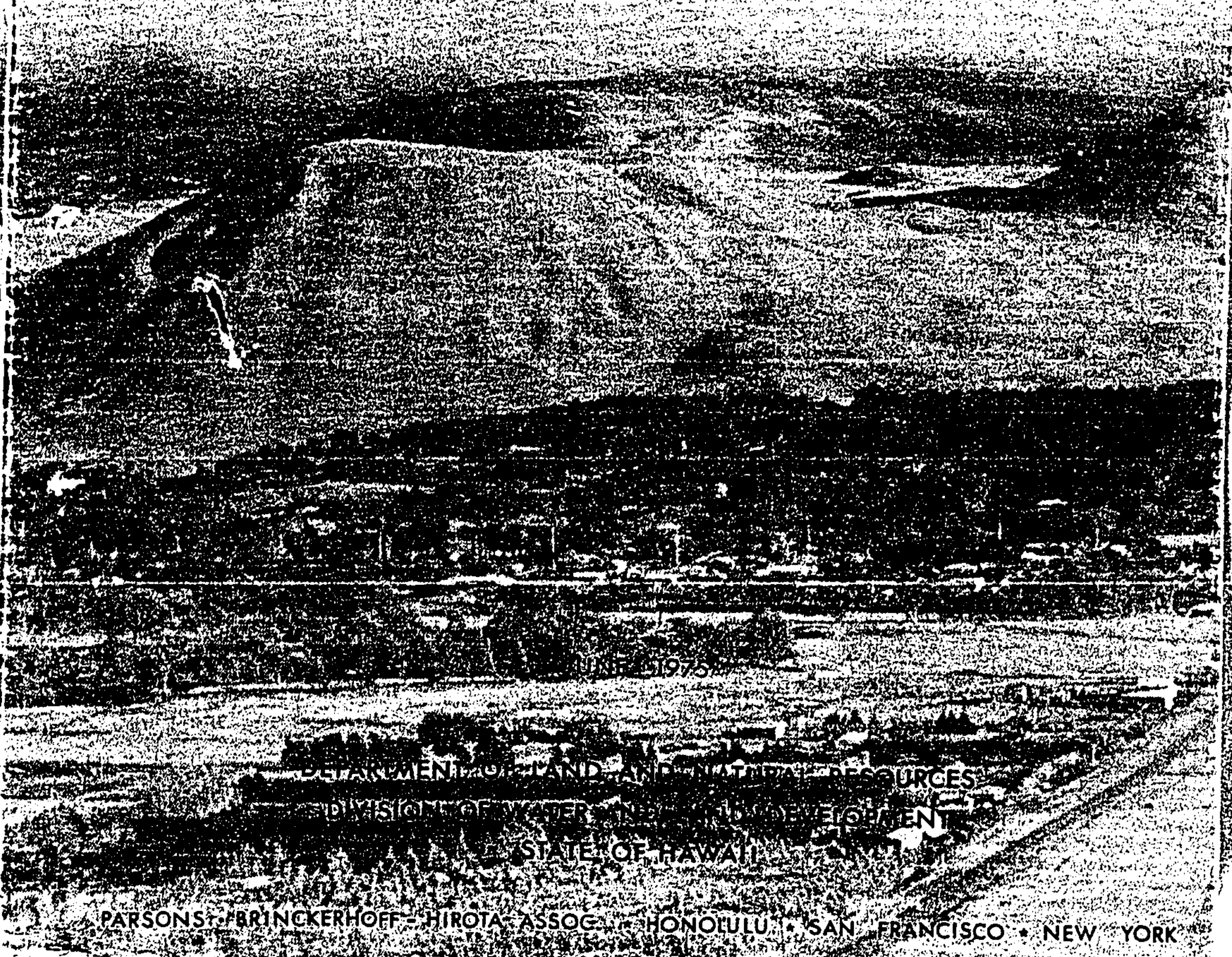
FINAL

ENVIRONMENTAL IMPACT STATEMENT

KOHAKOHAU DAM PROJECT

REPORT R 52

SOUTH KOHALA WATER PROJECT
ISLAND OF HAWAII



JUNE 1975

DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF WATER AND LAND DEVELOPMENT
STATE OF HAWAII

PARSONS - BRINCKERHOFF - HIROTA ASSOC. • HONOLULU • SAN FRANCISCO • NEW YORK

KOHAKOHAU DAM PROJECT FINAL EIS

COVER PHOTO:

The town of Waimea, Island of Hawaii and the Kohala foothills as seen from above the Waimea-Kohala Airport.

FINAL

ENVIRONMENTAL IMPACT STATEMENT

KOHAKOHAU DAM PROJECT

SOUTH KOHALA DISTRICT

ISLAND OF HAWAII

REPORT R 52

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF WATER AND LAND DEVELOPMENT

JUNE 1975

PARSONS BRINCKERHOFF-HIROTA ASSOCIATES
700 BISHOP STREET - SUITE 712 - HONOLULU, HAWAII

Description of Project:
Construction of a rock fill dam and attendant structures to impound Kohakohau Stream Waters and Diversions from the upper Hamakua Ditch. Dam location will be at an elevation of approximately 3700 ft. on the Kohakohau Stream near Waimea. Construction will be in two alternate stages with initial development resulting in an expected yield of 5 MGD and ultimate development yielding approximately 10 MGD. Thirteen percent of the system supplies will be used in the Waimea area, 12% in the Hamakua area and 75% in the Kawaihae Coastal area. Project will be owned and operated by the County of Hawaii Dept. of Water Supply. Estimated total cost is $20 million.

Revised on May 21, 1992

EIS Abstract Sheet

Abstract Number: 00301.0

OEQC Number:

Project Title:
Final Environmental Impact Statement for Kohakohau Dam Project

File Title:
Kohakohau Dam Project, South Kohala, Hawaii

Type & Date of Document:

X Final/Revised EIS	Date 06/ /75
_ Supplemental/Amended Final/Revised EIS	Date / /

Document Status & Date:

X Accepted by State	Date 07/ /76
_ Not Accepted by State	Date / /
_ Accepted by County	Date / /
_ Not Accepted by County	Date / /
_ Filed by Federal	Date / /
_ Not Filed by Federal	Date / /
_ Withdrawn	Date / /

Applicant(s):
1.
2.
3.
4.

Proposing Agency(s):
1. 301 S-DLNR-DOWALD
2.
3.
4.

Private Preparer(s):
1. Parsons Brinckerhoff-Hirota Associates
2.
3.
4.

Agency Preparer(s):
1.
2.
3.
4.

Accepting Authority(s)/Approving Agency(s):
1. 100 GOVERNOR
2.
3.
4.

EIS System:

( ) 1 NEPA ( ) 3 County ( ) 5 NEPA, County ( ) 7 State, County
(X) 2 State ( ) 4 NEPA, State ( ) 6 NEPA, State, County

Project Location:

(A) Island:	Judical District:	Area:
1. 03 Hawaii	37 South Kohala	37070 Waimea (Hawaii)
2.		
3.		
4.		

(B) Others

Tax Map Key(s):

1. 3-6-3- -	16. - - - -
2. - - - -	17. - - - -
3. - - - -	18. - - - -
4. - - - -	19. - - - -
5. - - - -	20. - - - -
6. - - - -	21. - - - -
7. - - - -	22. - - - -
8. - - - -	23. - - - -
9. - - - -	24. - - - -
10. - - - -	25. - - - -
11. - - - -	26. - - - -
12. - - - -	27. - - - -
13. - - - -	28. - - - -
14. - - - -	29. - - - -
15. - - - -	30. - - - -

Latitude: **Longitude:**

Type of Action(s):

( ) 01 Agriculture
( ) 02 Air Transporation
( ) 03 Aquaculture
( ) 04 Baseyards
( ) 05 Communications
( ) 06 Defense Operations
( ) 07 Dredging and Spoil Disposal
( ) 08 Educational Facilities
( ) 09 Energy Development
( ) 11 Fisheries/Marine Harvest
( ) 10 Flood Control/Drainage
( ) 12 Forestry
( ) 17 Grading/Filling
( ) 13 Hazadous Waste Management
( ) 14 Health Care Facilities
( ) 15 Hist/Arch Restoration
( ) 16 Hotels/Resorts
( ) 18 Industrial Facilities
( ) 19 Land Acquisition
( ) 20 Land Transportation
( ) 21 Land Use Change
( ) 22 Offices/Meeting Facilities
( ) 23 Parking Facilities
( ) 26 Parks & Recreation Facilities
( ) 24 Public Safety Facilities
( ) 25 Quarrying/Excavation/Mining
( ) 27 Research
( ) 28 Residential Development
( ) 29 Shopping Complex
( ) 30 Shoreline Management
( ) 31 Solid Waste Management
( ) 32 Waste Water Management
(X) 33 Water Resource Development
( ) 34 Water Transportation
( ) 35 Wildlife Management
( ) 99 Other ______________

Existing Condition(s):

( ) 01 Agriculture	( ) 15 Hazards Non-Natrl	( ) 31 Public Services
( ) 02 Air Quality	(X) 16 Hist/Arch Sites	(X) 32 Recreation
( ) 47 Aquaculture	( ) 17 History	( ) 33 Shore
(X) 03 Climate	( ) 18 Land Use	( ) 34 Soil
( ) 04 Conservation Land	( ) 19 Lifestyle	( ) 35 Solid Waste Disp
( ) 05 Economics	(X) 20 Nat Haz Erthquake	( ) 36 Structures
( ) 06 Employment	( ) 21 Nat Haz Flood	(X) 37 Surfce Water Hydr
( ) 45 Endg Sp/Habitats	( ) 22 Nat Haz Tsunami	(X) 38 Topo/Bathymetry
( ) 07 Erosion/Sediment	( ) 23 Nat Haz Volcano	( ) 39 Transportation
(X) 08 Fauna, Aquatic	( ) 24 Nat Haz Others	(X) 40 Utilities
(X) 09 Fauna, Terrest	( ) 25 Noise	( ) 41 Visual Setting
( ) 10 Flora, Aquatic	( ) 27 Oceanography	( ) 42 Waste Water Disp
(X) 11 Flora, Terrest	( ) 26 Pest Control	(X) 43 Water Quality
(X) 12 Geology	( ) 28 Population	(X) 44 Water Suply/Demnd
(X) 13 Grndwater Hydro	( ) 29 Project Backgrnd	( ) 46 Wind
( ) 14 Hazardous Waste	( ) 30 Public Hlth/Safty	( ) 99 Other ______

Impact(s):

( ) 01 Agriculture	( ) 15 Hazards Non-Natrl	( ) 31 Public Services
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( ) 13 Grndwater Hydro	( ) 29 Project Backgrnd	( ) 46 Wind
( ) 14 Hazardous Waste	( ) 30 Public Hlth/Safty	( ) 99 Other ______

Appendix(es):

( ) 01 Agriculture	( ) 15 Hazards Non-Natrl	( ) 31 Public Services
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( ) 47 Aquaculture	( ) 17 History	( ) 33 Shore
( ) 03 Climate	( ) 18 Land Use	( ) 34 Soil
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FINAL

ENVIRONMENTAL IMPACT STATEMENT

KOHAKOHAU DAM PROJECT

SUMMARY STATEMENT

I. Project Background and Description: In 1964 the State of Hawaii, Department of Land and Natural Resources, Division of Water and Land Development (DOWALD), and the County of Hawaii Department of Water Supply, made a study of the public water system in the South Kohala-Hamakua Region and outlined a water development program that would better meet the area's future water needs. Over the ensuing years, various elements of the program were implemented, including the construction of supply works, storage reservoirs, and an expanded treatment plant. In the study, the impoundment of Kohakohau streamwaters by a dam was proposed as a future measure. In 1970, the State Division of Water and Land Development completed a study supporting the engineering feasibility of constructing such a dam and reservoir. As currently proposed, the Kohakohau Dam Project would be located at approximate elevation 3,700 feet on the Kohakohau Stream near Waimea, Hawaii. The project would consist of a rock-fill dam and attendant structures to impound Kohakohau streamwaters and diversions from the Upper Hamakua Ditch. The project could be constructed in two alternate stages: (1) ultimate development, resulting in an expected yield of 10 mgd, and (2) initial development, resulting in an expected yield of 5 mgd. The initial development stage could later be expanded to the ultimate capacity. As a part of the Waimea-Kawaihae-Puukapu system of water supply facilities, the components of the Kohakohau Dam Project would be owned and operated by the County of Hawaii Department of Water Supply upon completion. The project waters would be used for domestic and municipal purposes. On the basis of potential water needs of the currently zoned urban lands in the South Kohala-Hamakua areas, about 13 percent of the system supplies would be used in the immediate Waimea area, about 12 percent exported to the Hamakua area, and 75 percent exported to the Kawaihae coastal area in South Kohala. The corresponding population supportable with these supplies would be as follows: Waimea area, 5200; Hamakua area, 8100; and Kawaihae area, 19,400.

II. Existing Environment: The study area comprises a gross area of approximately 1,000 acres, located within the Kohala Watershed Reserve and the Kohala Forest Reserve. Public access to the area is currently limited to entries for official purposes. The proposed facilities lie in a middle elevation, wet forest characterized by relatively sparse growths of tree ferns, shrubs and stunted trees. No rare or endangered plants are found in the area. Wildlife populations are generally small and are common to the islands, with the exception of the Koloa (a native duck). Two Koloas, the only species of plant life, birds, or mammals in the study area considered rare or endangered, were observed passing over the study area. There is no appreciable aquatic life in Kohakohau Stream. The area is believed to be too wet and high in elevation to have been devoted to ancient agriculture or other uses and exhibits no historic or archaeologic sites today. Air quality and noise levels in the study area are virtually unaffected by human activities. Kohakohau streamwaters generally exhibit high physical and chemical qualities with the exception of occasional high color and peaty taste. Intermittent flooding occurs during intense rainfall periods, but downstream damage has been minimal. The study area is located in a Zone III seismicity area (as is the entire island of Hawaii) and is comparable to the seismically active area of Southern California. The South Kohala-Hamakua region of the island of Hawaii exhibits a decentralized distribution of population and land use. Population in the combined districts has increased since 1970, reversing the declining trend of the period 1920 to 1970. The economy of the region is partially dominated by agriculture.

III. Future Environment Without the Project: No significant changes in physical and environmental characteristics of the project study area are expected without the Kohakohau Dam Project. Anticipated changes in socio-economic conditions include a growth in population and economic activity in the region and primarily in the South Kohala District. Projections indicate substantial future resort, residential, and commercial growth in the area and primarily along the South Kohala coastline, which is expected to spur economic activity and shift labor and income away from agricultural patterns. Existing water supplies will be insufficient to meet expected increasing demands within the near future.

