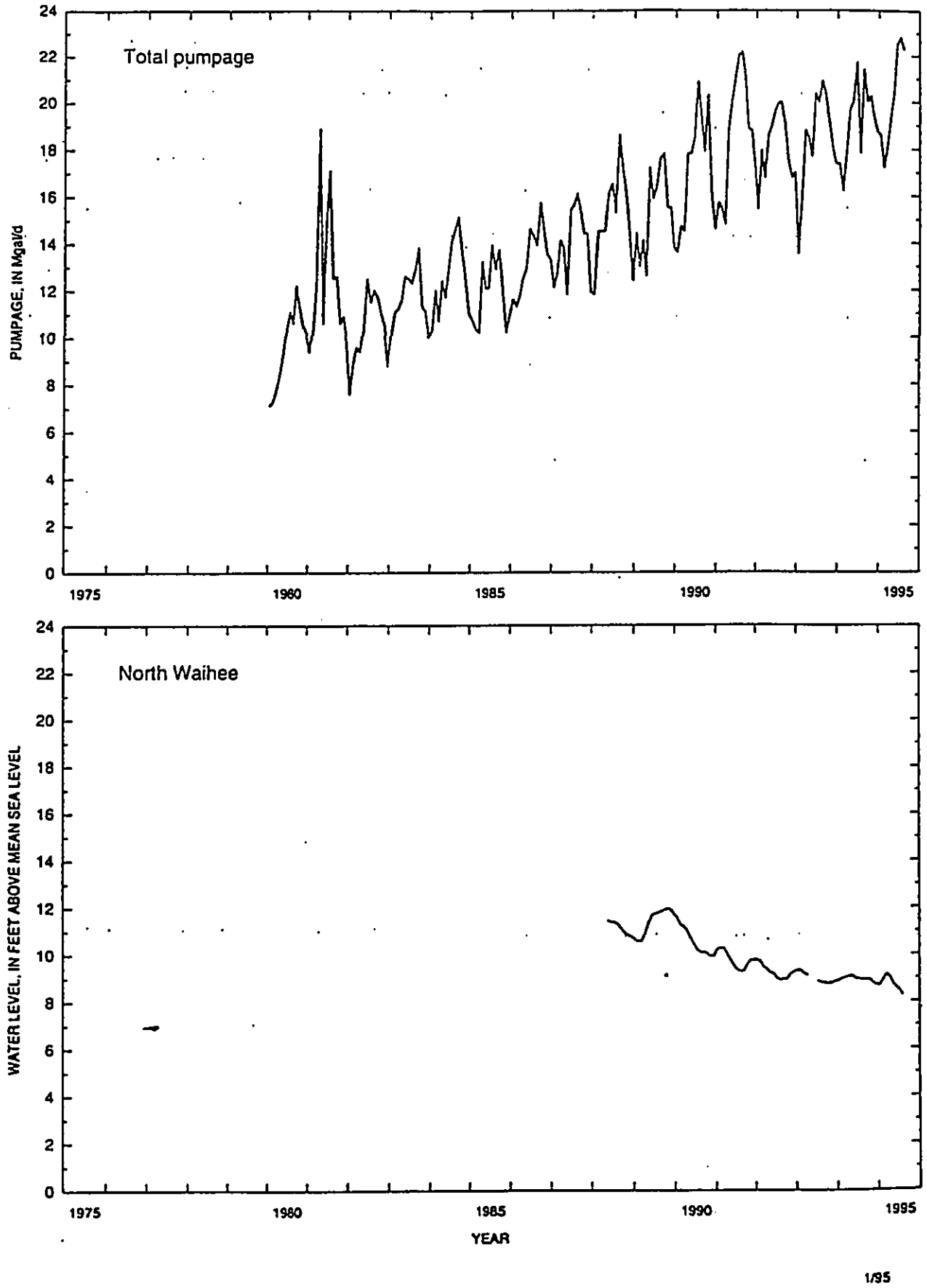


FIGURE 13. N. Waihee Water Level & Aquifer Pumpage Over Time

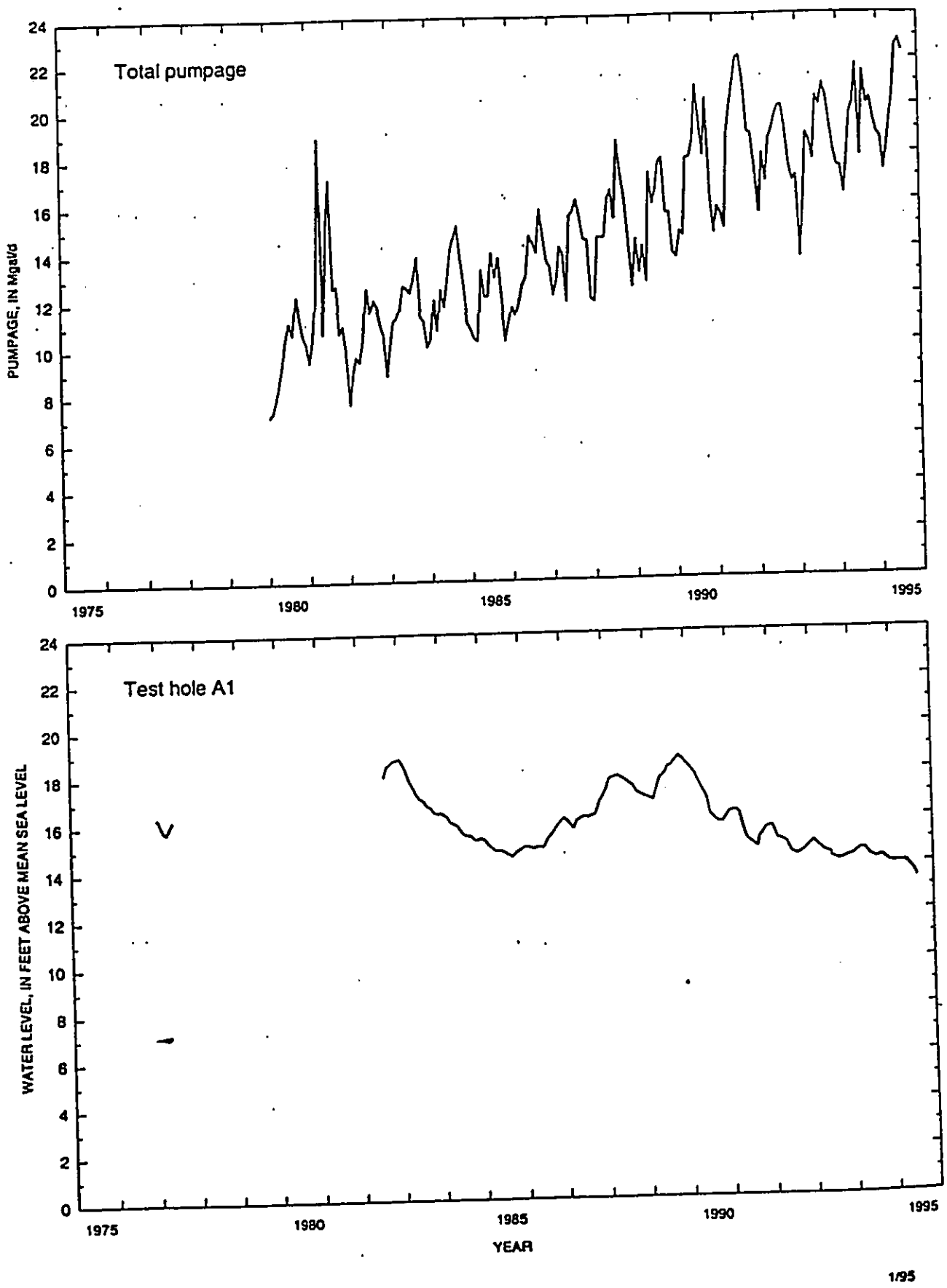


FIGURE 14. TH A1 Water Level & Aquifer Pumpage Over Time

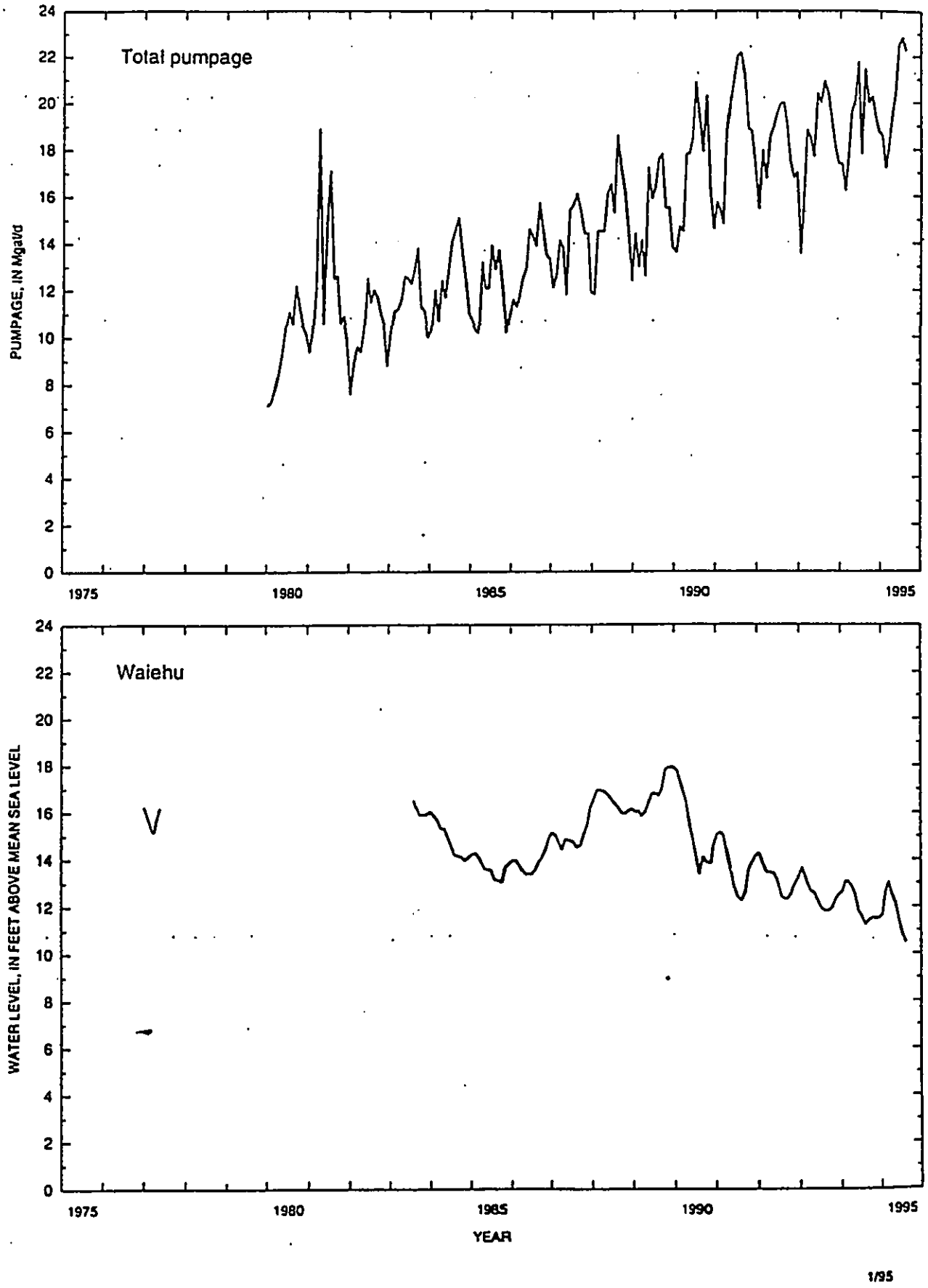


FIGURE 15. Waiehu Water Level & Aquifer Pumpage Over Time

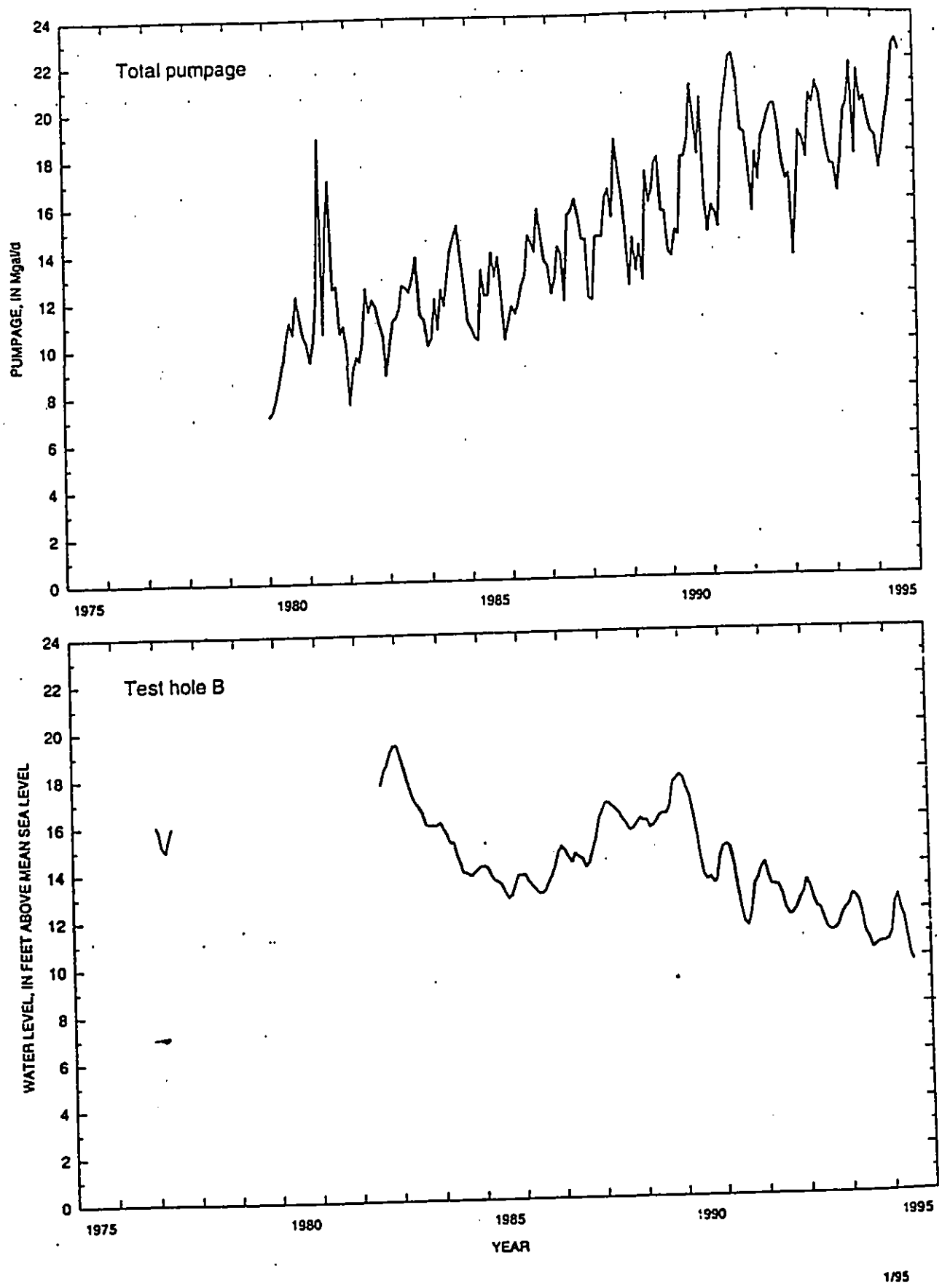


FIGURE 16. TH B Water Level & Aquifer Pumpage Over Time

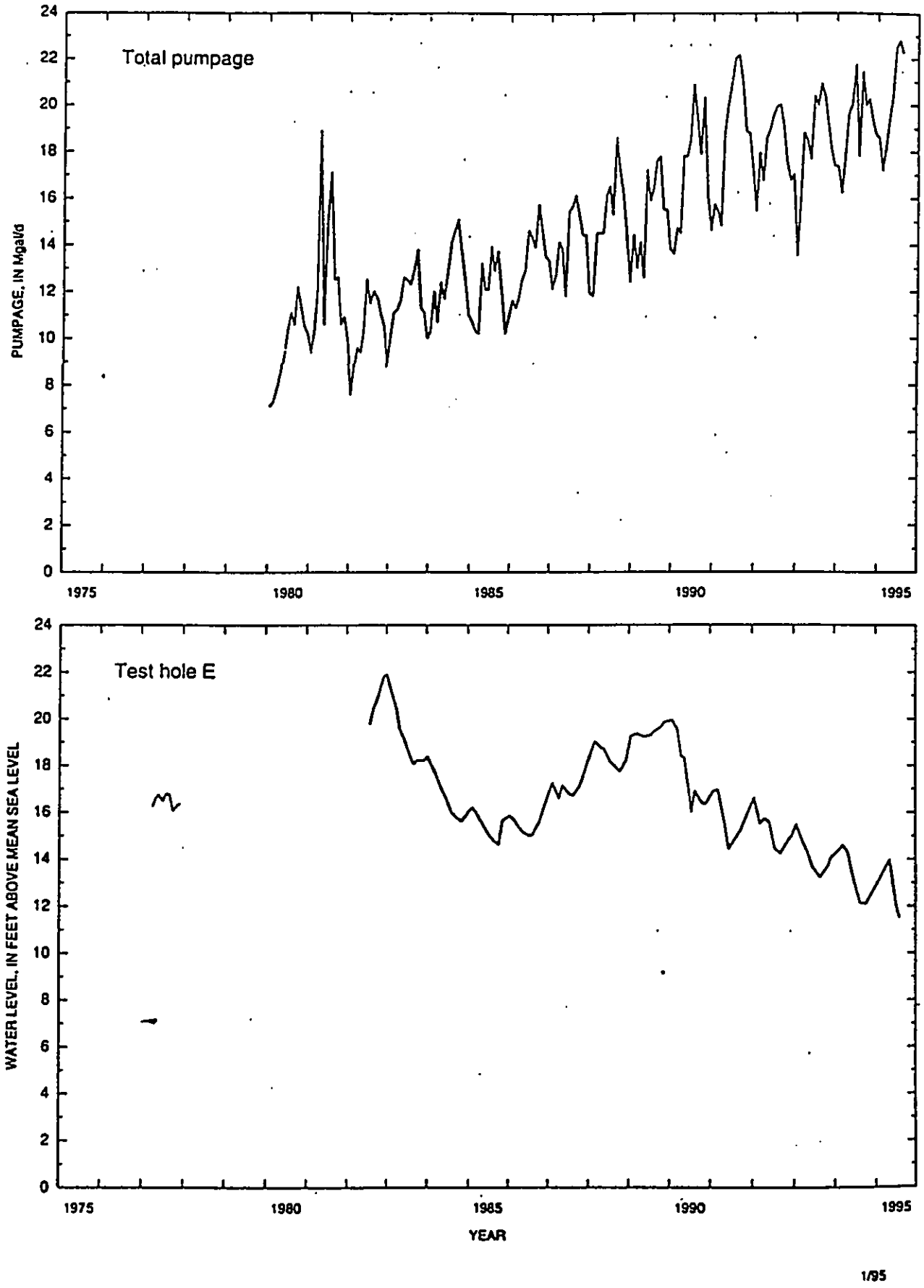
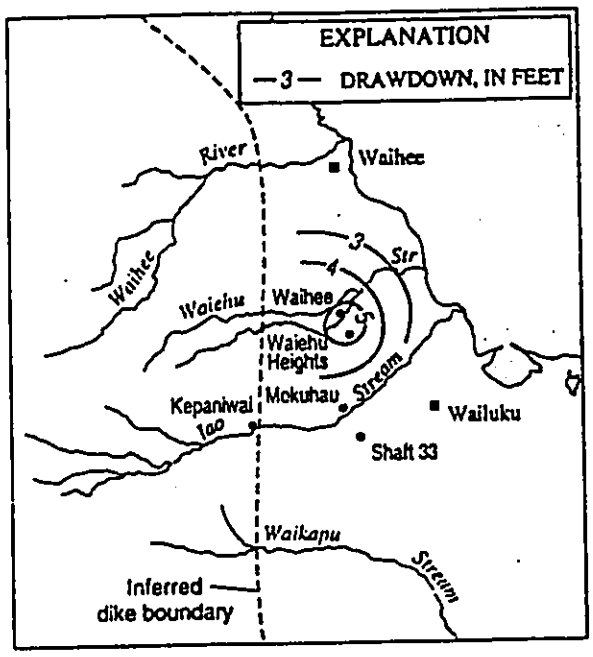
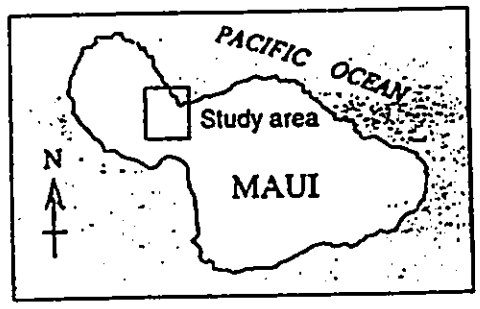


FIGURE 17. TH E Water Level & Aquifer Pumpage Over Time

WELL FIELDS AND PUMPAGE

DRAWDOWN NEAR WAIHEE, WAIEHU WELL FIELDS, 1977-95





LOCATION OF STUDY AREA

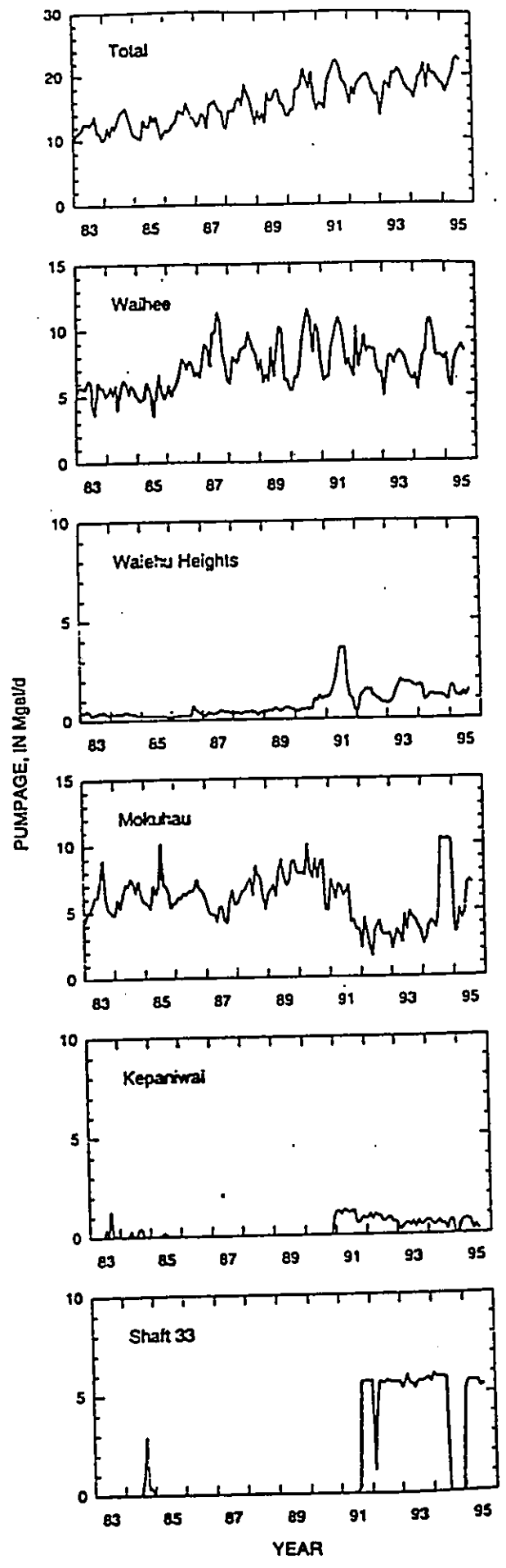


FIGURE 18. Cone of Depression (5' Decrease)

3.6 Response of the Transition Zone

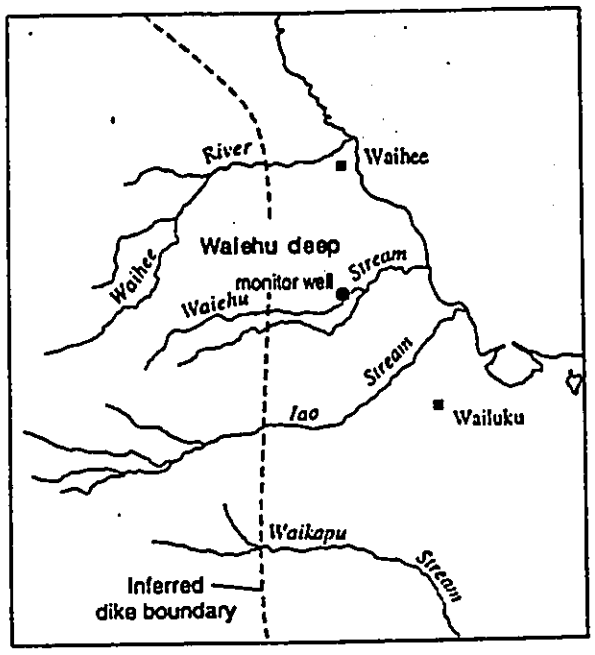
Figure 19 presents lens chloride profile data from Waiehu Deep Monitor Well for six different depths. These graphs show how chloride concentrations have changed at different depths over time in response to pumpage and changes in recharge. The volume of the lens has shrunk due to pumpage and loss of recharge, and as a result the transition zone has risen. The thickness of the lens has decreased and the midpoint of the lens has risen.

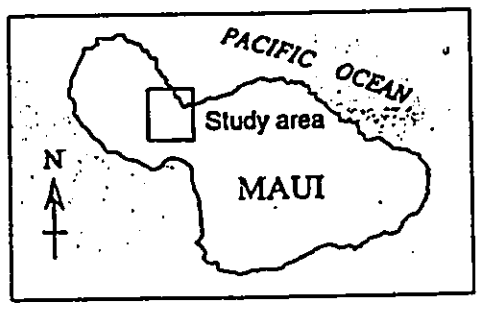
It is interesting to note that with water levels at the Waiehu Deep Monitor Well currently at 11 feet, the Ghyben-Herzberg principle predicts the mid-point of the lens at 440 feet below sea level. However, the depth of the midpoint (9,500 ppm concentration) is about 700 feet. This points out the importance of a deep monitor well to be able to assess the actual thickness of the basal lens. Possible explanations are that the midpoint is gradually moving up to 440 feet or that the transition zone is responding to higher water levels than the measured 11 feet.