IV. Impact of the Kohakohau Dam Project: The Kohakohau Dam Project will inundate approximately 120 or 80 acres of middle elevation, wet forest and will provide an estimated 10 or 5 million gallons per day of potable water for South Kohala and Hamakua, depending upon development stage of the project. Construction, access, and quarry areas will sustain surface damage but will revegetate. Habitat areas for a small population of birds and mammals will be disturbed, but relocation of the species to surrounding areas will occur. An increase in wet land habitat for the Koloa (endangered duck species) will be provided. Intermittent flooding on Kohakohau Stream will be minimized. Less than 1 percent of the total area of the Kohala Forest Reserve will be changed from the existing condition. Although the natural visual character of 3,000 to 4,000 feet of the Kohakohau Stream system will be lost to inundation, only a negligible impact to the visual quality of the Kohala slopes and foothills will result from proposed facilities. No historic or archaeologic sites will be affected by the project. Air pollution and noise levels in the study area will increase moderately during the construction period. Kohakohau streamwaters will exhibit a temporary increase in turbidity and solids concentrations, and flows below the dam will be attenuated and probably reduced upon completion of facilities. The safety of the proposed Kohakohau Dam under earthquake loading was analyzed, indicating that under the most critical and improbable possible conditions (i.e., maximum potential earthquake with full reservoir, resulting in settlement of the dam and cracking of the impervious concrete membrane), the estimated leakage from the reservoir would not erode or displace the rockfill dam and would correspond to the maximum probable flow of Kohakohau Stream from which no appreciable downstream damage will result. The Kohakohau Dam Project will provide a significant increase in the available domestic water supply in South Kohala and Hamakua, which may result in a slight acceleration in expected residential, commercial, and resort development in the region. A small number of jobs may be created for local workers, and a short-term surge in local economic activity will result from the work force during construction of the project. Potential hydroelectric generation facilities may result in slightly reduced power rates in the region.

V. <u>Unavoidable Adverse Impacts</u>: Adverse impacts expected to be unavoidable with available preventive and remedial measures include temporary surface damages by excavation and stripping which will be minimized in the long-term by revegetation, loss of up to 4,000 feet of the Kohakohau Stream by inundation, temporary reductions in air and water qualities during construction, and potential reduction in stream flows below the dam. Minimal adverse effects will include the slight visual intrusion of proposed facilities and the conversion of a small area of the Kohala Forest and Watershed Reserve acreages to an accessory use.

VI. <u>Alternatives to the Kohakohau Dam Project</u>: Eight alternatives considered to have potential engineering, economic, and environmental feasibility in meeting the objectives of the Kohakohau Dam Project were investigated.

They are: (1) tunneling for dike-confined ground water, (2) pumping of Waipio Valley surface waters, (3) pumping of Kehena Ditch waters, (4) drilling for fresh basal water at elevation 2,700 feet, (5) drilling for basal water at elevation 1,200 feet, (6) desalination of sea-water, (7) successive use of existing waters, and (8) incremental improvements to existing facilities and other suggestions. Alternative dam sites evaluated in previous studies were scrutinized. In addition, the alternative of no action was considered. The most practicable and reliable alternatives from an engineering standpoint are (a) the Kohakohau Dam Project, (b) the pumping of Waipio Valley surface waters, and (c) the drilling for fresh basal water at high elevations (near 2,700 feet). Tunneling for suspected dike-confined ground water involves uncertainty and risks, as does the drilling for suspected fresh water at lower elevations. Desalination and successive use of existing waters may be feasible in the future. In summary, other alternatives exhibit high exploration and development costs or offer unknown or unreliable yields in comparison with the Kohakohau Dam Project. The no-action alternative would necessitate the public or private development of localized and incremental water supplies where water is available and would result in insufficient supplies in water-lacking areas. The Kohakohau Dam Project offers the most reliable and economical solution of the alternatives evaluated and results in minimal environmental disturbances. No other alternative exhibits comparable advantages in reliability, cost, and environmental compatibility.

VII. <u>Comments on the Draft Environmental Impact Statement</u>: Comments submitted in the review process and as written testimony are summarized later in this report and are presented with responses in Appendix B.

FINAL

ENVIRONMENTAL IMPACT STATEMENT
KOHAKOHAU DAM PROJECT, SOUTH KOHALA, HAWAII

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FINAL ENVIRONMENTAL IMPACT STATEMENT

KOHAKOHAU DAM PROJECT

INTRODUCTION

In the early 1960's domestic water supplies in South Kohala and Hamakua were troubled with problems of droughts and poor qualities of color and taste. Recognizing the development potential of South Kohala, and anticipating future domestic water requirements in the area, the Hawaii State Department of Land and Natural Resources, Division of Water and Land Development, studied potential water supply sources and systems for the South Kohala and Hamakua Districts and prepared recommendations for the development of identified water resources to alleviate existing problems and meet projected demands. 1/ In 1965, the Department of Land and Natural Resources completed A Water Development Plan for South Kohala - Hamakua 2/ which outlined a program of specific actions to provide a reliable and adequate system for domestic water supply in South Kohala. Many of the proposed facilities have been completed and are now operated by the County of Hawaii Department of Water Supply. Among the measures suggested to meet future water demands was the development of an impoundment on Kohakohau Stream, which had received previous attention and investigation. In 1970 the Department of Land and Natural Resources, Division of Water and Land Development, completed a report 3/ supporting the engineering

1/ Reference 34.
2/ Reference 31.
3/ Reference 36.

feasibility of constructing a dam and reservoir on the Kohakohau Stream above Waimea, Hawaii. The project would impound waters from the Kohakohau and Alakahi Streams for use in the South Kohala and Hamakua Districts.

This environmental impact statement has been prepared to investigate and assess potential environmental effects of the Kohakohau Dam Project. In addition, it documents comments and concerns expressed by interested parties during the course of the environmental impact studies. This statement is submitted in compliance with the Executive Order, August 23, 1971 4/ of the Governor of Hawaii, and the guidelines presented in the Draft Manual for the Preparation and Processing of Environmental Impact Statements 5/ of the State of Hawaii. In addition, the National Environmental Policy Act of 1969 (NEPA) 6/ has been consulted in the preparation of this statement.

4/ Reference 48.
5/ Reference 47,
6/ Reference 67.

I. PROJECT IDENTIFICATION

1 - Project Location

The project is located in the South Kohala District of the island of Hawaii, State of Hawaii, the largest and southernmost island in the Hawaiian Archipelago (see Figures 1 and 2). As shown in Figure 3, the Kohakohau Stream flows from near the summit of the Kohala Mountains southeastward toward the town of Waimea and then westward to the Pacific Ocean. The gross project study area, as shown in Figure 4, encompasses an area of about 1,000 acres and is located approximately one to three miles north-northwest of the Waimea town boundary and primarily within lands owned or held by the State of Hawaii.

As shown in Figure 4, the project study area is located within the Kohala Watershed Reserve of the Kohala Forest Reserve and within a proposed "protective subzone" of a State of Hawaii conservation district 7/ . As a restricted watershed, the area is accessible only by special permit in accordance with requirements designated by the Department of Health. As a portion of a proposed "protective subzone" of a state conservation district, the area would be reserved for designated uses intended to protect natural areas such as restricted watersheds, fish and wildlife sanctuaries, natural reserves, and significant historic and archaeologic sites. Permitted conditional uses would include recreational hunting and the development of water collection, pumping, storage, and transmission facilities. These conditional

7/ As defined in Reference 40.

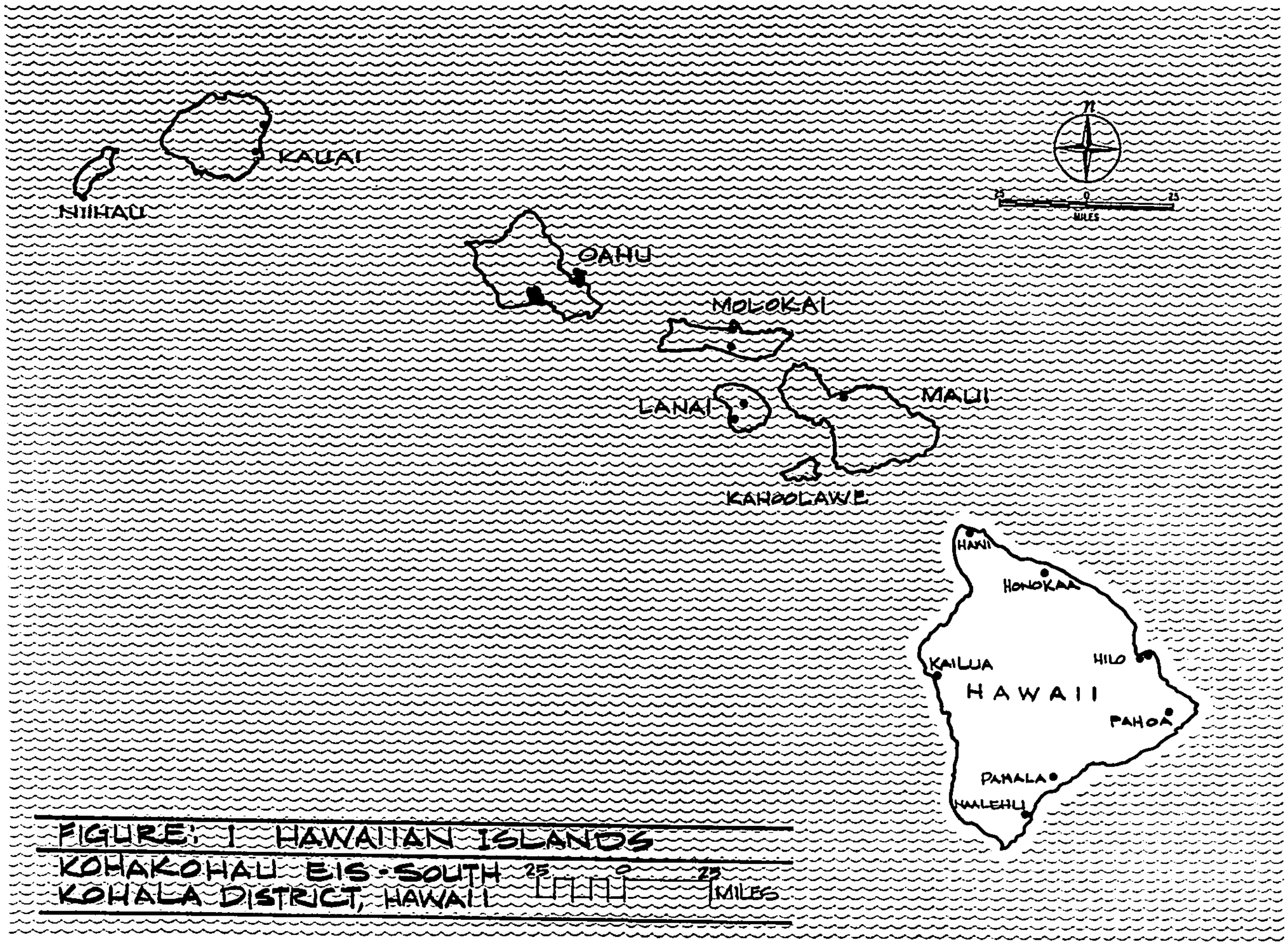


FIGURE: 1 HAWAIIAN ISLANDS
KOHAKOHAU EIS - SOUTH
KOHALA DISTRICT, HAWAII
25 0 25 MILES

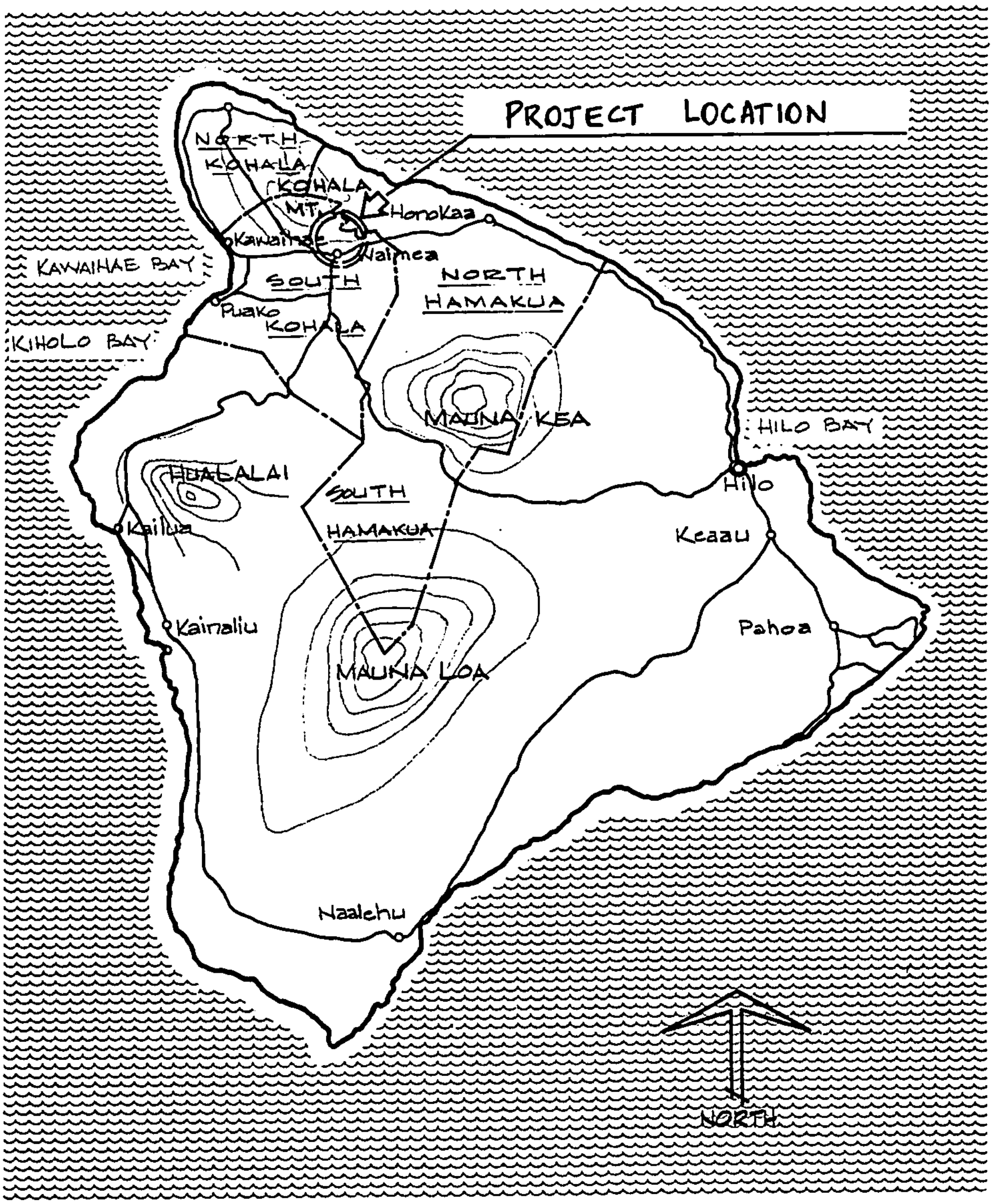


FIGURE : 2 ISLAND OF HAWAII

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

5 0 5 10 15 MILES

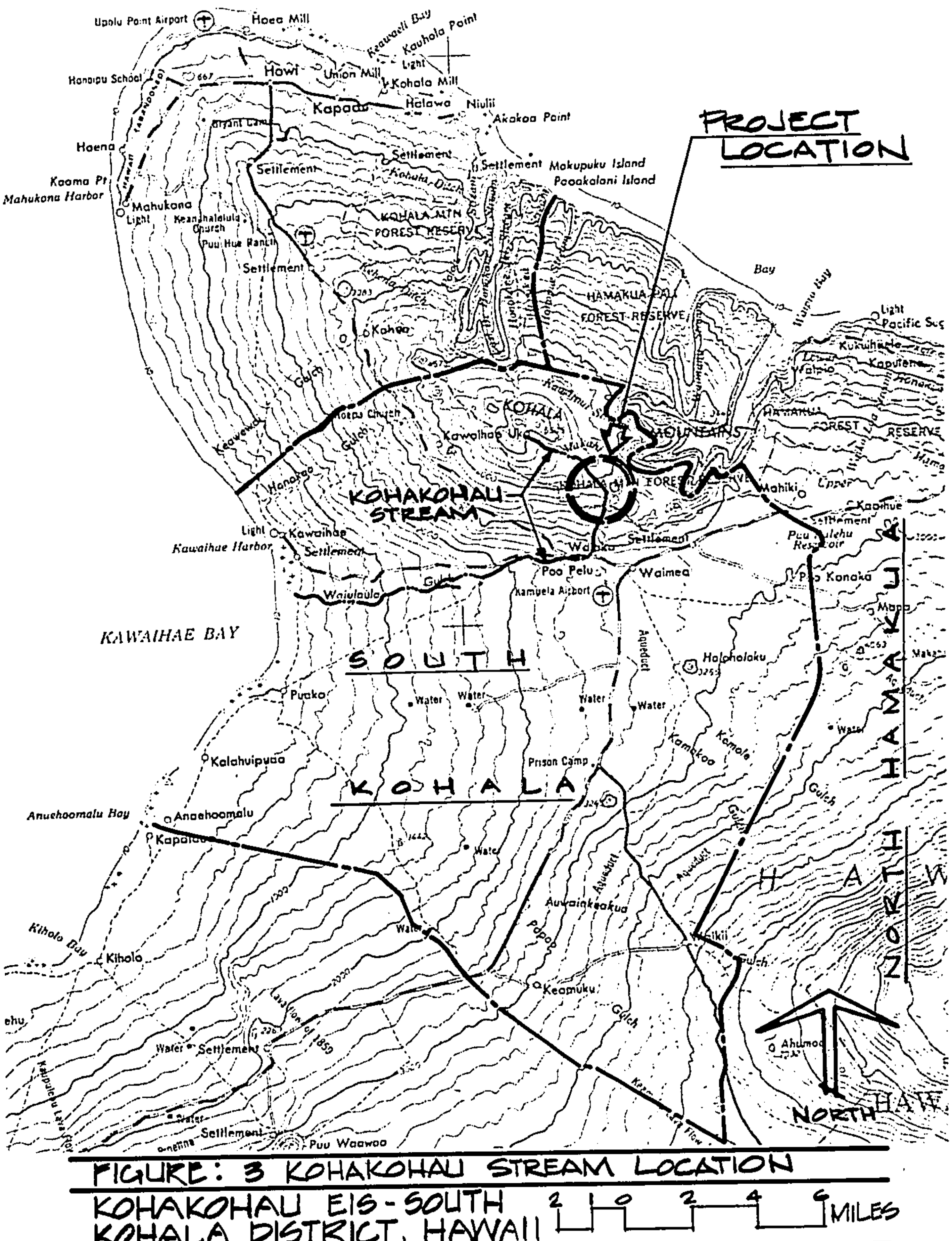


FIGURE: 3 KOHAKOHAU STREAM LOCATION

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

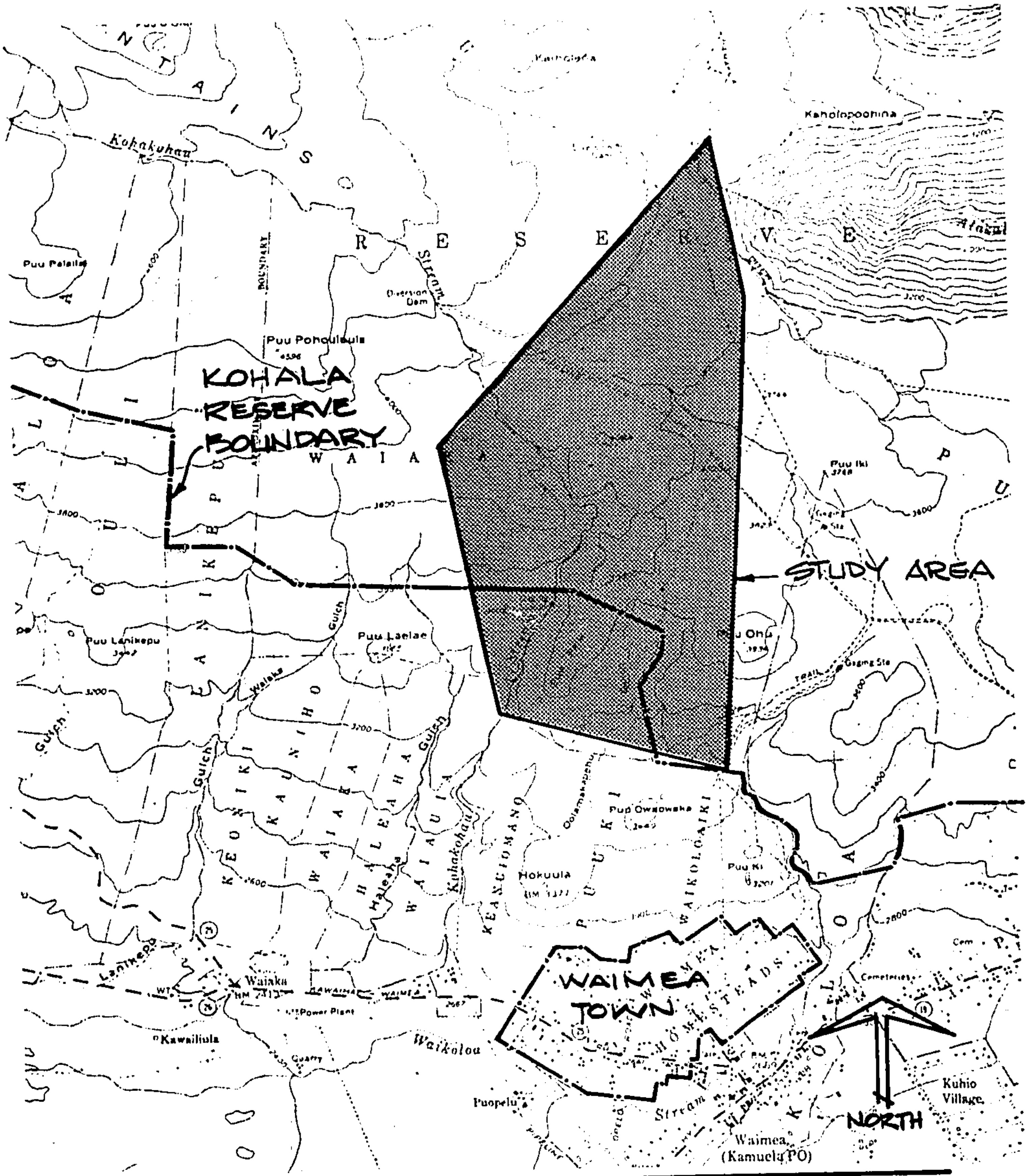


FIGURE : 4 KOHAKOHAU STUDY AREA

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

1000 0 1000 3000 FEET

uses would be governed by the Board of Land and Natural Resources, State of Hawaii, in order to promote intended objectives of the protective sub-zone.

The project study area (an estimated 1,000 acres) comprises approximately 2 per cent of the total area of the Kohala Forest Reserve, approximately 10 per cent of the total area of the Kohala Watershed Reserve, and an unknown per cent of the total area of the proposed protective subzone in which it would be located. Areas permanently affected by components of the project would represent a small portion of the total 1,000 - acre study area. These areas are identified in following discussions of the existing environment and the impacts of the Kohakohau Dam Project.

2 - Project Description

This environmental impact statement addresses the elements of the Kohakohau Dam Project as identified in previous studies and as further delineated and detailed in subsequent studies, investigations, and discussions. As currently proposed, the Kohakohau Dam Project comprises the elements discussed as follows.

A - Development Alternatives

Facilities considered in the Kohakohau Dam Project could be provided in two alternate schemes of development: (1) Ultimate development, resulting in an expected yield of 10 mgd, and (2) Staged development, resulting in an initial yield of 5 mgd which would be increased to 10 mgd at a future date by the expansion of facilities and structures. Each of these development alternatives is discussed as follows in terms of the major components required, the peripheral considerations, and the estimated construction costs.

B - Major Project Elements

Major facilities proposed in the Kohakohau Dam Project, as shown in Figure 5, and common to both the ultimate development and staged development alternatives, are (1) the primary dam structure, (2) the spillway chute, (3) the outlet pipe, and (4) the Upper Hamakua Ditch (UHD) diversion. Each development alternative incorporates unique features discussed as follows:

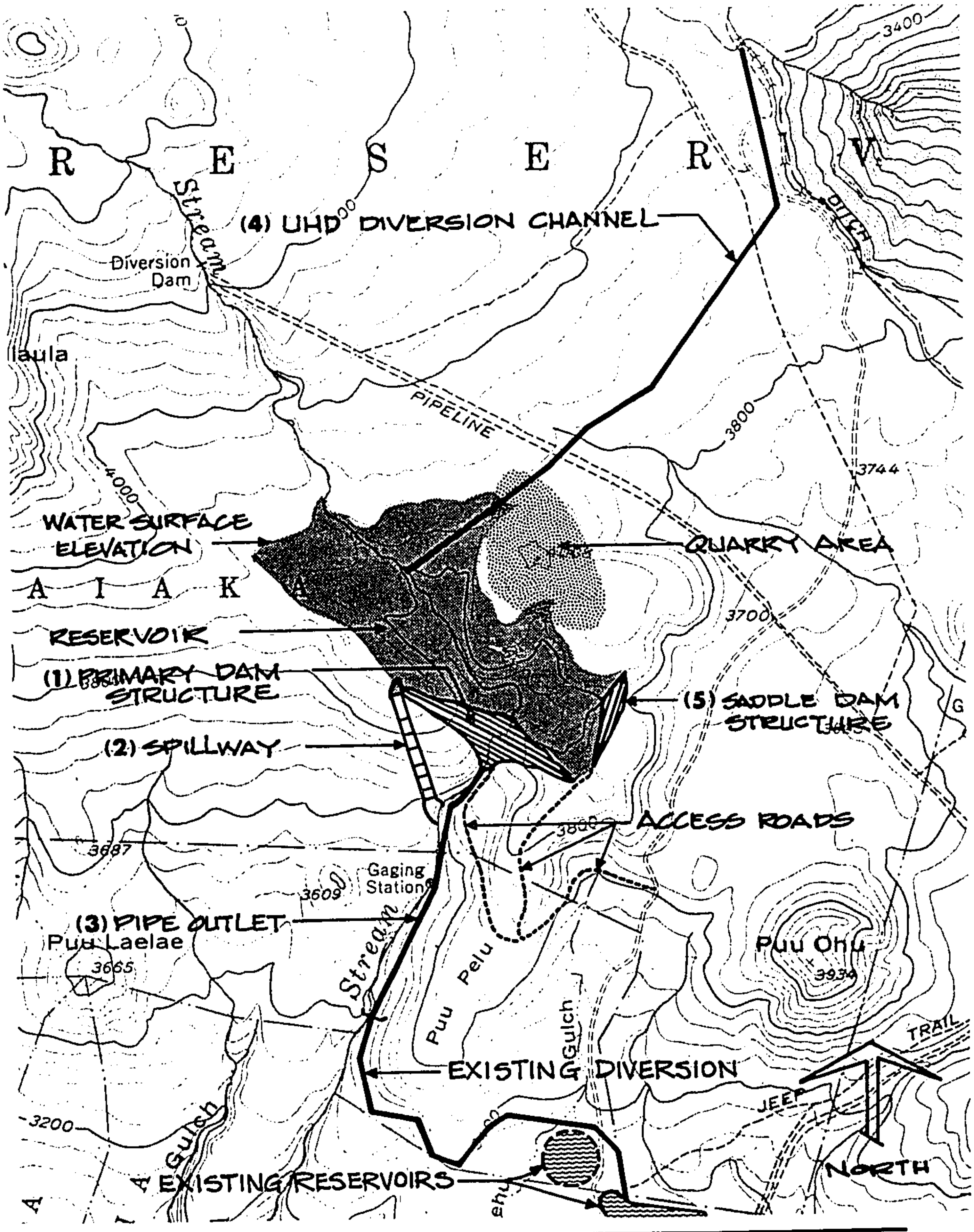


FIGURE: 5 ULTIMATE DEVELOPMENT ALTERNATIVE

KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII

500 0 500 1500 FEET

1. Ultimate Development. Components of the ultimate development alternative, as shown in Figure 5, are:

a. Primary dam structure. The proposed dam would be constructed of rock fill with a reinforced concrete surface membrane and would rise 205 feet from the bottom stream elevation of 3,675 feet to elevation 3,880 feet.

b. Saddle dam structure. Also constructed of rock fill with a reinforced concrete membrane, the proposed saddle dam would rise 85 feet from the low point of the saddle.

c. Spillway. The preliminary spillway investigation specifies a 115-foot-wide structure about 1,100 feet in total length.

d. Outlet pipe. The proposed outlet pipe would extend some 4,030 feet from the reservoir to the existing Kohakohau Diversion pipeline, at approximate elevation 3,405 feet.

e. Upper Hamakua Ditch (UHD) Diversion Channel. The proposed 5-foot-wide channel would extend some 7,000 feet to the UHD at the Alakahi Stream.

The primary and saddle dams would impound waters of the Kohakohau and Alakahi Streams to a working surface level of 3,869 feet in elevation. The proposed rock quarry area shown in Figure 5 was identified in the 1970 Feasibility Report 8/ as the best potential source of required construction material. Access trails and roads would be required approximately in the

8/ Reference 36.

areas indicated.

2. Staged Development. Components of the initial stage of development, as shown in Figure 6, are:

a. Primary dam structure. The proposed dam would be constructed of rock fill with a reinforced concrete surface membrane and would rise 145 feet from the stream bottom to an elevation of 3,820 feet.

b. Spillway. A structure of 115 feet in width and about 1,100 feet in length would be required.

c. Outlet pipe. The pipe required would extend from the reservoir to the existing Kohakohau Diversion pipeline.

d. UHD Diversion Channel. The required channel would extend the same 7,000 foot length to the Upper Hamakua Ditch at the Alakahi Stream.

The primary dam would impound water to a normal surface level of 3,807 feet in elevation. Required construction materials would be obtained from the same proposed quarry area, but in a smaller quantity. Access roads and trails would be required in essentially the same locations and scale as in the ultimate development alternative.

To reach the ultimate (10mgd) expected capacity of the site, the initial stage facilities could be expanded to the size of the ultimate development structures essentially by (1) extending the primary dam from elevation 3,820 to elevation 3,880 feet, (2) relocating the spillway structure, and(3) constructing the saddle dam.