Figure 20 presents a profile of the Waiehu Deep Monitor well over time. A comparison can be made of the changes between 1985, 1990, and 1995. As can be seen, the midpoint continues to move upward in the Waiehu Deep Monitor Well. This is in response to declining water levels, which are predominantly due to pumpage. The rate of movement of the midpoint is about 8.3 feet per year based on the ten-year average data from Waiehu Monitor well. There is still a core of fresh water extending from the water table to over 600 feet below sea level in the aquifer. The bottom of the wells are at about 250 feet below sea level. This means that there is still about 350 feet of fresh water available.

From Figure 21, it can be seen that from 1988 to 1991 the aquifer appeared to near equilibrium. However, as pumpage reached new historical highs beginning in 1991, the midpoint responded by resuming its upward movement. We would expect the rate of upward movement to slow, similar to the 1988 to 1991 period, when pumpage is held more constant and a new static equilibrium head is established. The transition zone needs to be monitored and pumpage controlled to ensure long-term stabilization of water level decline and of the upward movement of the transition zone.

WAIEHU DEEP MONITOR WELL





LOCATION OF STUDY AREA

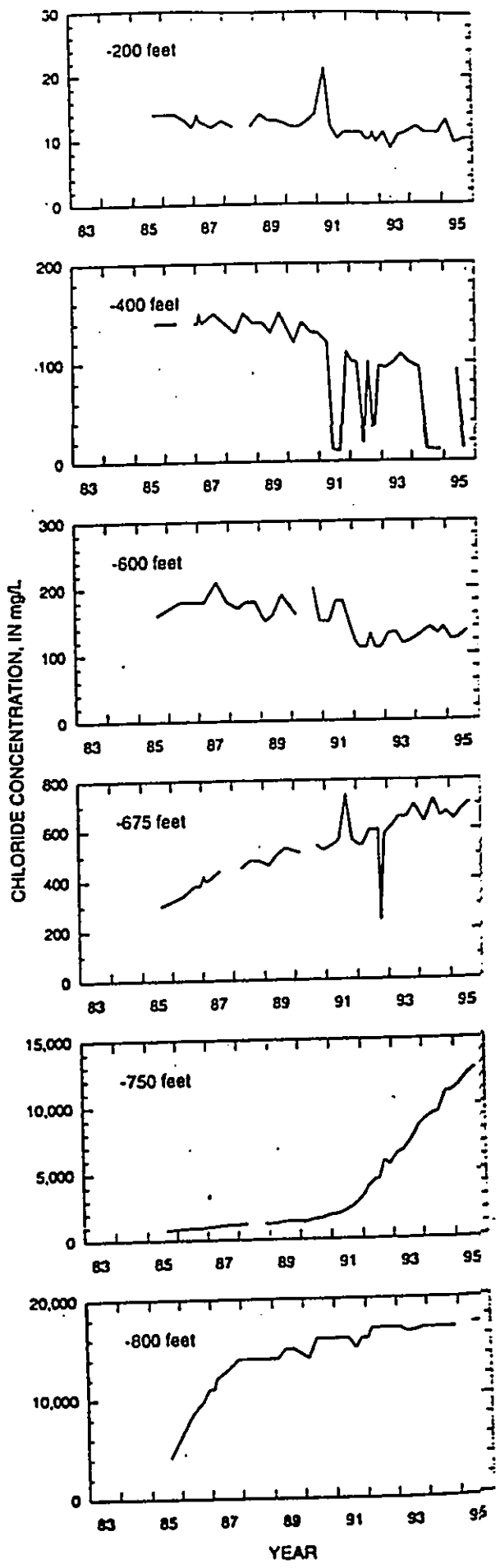


FIGURE 19. Waiehu Deep Monitor Well (five profiles)