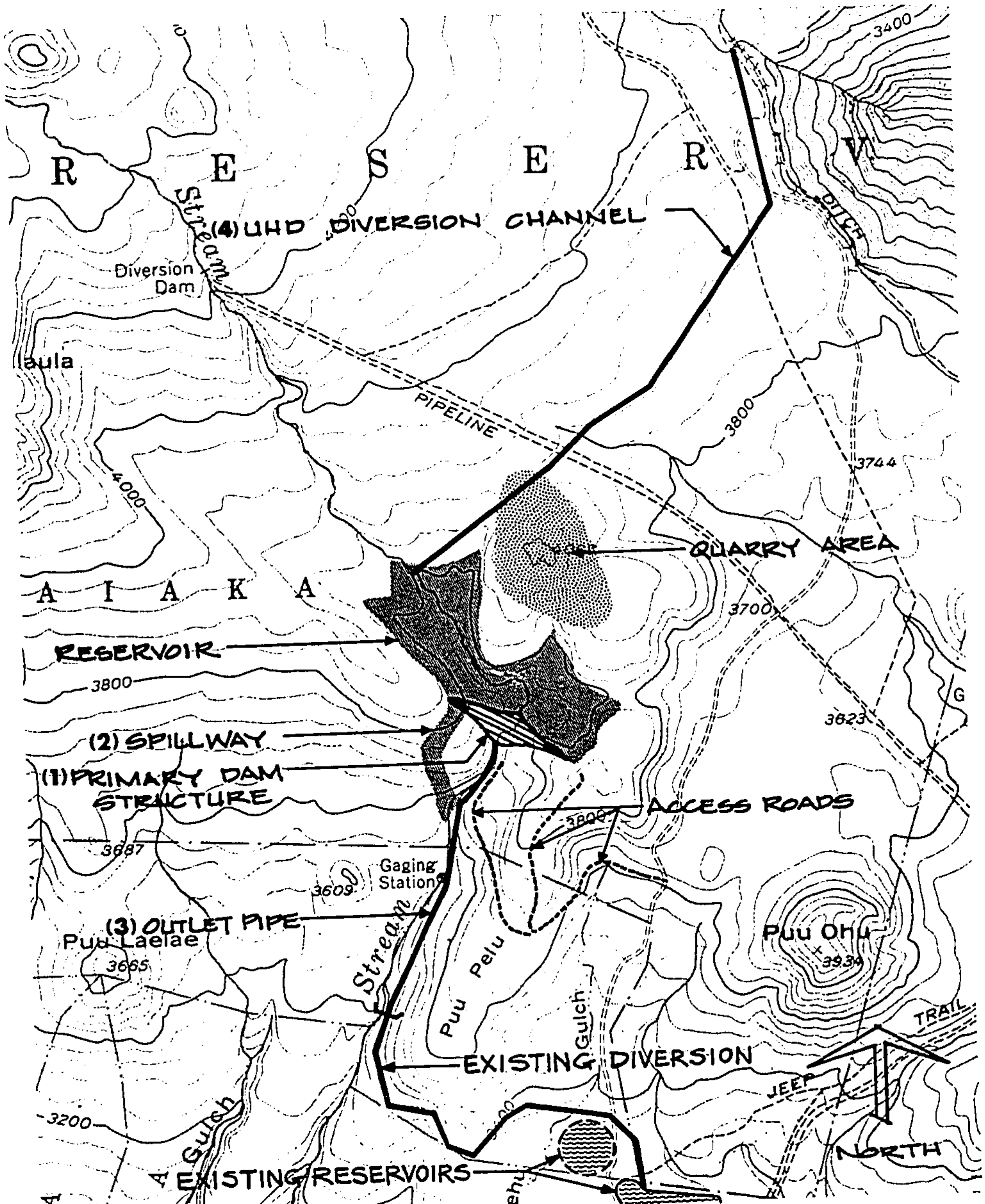


FIGURE: 6 INITIAL DEVELOPMENT ALTERNATIVE

KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII

500 0 500 1500 FEET

C - Disturbed Areas and Other Considerations

Activities in the potential construction and operation of the Kohakohau Dam Project are expected to result in disturbance to the surface areas described as follows:

1. Area of Inundation. The area inundated in the initial stage of development would be approximately 80 acres; in the ultimate development alternative, approximately 120 acres.

2. UHD Diversion Area. In either development alternative the area affected would be a strip approximately 7,000 feet in length from the reservoir to the existing junction of the Upper Hamakua Ditch and the Alakahi Stream. Maximum width of the channel would be 5 feet, and the section width required for construction would be about 20 feet.

3. Outlet Pipe Area. In either development alternative the area affected would be a strip approximately 4,000 feet in length from the primary dam to the existing Kohakohau Stream Diversion. The section required for construction would be about 20 feet.

4. Dam Fill Area. The area covered by fill material for the primary dam in the initial stage of development would be approximately 8 acres; in the ultimate development alternative, approximately 10 acres for the primary dam and 5 acres for the saddle dam.

5. Spillway Area. In either development alternative the area affected would be approximately 115 feet in width by 1,100 feet in length, or about three acres.

6. Quarry Area. Each development alternative would require some quantity of rock materials from the area shown in Figures 5 and 6 which comprises approximately 40 acres upstream from the site of the primary dam. This area would be stripped and cleared to expose underlying rock materials.

7. Access Areas. Each development alternative would require major access routes in the locations shown in Figures 5 and 6 and minor access routes and trails throughout the project area.

In addition to these disruptions, construction of proposed facilities would entail (1) the temporary diversion of Kohakohau Streamwaters, and (2) the dewatering or filling of swampy areas where construction activities would be hampered.

1. Diversion of Streamwaters. As discussed in the 1970 Feasibility Report, 9/ diversion during construction could be achieved in the following ways:

a. Construction of a temporary cofferdam at a point about 1,000 feet upstream of the dam axis where the valley is narrow, perhaps near one of the waterfalls, and diversion of the water along the west abutment in a closed or open conduit. The elevation of the temporary diversion along the abutment and the conduit will depend upon the elevation and location of the temporary diversion dam. Once the construction of the pipe outlet through the dam is completed and the dam extends fully across the valley to a sufficient elevation, the pipe outlet can be used

9/ Ibid.

to divert the stream. Advantage can be taken of the storage volume provided by the dam to attenuate flows that exceed the pipe outlet capacity.

b. Construction of a tunnel through the west abutment which would serve as a diversion conduit during construction of the dam and as the spillway outlet after the dam is completed. The tunnel would be fitted with a vertical shaft morning glory spillway in the final condition.

2. Dewatering or Filling of Swampy Areas. Problems have been encountered in the past with the operation of equipment in the wet areas in the Forest Reserve. Existing access trails to the site and to other pipelines and ditches above the study area employ imported materials for stable and dry conditions. It is expected that activities in the wetter portions of the project area would encounter similar problems and require dewatering or filling.

D - Estimated Costs

Cost estimates were developed in the 1970 Feasibility Report 10/ for (1) Initial Stage, (2) Final Stage, and (3) Ultimate Development alternatives based on construction cost data guides, bids for previous water-related construction projects, and information obtained from local contractors. Table 1 presents a summary of those 1969 costs and estimated

10/ Ibid.

1974 equivalent costs. 11/ These revised figures represent expected construction costs if construction would occur in 1974. Clearly the uncertainty of inflationary trends and attendant increases in costs of materials, equipment, and labor could make these updated costs unrealistic. More importantly, the total lead time (e.g., the time required for planning, design, and construction) in implementing the Kohakohau Dam Project is estimated as 4 to 5 years, implying that these estimated 1974 costs could well increase another 30 percent (at current inflationary rates) before completion of the project.

Table 1

Updated Construction Cost Estimates

Development Alternative	Construction Year	
	1969	1974
(1) Initial Stage	$ 5.95 Million	$ 8.0 Million
(2) Final Stage	9.51 Million	12.5 Million
Total (Two-Stage)	15.46 Million	20.0 Million
(3) Ultimate (One-Stage)	14.26 Million	18.5 Million

11/ 1974 costs estimated as 30 percent higher than in 1969, based primarily on the First Hawaiian Bank construction cost index (Reference 15).

3 - Project Background and Purpose

A - Historical Narrative

In the early 1960's the domestic water supply facilities in South Kohala and Hamakua were unable to meet demand requirements during drought periods and exhibited substandard quality conditions of color and taste. With anticipation of additional domestic water demands from new coastal developments, concerns grew for the need for additional and reliable water supply facilities in the districts. In the period 1962 to 1964, the State of Hawaii, Department of Land and Natural Resources, Division of Water and Land Development, completed two preliminary reconnaissance studies, the Interim Report on Hamakua-Kohala Water Study, 12/ and the Preliminary Report on the Water Resources of Kohala Mountain and Mauna Kea.13/ These studies indentified known sources of water and recommended further investigations of certain promising sources to evaluate future development potentials.

Then, in 1964, the Division of Water and Land Development undertook a comprehensive analysis of existing and potential domestic water supplies and facilities for South Kohala and Hamakua and, in the 1965 report, A Water Development Plan for South Kohala - Hamakua, 14/ presented a water development plan which would provide water for the demands of the foreseeable future by tapping surface waters on the southern slope of Kohala Mountain.

12/ Reference 34.
13/ Reference 39.
14/ Reference 31.

The elements of that plan included diversion, transmission, storage, and treatment facilities on the Waikoloa and Kohakohau Streams. Damming of the Kohakohau Stream was proposed "as a means of augmenting the water supply when future demands exceed 3.3 million gallons a day." 15/ Since that time the elements proposed in the recommended plan have been completed or are under construction (see Figure 8 and discussion of existing facilities) with the exception of the Kohakohau Dam Project.

In 1970 the State Division of Water and Land Development completed the Kohakohau Dam Engineering Feasibility 16/ study which investigated alternative dam sites and supported the engineering feasibility of a dam at an approximate elevation of 3,700 feet on the Kohakohau Stream. As previously discussed, that study outlines the project addressed in this environmental impact statement.

B - Existing Facilities

Existing domestic and agricultural water supply systems in the South Kohala and Hamakua Districts are summarized as follows and are shown on Figures 7, 8, and 9.

1. Domestic Systems. Three major domestic systems presently use water from South Kohala sources: (1) the Kawaihae-Puako System, (2) the Waimea-Puukapu System, and (3) the Hamakua System, as shown in Figure 7. South Kohala water supply facilities are shown in Figure 8. Those facilities include (1) the

15/ Ibid, page 6.
16/ Reference 36.

Waikoloa Diversion, (2) the lower 50 million gallon reservoir, (3) the Kohakohau Diversion, (4) the filtration plant, and (5) the upper 50-million gallon reservoir (under constuction).

Some private water supply and transmission facilities have been developed to meet local needs. Principal among these systems in the South Kohala and Hamakua Districts is the Boise-Cascade System, which employs privately-developed wells. The location of this system is shown in Figure 7.

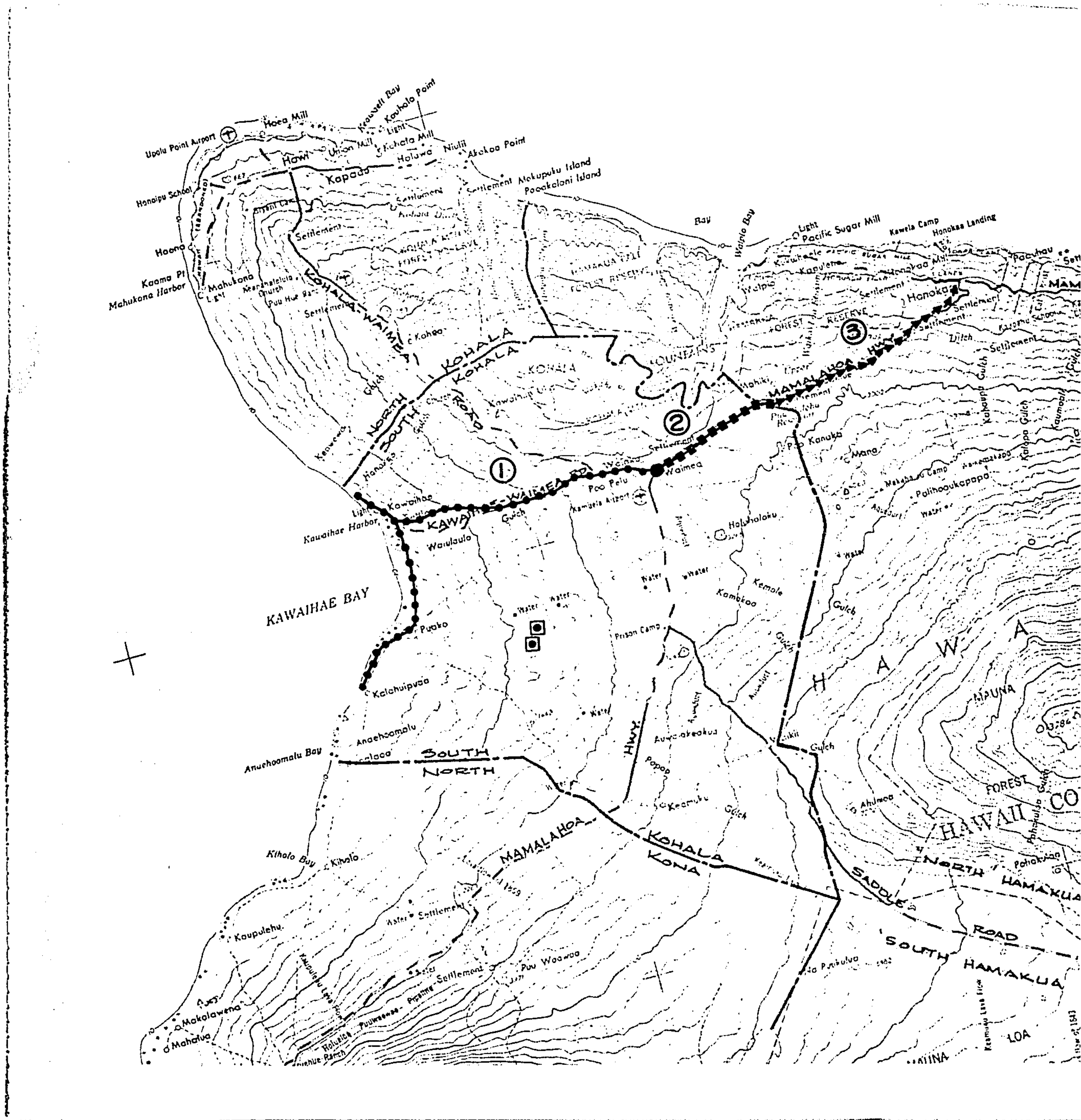
2. Agricultural Systems. Major agricultural systems in the South Kohala and Hamakua Districts are: (1) the Lalamilo Irrigation System, (2) the Parker Ranch System, and (3) the Hawaiian Irrigation Company System, shown in Figure 9.

C - Planned Facilities

As shown in Figure 7, the Hawaii County Department of Water Supply has proposed a 20-inch pipeline following the alignment of the proposed Waimea-Kawaihae Road. Other improvements include construction of a new water main from Waimea to Honokaa (presently under contract). The upper 50-million gallon reservoir (see Figure 8) was scheduled for completion in early 1975.