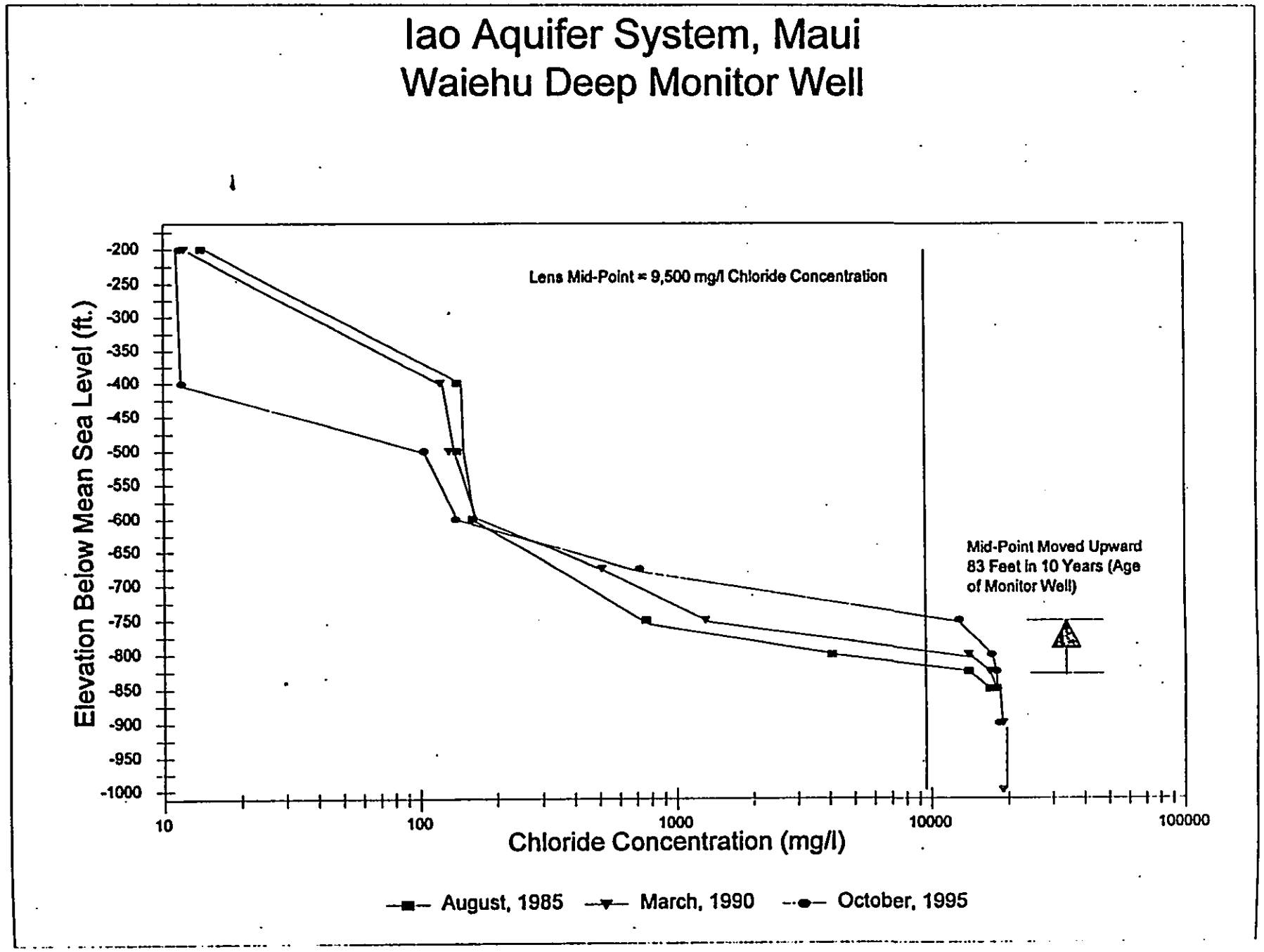


FIGURE 20. Waiehu Deep Monitor Well Changes in Depth of Mid-Point

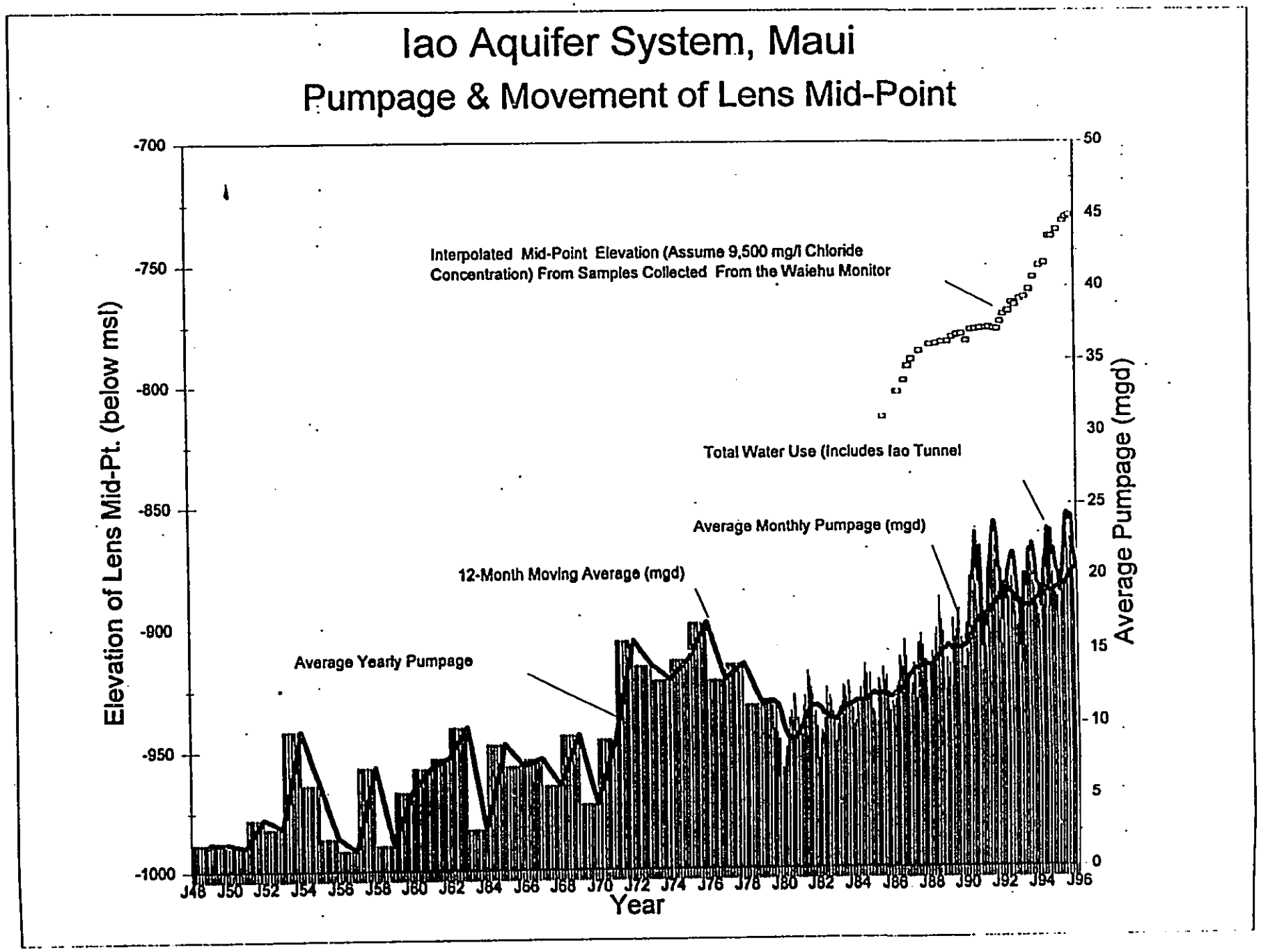


FIGURE 21. Iao Pumpage & Movement of Lens Mid-Point

3.7 Future Development and Projected Water Use

The total water production requirements for the MBWS Central Maui Water System is estimated to be 30.5 mgd by the year 2010 (Maui County WUDP, 1990). The MBWS also projected annual increases in demand for the next few years ranging from 1.5 to 3 mgd. Their "most probable" estimate is an increase of 0.75 to 0.8 mgd per year, or 2 to 2.5 mgd by the end of 1998 (three years). Further, the MBWS has made the following commitments, although no time frame was submitted:

1.	Water Commitments (Water System Development Fee Rule)	0.410 mgd
2.	Approved building permits	0.480 mgd
3.	Pending and approved building permits	0.476 mgd
4.	Central Maui Joint Venture (contractual obligation)	6.75 to 7 mgd

Maui BWS has specified long term plans for additional ground water source developments outside the Iao Aquifer System. The integration of drilled wells in the Waihee Aquifer system (Figure 1) is planned and will provide 2 to 3 mgd. Also, the MBWS plans to connect new wells in the Koolau Aquifer Sector, mainly in the Haiku Aquifer System, State Aquifer Code 60401, which would produce 10.5 mgd. Two wells have been constructed: Hamakuapoko Wells 1 & 2 in the Paia Aquifer System (Figure 1) which should supply 2 mgd of the 10.5 mgd for the proposed Koolau Aquifer Sector Well Field Plan. According to the MBWS, it was expected that sources from either the North Waihee, Paia, or Haiku aquifers would be on-line before the sustainable yield of the Iao Aquifer was exceeded.

Maui BWS expects to implement the following short-term alternatives (Table 3), but also expects to exceed the sustainable yield of Iao Aquifer for brief periods over the next three years. Other alternatives are conservation and leak detection.

Table 3. MBWS Short-Term Development Alternatives

Alternative	Now	Incremental mgd on-line by: End of 1996	End of 1997	End of 1988
Hamakuapoko		1	2	
North Waihee				
Reynolds Foods Wells	0.25			
Kepaniwai	0.5			
Waihee or Iao Ditch			1.5 to 2	
Wailuku Shaft			5	
Waikapu Tank Well				1 to 2
Cumulative Total	0.75	1.75	10.25	11.75

IV. CRITERIA FOR DESIGNATION

HRS §174C-44 states:

§174C-44 Ground water criteria for designation. In designating an area for water use regulation, the commission shall consider the following:

1. Whether an increase in water use or authorized planned use may cause the maximum rate of withdrawal from the ground water source to reach ninety percent of the sustainable yield of the proposed water management area;

2. There is an actual or threatened water quality degradation as determined by the department of health;

3. Whether regulation is necessary to preserve the diminishing ground water supply for future needs, as evidenced by excessively declining ground water levels;

4. Whether rates, times, spatial patterns, or depths of existing withdrawals of ground water are endangering the stability or optimum development of the ground water body

due to upconing or encroachment of salt water;

5. Whether the chloride contents of existing wells are increasing to levels which materially reduce the value of their existing uses;

6. Whether excessive preventable waste is occurring;

7. Serious disputes respecting the use of ground water resources are occurring; or

8. Whether water development projects that have received any federal, state, or county approval may result, in the opinion of the CWRM, in one of the above conditions.

Each criterion is assessed in light of the existing data and analyses as follows:

CRITERION 1.

Whether an increase in water use or authorized planned use may cause the maximum rate of withdrawal from the ground water source to reach ninety percent of the sustainable yield of the proposed water management area.

Discussion

This criterion is met in the Iao Aquifer System. Current pumpage is 20.5 mgd (twelve month moving average) and the sustainable yield is 20 mgd. Authorized planned use further exacerbates the comparison of demand to sustainable yield.

Conclusion: **CRITERION 1 MET**

CRITERION 2.

There is an actual or threatened water quality degradation as determined by the Department of Health.

Discussion

No evidence has been presented by the Department of Health during the preparation of these findings of fact that indicate this criterion has been met at this time.

DOH has tested Shaft 33 for 48 volatile organic chemicals, VOCs, with negative results and no evidence of water quality degradation due to contamination. No other water quality degradation has been determined by DOH for the Iao Aquifer System.

Conclusion: **CRITERION 2 NOT MET**

CRITERION 3.

Whether regulation is necessary to preserve the diminishing ground water supply for future needs, as evidenced by excessively declining ground water levels.

Discussion

Declining ground water levels have been observed throughout the aquifer. The maximum drawdown is near the Waihee and Waiehu wells, which started pumping in 1977. The measured drawdown is 5 feet near the wells. Using the Ghyben-Herzberg principle, the decrease of 5 feet results in a 200 foot rise in the midpoint of the lens. With about 350 feet between the bottom of the wells and the top of the transition zone, there appears not to be excessive declines in the ground water levels.

However, it is unclear if the drawdown will equilibrate at 5 feet although there is evidence from past aquifer behavior that it is near equilibrium. It most certainly will not equilibrate if pumpage is not held constant. Therefore, this criterion may not be met now but may easily be triggered if pumpage is increased or if there is further evidence that ground water levels continue to decline unacceptably and the transition zone continues to rise. The system must continue to be monitored.

Another problem is the lack of data about the movement of the interface near the Mokuhau wells. This is the most heavily pumped area of the aquifer, and there is no information to determine whether ground water level decline is excessive near these wells

Conclusion: **CRITERION 3 NOT MET**

CRITERION 4.

Whether rates, times, spatial patterns, or depths of existing withdrawals of ground water are endangering the stability or optimum development of the ground water body due to upconing or encroachment of salt water.

Discussion

There is evidence that chloride levels have increased in all areas of the Iao Aquifer. Further, under present withdrawal rates, depths and spatial patterns, there is an upconing problem as evidenced by significant chloride increases in Mokuhau Well No. 2. We know that the midpoint of the lens is rising based on measurements at the Waiehu Deep Monitor Well. Equilibrium has not been reestablished in this aquifer. Pumpage, water levels, and chlorides at each well must be regulated to ensure stability of the basal lens. We know that spreading out the pumpage (from Mokuhau to Wailuku Shaft) improved the chloride levels at Mokuhau. Also, temporarily increased pumpage at the Waiehu Heights wells (due to a pipeline break) greatly increased chloride levels there. Therefore, the rates, times, spatial patterns, or depths of the wells are endangering optimum development of the aquifer due to upconing problems.

Conclusion: **CRITERION 4 MET**

CRITERION 5.

Whether the chloride contents of existing wells are increasing to levels which materially reduce the value of their existing uses.

Discussion

In general, with the exception of one well, there is no evidence that suggests this criterion is being met at this time, although this may change in the near future.

Although there has been significant increases in chloride concentrations from initial concentrations in the Mokuhau and Waiehu Well regions, such increases have not been to levels that materially reduce the value of existing uses. Mokuhau # 2 is the only well that is exceeding the EPA 250 ppm guideline, but this source can be mixed with the other Mokuhau wells to produce water with acceptable chloride content. There has been no other

evidence of existing uses or products from such use being devalued.

Management efforts by MBWS have occurred to ease the chloride concerns before they reach levels that met this criterion. Shaft 33 has been reactivated to ease pumpage in the Mokuhau area and should help to stabilize chloride concentrations. However, should pumpage increases continue, chlorides may increase, triggering this criterion.

Conclusion: **CRITERION 5 NOT MET**

CRITERION 6. **Whether excessive preventable waste is occurring.**

Discussion

At this time, there is no evidence that this criterion has been met.

Although there have been several instances of major leaks within the Central Maui Water System, MBWS has shown it can respond to leaks within their system to prevent further loss of water through system leaks. Furthermore, MBWS has increased their capability to conduct a leak detection program.

Conclusion: **CRITERION 6 NOT MET**

CRITERION 7. **Serious disputes respecting the use of ground water resources are occurring.**

Discussion

Since there is a single purveyor of ground water from the Iao Aquifer System, actual serious disputes are not occurring. However, testimony from West Maui-Moloka'i Taro Farmers Association has raised the issue of future competing uses if increased pumpage from the dike aquifer in the Iao System affects streamflows, existing taro farmers, and possibly, unexercised appurtenant rights.

Conclusion: CRITERION 7 NOT MET

CRITERION 8. Whether water development projects that have received any federal, state, or county approval may result, in the opinion of the CWRM, in one of the above conditions.

Discussion

There is inadequate evidence at this time that the remaining unmet criteria (criteria 2, 3, 5, 6, and 7) will be triggered because of approved water development projects. In fact, additional water sources with no net increase in pumpage would actually reduce the chance of triggering other criteria as the spreading of pumpage is beneficial and a step towards optimization. However, unless the system is managed and pumpage rates are retained at current levels, this criterion may be met. The system must be strongly managed and monitored to prevent further threat to the resource.

Conclusion: CRITERION 8 NOT MET

V. CONCLUSION

From the analysis of public testimony, current, and future water resource conditions concerning the Iao Aquifer System, this report makes the following conclusions:

1. Evidence does not exist justify changing the current sustainable yield estimate of the Iao Aquifer System, which is 20 mgd.

2. The transition zone has been rising at a steady rate and new equilibrium levels have not yet been achieved.

3. Increased chloride concentrations in some of the wells are the result of localized upconing, and chloride concentrations in one of the wells has exceeded the Department of Health's guideline concentrations;

4. Water use from the Iao Aquifer System is largely municipal for the MBWS;

5. Current 1995 ground water withdrawals from the Iao Aquifer System average 20.5 mgd (12 month moving average) or more than 100% of sustainable yield; and

6. The information available indicates that Iao Aquifer System meets the following criterion under the State Water Code concerning designation of ground water management areas:

   - **[§174C-44(1)]** Whether an increase in water use or authorized planned use may cause the maximum rate of withdrawal from the groundwater source to reach ninety percent of the sustainable yield of the proposed water management area; and

   - **[§174C-44(4)]** Whether rates, times, spatial patterns, or depths of existing withdrawals of ground water are endangering the stability or optimum development of the ground water body due to upconing or encroachment of salt water.

MATERIAL SAFETY DATA SHEET
OSHA-20 DATA

SECTION I

MANUFACTURER MEMTEC AMERICA CORP. TELEPHONE 410 - 252 - 0800
ADDRESS 2033 GREENSPRING DRIVE TIMONIUM, MARYLAND 21093
CHEMICAL NAME ALKALINE CIP & HOT TANK NAME MEMCLEAN EXA2
CHEMICAL FAMILY HIGHLY ALKALINE DETERGENT FORMULA N/A

SECTION II - HAZARDOUS INGEDIENTS

HAZARDOUS INGREDIENTS	PERCENT	TLV UNITS
* SODIUM HYDROXIDE CAS #1310-73-2	< 40	2mg /cu meter

* Corrosive hazard, TLV is from dust due to product dry out or misting of the liquid cleaner. Product contains no volatile solvents.

SECTION III - PHYSICAL DATA

BOILING POINT > 212 F
VAPOR PRESSUSE < 20 mm @ 75 F
VAPOR DENSITY N/A
SOLUBILITY IN WATER 100 %
APEARANCE / ODOR LIQUID , MILD DETERGENT ODOR
SPECIFIC GRAVITY 1.420 g / cc
PERCENT VOLATILE > 50
EVAPORATION (WATER =1) 1
OTHER

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

FLASH POINT / METHOD None TOC FLAMMABLE LIMITS N/A
EXTINGUISHING METHOD NONE REQUIRED
SPECIAL FIRE FIGHTING PROCEDURES NONE REQUIRED

UNUSUAL FIRE AND EXPLOSION HAZARDS NONE

Appendix 10 MSDS sheets for clean in place solution

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE SEE SECTION II

EFFECTS OF OVEREXPOSURE EYES - severe burns. SKIN - burns. INGESTION - severe internal burns

EMERGENCY FIRST AID PROCEDURES Wash from eyes immediately with lots of water for 15 minutes and seek medical attention. Wash from skin immediately with lots of water. If spilled on clothing remove immediately and wash before reuse. If skin burning occurs see a physician. Ingestion - immediately give lots of water, orange juice, or diluted vinegar and see a physician. Note to physicians - Treat as Sodium Hydroxide ingestion

SECTION VI - REACTIVITY DATA

STABILITY UNSTABLE- _____ CONDITIONS TO AVOID _____

STABLE- X

INCOMPATIBLE MATERIALS Acids of all types

HAZARDOUS DECOMPOSITION PRODUCTS None

HAZARDOUS POLYMERIZATION MAY OCCUR- _____ CONDITIONS TO AVOID _____

WILL NOT OCCUR- X

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IF SPILLED OR RELEASED Wear rubber boots and gloves, neutralize with dilute acids and flush area with plenty of water.

WASTE DISPOSAL METHOD Neutralize and sewer, landfill or other methods complying with local, state, and federal regulations

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION None required when used as directed.

VENTILATION N/A Required only if product is misted or allowed to dry out and form dust particulates due to poor cleanup of work area.

GLOVES Rubber or Plastic

EYE PROTECTION Yes - Glasses or Goggles

Wear rubber boots and full alkali protective clothing for major exposure.

OTHER PROTECTIVE EQUIPMENT Water source to wash out eyes and off skin.

SECTION IX - SPECIAL PRECAUTIONS

HANDLING AND STORAGE Store between 40 and 100 F. Keep containers closed.

OTHER PRECAUTIONS Avoid contact with eyes, skin, clothes, and shoes.

Occidental Chemical Corporation
Industrial & Specialty Chemicals Division

MSDS 433 A

MATERIAL SAFETY DATA SHEET

Product Information

Product Name
SODIUM HYDROXIDE, 50% LIQUID

CAS Registry Number
1310-73-2

Common Name or Synonym
Caustic soda
Lye

Chemical Family
Alkali

Chemical Name
Sodium hydroxide

Chemical Formula
NaOH

Health Data

DANGER! SODIUM HYDROXIDE CAN CAUSE SEVERE BURNS OR BLINDNESS.
PROMPT TREATMENT IS IMPORTANT TO MINIMIZE EFFECTS OF OVEREXPOSURE.

First Aid Measures

Eye Contact: IMMEDIATELY, flush eyes with a directed stream of water for at least 15 minutes. Forcibly hold eyelids apart to ensure complete irrigation of all eye and lid tissue. GET IMMEDIATE MEDICAL ATTENTION. Contact lenses should not be worn when working with this chemical.

Skin Contact: IMMEDIATELY flush contaminated skin with water and wash with soap and water. If large areas of the body are contaminated or if clothing is penetrated to the skin, immediately use safety shower preferably removing clothing while under the shower. Flush exposed areas with large amounts of water for at least 15 minutes. GET PROMPT MEDICAL ATTENTION. Wash clothing before reuse.

Inhalation: If a person breathes in a large amount of mist, move the exposed person to fresh air at once. If breathing has stopped, perform artifical respiration. Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.

Ingestion: If person is conscious, immediately administer large quantities of water. Do not induce vomiting. Avoid having an unconscious person vomit. GET IMMEDIATE MEDICAL ATTENTION.

Effects of Overexposure: Sodium hydroxide as a solid or in dusts, mists or solutions may cause irritation of the eyes and, with greater exposure, severe burns with possible blindness. Contact of the skin may cause skin irritation and, with greater exposure, severe burns with scarring. Ingestion of sodium hydroxide may cause intense pain, nausea, vomiting and collapse. Swallowing sodium hydroxide may cause severe burns of the mouth, throat, esophagus and stomach. Death may result.

Inhalation of dust or mist can cause injury to the entire respiratory track. Repeated local contact of dusts, mists or solutions may cause burns and permanent scarring. Cases of squamous cell carcinoma of the esophagus have occurred years after ingestion.

Sodium hydroxide solutions cause burns on contact with all body tissues. Prolonged contact with even dilute sodium hydroxide solutions may cause tissue destruction. A latent period may exist between exposure to skin and sense of irritation. In human studies skin irritation has been observed at concentrations as low as 0.12% for one hour.

Toxicity: Acute Oral Toxicity
LD_{50} (rabbit, 10% solution):
500 mg/kg

Corrosive to animal tissues.

Emergency Telephone Number Available 24 Hrs (Day, [illegible])

Sodium Hydroxide, 50% Liquid

MSDS 433 A

MATERIAL SAFETY DATA SHEET

Ingredients

	Percent	Threshold Limit Value*
Sodium Hydroxide	50	2 mg/m³ Ceiling Limit (dust and mists)
Water	50	Not applicable

* ACGIH, 1984-85 Edition.

Hazardous Reactivity

Incompatibility: Water added to solutions of sodium hydroxide may cause localized overheating and splattering. Contact with acids, flammable liquids and organic halogen compounds, especially trichloroethylene, may cause fires and/or explosions. Contact with metals such as aluminum, tin and zinc causes the formation of flammable hydrogen gas. Contact with nitromethane and similar nitro compounds causes the formation of shock sensitive salts.

Hazardous Decomposition Products: None

Conditions To Avoid: Overheating in storage accelerates corrosion. Store separately from materials which can react with sodium hydroxide; especially acids, chlorocarbons, nitroparaffins and phosphorus. When diluting, use agitation and add concentrated sodium hydroxide to water at a controlled rate to control heat of dilution and to avoid splattering. Do not add water to sodium hydroxide.

Handling and Storage

Precautions: Prevent possible eye and skin contact by wearing protective clothing and equipment.

Storage tanks must be vented and diked.

Store drums of sodium hydroxide separate from acids, metals and explosives. Provide adequate drainage.

When diluting, use agitation and add concentrated caustic to water at a controlled rate to control heat of dilution and to avoid splattering. Do not add water to sodium hydroxide.

Environmental Protection

Procedure In Case Of Spill Or Release: Only trained personnel wearing protective equipment should handle spill cleanup.

Avoid personal contact. Contain spill if possible; if not, dilute and flush with water. Following flushing, neutralize with dilute acid, preferable acetic. In some locations a liberal covering of sodium bicarbonate may be used. If spill enters sewer system or stream notify sewer authorities and/or pollution control authorities. Report all spills of 1000 lbs. or more to the National Response Center, 1-800-424-8802.

Waste Disposal Method: Dispose in approved chemical disposal area or in a manner which complies with all local, state and federal regulations. Do not flush to sewer.

Sodium Hydroxide, 50% Liquid

MSDS 433 A

MATERIAL SAFETY DATA SHEET

Additional Information

Sodium hydroxide is listed in the TSCA Chemical Substance Inventory under CAS No. 1310-73-2.

See OCC Product Data Sheets 101, 732, 735 and Product Information Manual No. 1002 for product specifications, packaging and other information.

Hazard ratings according to the Hazardous Materials Identification System (HMIS) developed by the National Paint and Coatings Association are:

Health, 3	Flammability, 0;
Reactivity, 2;	Personal Protection, X.

Sodium hydroxide is one of the compounds considered to be an occupational health hazard based on Criteria Documents issued by the National Institute for Occupational Safety and Health (NIOSH).

Sodium hydroxide is one of the chemical substances for which information is contained in a computerized database developed and maintained by the International Register of Potentially Toxic Chemicals (IRPTC), a component of the United Nations Environmental Programme.

For additional non-emergency information, contact Technical Service, Occidental Chemical Corporation, Industrial & Specialty Chemicals Division, 716/286-3000.

☐ New ☒ Revised Date June, 1985

Occidental Chemical Corporation
Industrial & Specialty Chemicals Division
Occidental Chemical Center, 360 Rainbow Boulevard South
Box 728, Niagara Falls, New York 14302 716/286-3000

SCAN JUN 30 1996

Occidental Chemical Corporation

Industrial & Specialty Chemicals Group

Data Sheet

DATA SHEET NO. 735H
February, 1985

CAUSTIC SODA LIQUID
Standard Grade (Niagara)
CAS No.: 1310-73-2

Description:

Occidental Diaphragm Grade Caustic Soda is a clear to slightly turbid solution containing 50% NaOH by weight. It is produced at Niagara Falls, New York.

Formula: NaOH **Molecular Weight:** 40

Specifications:

Sodium Hydroxide Equiv.	NaOH*	49.0% Min. - 51.0% Max.
Sodium Oxide Equiv.	Na_2O	38.0% Min. - 39.5% Max.
Sodium Carbonate	Na_2CO_3	0.20% Max.
Sodium Chloride	NaCl	1.3% Max.
Sodium Sulfate	Na_2SO_4	0.020% Max.
Sodium Chlorate	$NaClO_3$	0.30% Max.
Iron	Fe	0.0008% Max.

*Equivalent to total alkalinity.
Weight percent on liquid basis

Physical Properties:

Melting Point, 50%	55°F (13°C)
Weight per gallon, 50%	12.8 lbs.

Uses:

Caustic Soda is used in the manufacture of paper pulp, soap, chemical intermediates, resorcinol, indigo, sodium salts, dyes and pigments, ceramics, pharmaceuticals, cosmetics and in the preparation of boiler water softening and cleaning compounds. It is also used for regenerating water treatment units, reclaiming tin, paper and rubber, bleaching of textiles and paper, mercerizing cotton and dyeing and printing textiles, in metal industries, petroleum refineries and many other industries.

J. R. Simplot Company. CHEMICAL LABEL

SODIUM HYDROXIDE
(UN 1823 - Dry or UN 1824 - Liquid)

IN CASE OF ACCIDENT OR SPILL, CALL CHEMTREC 800-424-9300

HAZARDS

Strong, corrosive action upon all body tissue with ultimate scarring. Severe eye hazards. Mists, vapors and dusts will cause small burns. Ingestion causes serious damage to mucous membranes or other tissue with which contact is made. Inhalation of dust or mist can cause lung damage.

PERSONAL PROTECTION

Wear chemical goggles, face shield, protective gloves, clothing and footwear when handling this material. Wear respiratory protection when exposed to mist or dust. Emergency shower and eye wash should be available.

FIRST AID

Flush skin or eyes with plenty of water for at least 15 minutes. Eyelids should be held open to allow water to irrigate eyes. If swallowed, drink large quantities of water. Get medical attention.

FIRE AND REACTIVITY

Non-flammable. Reacts violently with water or steam to produce heat and will attack living tissue. Contact with some metals can generate flammable hydrogen gas.

SPILL REPORTING

Federal regulations require carriers to report any spill or discharge of any quantity of sodium hydroxide to the proper authorities on DOT Form F-5800.1. Under certain circumstances an immediate report of a spill or discharge is also required (See 49 CFR Section 171.15 and .16). Additionally, if 1000 pounds or more of sodium hydroxide is spilled or discharged (accidentally or intentionally) into the environment, the spill must be reported immediately to the U.S. Coast Guard National Response Center at either of the following toll-free numbers: 800-424-8802 or 202-426-2675 (See 49 CFR Section 171.17), (40 CFR Section 302.6).

Appendix 11 Alternative screening worksheets

BOARD OF WATER SUPPLY
COUNTY OF MAUI

DRAFT

SOURCE ALTERNATIVES

ALTERNATIVES:	ADDITIONAL WATER AVAILABLE	DEVELOPMENT COST	DEVELOPMENT TIME	OPERATING COST	IMPACT ON COMMUNITY	WATER QUALITY	DEPENDABILITY	POTENTIAL FOR FUTURE USE	ACCESSIBILITY	IMPACT ON EXISITING IAO SOURCES	FUNDING COMMITMENT	REGULATORY ACTION
ALTERNATIVE SOURCES - SURFACE WATER												
1 Iao Ditch at Iao Tank	1.5 - 2.0 MGD	$0.5 M	6/1/96	$ 30/1000 gal + testing	Reduction of Ag. Water	Good needs testing	Depends on Iao Stream	Short term emergency use	2,500' to Iao tank	Reduced demand on Iao	None	Comply w/ SWTR
2 Waihee Ditch at Iao Tank	1.5 - 2.0 MGD	$0.5 M	6/1/96	$ 60/1000 gal + testing	Reduction of Ag. Water	Good needs testing	Depends on Waihee Str.	Short term emergency use	150' to Iao tank	Reduced demand on Iao	None	Comply w/ SWTR
3 Waihee Ditch at Waihee Tank	1.5 - 2.0 MGD	$0.53 M	6/1/96	$ 30/1000 gal + testing	Reduction of Ag. Water	Good needs testing	Depends on Waihee Str.	Short term emergency use	1200' to CMUV tank	Reduced demand on Iao	None	Comply w/ SWTR
ALTERNATIVE SOURCES - EXISTING WELLS WITH PUMP												
4 Reynolds Pond Well #1	0.25 MGD	$0.150 M	Pau	$0.60/1,000 gal	Public perception on WQ	Meets EPA/DOH	35 yr old pump - Table	Short term emergency use	Need to dirt road	Reduced demand on Iao	Pau	Continued weekly testing
5 Reynolds Pond Well #2	0.25 MGD	$0.815 M	4/1/96	$0.30/1,000 gal	Public perception on WQ	ID of contamin. source	Good new pump	Short term emergency use	Good	Reduced demand on Iao	None	Continued weekly testing
6 Maui Land Well #1	0.25 MGD	$0.075 M	6/1/96	$0.60/1,000 gal	Public perception on WQ	Meets EPA/DOH	Six year old pump	Short term emergency use	Good	Reduced demand on Iao	None	Continued weekly testing
7 Maui Land Well #2 Maui Land Needs	0.25 MGD	$0.095 M	6/1/96	$0.30/1,000 gal	Public perception on WQ	Meets EPA/DOH	Six year old pump	Short term emergency use	In use by others; next dirt road	Reduced demand on Iao	None	Continued weekly testing
8 Waihee #679	0.30 MGD	$0.100 M	4/1/96	$0.40/1,000 gal	Public perception on WQ	Expected Cl=100ppm	Good new pump	Short term emergency use	Long pipeline	Reduced demand on Iao	None	DOH approvals required
INCREASE PUMPING ALTERNATIVE												
9 Kepaniwai	0.25 MGD	None	None	$0.10/1,000 gal	None	Meets EPA/DOH	25 yr old pump on system	Part of BWS system	Existing	CWRM determination	N/A	None
ALTERNATIVE SOURCES - EXISTING WELLS WITHOUT PUMP												
10 Wailuapo Well #1	0.50 MGD	$0.200 M	6/1/96	$0.45/1,000 gal	Generator noise	Non-potable; possibly Cl>250ppm	Dependent on power source	Maybe; limited to sustainable yield	Excellent next to road owner - C. Brewer	Dependent on leakage from Iao aquifer	None	Permitting
11 N. Waihee Well #3	2.0 - 4.0 MGD	Phase 1 - $17.1M	1/96 - 12/97	$0.32/1,000 gal	None	Meets EPA/DOH	Excellent	Excellent/with N. Waihee sg.	Dependent on agrmt w/C. Brewer	Reduced demand	Budgeted	None
12 Hamakuapoko Well #1	0.6 MGD	$2.3 M	1/97 not including EIS	$0.40/1,000 gal	None	Meets EPA/DOH	Excellent	Excellent/with A&B sg.	Limited by EIS contested case	Reduced demand on Iao	Committed	Pump install permit, NPEDS/EIS
13 Hamakuapoko Well #2	0.6 MGD	$1.9 M	6/97 not including EIS	$0.50/1,000 gal (need treatment)	Slightly higher operating cost	Further study/testing	Excellent	Excellent/with A&B sg.	Limited by EIS contested case	Reduced demand on Iao	Committed	DBCP testing/EIS
14 N. Kihei Well #3	0.5 MGD	$1.3 M well $2.3 M pipeline	1/96 - 12/97	$0.35/1,000 gal	None	Unknown	Unknown because of WQ	Good for ag park; nonpotable	Next to cane haul road	None	None	Permitting & testing
15 Puunene Airpot Well #6	WELL LOCATION UNKNOWN											
ALTERNATE SOURCES - DRILL NEW WELLS												
16 New Well #1 - Wailapo	1-2 MGD	$1.5 M	6/97	$0.32/1,000 gal	None	Meets EPA/DOH	Subject to testing	May be part of Iao aquifer	No deed to property; subject to drill permit	Well spread pumping	None	Pump and drill permit
17 New Well #2 - Waihee Property	2.0 MGD (1.0 MGD into system)	$1.5 M	6/97	$0.32/1,000 gal	None	Meets EPA/DOH	Subject to testing	Have option on the property	BWS option	Reduced demand on Iao	None	Permitting EA
CONSERVATION ACTIONS												
18 Voluntary - Central Maui	5% maybe (1.0MGD); post Iao = usage incr.	$0.25 M	7/1/97	Reduction in revenue	Reduced service levels	No change	Unknown	Dependent of continuing education effort	N/A	Reduced demand on Iao	None	None
19 Mandatory - Central Maui	% Declared by Board	$0.010M	7/1/97	Reduction in revenue	Reduced service levels	No change	80%	Dependent of continuing education effort	N/A	Reduced demand on Iao	None	None
OTHER ACTIONS												
20 Spread pumping at Wailuku Shaft	?????	$1.6 M	6/1/96	$.25/1000 gal	Dangerous work envire.	Meets EPA/DOH	Limited back-up	Limited by agreement to Aug 96; may be extended	10,800' of-16" pipeline to CM emission line	Increase Iao aquifer pest sustainable yield	None	None
21 Wastewater reuse	(Need to research)	0	(Work w/DPW)	0	Addt'l cost of construction	Needs EPA/DOH appv	Dependent on TP supply	N/A	N/A	N/A	N/A	DOH approval
22 Showerhead retrofit	Up to 1.0 MGD reduction in existing use	$250,000 (12,000 showerheads)	On-going; 3 mos	None	Reduction of water rev.	N/A	Unknown	Limited	Depends on community interest	Reduced demand on Iao	$1,000	None
23 Implement rate increase	Unknown	$150,000	3/1/96 - 4/1/96	None	Higher water rates	N/A	Price elasticity unknown	Good	Dependent on full community support	Reduced demand on Iao	None	Requires approvals
24 Request temporary increase in sustainable yield	3.0 MGD	Administration time	Public hearings thru CWRM	None	Possible temporary increase in Cl levels	Meets EPA/DOH	Possible increase in chlorides	Depends on impact on Iao aquifer	Existing	Increased demand on Iao aquifer, Cl levels?	Operations	Requires CWRM approval
26 Desalination plant	1.0 MGD	$1.0 M	12/97	$4-5/1,000 gal	Higher water rates	Meets EPA/DOH	Unknown	High operating cost	Plans not readily avail.	Reduced demand on Iao	None	Requires approvals