D - The Role of the Kohakohau Dam Project

The Kohakohau Dam Project would supplement existing facilities in the South Kohala supply system (see Figure 8) by providing a total storage capacity and estimated yield of 390 million gallons and 5 mgd for the initial development alterna-



Upolu Point Airport
Hawi
Kapaau
Mahukona Harbor
KOHALA-WAIMEA
NORTH KOHALA
SOUTH KOHALA
Kawaihae Harbor
KAWAIHAE BAY
Puako
Waimea
Waipio Bay
Pacific Sugar Mill
Honokaa
MAMALAHOA HWY.
Anaehoomalu Bay
Kiholo Bay
Kaupulehu
Makalawena
KOHALA
KONA
SADDLE ROAD
NORTH HAMAKUA
SOUTH HAMAKUA
HAWAII

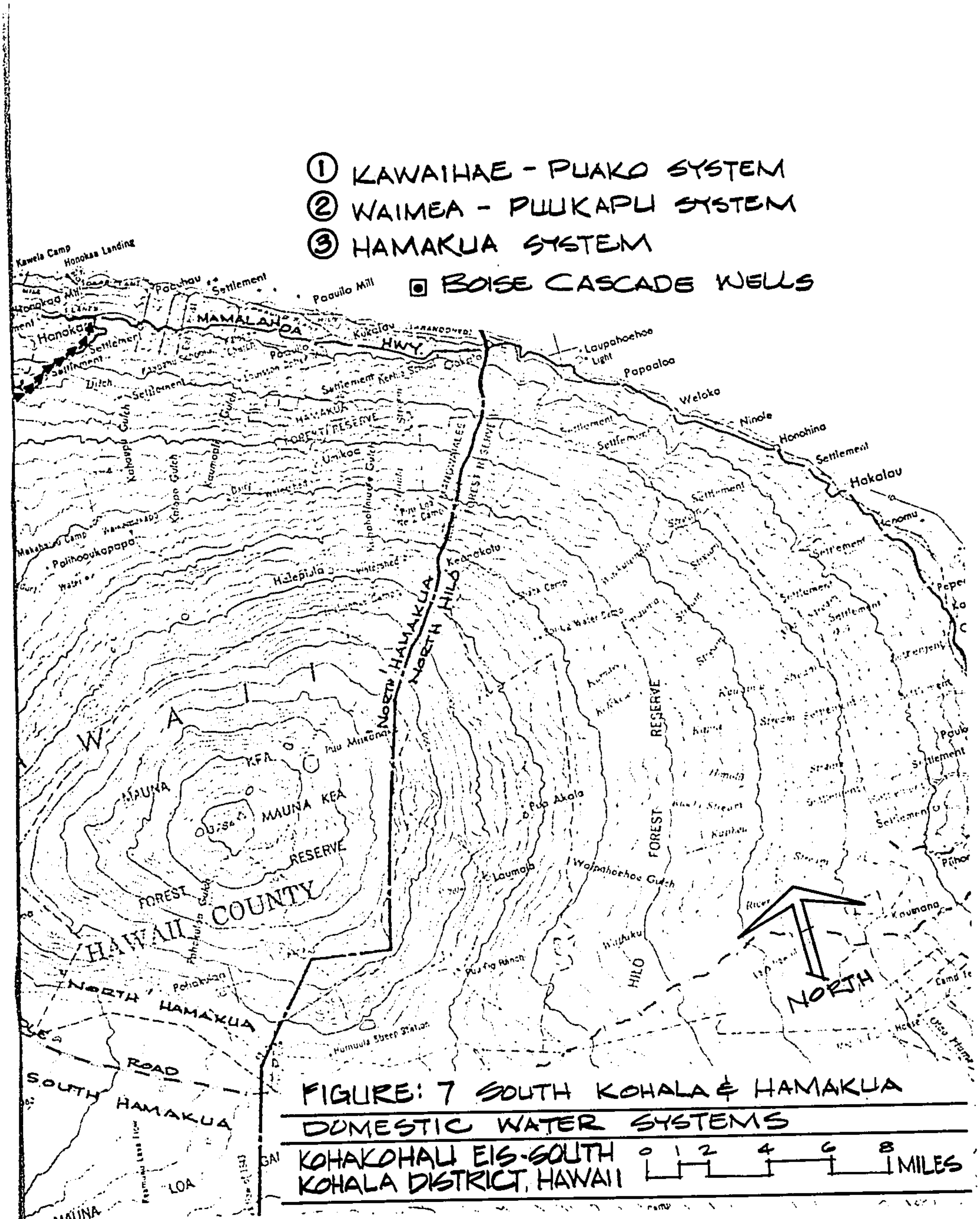
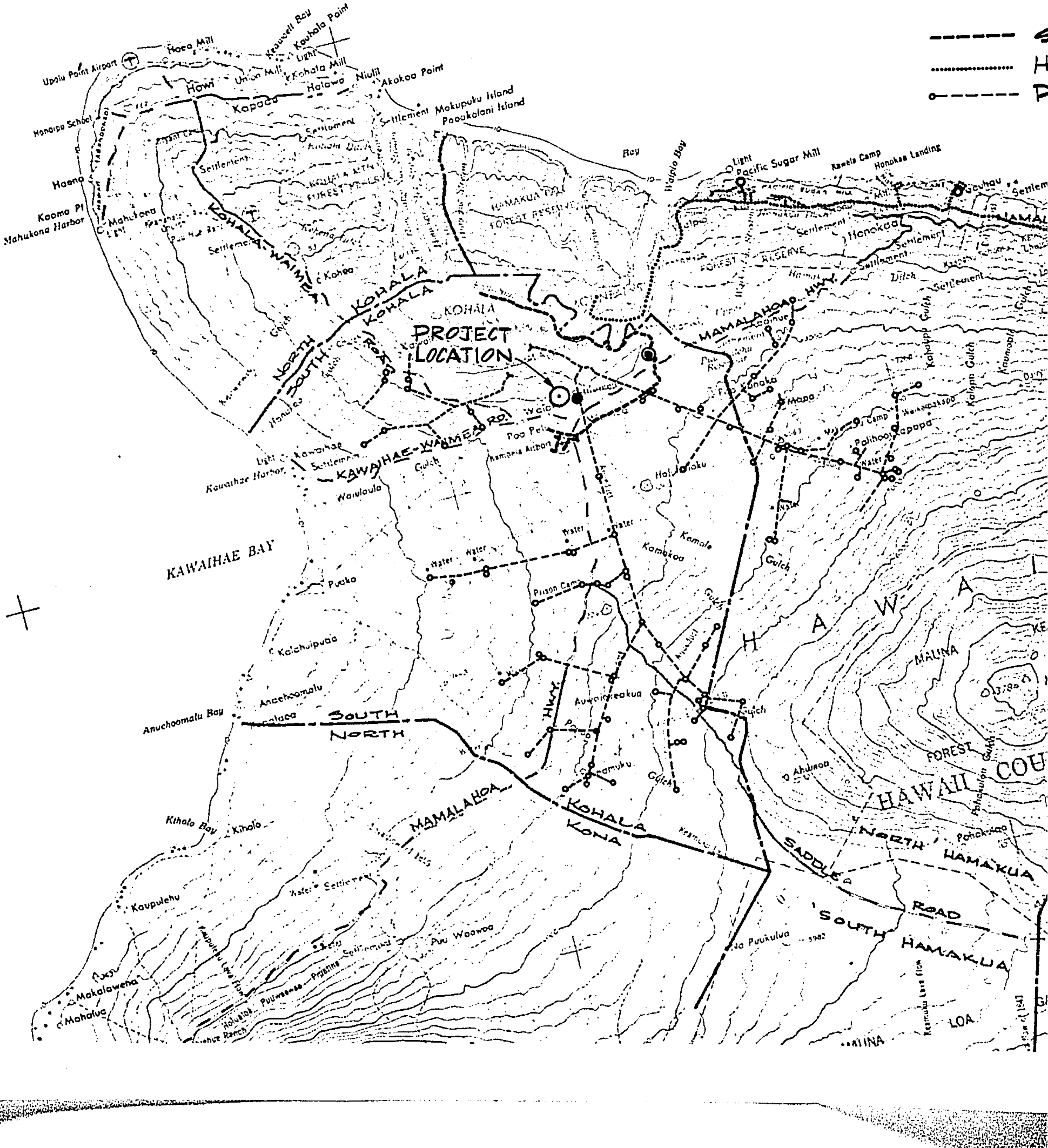


FIGURE: 7 SOUTH KOHALA & HAMAKUA DOMESTIC WATER SYSTEMS

KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII



PROJECT LOCATION
NORTH KOHALA
SOUTH KOHALA
KOHALA-WAIMEA
KAWAIHAE-WAIMEA RD.
MAMALAHOA HWY.
KAWAIHAE BAY
SOUTH
NORTH
MAMALAHOA
KOHALA
KONA
HWY.
SADDLE ROAD
NORTH HAMAKUA
SOUTH HAMAKUA
HAWAII COU
MAUNA
FOREST
Upolu Point Airport
Hawi
Kapaau
Halawa
Niulii
Akakoa Point
Mahukona Harbor
Kawaihae Harbor
Kawaihae
Puako
Anaehoomalu Bay
Kiholo Bay
Kiholo
Kaupulehu
Makalawena
Mahaiula
Puu Waawaa
Waipio Bay
Pacific Sugar Mill
Honokaa
Kawela Camp
Honokaa Landing
Poo Pelo
Holoholoku
Kamakoa
Prison Camp
Ahumoa
Puu Kulua
Kohala Mill
Union Mill
Hoea Mill
Settlement
Kohala Forest Reserve
Hamakua Forest Reserve
Water
Gulch

------ STATE SYSTEM (Irrigation)
.... HAWAIIAN IRRIGATION Co. SYSTEM (Irr'tn & Domestic)
o------ PARKER RANCH SYSTEM (STOCK)

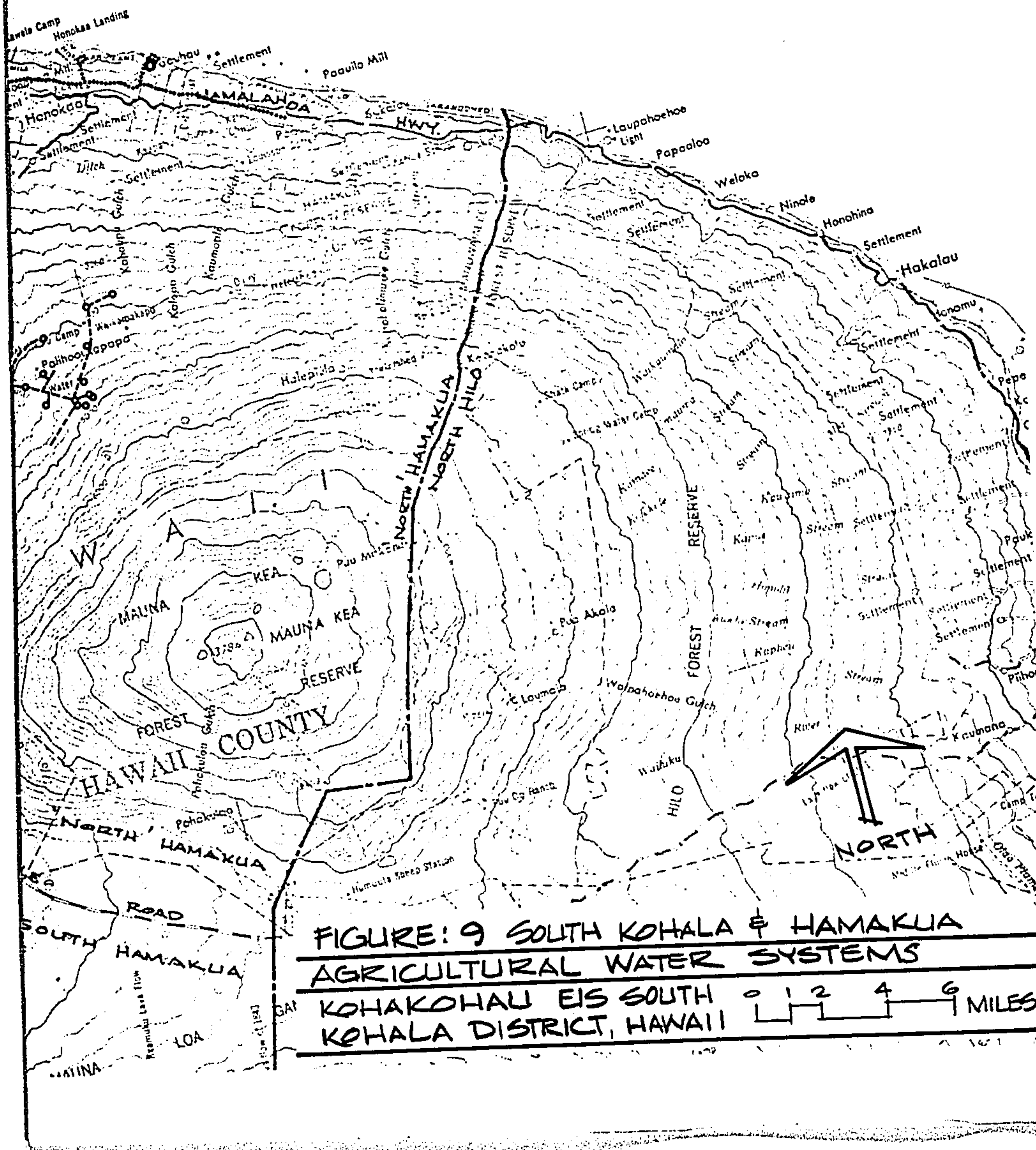


FIGURE: 9 SOUTH KOHALA & HAMAKUA AGRICULTURAL WATER SYSTEMS
KOHAKOHAU EIS SOUTH KOHALA DISTRICT, HAWAII

tive or 1,787 million gallons and 10 mgd for the ultimate development alternative. Impounded waters would be used primarily to meet existing and future domestic demands.

It is intended that surface waters impounded by the dam would be treated and used in Waimea and Hamakua, and mixed with brackish well water in the coastal areas (see Figure 22 and accompanying discussion of brackish well development). By mixing these fresh waters with brackish well water on a variable mix basis (depending upon salinity of the well water), the total domestic yield provided in coastal areas would be a multiple of the quantity of impounded water used. Based upon the potential needs of the currently zoned lands in the South Kohala-Hamakua areas, about 13 percent of the system supplies would be consumed in the immediate Waimea area, about 12 percent exported to the Hamakua area and 75 percent exported to the Kawaihae coastal lands of South Kohala.

E - Legal Considerations

The State of Hawaii Division of Water and Land Development has conducted investigations of the water rights and other legal considerations in relation to the South Kohala-Hamakua Water Study and Kohakohau Stream studies.[17/] Studies and negotiations have culminated in written agreements and court decisions with Kohakohau Stream, Waikoloa Stream, and Upper Hamakua Ditch (UHD) water right holders concerning the proposed Kohakohau Dam Project.

[17/] See References 38 and 78.

In brief, the agreements represent the conclusion of negotiations to the satisfaction of all parties concerned and permit major future draws above the potential damsite by private water right holders and very small claims to waters below the potential damsite. No legal minimum flow requirement exists below the proposed damsite other than that flow required to supply that minor private claim.

4 - Current Status of the Project

The 1970 Feasibility Report 18/ on the Kohakohau Dam Project represents the completion of preliminary planning and engineering studies for the project. No additional studies have been completed or initiated since that time, no construction bids have been solicited or contracts negotiated, and no State construction funds are presently appropriated for the project. It is intended that after this environmental impact statement is completed and analyzed, a decision will be made on whether or not to proceed with the project as presently proposed or in a modified form.

Should the decision be made to proceed with the project as outlined in the 1970 Feasibility Report, 19/ it is certain that additional engineering studies would be required before construction would begin. Precise future dates for construction and completion could not be predicted at this time; however, it is estimated that actual construction of the dam and supporting structures would require a minimum of two or three years with a construction force in the order of fifty workers. Total lead time (e.g., the time required for planning, site explorations, design, advertising and negotiating of contracts, and actual construction) for the project is estimated to be four or five years; therefore, should the decision be made in early 1975 to proceed with the project, completion of proposed facilities could not be expected before 1979 or 1980.