12/12/96

WELL	OWNER	STATUS	TOTAL DEPTH	CASING DEPTH	CASING DIAM	TMK	CHLORIDES	DRAWDOWN	COMMENTS
4626-01	Maui County	UNU	260		8"		340-453	No Data	Ground 236', UNU since '71, 3'6" static water level "Waiakoa Gulch" drilled 1949. Cl. 453 at 85 gpm
-01	HC&S	UNU	198		12"	3-8-4:?	No Data	No Data	UNU since 1971 Drilled 1900, used 1971. No file per CWRM.
-01	N. Makimoto	OTH			No Dat	3-8-6:?	No Data	No Data	No file per CWRM Ground 120'
-01	DOWALD				12"			9.5	Drawdown 9.5 at 700 gpm
-01	HC&S				No Dat		280-491	3.6	Kihei Shaft. pipeline toward our system? Ground 325' No file per CWRM. Pump test 18.14 mgd (12600 gpm) 12MAV 15.3
4928-01	STATE	UNU	70		8"		243		Initial Head 3.6, Pump 0.43 MGD Ground Elevation 70, Puunene AP Test Hole, Not a great location
-02	HC&S	UNU	53		12"		298-305		Initial Head 3.7, 4.3 Static later, Not a great location Ground Elevation 50, Pump 2.88 MGD, 1'3" Drawdown
-01	HC&S	LOS			6"		80-125		No more data per CWRM Cl. 80-125 @ 175 gpm. Ground elevation 105'.
5026-02	USGS	OBS			1"				120' Ground elevation. Too small.
5126-01	HC&S	LOS	185		6"		270		Waikapu Shaft TH. Lost Well. No file per CWRM.
-02			129		No Dat		250-620		Pump rate was 9444 gpm! Chlorides lower at lower rates? No file per CWRM
5130-01	DOWALD	UNU	757	569 609	8"		20-45	40	Drawdown too high. 40' at 90 gpm. UNU since 73
-02	DOWALD	UNU	1020	520 570	20"		13-50		Draw down 73' at 500 gpm - in the alluvium. UNU since 74
-01	HC&S	Waikapu Tunnel							Ground Elevation 1360'
5132-02	HC&S	Waikapu Tunnel							Ground Elevation 1500'
-01	M&P	IND	300		20"		110-145		Cannery Shaft, Undesirable location Ground Elevation 20', Pump 1042 gpm, 0.9' Drawdown
-01	Iao Valley Tunnel	TH			1"				Wailuku Agribusiness Test Hole only 1"
-01	Wailuku Sugar								"Black Gorge Tunnel" Tunnel with 33' static head, 0.6' drawdown
5332-03	Wailuku Sugar	SLD							"Field Gorge Tunnel"
-04	DOWALD COUNTY				1"				5332-05 is Kepaniwai. This was test hole.
5333-01	Wailuku Sugar	IRR							Irrigation Tunnel. Gound Elevation 1425'
-02	Wailuku Sugar	SLD							Ground Elevation 1475' SLD
-01	HC&S	Waihee Tunnel							1625' Ground Elevation 4.9 MGD?
5434-02	HC&S	Waihee Tunnel							1650' Ground Elevation 1 MGD?
-01					2"				Observation Hole
-02									North Waihee Well 1
5831-03									North Waihee Well 2
-01					4"		20		Ground Elevation 475'

MINUTES FOR THE MEETING OF THE COMMISSION ON WATER RESOURCE MANAGEMENT

DATE: January 24, 1996
TIME: 9:00 a.m.
PLACE: HGEA-David Trask Building
2145 Kaohu Street, Room 207
Wailuku, Maui

Chairperson Michael Wilson called the meeting of the Commission on Water Resource Management to order at 9:10 a.m.

The following were in attendance:

MEMBERS: Mr. Michael Wilson
Mr. Richard Cox
Dr. Lawrence Miike
Mr. David Nobriga
Mr. Herbert Richards, Jr.

EXCUSED: Mr. Robert Girald

STAFF: Ms. Rae Loui
Mr. Roy Hardy
Mr. Charley Ice
Mr. Eric Hirano
Ms. Janis Uwaine

COUNSEL: Mr. William Tam

OTHERS:

William Meyer
Byron Walters
Kit Hoff
Melanie Nakamoto
Dorvin D. Ceis
Jim Murray
P. Seitz
Marie Kimmey
J. P. Schmidt
Rodney Kaulupali
William Spencer
Ed Tanji
Jim Smith
Jim Williamson
George Tengan
Kimo Apana
James Okazaki
Sheri Clark
Ellen Kraftsow
Conrad Higashionna
T. A. Kalani Haia
Brian Perry
M. Quinn
Nancy Bermel
James Kumagai
Hugh Starr
Gary W. Zakian
David Craddick

All written testimonies submitted at the meeting are filed in the Commission office and are available for review by interested parties. The items were not taken in the order posted on the agenda.

ITEM 1. MINUTES OF THE NOVEMBER 8, 1995 AND DECEMBER 6, 1995 MEETINGS

MOTION: (COX/NOBRIGA)

To approve the minutes of November 8 and December 6, 1995.

UNANIMOUSLY APPROVED

Appendix 12 CWRM Milestone Schedule

STAFF RECOMMENDATION:

Staff recommended that the Commission defer action on the applications listed in this submittal until the next Commission meeting on Oahu.

MOTION: (NOBRIGA/COX)

To approve staff's recommendation.

UNANIMOUSLY APPROVED.

Chairperson Wilson called for a short recess. (10:10 a.m.)

AGENDA #2

Chairperson Wilson called the meeting back to order at 10:30 a.m.

ITEM 1. Recommendation on the Petition for the Designation of Iao Aquifer System as a Ground Water Management Area

PRESENTATION OF SUBMITTAL: Deputy Director Rae Loui made the presentation with the assistance of William Meyer of the United States Geological Survey.

STAFF RECOMMENDATION:

The Findings of Fact Report and staff submittal was amended as follows (additions underlined):

1. Evidence does not exist to justify changing the current sustainable yield estimate of the Iao Aquifer System, which is 20 million gallons per day (mgd), to another number.

2. The transition zone has been rising at a steady rate in reponse to increasing pumpage and new equilibrium levels have not yet been achieved.

3. Increased chloride concentrations in some of the wells are the result of localized upconing, and chloride concentrations in one of the wells has exceeded the Department of Health's guideline concentrations;

4. Water use from the Iao Aquifer System is largely municipal for the MBWS;

5. Current 1995 ground water withdrawals from the Iao Aquifer System average 20.5 mgd (12 month moving average) or more than 100% of sustainable yield; and

6. The information available indicates that Iao Aquifer System meets the following criteria under the State Water Code (Hawaii Revised Statutes §174C) concerning designation of ground water management areas:

- [HRS §174C-44(1)] Whether an increase in water use or authorized planned use may cause the maximum rate of withdrawal from the ground water source to reach ninety percent of the sustainable yield of the proposed water management area; and

- [HRS §174C-44(4)] Whether rates, times, spatial patterns, or depths of existing withdrawals of ground water are endangering the stability or optimum development of the ground water body due to upconing or encroachment of salt water.

The portion of the staff submittal relating to the critical path items for the MBWS new source alternatives were amended in response to updated schedules provided by MBWS on January 22, 1996 as follows:

Selected critical path items for the four source alternatives are listed below:

Waihee/Iao Ditch	Obtain membranes by March 1, 1996 Reach land use agreement by April 1, 1996 Complete design, EA and permits by Aug 1, 1996 Bid line construction by Aug. 1, 1996 Award line construction bid by Nov. 1, 1996 Install membranes by Nov 1, 1996
North Waihee	Execute purchase agreement by February 15, 1996 Issue bid specs by July 1, 1996 Award Bid by Sept 1, 1996 Start pump installation by Nov. 1, 1996 Complete pump installation by March 1, 1997 Complete construction by Aug 1, 1997
Wailuku Shaft	Extend use agreement by Aug 1, 1996 Complete design by Feb 1, 1997 Obtain pipe easements by May 1, 1997
Waikapu Tank Well	Obtain well site agreement by June 1, 1996 Complete design by June 1, 1996 Complete EA by June 1, 1996 Issue bids by Sept 1, 1996 Award Bids by Nov 1, 1996 Complete construction by May 1, 1997

Similarly, the table in the staff submittal entitled "Quarterly Comparison of Projected Demand to Sources Available to Meet Demand" was amended as shown in the attachment.

The staff recommendations were amended as follows:

It is recommended that the Commission, pursuant to its authority under HRS §174C:

1. Approve the Findings of Fact Report as final and as fulfillment of the research and investigations necessary under HRS §174C-46.

2. Direct the Chairperson to consult with the Maui County Council, Board of Water Supply, and Maui County Mayor by February 28, 1996, regarding the proposed designation of Iao Aquifer as a ground water management area.

3. Issue an Order to Show Cause to the County of Maui Why: 1) a water emergency should not be declared to prohibit an increase in pumpage from the Iao Aquifer, and 2) the following actions deemed necessary to meet the emergency should not be ordered.

<u>Actions Deemed Necessary to Meet the Emergency:</u>

a) Increases in pumpage from the Iao Aquifer will be prohibited, including all dike, basal, and caprock sources.

b) The MBWS shall publish a notice of the CWRM's declaration of a water emergency in the county newspaper with widest circulation. The notice shall include a description of all measures planned by the MBWS to reduce consumption and to develop new sources as well as any other information as directed by the CWRM. The notice shall be reviewed by the CWRM prior to publication. Publication shall be done each day for the first week of the emergency and once a week thereafter until the emergency is rescinded.

c) The MBWS shall send each registered user of water and permittee of Iao Aquifer and caprock water a copy of the emergency notice. The CWRM staff shall supply registrant information.

4. If the following milestones are not achieved by March 1, 1996, the Commission shall hold the Order to Show Cause Hearing described in recommendation 3 by March 31, 1996:

- o Execute purchase agreement for the North Waihee Wells
- o Obtain membranes for treatment of the Waihee/Iao Ditch water
- o Sign contract to prepare bid package for North Waihee Wells

Evidence must be submitted by March 5, 1996 that these milestones have been achieved.

5. (a) If the following milestones are not achieved by May 1, 1996, the CWRM shall issue the Order to Show Cause described in 5 (b):

- o Achieve milestones listed in number 4
- o Reach land use agreement for the Waihee/Iao Ditch
- o Complete design for North Waihee wells

Evidence must be submitted by May 5, 1996 that these milestones have been achieved.

(b) Order to Show Cause to the County of Maui Why: 1) the CWRM should not designate Iao Aquifer as a ground water management area and declare a water shortage, and 2) the following order requiring actions deemed necessary to meet the water shortage should not be ordered.

<u>Proposed Order Following the Declaration of Water Shortage:</u>

1) The Maui Board of Water Supply shall submit to the CWRM within a specified timeframe a water shortage plan to decrease pumpage from the Iao Aquifer System by 1 mgd, 2 mgd, 3mgd, and 4 mgd. The CWRM shall review the plan prior to implementation. Implementation of a specified level of reduction shall start within 90 days.

2) The water shortage plan shall consider: 1) a detailed water conservation plan to include voluntary and mandatory measures, target groups, savings goals, implementation plans, and reporting of results, 2) acceleration of leak detection and repair efforts, 3) restrictions on the issuance of water meters and further

commitments of water, and 4) monthly reporting of the results.

6. If the following milestones are not achieved by July 1, 1996, the CWRM shall hold the Order to Show Cause Hearing described in recommendation 5 before July 31, 1996:

- o Achieve milestones listed in numbers 4 and 5
- o Issue bid specs for North Waihee Wells
- o Obtain site agreement, for Waikapu Tank Well
- o Complete design for Waikapu Tank Well
- o Complete EA for Waikapu Tank Well

Evidence must be submitted by July 6, 1996 that these milestones have been achieved.

7. If the following milestones are not achieved by November 1, 1996, the CWRM shall schedule decision-making by November 30, 1996 on the designation of Iao Aquifer System as a ground water management area:

- o Achieve milestones listed in numbers 4, 5, and 6
- o Award bid for North Waihee Wells
- o Deliver materials and begin pump installation for the North Waihee Wells
- o Complete design, EA, and permits for Waihee/Iao Ditch
- o Extend use agreement for the Wailuku Shaft to allow an increase in pumpage

Evidence must be submitted by November 5, 1996 that these milestones have been achieved.

TESTIMONIES:

Mr. David Craddick, Director of the Maui Department of Water Supply,answered questions from the Commissioners. Mr. Craddick acknowledged that the source development schedule is ambitious, but that DWS is committed to achieving it. In response to a question as to whether DWS is managing the system as effectively as possible, Mr. Craddick said that more could be done with conservation. With regard to the Waihee/Iao Ditch

Appendix 13

Correspondence Regarding Draft EA

United States Department of Agriculture

Natural Resources Conservation Service

210 Imi Kala St
Suite 209
Wailuku, Hi 96793

July 25, 1996

Maui County Board of Water Supply
Water Resources & Planning Division
200 S. High St., 5th Floor
Wailuku, HI 96793

Dear Ladies and Gentlemen:

Subject: Draft EA for Iao Treatment Facility and Related Pipeline; TMK: 3-5-01: 21, and 3-5-01:1

Withdrawal of ditch water presently has minimal impact on agriculture due to crop changes, downscale of agriculture and land use changes, however, will it have any significant impact on future agriculture? In terms of million gallons per day, are there any average statistics noting average ditch delivery per day as it relate to crops usage, available ag acreage and land use changes?

How temporary is the use of the withdrawn water from the ditch?

Thank you for the opportunity to comment.

Sincerely,

Neal S. Fujiwara
District Conservationist

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Neal S. Fujiwara
210 Imi Kala Street
Suite 209
Wailuku, HI 96793

November 11, 1996

RE: Final Environmental Assessment and Negative Declaration for the Iao Treatment Facility and Related Pipeline; TMK 3-5-01:021 and 3-5-01:001

Dear Mr. Fujiwara,

Thank you for your review and comment on the Draft EA for the project referred to above. We appreciate your concern for the future of agriculture. The following responds to your questions in the order in which they were posed.

The project is unlikely to impact future agricultural production, as the contract for use of the ditch ends after a three year period. Even if this agreement were extended, it would be unlikely to go beyond the time needed to get new wells on line, one or two more years at most.

Historical Ditch Flow Data are provided in Appendix 8 of the Document. Data is presented for mean flows during the 23 year period from 1955 to 1977. The low 23 year monthly mean flow was in December, at 7.76 mgd for the 23 year period. The high monthly mean flow was in April, at 11.52 mgd over the 23 year period.

In terms of crop usage, the cost of using the ditch in the agreement was related to anticipated potential crop losses. Specific irrigated acreages by each company were somewhat proprietary, however in general it was stated that the ditch is used to irrigate roughly 6,500 acres of Wailuku Agribusiness and HC&S property, and that of these, 200 acres could be impacted.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FORT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF

Planning and Operations Division

October 1, 1996

Mr. David Craddick, Director
Board of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Maui, Hawaii 98793-7109

Dear Mr. Craddick:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment (DEA) for the Iao Treatment Facility and Related Pipeline Project, Maui (TMK 3-5-1: 1 and 21). The following comments are provided pursuant to Corps of Engineers authorities to disseminate flood hazard information under the Flood Control Act of 1960 and to issue Department of the Army (DA) permits under the Clean Water Act; the Rivers and Harbors Act of 1899; and the Marine Protection, Research and Sanctuaries Act:

a. Based on the information provided, a DA permit will not be required for the project. Please contact our Regulatory Section at 438-9258 for further information and refer to file number 960000372.

b. The flood hazard information provided on page 23 of the DEA is correct.

Sincerely,

Lawrence O. Muraoka, P.E.
Acting Chief, Planning
and Operations Division

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Lawrence O. Muraoka, P.E.
Acting Chief, Planning & Operations Division
Department of the Army
Pacific Ocean Division, Corps of Engineers
Fort Shafter, Hawaii 96858-5440

October 18, 1996

Re: Response to Comments, dated 10/1/96, received 10/2/96 on Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Mr. Muraoka,

Thank you for your review and comment on the Draft EA referred to above. We understand that a DA permit will not be required and that the flood hazard information provided is correct. We have contacted your regulatory office as suggested, and appreciate your assistance.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.
Sincerely,

David Craddick
Director

A1996046

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON
CHAIRPERSON

ROBERT G. GIRALD
DAVID A. NORINGA
LAWRENCE H. MIKE
RICHARD H. COX
HERBERT M. RICHARDS, JR.

RAE M. LOUI, P.E.
DEPUTY

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P. O. BOX 621
HONOLULU, HAWAII 96809

OCT -7 1996

Mr. David Craddick, Director
Maui Board of Water Supply
Water Resources and Planning Division
200 South High Street, 5th Floor
Wailuku, Hawaii 96793

Dear Mr. Craddick:

SUBJECT: Draft EA for Iao Treatment Facility

Thank you for the opportunity to review the subject document. Our comments related to water resources are marked below.

In general, the CWRM strongly promotes the efficient use of our water resources through conservation measures and use of alternative non-potable water resources whenever available, feasible, and there are no harmful effects to the ecosystem. Also, the CWRM encourages the protection of water recharge areas which are important for the maintenance of streams and the replenishment of aquifers.

[X] We recommend coordination with the county government to incorporate this project into the county's Water Use and Development Plan.

[ ] We are concerned about the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] A Well Construction Permit and a Pump Installation Permit from the CWRM would be required before ground water is developed as a source of supply for the project.

[ ] The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit from the CWRM would be required prior to use of this source.

[ ] Groundwater withdrawals from this project may affect streamflows. This may require an instream flow standard amendment.

[ ] We recommend that no development take place affecting highly erodible slopes which drain into streams within or adjacent to the project.

[ ] If the proposed project diverts additional water from streams or if new or modified stream diversions are planned, the project may need to obtain a stream diversion works permit and petition to amend the interim instream flow standard for the affected stream(s).

[ ] Based on the information provided, it appears that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.

[ ] Based on the information provided, it does not appear that a Stream Channel Alteration Permit pursuant to Section 13-169-50, HAR will be required before the project can be implemented.

[ ] An amendment to the instream flow standard from the CWRM would be required before any streamwater is diverted.

[ ] Any new development that is permitted along a stream that is not yet channelized should be based on the express condition that no streams will be channelized to prevent flooding of the development. Development in the open floodplain should not be allowed; other economic uses of the floodplain should be encouraged.

[X] OTHER: As noted, the aquifer is currently overpumped, and this project provides a means to avoid aquifer degradation while bringing alternative sources on-line on a more permanent basis.

If there are any questions, please contact Charley Ice at 587-0251 or toll free at 984-2400, extension 70251.

Sincerely,

RAE M. LOUI
Deputy Director

CI:ss

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Honorable Rae Loui, Deputy Director
Commission on Water Resource Management
Department of Land & Natural Resources
State of Hawaii
PO Box 621
Honolulu, HI 96809

October 21, 1996

RE: Response to comments, dated 10/7/96, received 10/9/96, on Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Ms. Loui,

Thank you for your review and comment on the Draft Environmental Assessment for Iao Treatment Facility. As you suggested, we will incorporate this project into Water Use and Development Plan.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

"By Water All Things Find Life"

Printed on recycled paper

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
54 SOUTH HIGH ST., ROOM 101
WAILUKU, HAWAII 96793-2198

MICHAEL D. WILSON
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY DIRECTOR
GILBERT S. COLOMA-AGARAN

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

July 30, 1996

Mr. David Craddick
Maui County Board of Water Supply
Water Resources & Planning Division
200 South High Street, 5th Floor
Wailuku, Hawaii 96793

RE: Draft Environmental Assessment for Iao Treatment Facility And Related Pipeline; TMK 3-5-01:021, and 3-5-01:001

Dear Mr. Craddick,

The DEA for the 2 MGD Iao Treatment Facility and Pipeline was received and reviewed. As you are aware, on May 20, 1996, a site visit was undertaken at the affected area for the proposed tank to determine potential impacts on terrestrial flora and fauna at the tank and its immediate surroundings. We do have the expertise to comment on affected flora and fauna, and did so (see letter Appendix 6, page 66). However, the DEA's main focus currently concerns commentaries on sustainable water yields, aquifer water withdrawals, and production of pure water which are beyond the purview of this Division.

It would seem that most appropriate and specific comments and response should be redirected and solicited from our Division's Commission on Water Resource Management and perhaps Aquatic Resources Division.

Sincerely,

Dr. Fern P. Duvall II,
Wildlife Biologist

cc.
Mr. Wesley Wong, Maui District Manager
Mr. Wayne Ching, Honolulu Administration.

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
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Dr. Fern P. Duvall II
Wildlife Biologist
Division of Forestry & Wildlife
Department of Land and Natural Resources
State of Hawaii
54 South High Street, Room 101
Wailuku, Hawaii 96793-2198

October 21, 1996

RE: Comments dated 7/30/96, received 8/1/96 on Draft Environmental Assessment for Iao Treatment Facility and Pipeline

Dear Dr. Duvall,

Thank you for your review and comment on the Draft EA referenced above. We understand that flora and fauna will not be adversely impacted. We appreciate your concern regarding aquifer withdrawals, and aquatic resources. We sent copies of the Draft EA to the Commission on Water Resource Management and to the Aquatic Resources Division at the time of publication and mailing to you. Their comments have been included in this section of the EA.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

for David Craddick
Director

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES
1151 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

October 21, 1996

MEMORANDUM

TO: Ellen Kraftsow, Division of Water Resources and Planning
Maui Board of Water Supply

FROM: Bill Devick, Acting Administrator
Division of Aquatic Resources

SUBJECT: Comments on Draft Environmental Assessment for Iao Treatment Facility

We have no objections to the proposed facility, which essentially will use already diverted stream water and discharge back into an artificial system. Therefore, it will not change existing instream conditions or affect native biota or ecosystems.

However, the express purpose of the project, to "mitigate groundwater withdrawals from the Iao aquifer," opens questions about established policies and impacts related to the substantial diversions of water from Iao Stream. These are addressed in the attached August 5, 1996 memorandum from Skippy Hau, our Maui aquatic biologist.

DIVISION OF AQUATIC RESOURCES - MAUI
DEPARTMENT OF LAND & NATURAL RESOURCES
130 Mahalani Street
Wailuku, Hawaii 96793
Phone # (808) 243-5327
FAX #(808)243-5326
August 5, 1996

To: Bill Devick, Acting Administrator

From: Skippy Hau, Aquatic Biologist

Subject: Draft Environmental Assessment for Iao Treatment Facility and Related Pipeline (TMK 3-5-01:021, and 3-5-01:001)

What is the impact of existing stream diversions on water recharge for the Iao aquifer? The impact of diverted streams which appear more obvious during drought conditions needs to be better understood. The watershed structure has dramatically changed and many natural watershed functions have not been fully assessed in environmental studies. The proposed project will be a temporary solution to use 2 million gallons of water per day from the Iao ditch until March 1999. However, approximately 83 mgd are diverted from Iao Stream (Letter from M. Tagomori to H. Sakuda, 1991) based on water-use declarations. A larger, more sustainable solution in this situation would be to restore a minimum flow to both Waikapu, Iao and Waiehu Streams through released flows or diversion modifications. This would improve natural recharge conditions often associated with flowing streams. Further monitoring would be needed to determine the long term improvement in water recharge. Improving sustainable water sources will not create new water for over-committed plans.

The increases in impervious surfaces through development, the use of storm drainage systems to move water off the land, and the loss of natural watershed areas contributes to less efficiency in putting water into underground aquifers. These changes in the watershed need to be carefully evaluated in development plans.

The compensation of HC&S for crop losses below 11.5 mgd seems contradictory when Iao Stream is allowed to be totally diverted and flow rarely reaches the ocean. There has been no compensation for the loss of natural stream habitat or stream productivity. With these losses, there has been a decline in freshwater stream gathering and marine fisheries along with increases in turbidity, sediment, and nutrients.

The proposed treatment facility is a temporary solution to the overall problem. The water continues to be taken from the impacted Iao watershed. There also is no plan for a conservation reserve to address prolonged drought conditions similar to what we have experienced since the ending of 1994.

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Bill Devick, Acting Administrator
Division of Aquatic Resources
Department of Natural Resources
1151 Punchbowl Street
Honolulu, HI 96813

October 22, 1996

RE: Response to Comments, dated 10/21/96, received 10/21/96 on Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Mr. Devick,

Thank you for your review and comment on the Draft EA referenced above. We understand from your letter that the facility will not impact existing in-stream conditions or affect native biota or ecosystems.

We acknowledge that some larger issues exist, as discussed in your appended memorandum. As you are aware, stream restoration is beyond the scope of this project, or the authority of BWS to undertake on its own. However, we believe that dialogue on such issues has been opened with the Stream Protection and Management review process, and expect to be speaking with you further on these topics.

In terms of returning water to the Iao aquifer, restoration of flows to the lower reaches of Iao, Waikapu and Waiehu streams may or may not substantially mitigate aquifer depletion from existing withdrawals. This would depend on the amount of run-off versus recharge from the streams, and whether the recharge occurred within the zone of capture for the pumping wells. It may decrease the risk of saltwater intrusion, but again this would depend on recharge vs. runoff. There are larger issues in terms of ecosystems that may be addressed by restoration of this stream flow, but we agree that such an undertaking would require extensive coordination between multiple agencies and the private sector. Competing interests for agricultural uses would also need to be taken into account, as well as potential lost recharge due to further decreases in irrigation. Such a dramatic overhaul of existing conditions is well beyond the scope of this project.

We appreciate your concerns regarding changing aquifer conditions, and agree that increasing impervious surfaces reduces recharge generally. We endeavor to introduce the planning commission to these issues during in a periodic workshop, and to raise these issues in permits where they affect our drinking water systems. We would also welcome an open dialogue with the Division of Aquatic Resources on this issue.

With regard to your comments on compensation, we appreciate your concern for having some monies in reflection of and for the purpose of addressing the externalities to aquatic ecosystems. As you know, imposition of such fees is also beyond our authority.

Finally, your concerns regarding changing aquifer conditions due to changing irrigation, as well as drought and conservation are well taken. Our 1992 Draft WUDP did discuss issues of natural aquifer recharge versus irrigated recharge and the impacts of changing conditions. We have $250,000 budgeted for conservation on the Central Maui system, and longer term conservation plans are under way. In terms of a conservation reserve for the ecosystem in drought conditions, again, although our ability to enforce such a reserve has limitations, we would be interested in discussing with you appropriate means of determining and implementing such reserves in circumstances where we are able to do so.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

E. David Craddick
Director

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

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

August 5, 1996

Mr. David Craddick, Director
County of Maui Board of Water Supply
P.O. Box 1109
Wailuku, Hawaii 96793-7109

LOG NO: 17773 ✓
DOC NO: 9607KD21

Dear Mr. Craddick:

SUBJECT: Chapter 6E-8 Historic Preservation Review -- Draft Environmental Assessment for the Iao Treatment Facility and Pipeline
Wailuku, Wailuku District, Island of Maui
TMK: 3-5-01: 21 and 3-5-01: 01

We have reviewed the Draft Environmental Assessment (DEA) the proposed water treatment facility and pipeline, to be developed by the County of Maui Board of Water Supply. The treatment facility is to be located at an existing water storage tank site along Alu Road; the pipeline will connect the treatment facility to the Iao Ditch, located uphill.

We have previously reviewed this project (letter to Ellen Kraftsow June 6, 1996), and our comments are attached to the DEA. In the prior review, we indicated that the project area has been previously impacted by construction of the existing facility and by modern cultivation for pineapple. No known historic sites are present within the area. We indicated that the project would have "no effect" on historic sites.

We have received no new information since our previous review, and there have been no changes in the proposed project. We therefore believe that this project will have "no effect" on historic sites.

Please contact Ms. Theresa K. Donham at 243-5169 if you have any questions.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

KD:jen

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Honorable Don Hibbard, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
State of Hawaii
33 South King Street, 6th Floor
Honolulu, HI 96813

October 21, 1996

RE: Response to Comments dated 8/5/96, received 8/6/96 on Draft Environmental Assessment for Iao Treatment Facility and Pipeline

Dear Mr. Hibbard,

Thank you for your review and comment on the Draft EA referenced above. We understand from your letter that the project will have "no effect" on historic sites.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

"By Water All Things Find Life"

Printed on recycled paper

0996036

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIKE
DIRECTOR OF HEALTH

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

In reply, please refer to

September 4, 1996 96-119/epo

Mr. David Craddick
Director
Board of Water Supply
County of Maui
P. O. Box 1109
Wailuku, Hawaii 96793-7109

Dear Mr. Craddick:

Subject: Draft Environmental Assessment (DEA)
Iao Treatment Facility and Pipeline
Wailuku, Maui
TMK: 3-5-01: 1

Thank you for allowing us to review and comment on the subject project. We have the following comments to offer:

Water Pollution

A National Pollutant Discharge Elimination System (NPDES) permit is required for any discharge to waters of the State including the following:

1. Storm water discharges relating to construction activities for projects equal to or greater than five acres;
2. Storm water discharges from industrial activities;
3. Construction dewatering activities;
4. Cooling water discharges less than one million gallons;
5. Groundwater remediation activities; and
6. Hydrotesting water.

Any person requesting to be covered by a NPDES general permit for any of the above activities should file a Notice of Intent with the Department's Clean Water Branch at least 90 days prior to commencement of any discharge to waters of the State.

Any questions regarding this matter should be directed to Mr. Denis Lau of the Clean Water Branch at 586-4309.

Drinking Water

1. Section III, A. Need for the Proposed Action, page 6, states that "... The membrane filtration units have been tested elsewhere on Maui, and performed well in meeting treatment requirements and producing pure water..." Since there is no direct reference to the "elsewhere on Maui" site, we will assume that the DEA is referring to the Kamole plant since it is the only site where the Memcor 10C was pilot tested. Thus, the subsequent discussion will refer to the Kamole Plant.

2. The Maui Department of Water Supply (DWS) must demonstrate to the Department of Health (DOH) that the raw water quality from the Iao Ditch is equal to or exceeds the Kamole raw water quality. There must be a discussion of how the Iao Ditch and Kamole raw source water microscopic particulate analyses (MPAs) compare. It is important to note that one of our major concerns is the apparent lack of historical water quality data for the Iao source. Little is known about the fluctuations in turbidity, MPA, etc.

3. Section III, D. Proposed Water Treatment System, page 8, states that "... The two continuous micro filtration (CMF) modules have a combined capacity of 1.6 - 2.4 MGD at a flux rate of 0.5 ~ 0.75 gpm/meter^2 of membrane." Please note that the Kamole filtration plant has only been approved at a flux rate of 0.5 gpm/meter^2.

4. An engineering report must be submitted and receive approval prior to the construction of the proposed treatment plant. The engineering report, at a minimum, shall include a watershed sanitary survey, a description of the proposed treatment plant, a preliminary layout plan, a schedule for financing and constructing the proposed treatment plant, and a detailed explanation on how the proposed treatment plant will be able to meet the filtration and disinfection criteria. The Department's Surface Water Treatment Rule Administrative Manual, page 2-5, outlines these requirements.

5. The total treatment process (filtration plus disinfection) for the system must achieve at least a 3-log (99.9 percent) removal and inactivation of Giardia and a 4-log (99.99 percent) removal and inactivation of viruses. In addition, an emergency plan, in the event of disinfection failure, shall be submitted and received approval prior to operation. The Department's Surface Water Treatment Rule Administrative

96-119

Manual, Chapter 3, Disinfection Criteria, outlines the disinfection requirements.