18/ Reference 36.
19/ Ibid.

II. EXISTING ENVIRONMENT

SOCIO-ECONOMIC SETTING

1 - Historic and Archaelogic Potential

The North and South Kohala Districts of the island of Hawaii exhibit a rich history and display numerous existing sites and places of historic and archaeologic interest. As the birthplace of King Kamehameha I, the Kohala area is significant in Hawaiian history.

A - History

In about 450 A.D. the Hawaiian Islands were occupied by people of the Polynesian race. A large number of immigrants, believed to be from Tahiti, arrived about 1100 A.D. The great Hawaiian warrior and ruler King Kamehameha I was born in Kohala in 1736. The first recorded contact by Europeans with the Hawaiian Islands was in 1778 when Captain James Cook visited, and the island of Hawaii first received European visitors in 1779 when Captain Cook dropped anchor in Kealakekua Bay, south of where Kailua is located today, on the western shore of the island. In 1793 British Captain George Vancouver commented on the "villages and plantations of the fertile, populous western part of Kohala and the rich productive plains of Waimea."20/ Having cattle on board as a gift for King Kamehameha I, Vancouver especially noted the "luxuriant natural pasture" in Waimea. In 1820, missionaries on the sailing ship Thaddeus described the

20/ Historical quotations taken from Reference 44.

"green slopes of Kohala." Other explorers before 1800 described the area from Mahukona (in the North Kohala District) to Puako (south of Kawaihae) as "extensively cultivated and productive."

During the late eighteenth and early nineteenth centuries, commerce and other activities in the Kohala areas effected changes in the natural landscape. In 1832 the Rev. Lorenzo Lyons, a Congregational missionary living in Waimea, wrote, "Kawaihae is about as desolate a place as I have ever seen, nothing but barrenness with here and there a native hut." The forest which had extended to a much lower elevation than today had been destroyed by trade in sandalwood (iliahi), cutting of the remaining trees for firewood, and the large wild herds of cattle and goats descendant from Vancouver's original herd. In 1815 John Palmer Parker was hired to thin these wild herds and remained to establish the Parker Ranch which still operates today as one of the largest ranches in the world.

B - Archaeologic Potential

There is considerable visible evidence remaing today that large Hawaiian settlements were located in the Kohala areas prior to 1800. The ruins of numerous large stone temples (heiaus), walls of former Hawaiian villages, and remnants of ancient agricultural systems are visible in the lower coastal areas of the North Kohala, South Kohala, and Kona Districts. Large temple platforms and enclosures built of local rock are preserved at Kawaihae, and the Puukohola Heiau, at Kawaihae, is listed as a State historic site and a National Historic Landmark. In addition, petroglyphs have been found near the

Lalamilo agricultural area, 21/ approximately ten miles south and west of the proposed damsite, as shown on Figure 10.

Although numerous visible historic sites exist along coastal lands and lowlands in West Hawaii, and an extensive system of ancient rock walls, believed to have marked agricultural plots, on the northwestern slope of Kohala Mountain is discernable from the air, there is no evidence that similar or other sites exist in the study area (see Figure 4). The area is believed to be too high in elevation to have been devoted to ancient agriculture and could only have been visited in transitory uses.

The Federal Register and the State list of Historic Sites include no sites within the study area. The State of Hawaii, Department of Land and Natural Resources, Division of State Parks has analyzed available records and stereo air photographs and has found no historic or archaeological sites in the area. Field surveys of the study area conducted for general reconnaissance and studies of flora and fauna during January, February, and March, 1974, resulted in no sightings of suspected historic or archaeologic sites.

In addition, contacts with other agencies and historians including the Bishop Museum, the Kamuela Museum, the University of Hawaii Department of Anthropology (Manoa), the University of Hawaii Department of Social Sciences (Hilo), and the County of Hawaii Planning Department have resulted in the identification of no known historic or archaeologic sites in the study area.

21/ From Reference 6.

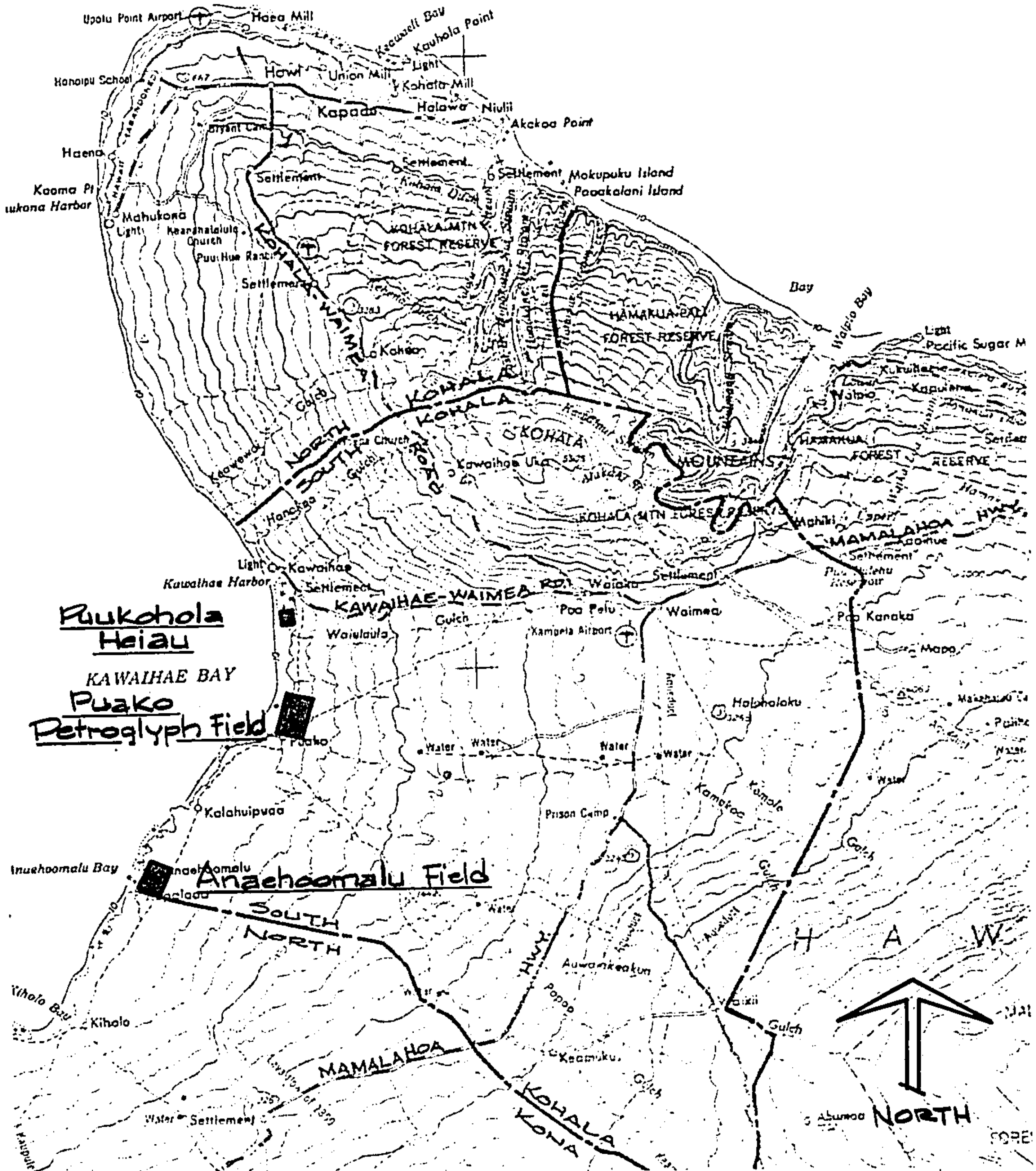


FIGURE: 10 HISTORIC SITES NEAR WAIMEA, HAWAII

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

0 1 2 4 6 8 MILES

2 - General Development Patterns

The Hamakua District, historically dependent economically on the sugar cane industry, has exhibited a decline in population and development since before 1950. This decline has been largely caused by the mechanization of sugar plantations. Within the district, sugar, cattle, macadamia nuts, and diversified agriculture provide income and employment. There has been some migration into the town of Honokaa, the commercial and residential center of the district, but the district population has continued to decline. Tourism has historically played no significant role in the Hamakua District.

The South Kohala District, on the other hand, has exhibited a significant growth trend since 1950,and, in the decade 1960 to 1970, displayed the greatest percentage increase in population of any district in Hawaii County. Within the district, cattle ranching, diversified agriculture, and tourism are primary bases of income and employment. There is presently a considerable amount of investor interest in South Kohala, and several large resort and residential development projects are planned south of Waimea and along the coast. Kawaihae Harbor is the second deepwater port on the island and provides the opportunity for new recreational, commerical, and industrial activities, although no substantial activity or development has been realized to date.

The opening of the Mauna Kea Beach Hotel in 1965 and the development of irrigated tracts for truck farming in the Lalamilo area in 1961 have spurred activity in the South Kohala District in the 1960's.

3 - Population and Land Use

A - Population

Historical resident population in the South Kohala and Hamakua Districts is given in Table 2. 22/ As indicated, 1970 marked the first census year that the trend of declining population in the combined districts was reversed, resulting from the significant growth in the South Kohala District from 1960 to 1970 (an increase of 772 persons, representing a 50.2% change in ten years).

B - Land Use

The South Kohala and Hamakua Districts comprise a combined total of over 570,000 acres of land area (about 890 square miles, or 22 percent of the total area of the island of Hawaii). Of that combined total, about 174,000 acres are included in the South Kohala District (about 30 percent) and about 396,000 acres comprise the Hamakua District (the remaining 70 percent).

The State of Hawaii Land Use Commission has classified all lands of the State by four designations: (1) Urban, (2) Rural, (3) Agricultural, and (4) Conservation. These designations provide the legal framework for implementing planning objectives and regulating land uses. The Comprehensive Zoning Ordinance for the County of Hawaii 23/ is the legal instrument which regulates the use of land in the judicial districts and establishes nine zoning categories: (1) Single-family resi-

22/ Data for Table 2 are taken from Reference 8.
23/ Reference 5.

Table 2

Resident Population, South Kohala and Hamakua Districts 1920 - 1971.

	Jan.1 1920	Apr.1 1930	Apr.1 1940	Apr.1 1950	Apr.1 1960	Apr.1 1970	Jul.1 1971
South Kohala District	1,304	1,250	1,352	1,505	1,538	2,310	2,394
Waimea					657	756	
Other					881	1,554	
Hamakua District	9,122	8,864	8,244	6,056	5,221	4,648	4,795
Honokaa					1,247	1,555	
Kukuihaele					424	310	
Paauilo					1,059	710	
Other					2,491	2,073	
TOTAL	10,426	10,114	9,595	7,561	6,759	6,958	7,189

dential, (2) Multiple residential, (3) Resort, (4) Commercial, (5) Industrial, (6) Residential-Agriculture, (7) Agriculture, (8) Open, and (9) Unplanned.

Within the South Kohala and Hamakua Districts, the Waimea, Kawaihae, and Honokaa-Paauilo areas exhibit the greatest relative current development as evidenced by the numbers of acres of lands devoted to urban and high-density uses. Large areas in each of the districts are either zoned for urban and high-density uses and are vacant or are zoned as "Unplanned" and are presumably available for future development.

4 - Economy and Employment

A - Economic and Manpower Indicators

Tables 3 and 4 present selected economic indicators for the South Kohala and Hamakua Districts based on 1970 Census data. 24/ As indicated, "other industries", primarily agriculture, employ a high proportion of the workers in each district. In the South Kohala District, truck farming and ranching employed nearly one-quarter of all workers; in the Hamakua District, sugar production employed a high percentage of workers. Other important industries in the Hamakua District are manufacturing and personal services.

Median 1969 family income was $9,181 in the South Kohala District and $8,373 in the Hamakua District, compared with the Hawaii County median of $9,750 and the State median of $11,553. Lower income levels in these districts are attributed to the partial domination of agricultural activities. Unemployment was 4.1 per cent in South Kohala and 1.5 per cent in Hamakua, compared with the Hawaii County rate of 2.8 per cent and the State rate of 3.0 per cent.

24/ Reference 68.

Table 3

1969 Economic and Manpower Indicators, Profile A

ITEM	SOUTH KOHALA DISTRICT		HAMAKUA DISTRICT	
	Number	Percent Distribution	Number	Percent Distribution
Population				
Total	2,310	100.0	4,648	100.0
White	906	39.2	1,611	34.7
Non-White	1,404	60.8	3,037	65.3
Labor Force Status				
Civilian Labor Force	951	100.0	1,816	100.0
Employed	912	95.9	1,788	98.5
Unemployed	39	4.1	28	1.5
Class of Worker				
Total Workers	912	100.0	1,788	100.0
Wage & Salaried	740	81.1	1,348	75.4
Government	90	9.1	296	16.5
Self-employed	66	7.2	139	7.8
Unpaid Family Worker	16	1.8	5	0.3
Industry				
Total Workers	912	100.0	1,788	100.0
Construction	124	13.5	156	8.7
Manufacturing	21	2.3	501	28.0
Transportation	28	3.1	16	1.0
Comm. & Utilities	9	1.0	30	1.7
Wholesale Trade	8	0.9	0	0
Retail Trade	145	15.9	145	8.1
Fiance, Ins. & Real Estate	32	3.5	11	0.6
Business & Repair Services	14	1.5	5	0.3
Personal Services	163	17.9	192	10.7
Health Services	18	2.0	47	2.6
Educational Services	92	10.0	109	6.1
Other Professional Services	17	1.9	37	2.1
Public Administration	28	3.1	118	6.6
Other Industries	213	23.4	421	23.5

Table 4

1969 Economic and Manpower Indicators, Profile B

ITEM	SOUTH KOHALA DISTRICT		HAMAKUA DISTRICT	
	Number	Percent Distribution	Number	Percent Distribution
Occupation				
Total Workers	912	100.0	1,788	100.0
Professional & Technical	99	10.8	128	7.1
Managerial & Administrative	94	10.3	68	3.8
Sales Workers	63	6.9	47	2.6
Clerical Workers	90	9.9	126	7.0
Craftmen & Foremen	150	16.4	319	17.8
Operatives	73	8.0	281	15.7
Laborers, exc. farm	47	5.2	132	7.4
Farm Workers	151	16.6	376	21.0
Service Workers	126	13.8	290	16.2
Private Household Workers	19	2.1	21	1.2
Income - 1969				
Total families	562	100.0	1,086	100.0
Median Family Income	$9,181	---	$8,373	---
Families Below Poverty Level	63	11.2	129	11.9
Families with Public Assistance Income	23	4.1	63	5.8
Vietnam-era Vaterans				
Years of School Completed				
Persons, 25 years & over	1,233	100.0	2,615	100.0
No School years completed	32	2.6	290	11.0
Elementary: 1-8 years	265	21.5	995	38.0
High School: 1-3 years	255	18.2	444	17.0
4 years	422	34.2	653	25.0
College: 1-3 years	128	10.4	93	3.6
4 years & more	161	13.1	140	5.4
Median School Years Completed	12.2	---	9.2	---
High School Graduates	711	57.7	886	33.9

B - Agriculture, Commerce, and Industry

Although sugar production has been the primary agricultural activity in the Hamakua District, other agricultural interests currently include ranching, dairying, hog raising, macadamia nut production, and truck farming. The decline of sugar production in the district has released some lands for private cultivation, and the 1971 General Plan 25/ recommends development of diversified agriculture in the area. The Kamuela area in the South Kohala District exhibits some of the most productive truck farming land in the county. The opening of the Lalamilo farmlots southwest of Waimea in 1961 provided new opportunities for private agricultural development. Various sources, notably the 1971 General Plan 26/ and the Big Island Agriculture Development Seminar, 27/ have outlined the need for County and State assistance in providing additional water at reasonable costs for agricultural needs in the South Kohala District.

The towns of Honokaa and Waimea provide primary commercial facilities for the Hamakua and South Kohala Districts, respectively. The establishment of these towns as regional commercial centers has been encouraged. In addition, the Kawaihae area and existing and proposed developments along the coast south of Kawaihae are expected to contain other commercial facilities.

Sugar processing is the major industrial activity in Hamakua. Macadamia nut processing and other industrial activ-

25/ Reference 6.
26/ Ibid .
27/ Reference 58.

ities of a smaller scale have been encouraged. Waimea and Kawaihae are the primary locations of industrial activity in South Kohala. Industrial activities at Waimea include food processing and dairying, and at Kawaihae include storage and chemical production. The Kawaihae Harbor area is proposed as a major port facility.

5 - Power and Transportation

A - Power

Electricity is the major form of energy utilized on the island of Hawaii. The Hilo Electric Light Company operates five power generation plants in the County. Three are located in Hilo, one in Waimea, and one in Ka'u. The total generating capacity of the Waimea plant is 11,250 kilowatts. Substations are found in Kawaihae and other locations. The primary source of energy for the power generating plants is imported fuel oil, which has resulted in power rates on the island comparing with the highest in the nation. One of the Hilo plants generates power from hydroelectric sources. Locations of the Waimea plant and the Kawaihae substation are shown in Figure 11.

In the period 1960 to 1969, power consumption in Hawaii County increased 125 per cent, and average annual consumption per household increased from 3,084 kilowatt hours to 4,845 kilowatt hours, while population during the same period rose only 3.5 per cent. 28/ Assuming an average annual consumption of 5,870 kilowatt hours per household, 29/ it is estimated that the town of Waimea (estimated 250 households in 1973) uses an average of 70 kilowatts (steady demand) or 4020 kilowatt hours per day. The 1971 cost of power in Hawaii County was 3 to 4¢ per kilowatt hour, 30/ compared with an estimated median rate of 1.5 to 2.0¢

28/ From Reference 6.
29/ Average 1971 use on the outer islands, from Reference 19.
30/ Reference 19.


Upolu Point Airport
Hoea Mill
Kawaihi Bay
Kauhola Point
Kohala Mill
Halawa
Niulii
Akakoa Point
Hawi
Kapa
Mokupuku Island
Paaakalani Island
Honoipu School
Haena
Koama Pt
Mahukona
Mahukona Harbor
Settlement
KOHALA-WAIMEA
Kohala
NORTH KOHALA
SOUTH KOHALA
ROAD
Waipio Bay
Pacific Sugar Mill
Kawela Camp
Honokaa Landing
Honokaa
Paauhau
MAMALAHOA HWY.
Waimea
Puu Kanaka
Poliahaukupapa
Kawaihae Harbor
Kawaihae
KAWA
Gulch
PROPOSED HWY.
Holoholoku
Kamakoa
KAWAIHAE BAY
Puako
Kalahuipuaa
Anaehoomalu
Anaehoomalu Bay
SOUTH
NORTH
H A W A
MAUNA
FOREST
HAWAII COU
MAMALAHOA
KOHALA
KONA
NORTH HAMAKUA
SADDLE
ROAD
SOUTH HAMAKUA
Kiholo Bay
Kiholo
Settlement
Kaupulehu
Puu Waawaa
Makalawena
Mahaiula
LOA
MAUNA

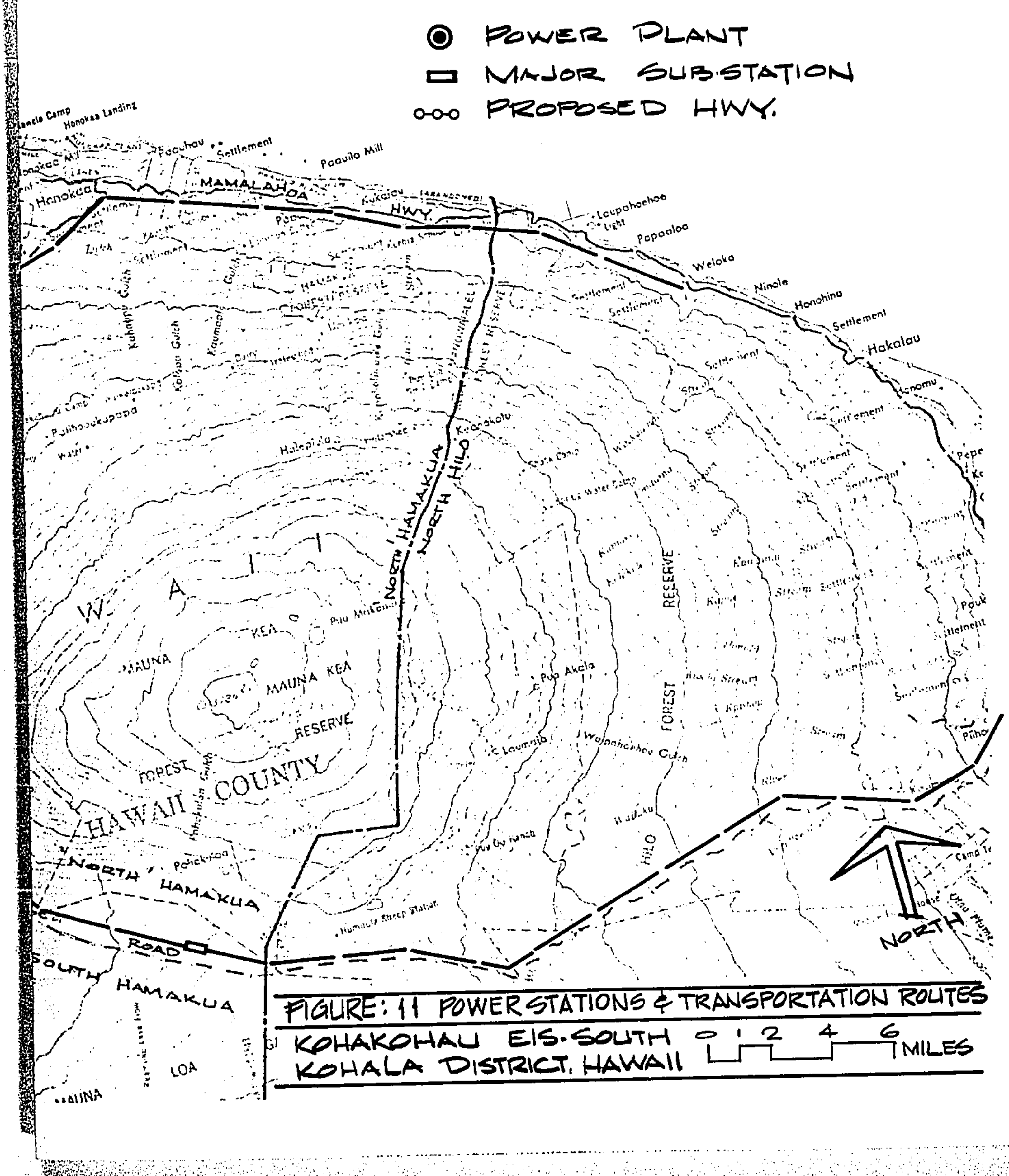


FIGURE: 11 POWER STATIONS & TRANSPORTATION ROUTES

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

0 1 2 4 6 MILES

per kilowatt hour on the mainland. In addition, rising costs for fuel oil are expected to increase the already high 1973 power rates.

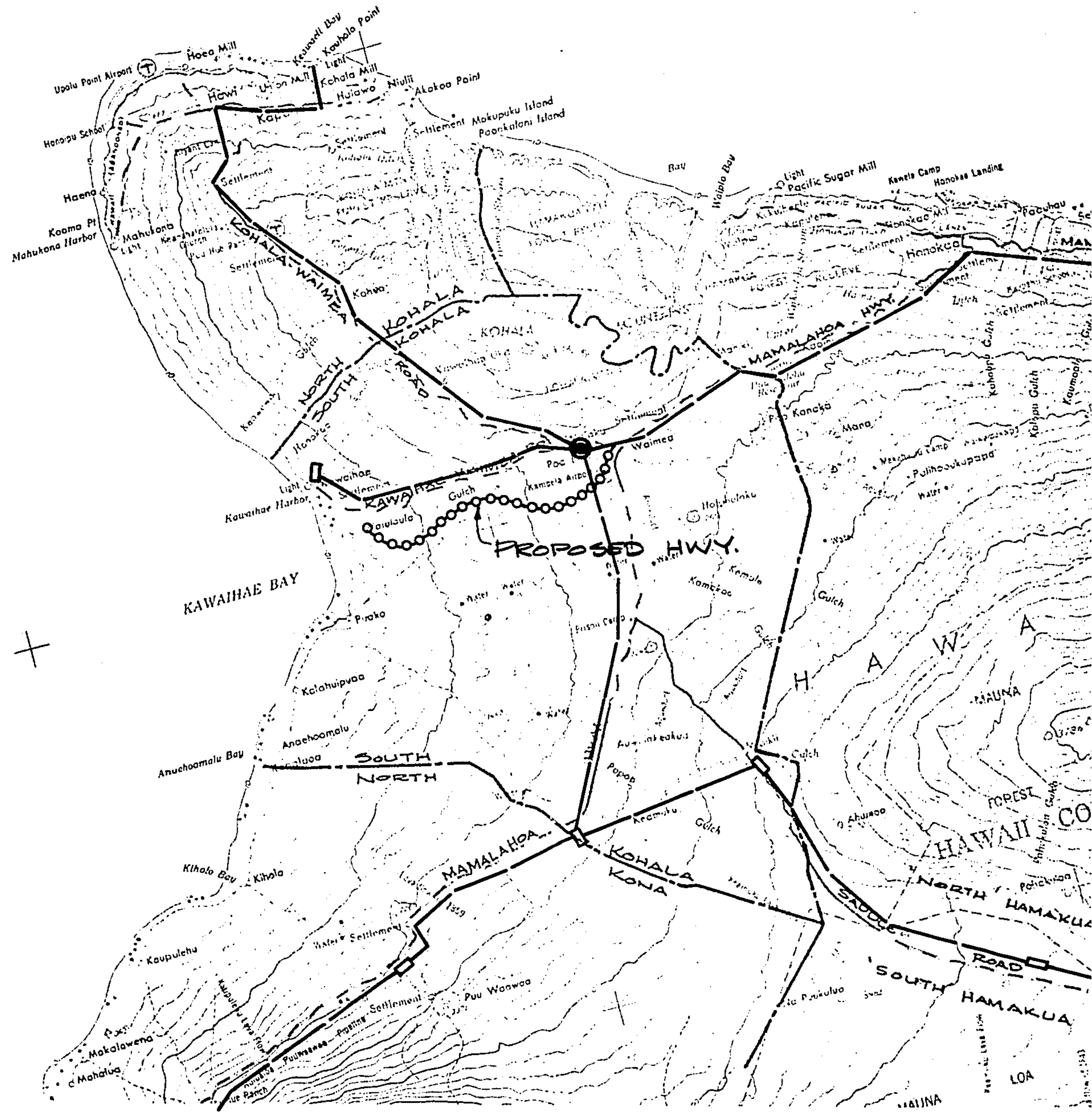
B - Transportation

As shown in Figure 11, the South Kohala and Hamakua Districts are served by the Hawaii Belt Highway from Hilo, the Saddle Road from Hilo, the Mamalahoa Highway from Kona, and the Waimea-Kawaihae Road. A new route to replace the Waimea-Kawaihae Road has been proposed, as shown on Figure 11, and has received some disapproval from local residents. This new route would have a significant impact on the pattern of development and land use in the South Kohala District. The proposal is currently under evaluation by the State Department of Transportation and an environmental impact statement is in preparation at this time. Most recent information indicates that construction of the highway would not begin before the period of 1976 to 1978. The route from Kawaihae to Kona is under construction at this time.

An air terminal is located at Kamuela in the South Kohala District. Other airports are located outside the South Kohala and Hamakua Districts at distances of approximately 20 to 60 miles. A major deepwater port facility is proposed at Kawaihae, but existing commercial traffic in the harbor is light.

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY
SEE FRAME(S)
IMMEDIATELY FOLLOWING