6. An operations manual shall be submitted and receive approval before the treatment plant goes into operation. The Department's Surface Water Treatment Rule Administrative Manual, page 2-13, outlines the requirements. An updated operations manual shall be submitted in July of the year following approval of the original operations plan.

7. It is our understanding that Maui DWS will be contacting the DOH's Clean Water Branch, on the possible NPDES permit requirements.

If you should have any questions, please contact Ms. Queenie Tan of the Safe Drinking Water Branch at 586-4258.

Maui Environmental Health

1. Iao State Park is located upstream of the intake. The restrooms are serviced by cesspools and the stream is also used for recreational swimming purposes. These may have possible impact on the quality of the water.

2. The Wastewater Branch of the Department should be consulted regarding disposal of backwash water into Waihee Ditch. A question has been raised on whether the backwash water is considered wastewater.

3 Iao stream is subject to high turbidity during heavy rainfall. Consideration should be given to automatic monitoring and shut off when turbidity reaches levels beyond the limits of the CMF module.

Any questions regarding the Maui Environmental Health comments should be directed to Mr. Herbert Matsubayashi, Chief Sanitarian on Maui at 984-8230.

Sincerely,

for BRUCE S. ANDERSON, Ph.D.
Deputy Director for Environmental Health

c: CWB
MDHO
SDWB
WWB

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Honorable Bruce Anderson, Ph.D.
Deputy Director for Environmental Health
State of Hawaii Department of Health
PO Box 3378
Honolulu, HI 96801

October 21, 1996

RE: Response to Comments dated 9/4/96, received 9/9/96 on Draft Environmental Assessment for Iao Treatment Facility and Pipeline

Dear Dr. Anderson,

Thank you for your review and comment on the Draft EA referenced above.

The following addresses questions raised in the sections of your letter.

Water Pollution We have received confirmation from your Clean Water Branch and from the Army Corps that the project involves no discharge into State Waters, and that an NPDES, 401 Water Quality Cert or other permit is not required. These letters are presented in this section of the Final EA.

Drinking Water
The membrane filtration units were tested at the Iao site from July 6th to August 8th. MPAs and summary report were submitted to the Safe Drinking Water Branch on September 26th. The units appeared to meet the requirements of the Surface Water Treatment Rule.

The capacity of the continuous microfiltration (CMF) modules in the DEA refers to manufacturers data. We anticipate that actual approvals will follow the performance of the CMF modules upon testing, and will follow guidelines set by DOH on this matter.

We acknowledge that an engineering report, operations manual and emergency plan must be submitted and receive approval prior to use of the plant. A pilot study for the treatment has been submitted, and a preliminary engineering report will be prepared and submitted. We will also submit an emergency plan for review and approval prior to plant operation. Thank you for your guidance in

referring to the applicable criteria for preparation of these documents.

Maui Environmental Health
We acknowledge that the stream is used for recreational swimming purposes, and subject to potential biological contamination from animals and humans. This information was included in section IV H of the Draft EA. The upper parking lot is up-stream of the intake, and the more heavily trafficked Kepaniwai park is down-stream of the site. Never the less, the results of the MPA and pilot studies should reveal whether the treatment is adequate.

Pursuant to your suggestion, we have contacted the State Wastewater Branch, and confirmed that the backwash effluent is not considered wastewater.

Thank you for your suggestion regarding automatic monitoring and shutoff for high turbidity conditions. This will be incorporated into the project.

We appreciate your detailed review of this project. Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIKE
DIRECTOR OF HEALTH

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

In reply, please refer to
EMD/CWB

0896014

July 29, 1996

P0743KP

Mr. David Craddick, Director
Board of Water Supply
County of Maui
P.O. Box 1109
Wailuku, Hawaii 96793-7109

Dear Mr. Craddick:

Subject: Draft Environmental Assessment for the
Iao Treatment Facility and Related Pipeline
TMK: 3-5-01)021 and 3-5-01:001
Iao, Maui, Hawaii

The Department of Health acknowledges the receipt of the draft environmental assessment for the subject project and has the following comments:

1. The applicant should contact the Army Corps of Engineers (COE) to identify whether a Federal permit (including a Department of Army (DA) permit) is required for this project. A Section 401 Water Quality Certification (WQC) is required for "Any applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters...", pursuant to Seccion 401(a)(1) of the Federal Water Pollution Act (commonly known as the "Clean Water Act (CWA)").

2. If the project involves the following discharges into state waters, an NPDES general permit is required for each activity:

   a. Storm water runoff associated with construction activities, including clearing, grading, and excavation that result in the disturbance of equal to or greater than five (5) acres of total land area;

   b. Construction dewatering effluent;

   c. Non-contact cooling water;

d. Hydrotesting water; and

e. Treated contaminated groundwater from underground storage tank remedial activity.

3. The Department has learned from Wailuku Agriculture Business that Waihee Ditch ends at a reservoir and is solely used for irrigation purposes. Wailuku Agriculture Business, owner of the ditch, further determined that Waihee Ditch does not enter any state water. Therefore, Waihee Ditch would not be considered a state water and the proposed Iao Treatment Facility would not require a NPDES individual permit to discharge filter membrane backwash water.

Should you have any questions regarding this matter, please contact Ms. Kris Poentis, Engineering Section of the Clean Water Branch, at 586-4309.

Sincerely,

DENIS R. LAU, P.E., CHIEF
Clean Water Branch

KP:cr

BOARD OF WATER SUPPLY
COUNTY OF MAUI
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Honorable Dennis Lau, Chief
Clean Water Branch
State of Hawaii Department of Health
PO Box 3378
Honolulu Hawaii 96801-3378

October 18, 1996

RE: Response to comments dated 7/29/96, received 8/2/96 on Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Mr. Lau,

Thank you for your review and comment on the Draft EA referenced above. We understand from your letter that an NPDES permit will not be required for the project. We have also contacted the Army Corps to confirm that no Section 401 Water Quality Certification is required for this project.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

for David Craddick
Director

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

LAWRENCE MIKE
DIRECTOR OF HEALTH

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

In reply, please refer to:
File.

August 2, 1996

Maui County Board of Water Supply
Water Resources & Planning Division
200 South High Street, 5th Floor
Wailuku, Maui, Hawaii 96793

Gentlemen:

SUBJECT: Draft Environmental Assessment
Iao Treatment Facility and Related Pipeline

We have completed review of the subject draft environmental assessment. We have no comments to offer at this time.

Thank you for allowing us the opportunity to comment on the proposed project. Should you have any questions, please contact Mr. Daryn Yamada, Supervisor of our Noise Section at 586-4700.

Very truly yours,

Jerry Y. Haruno
Environmental Health Program Manager
Noise, Radiation & Indoor Air Quality Branch

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Mr. Jerry Haruno, Environmental Health Program Manager
Noise, Radiation & Indoor Air Quality Branch
State of Hawaii Department of Health
PO Box 3378
Honolulu, HI 96801

October 21, 1996

RE: Comments dated 8/2/96, received 8/4/96 on Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear MR. Haruno,

Thank you for your review and comment on the Draft EA referenced above. This acknowledges receipt of your letter.

Should you have any comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

for David Craddick
Director

"By Water All Things Find Life"

Printed on recycled paper

BOARD OF WATER SUPPLY
COUNTY OF MAUI
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Honorable Gary Gill, Director
Office of Environmental Quality Control
State of Hawaii
220 South King Street, Fourth Floor
Honolulu, HI 96813

October 21, 1996

RE: Response to Comments dated 9/4/96, received 9/9/96 on Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Mr. Gill,

Thank you for your review and comment on the Draft EA referenced above. The following responds to your comments.

1. On page 9 of the DEA, Section E, Cost of the Proposed Action, the County anticipates the cost for use of he water transport system to be approximately $763,520.40. Please discuss the cost for use of the water transport system in relation to Wailuku Agribusiness's cost to lease water from the State.

We have contacted the State Land Division regarding your inquiry, and they confirm that Wailuku Agribusiness does not have a water license, since it draws water from private lands. Cost of water licensing had no bearing on negotiations for use of the water. The fees charged were based on the use of the transport and collection system, and on anticipated losses in revenue due to inability to use this water for irrigation.

2. The present project is one of a series of projects related to water development in west and central Maui. Please discuss whether the Department has a master plan for water development in west and central Maui and whether such a programmatic master plan will be subject to environmental review under Chapter 343, HRS.

We assume the commenter is referring to two development projects the East Maui Development Plan and the North Waihee Development Plan. As stated in the document, The East Maui Development Plan was reviewed under Chapter 343 HRS, and is currently undergoing supplementation resulting from that review. The East Maui Development Plan affects the Central and Upcountry systems. The

North Waihee Development Plan affects only the Central Maui system, and was reviewed under Chapter 343 HRS during 1994. The present project has no bearing on the West Maui systems, which are Lahaina, Mahinahina and Honokohau.

3. After the three-year period for use of the Iao ditch water has expired, please disclose whether the water from the ditch will be used to restore the Iao stream and assess the long-term direct, indirect and cumulative impacts of stream restoration.

Restoration of stream flows is not part of this project. As mentioned on page 16, Section V.F. of the Draft EA, the use of Iao Ditch water has been on-going for at least 50 years. Even with restoration of flows to the stream, recovery would be hampered by extensive channelization of the lower reaches for flood control. Restoration of stream flows would also involve taking water from agriculture. BWS lacks authority to undertake such a restoration project. The ditch, collection and transport systems are the property of Wailuku Agribusiness. Restoration of the aquatic ecosystem would be even more complex, involving changes to the channelization of the stream removal or alteration of the channelization down stream would involve county, state & federal agencies in charge of streams and of flood control. Such efforts are beyond the scope of this project.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

BENJAMIN J. CAYETANO
GOVERNOR

0996032

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
220 SOUTH KING STREET
FOURTH FLOOR
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

September 4, 1996

The Honorable David Craddick, Director
County of Maui, Department of Water Supply
200 South High Street, 5th Floor
Wailuku, Hawai'i 96793

Dear Mr. Craddick:

We wish to submit for your response (required by Section 343-5(b), Hawaii Revised Statutes) the following comments on a July 1996, draft environmental assessment ("DEA") for "Iao Treatment Facility and Pipeline" sent to our office by your July 21, 1996, letter. Notice of this draft environmental assessment was published in the August 8, 1996, edition of the *Environmental Notice*.

1. On page 9 of the DEA, Section E, Cost of the Proposed Action, the County anticipates the cost for use of the water transport system to be approximately $763,520.40. Please discuss this cost in relation to Wailuku Agribusiness's cost to lease water from the State.

2. The present project is one of a series of projects related to water development in west and central Maui. Please discuss whether the Department has a master plan for water development in west and central Maui and whether such a programmatic master plan will be subject to environmental review under Chapter 343, HRS.

3. After the three-year period for use of Iao ditch water has expired, please disclose whether the water from the ditch will be used to restore the Iao stream and assess the long-term direct, indirect and cumulative impacts of stream restoration.

Please include this letter and your response in the final environmental assessment for this project. If there are any questions, please call Mr. Leslie Segundo, Environmental Health Specialist, at 586-4185. Thank you for the opportunity to comment.

Sincerely,

GARY GILL
Director

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Honorable Gary Gill, Director
Office of Environmental Quality Control
State of Hawaii
220 South King Street, Fourth Floor
Honolulu, HI 96813

October 21, 1996

RE: Response to Comments dated 9/4/96, received 9/9/96 on Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Mr. Gill,

Thank you for your review and comment on the Draft EA referenced above. The following responds to your comments.

1. On page 9 of the DEA, Section E, Cost of the Proposed Action, the County anticipates the cost for use of he water transport system to be approximately $763,520.40. Please discuss the cost for use of the water transport system in relation to Wailuku Agribusiness's cost to lease water from the State.

We have contacted the State Land Division regarding your inquiry, and they confirm that Wailuku Agribusiness does not have a water license, since it draws water from private lands. Cost of water licensing had bearing on negotiations for use of the water. The fees charged were based on the use of the transport and collection system, and on anticipated losses in revenue due to inability to use this water for irrigation.

2. The present project is one of a series of projects related to water development in west and central Maui. Please discuss whether the Department has a master plan for water development in west and central Maui and whether such a programmatic master plan will be subject to environmental review under Chapter 343, HRS.

We assume the commenter is referring to two development projects the East Maui Development Plan and the North Waihee Development Plan. As stated in the document, The East Maui Development Plan was reviewed under Chapter 343 HRS, and is currently undergoing supplementation resulting from that review. The East Maui Development Plan affects the Central and Upcountry systems. The

North Waihee Development Plan affects only the Central Maui system, and was reviewed under Chapter 343 HRS during 1994. The present project has no bearing on the West Maui systems, which are Lahaina, Mahinahina and Honokohau.

3. After the three-year period for use of the Iao ditch water has expired, please disclose whether the water from the ditch will be used to restore the Iao stream and assess the long-term direct, indirect and cumulative impacts of stream restoration.

Restoration of stream flows is not part of this project. As mentioned on page 16, Section V.F. of the Draft EA, the use of Iao Ditch water has been on-going for at least 50 years. Even with restoration of flows to the stream, recovery would be hampered by extensive channelization of the lower reaches for flood control. Restoration of stream flows would also involve taking water from agriculture. BWS lacks authority to undertake such a restoration project. The ditch, collection and transport systems are the property of Wailuku Agribusiness. Restoration of the aquatic ecosystem would be even more complex, involving changes to the channelization of the stream removal or alteration of the channelization down stream would involve county, state & federal agencies in charge of streams and of flood control. Such efforts are beyond the scope of this project.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

for David Craddick
Director

1096065

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPIOLANI BOULEVARD, SUITE 500
HONOLULU, HAWAII 96813-5249
PHONE (808) 594-1888
FAX (808) 594-1865

September 16, 1996

Mr. David Craddick
County of Maui
Board of Water Supply
200 South High Street, 5th Floor
Wailuku, HI 96793

Dear Mr. Craddick:

Thank you for the opportunity to review the Draft Environmental Assessment (DEA) for the Iao Treatment Facility and Pipeline, Island of Maui. The County of Maui proposes to take water from the Iao Irrigation Ditch, transport it to the Iao Tank, and then treat it using the Membrane Filtration technique. If successful, the project will increase the drinking water capacity of the Central Maui system by roughly 2 mgd for a period of about three years.

After a careful review of the DEA and supporting documentation, the Office of Hawaiian Affairs (OHA) has no objections to the proposed treatment facility. Based on the information contained in the DEA, the treatment facility will not bear significant long-term adverse impacts on adjacent areas nor upon existing flora or fauna habitats. Furthermore, the withdrawal of water from the Iao Irrigation Ditch will not apparently alter the stream capacity since water withdrawals occur all the time.

But OHA has some concerns about the fate of backwash water (40,000 to 140,000 gpd) plus chemicals which will be returned to the Iao Irrigation Ditch from the treatment facility. These backwash water will contain a high concentration of particles, microorganisms, and other residues which will eventually reach coastal areas and wetlands. Although the preparers indicate that adverse impacts of backwash water will be minimal, no data are included in the DEA to substantiate their contention. OHA urges the preparers to incorporate in the DEA mitigation measures to address potential pollution of backwash water on coastal zones. Please contact me, or Linda K. Delaney, the Land and Natural Resources Division Officer (594-1938), or Luis A. Manrique (594-1935), should you have any questions on this matter.

Sincerely yours,

Martha Ross
Deputy Administrator

LM:lm

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Martha Ross, Deputy Administrator
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard
Honolulu, HI 96813-5249

October 21, 1996

Re: Response to comments, dated 9/16/96, received 10/11/96 on the Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Ms. Ross,

Thank you for your review and comments on the Draft Environmental Assessment for the Iao Treatment Facility and Related Pipeline.

We are pleased that OHA has no objections to this project, and appreciate your concern for the aquatic environment.

You commented that no data were included in the DEA to substantiate that minimal impacts result from the backwash water. The following data are from section V. E., F. & G and VI B. of the DEA. During general operations, no chemical additions occur in the CMF units. Sodium hydroxide used during clean-in-place operations is not drained to backwash, but recycled to the CIP tank. Only residues of this 2% solution that remain in the filter array are available to enter this water. Further, a backwash tank has been installed to allow sedimentation of solids before returning backwash water to the ditch.

Pursuant to your concerns, we provide the following additional information. After clean-in-place operations, 29 gallons of 2% solution remain in the filter array. Using the following calculations,

- 29 x 0.02 = 0.58 gallons sodium hydroxide
- Low mean daily flow from 20+ years of data about 13 MGD (see appendix 8)
- 13 MGD per day/1,440 minutes per day = 9,028 gpm
- 0.58/9,028 = 0.000064, or 64 ppm
- Backwash frequency one time per filter every 2-6 weeks
- Number of filters = two

This means, that on two minutes (separated by two hours in CIP process), out of every 2-6 weeks, a small release of 64 ppm will enter the ditch. Again, this tiny amount would last for two, one minute periods, that occur once every two to six weeks.

As stated in Section V F of the DEA, backwash water and backwash from CIP operations containing dilute residue enters the Waihee Ditch, with mean flows ranging from 13 to 20 million. This ditch ends in an irrigation reservoir in the middle of a cane field in the central isthmus. With application to the soil, organics, particulates and other debris become part of the soil in the fields, or possibly utilized by plants. No adverse impacts to aquatic systems are anticipated.

We have also received assurance that manufacturers tests have never detected chemical residue in effluent from normal backwash operations. even without dilution.

These conclusions are also supported by the following information. The Department of the Army and Clean Water Branch of DOH have not required NPDES or 401 WQC permits, based on the conclusion that this project would not adversely impact state waters. The Division of Aquatic Resources has commented that the project will not affect existing in-stream conditions or affect native biota or ecosystems. These comments are included in this section.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Martha Ross, Deputy Administrator
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard
Honolulu, HI 96813-5249

October 21, 1996

Re: Response to comments, dated 9/16/96, received 10/11/96 on the Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Ms. Ross,

Thank you for your review and comments on the Draft Environmental Assessment for the Iao Treatment Facility and Related Pipeline.

We are pleased that OHA has no objections to this project, and appreciate your concern for the aquatic environment.

You commented that no data were included in the DEA to substantiate that minimal impacts result from the backwash water. The following data are from section V. E., F. & G and VI B. of the DEA. During general operations, no chemical additions occur in the CMF units. Sodium hydroxide used during clean-in-place operations are not drained to backwash, but recycled to the CIP tank. Only residues of this 2% solution that remain in the filter array are available to enter this water.

Pursuant to your concerns, we provide the following additional information. After clean-in-place operations, 29 gallons of 2% solution remain in the filter array. Using the following calculations,

- 29 x 0.02 = 0.58 gallons sodium hydroxide
- Low mean daily flow from 20+ years of data about 13 MGD (see appendix 8)
- 13 MGD per day/1,440 minutes per day = 9,028 gpm
- 0.58/9,028 = 0.000064, or 64 ppm
- Backwash frequency one time per filter every 2-6 weeks
- Number of filters = two

This means, that on two minutes (separated by two hours in CIP process), out of every 2-6 weeks, a small release of 64 ppm will enter the ditch. Again, this tiny amount would last for two, one minute periods, that occur once every two to six weeks.

As stated in Section V F of the DEA, backwash water and backwash from CIP operations containing dilute residue enters the Waihee Ditch, with mean flows ranging from 13 to 20 million. This ditch ends in an irrigation reservoir in the middle of a cane field in the central isthmus. With application to the soil, organics, particulates and other debris become part of the soil in the fields, or possibly utilized by plants. No adverse impacts to aquatic systems are anticipated.

We have also received assurance that manufacturers tests have never detected chemical residue in effluent from normal backwash operations, even without dilution.

These conclusions are also supported by the following information. The Department of the Army and Clean Water Branch of DOH have not required NPDES or 401 WQC permits, based on the conclusion that this project would not adversely impact state waters. The Division of Aquatic Resources has commented that the project will not affect existing in-stream conditions or affect native biota or ecosystems. These comments are included in this section.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Mr. Charles Jencks, Director
Department of Public Works and Waste Management
County of Maui
200 South High Street
Wailuku, HI 96793

October 18, 1996

RE: Response to Comments, dated 9/25/96 and 9/26/96, on Draft Environmental Assessment for Iao Treatment Facility & Pipeline

Dear Mr. Jencks,

Thank you for your review and comment on the Draft EA referenced above. We understand that no SUP or county permit will be required for this improvement.

Should you have any questions, please feel free to contact Ms. Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

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

October 21, 1996

RE: Response to comments dated 8/29/96, received 9/5/96, and subsequent revisions received 9/25/96 from Department of Public Works on Draft Environmental Assessment for Iao Treatment Facility and Pipeline

Dear Mr. Blane,

Thank you for your review and comment on the Draft EA referenced above. Pursuant to your suggestion, we contacted the Department of Public Works and Waste Management, and understand that after discussions between yourself and them that no SUP, CIZ or additional county permit will be required for the subject project.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

"By Water All Things Find Life"

LINDA CROCKETT LINGLE
Mayor

CHARLES JENCKS
Director

DAVID C. GOODE
Deputy Director

AARON SHINMOTO, P.E.
Chief Staff Engineer

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND WASTE MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

Solid Waste Division

September 26, 1996

Maui County Board of Water Supply
Water Resources & Planning Division
200 S. High Street, 5th Floor
Wailuku, HI 96793

Gentlemen:

Subject: DRAFT ENVIRONMENTAL ASSESSMENT
2 MGD IAO TREATMENT FACILITY AND PIPELINE
TMK:(2) 3-5-001:021 & 3-5-001:001

We reviewed the subject application and have no comments on the proposed project.

If you have any questions, please contact Aaron Shinmoto at 243-7845.

Sincerely,

CHARLES JENCKS
Director of Public Works
and Waste Management

AS:da/mt
cc: Engineering Division
Solid Waste Division
Wastewater Reclamation Division
g:\wcs\ctm\mgdiao.se

LINDA CROCKETT LINGLE
Mayor

0996010

DAVID W. BLANE
Director

GWEN OHASHI HIRAGA
Deputy Director

COUNTY OF MAUI
PLANNING DEPARTMENT
250 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793
August 29, 1996

Mr. David Craddick
Board of Water Supply
P. O. Box 1109
Wailuku, Hawaii 96793-7109

Dear Mr. Craddick:

RE: DRAFT ENVIRONMENTAL ASSESSMENT FOR IAO TREATMENT FACILITY AND RELATED PIPELINE, TMK: 3-5-01:0021 AND TMK: 3-5-01:0001, WAILUKU, MAUI, HAWAII

The Planning Department has reviewed the above Draft Environmental Assessment. Please be advised that the proposed use of a treatment facility is not a permitted use in the Agricultural District and you would, therefore, be required to obtain a State Land Use Commission Special Use Permit (SUP).

In addition, you are requested to contact the Department of Public Works and Waste Management (DPW&WM) for the appropriate County Zoning of the subject parcels. If the parcels are classified as being within the County Agricultural District, then a Conditional Use Permit will be required in addition to the SUP. If the parcels are located within the County Interim District, then a Use Variance will be required in addition to the SUP.

Thank you for the opportunity to comment. If further clarification is required, please contact Ms. Ann Cua of this office at 243-7735.

Very truly yours,

Gwen Hiraga

DAVID W. BLANE
Director of Planning

DWB:ATC:cmp
cc: Colleen Suyama, Planning Program Manager-Land Use Management Division
Clayton Yoshida, AICP, Staff Planner
Ann Cua, Staff Planner
David Goode, DPW&WM
General File
Project File (g:\planning\all\ann\craddick.ltr)

E Tani 20-0119

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RALPH NAGAMINE, L.S., P.E.
Land Use and Codes Administration

EASSIE MILLER, P.E.
Wastewater Reclamation Division

LLOYD P.C.W. LEE, P.E.
Engineering Division

BRIAN HASHIRO, P.E.
Highways Division

Solid Waste Division

COUNTY OF MAUI
DEPARTMENT OF PUBLIC WORKS
AND WASTE MANAGEMENT
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

September 25, 1996

MEMO TO: DAVID CRADDICK, DIRECTOR OF WATER SUPPLY

F R O M: CHARLES JENCKS, DIRECTOR OF PUBLIC WORKS

SUBJECT: IAO DITCH WATERLINE AND FILTRATION SYSTEM IMPROVEMENTS

I have discussed the above subject formally with the Planning Director, Mr. David Blane, and based upon my prior communication to you with regard to the special use permit and potential variance requirements for this project, we have agreed that at this time those applications need not be filed and that your proposed improvements are permitted per the current zoning. I repeat, no special use permit or additional County permit will be required for this subject improvement.

Should you have any questions, please feel free to call me at 243-7845.

CJ:mt

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109

Hawaiian Commercial & Sugar Company
PO Box 266
Puunene, Maui, Hawaii 96784

October 22, 1996

RE: Response to Comments dated 10/22/96, received 10/22/96, on Draft Environmental Assessment for Iao Treatment Facility and Related Pipeline

Dear Mr. Cameron,

Thank you for your review and comment on the Draft EA referenced above.

We understand from your letter that your concerns are primarily in two areas: The chemical residue from the clean-in-place Process at the plant, and the organics and particulates from the filter reject effluent. A backwash tank has been added to the project, to enable sedimentation of backwash solids before disposal of backwash water in to the ditch.

The clean in place process involves a 2% solution of sodium hydroxide. This solution is more dilute than additions to drinking water at selected storage tanks in the system. Chemical solution from the clean-in-place process is also recycled to a tank, and the same solution is expected to last for months. Clean-in-place solution is held in the tank and hauled away for disposal, so the only chemical addition to the ditch would be residue from the clean-in-place process. For two, one minute periods which occur every two to six weeks, (one for each CMF unit) backwash effluent may contain 64 parts per million upon entering the ditch. Apart from clean-in-place operations, during normal backwash, sodium hydroxide is not detectable in backwash effluent.

Any soil, organic matter, or other particulates contained in the backwash effluent are simply materials from the Iao Stream. As you know, the raw water in the Waihee Ditch at the location of the plant also has organics, particulates, soils and other matter. In fact, the raw water in the Waihee Ditch appears to have a greater loading of these materials, since it traverses a longer distance in the form of an uncovered ditch. Further, the backwash process uses

over two thousand gallons of raw water to clear the filters. The only increased concentration is from deposits on the filters. So backwash effluent is primarily un-altered stream water, with only some additional solids from the filters. It would be difficult if not impossible to detect any difference in organic loading due to the addition of stream water backwash effluent from the Iao Ditch.

We do not concur with the statement that our intention to utilize the ditch for backwash water was not made know to you. Our intention to utilize the ditch for backwash water was made clear to you during negotiations, as we requested credits for putting this water into the Waihee Ditch, but you allowed such credits only for returning water to the Iao Ditch. You were aware that we wanted to construct a treatment plant, and to deposit backwash water in the ditch. Given the extensive use of chemigation in your fields, your concern over this minute, trace addition is not warranted.

Finally, we point out that HC&S is already heartily compensated for potential agricultural losses due to lack of irrigation water by the lease agreement which you signed. There is special dispensation in this agreement for low flow conditions. We do not at all accept the proposition that water from the Waihee Ditch during the period of this project will adversely affect your irrigation operations. However, even if we did, we feel that your compensation is more than adequate. You may be interested to read other parties comments about that compensation in other letters in this section.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David Craddick
Director

BOARD OF WATER SUPPLY
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793-7109
Telephone (808) 243-7816 • Fax (808) 243-7833

Hawaiian Commercial & Sugar Company
PO Box 266
Puunene, Maui, Hawaii 96784

October 22, 1996

RE: Response to Comments dated 10/22/96, received 10/22/96, on Draft Environmental Assessment for Iao Treatment Facility and Related Pipeline

Dear Mr. Cameron,

Thank you for your review and comment on the Draft EA referenced above.

We understand from your letter that your concerns are primarily in two areas: The chemical residue from the clean-in-place Process at the plant, and the organics and particulates from the filter reject effluent.

The clean in place process involves a 2% solution of sodium hydroxide. This solution is more dilute than additions to drinking water at selected storage tanks in the system. Chemical solution from the clean-in-place process is also recycled to a tank, and the same solution is expected to last for months. Clean-in-place solution is held in the tank and hauled away for disposal, so the only chemical addition to the ditch would be residue from the clean-in-place process. For two, one minute periods which occur every two to six weeks, (one for each CMF unit) backwash effluent may contain 64 parts per million upon entering the ditch. Apart from clean-in-place operations, during normal backwash, sodium hydroxide is not detectable in backwash effluent.

Any soil, organic matter, or other particulates contained in the backwash effluent are simply materials from the Iao Stream. As you know, the raw water in the Waihee Ditch at the location of the plant also has organics, particulates, soils and other matter. In fact, the raw water in the Waihee Ditch appears to have a greater loading of these materials, since it traverses a longer distance in the form of an uncovered ditch. Further, the backwash process uses over two thousand gallons of raw water to clear the filters. The only increased concentration is from deposits on the filters. So backwash effluent is primarily un-altered stream water, with only some additional solids from the filters. It would be difficult if not impossible to detect any difference in organic loading due to the addition of stream water backwash effluent from the Iao Ditch.

We do not concur with the statement that our intention to utilize the ditch for backwash water was not made know to you. Our intention to utilize the ditch for backwash water was made clear to you during negotiations, as we requested credits for putting this water into the Waihee Ditch, but you allowed such credits only for returning water to the Iao Ditch. You were aware that we wanted to construct a treatment plant, and to deposit backwash water in the ditch. Given the extensive use of chemigation in your fields, your concern over this minute, trace addition is not warranted.

Finally, we point out that HC&S is already heartily compensated for potential agricultural losses due to lack of irrigation water by the lease agreement which you signed. There is special dispensation in this agreement for low flow conditions. We do not at all accept the proposition that water from the Waihee Ditch during the period of this project will adversely affect your irrigation operations. However, even if we did, we feel that your compensation is more than adequate.

Should you have any additional comments or concerns, please feel free to contact Ellen Kraftsow of my staff at 243-7835.

Sincerely,

David [illegible]addick
Director

A&B-HAWAII, INC.
HONOLULU

TELEPHONE: (808) 877-0081

HAWAIIAN COMMERCIAL & SUGAR COMPANY

P.O. BOX 266, PUUNENE, MAUI, HAWAII 96784

October 22, 1996

Mr. David Craddick, Director
Board of Water Supply
200 South High Street, 5th Floor
Wailuku, Hawaii 96793

Post-it® Fax Note 7671	Date 10/22	# of pages ▸ 2
To S. Kraftsow	From R.F. Cameron	
Co./Dept. DWS	Co. HC&SCo.	
Phone #	Phone # 877-6902	
Fax # 243-7833	Fax # 871-2149	

Dear Mr. Craddick:

SUBJECT: Iao Treatment Facility and Related Pipeline Draft Environmental Assessment

Thank you for this opportunity to provide comments on the preliminary consultation draft for the Iao Treatment Facility and Related Pipeline Draft Environmental Assessment. HC&S has the following comments concerning the project:

Section III.D. Proposed Water Treatment System:

1. HC&S is concerned about the plans to discharge the backwash effluent from the physical filter cleaning process into the Waihee Ditch. The soil, organic matter and other solids contained in the effluent may cause problems for our drip irrigation systems downstream of this area. A settling basin, tank or other means may be required to ensure that the undesirable solids are removed before the water enters Waihee Ditch.

2. HC&S is also concerned with the plans to undertake a chemical filter-cleaning process near our water supply ditches. We are concerned with the potential release of these chemicals into our ditches and water supplies. Accordingly, a mechanism must be developed to ensure that the chemical solution and/or any waters used in the chemical filter cleaning process which might contain chemical residue will not enter the Waihee Ditch.

   Please note that permission has never been requested nor granted to allow the Board of Water Supply to use chemicals in this process and deposit the washwater into our Waihee Ditch.

The Board should be liable for any damages that occur due to either of these filter cleaning process and should make any improvements necessary to protect the quality of the Waihee Ditch water.

Section V.F. Water Quality and Quantity:

HC&S' concerns about the quality of the backwash water that will be discharged to the Waihee Ditch are cited above. Although the backwash water will normally be diluted by the water in the ditch, at times the Waihee Ditch flow may be quite low, during a drought period, or non-existent when the ditch flow is curtailed for ditch cleaning and repairs. The flow at this portion of the Waihee Ditch has been significantly lower than the mean (as low as 8 MGD) during the past two weeks. Due to the variable ditch flows, the Board may not be able to discharge the backwash water from either the physical or chemical cleaning process into the Waihee Ditch if it causes any problems with our irrigation systems or our crops downstream. The Board shall, should be liable for any damages that occur.

Section V.H. Solids Management:

See comments in the two prior sections. HC&S would also like to assume that the waters from the two filter-cleaning processes will be benign and suitable for agricultural use. However, to be prudent, we must request the mitigating measures cited above and an assumption of all liability by the Board.

Section VI.C. Solids Management:

We repeat our comment to Section V.H. above. Mitigating measures may be necessary to address potential solids and chemical problems on our irrigation water systems and supplies.

Thank you for this opportunity to comment on this consultation draft. Please contact Rendall Moore at 877-6968 if you have any questions.

Sincerely,

R. F. Cameron
Plantation General Manager

cc: Avery Chumbley, Wailuku Agribusiness
OEQC