Upolu Point Airport
Hoea Mill
Keawaeli Bay
Kauhola Point
Light
Kohala Mill
Union Mill
Hawi
Niulii
Akakoa Point
Honoipu School
Settlement
Mokupuku Island
Paoakalani Island
Haena
Koama Pt
Mahukona Harbor
Mahukona
Waipio Bay
Light
Pacific Sugar Mill
Kawela Camp
Honokaa Landing
Honokaa
KOHALA-WAIMEA
KOHALA
KOHALA
NORTH
SOUTH
ROAD
MAMALAHOA HWY.
Waimea
Settlement
Kawaihae Harbor
KAWAIHAE
Gulch
PROPOSED HWY.
KAWAIHAE BAY
Puako
Kalahuipuaa
Anaehoomalu
Anaehoomalu Bay
SOUTH
NORTH
MAMALAHOA
KOHALA
KONA
Kiholo Bay
Kiholo
Kaupulehu
Makalawena
Mahaiula
Puu Waawaa
Settlement
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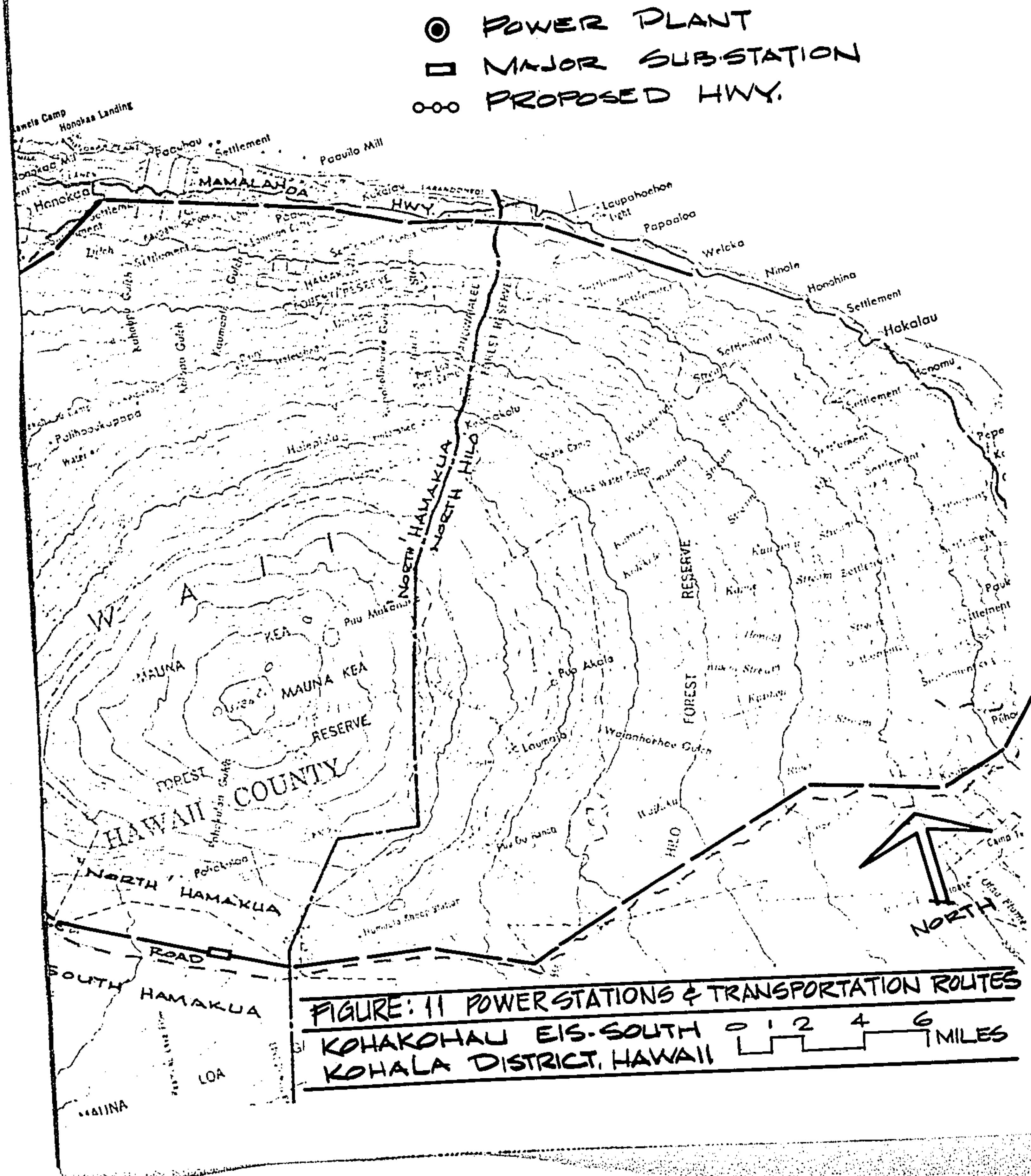
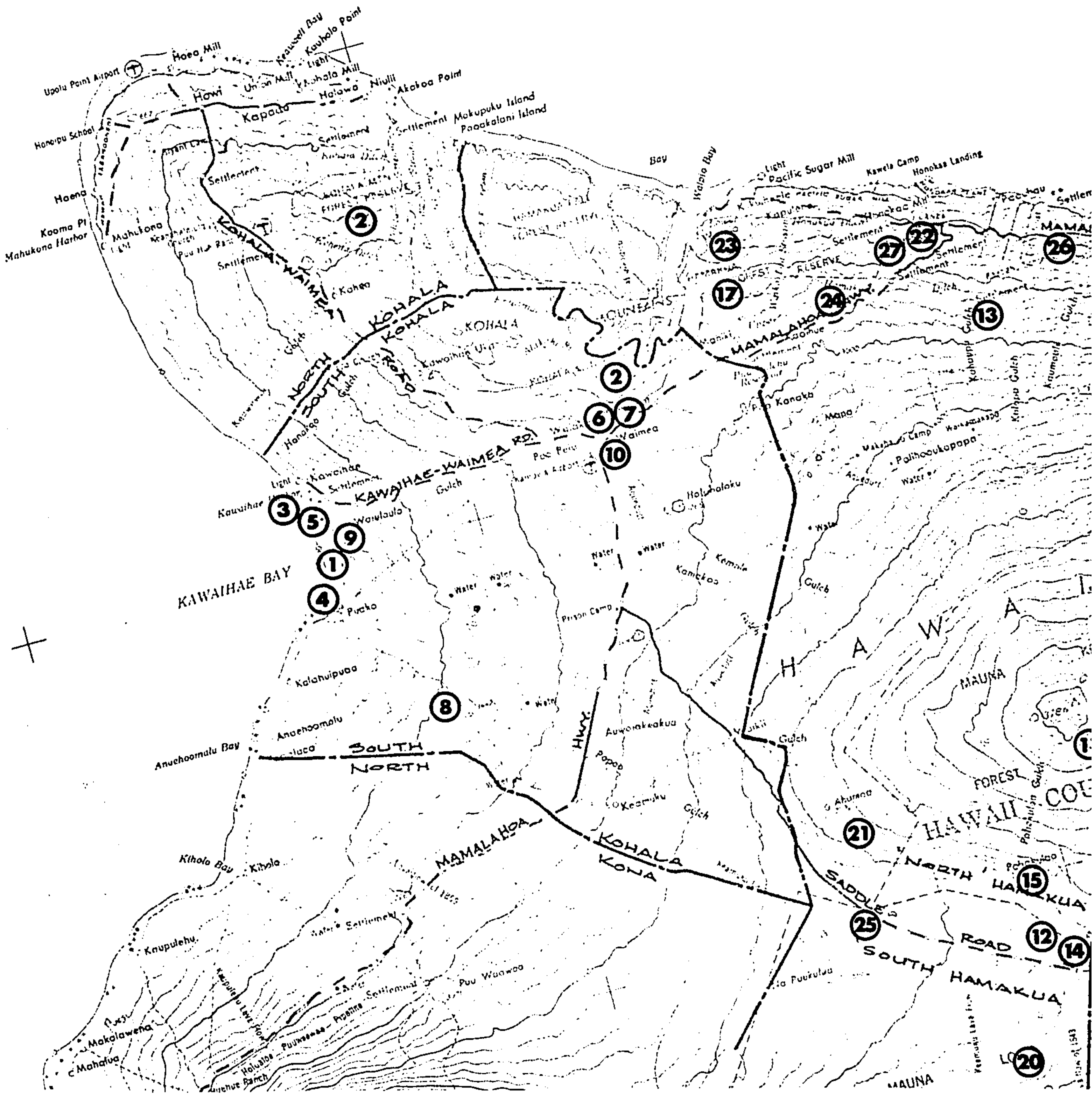


FIGURE: 11 POWER STATIONS & TRANSPORTATION ROUTES
KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII



Upolu Point Airport
Hoea Mill
Union Mill
Kohala Mill
Niulii
Akakoa Point
Kauhola Point
Halawa
Hawi
Kapaau
Mokupuku Island
Paaakalani Island
Settlement
Honoipu School
Haena
Kooma Pt
Mahukona Harbor
Mahukona
Waipio Bay
Pacific Sugar Mill
Kawela Camp
Honokaa Landing
KOHALA-WAIMEA
NORTH KOHALA
SOUTH KOHALA
Kahea
KOHALA
Kawaihae Uplands
MAMALAHOA HWY.
MAMALAHOA
Waimea
Kawaihae
KAWAIHAE-WAIMEA RD.
Kawaihae Harbor
Waiaulaula
KAWAIHAE BAY
Puako
Holoholoku
Kamakoa
Prison Camp
Kalahuipuaa
Anaehoomalu
Anaehoomalu Bay
SOUTH
NORTH
HWY.
Auwaiakeakua
Popoo
Keamuku
Gulch
Kiholo Bay
Kiholo
KOHALA
KONA
Kaupulehu
Puu Waawaa
Makalawena
Mahaiula
Huehue Ranch
H A W A I
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SADDLE ROAD
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Pohakuloa
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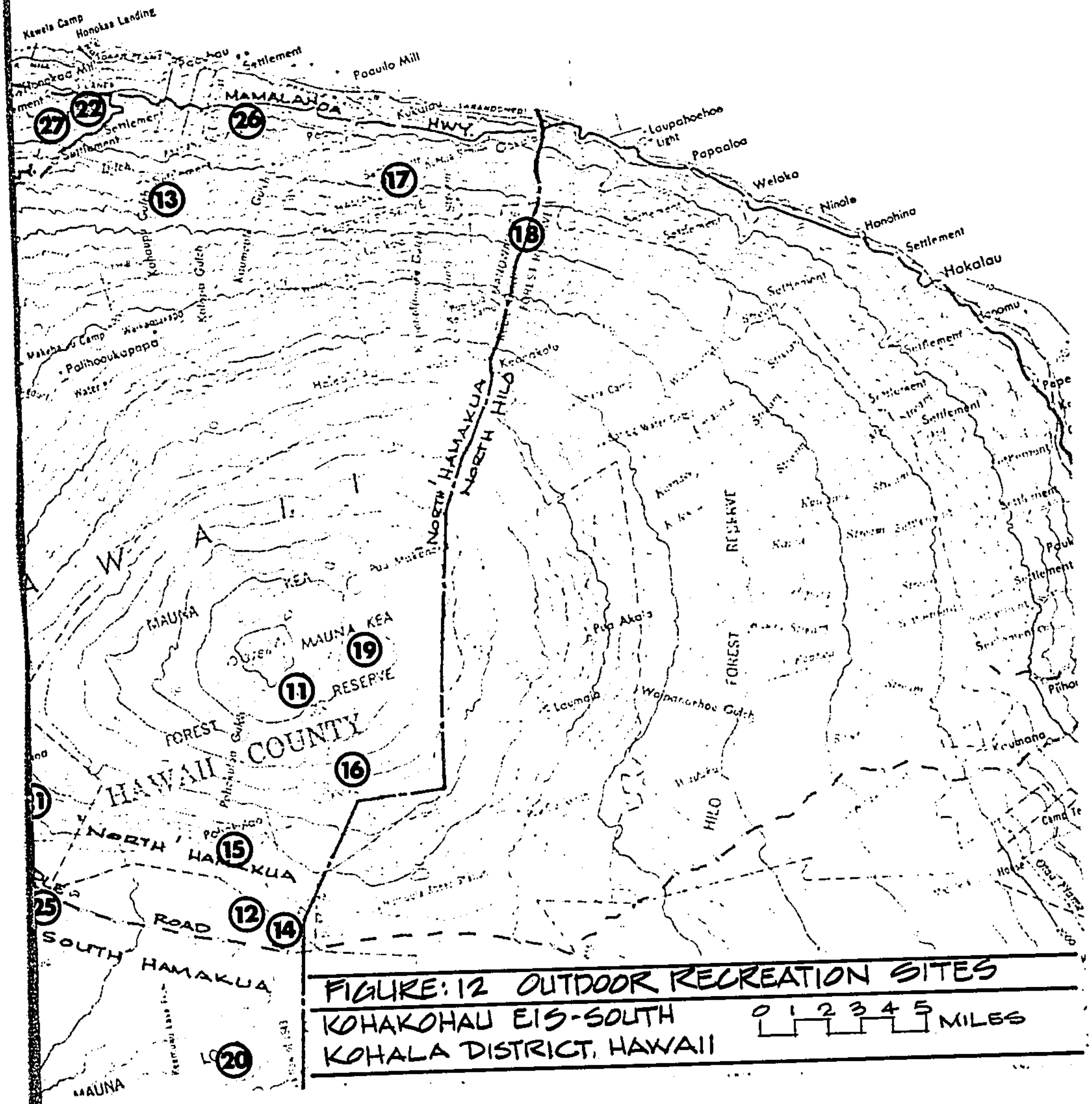


FIGURE: 12 OUTDOOR RECREATION SITES
KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII

Table 5

Outdoor Recreational Sites, South Kohala and Hamakua Districts

Location and Name of Site	Administering Agency	Acreage	Comments
South Kohala District			
1. Hapuna Beach State Park	State Division of Parks	300	Lodging, camping, surfing, swimming.
2. Kohala Forest Reserve	State Division of Forestry	23,800	Camping, trails, hunting, portions restricted.
3. Kawaihae Boat Harbor	State Division of Harbors	246	Marina, boat ramp, fishing.
4. Puako Launching Ramp	State Division of Harbors	0.5	Boat ramp, fishing.
5. Samuel A. Spencer (Kawaihae) Park	County of Hawaii	13.4	Camping, surfing, swimming.
6. Waimea Park	County of Hawaii	6.4	Town park, picnicking, tennis.
7. Waimea Park Site	County of Hawaii	2.8	Mountain hiking.
8. Equestrian Center	Boise-Cascade	---	Under construction
9. Mauna Kea Beach Hotel Golf Course	Private	---	
10. Parker Ranch	Private	---	Recreational hunting.

Table 5, continued

Hamakua District			
11. Mauna Kea Adz Quarry	State Division of Parks	---	Historic site.
12. Pohakuloa Military Camp	U. S. Army	---	Restricted to military, guests. Mountainous area.
13. Kalopa State Recreation Area	State Division of Parks	100	Forest area, camping, lodging.
14. Mauna Kea State Park	State Division of Parks	700	Mountain area, lodging, camping, hiking, skiing.
15. Pohakuloa Area	State Division of Parks	500	Mountain area, lodging, camping, hiking.
16. Hale Pohaku Area	State Division of Parks	200	Mountain area, lodging, camping, hiking.
17. Hamakua Forest Reserve	State Dvision of Forestry	4,633	Forest area, camping, hiking, recreational hunting.
18. Manowaialee Forest Reserve	State Division of Forestry	1,410	Camping, hiking, picnicking, recreational hunting.
19. Mauna Kea Forest Reserve	State Division of Parks	87,150	Lodging, camping, hiking. recreational hunting.
20. Manua Loa Forest Reserve	State Division of Forestry	160,470	Hiking, picnicking, recreational hunting.
21. Kaohe House Pasture Game Management Area	State Division of Fish and Game	6,440	Mountain area, hiking, recreational hunting.
22. Honokaa Swimming Pool	County of Hawaii	---	Swimming

Table 5, Continued

23.	Waipio Valley Lookout Point	County of Hawaii	1.4	Mountain Area, hiking.
24.	Camp Honokaia	Boy Scouts of America	240	Camping.
25.	Camp Kilohana	Girl Scouts of America	6.0	Camping.
26.	Camp Mekokiko	The Methodist in Hawaii	---	Lodging, camping.
27.	Hamakua Country Club	Private	---	
28.	Waiakoloa Golf Course	Private	---	

7 - Aesthetic/Amenity Considerations

The South Kohala District exhibits three distinct visual environments. The Waimea area is characterized by green rolling hills and grazing lands. The western coastal plain, in contrast, exhibits an arid, desert-like landscape with white sand beaches and blue ocean. The Kohala Mountains display grass-covered foothills and densely overgrown subtropical conditions at the higher elevations where average annual rainfall approaches 200 inches.

The Kohakohau Dam Project study area is located within the latter visual environment. Figure 13 shows three views of the potential project area: (A) from within the potential zone of inundation looking through the main saddle toward Waimea and Mauna Kea, (B) along the Kohakohau Stream bed, and (C) looking toward Waimea from the Kamuela Airport area. Within the study area, as located in Figure 4, the visual character is comprised of densely overgrown vegetation on the slopes of Kohala Mountain. A few waterfalls and pools, such as is shown in Figure 13, exist along the Kohakohau Stream bed but are virtually inaccessible. The dense tropical nature of the study area is indiscernible from populated and distant locations.

The Waimea Town area is characterized by the tranquil atmosphere of a small community located within a diversified natural setting. The capability of the Waimea-Kohala Airport to accommodate jet aircraft has, perhaps, resulted in the most significant intrusion on the apparent leisurely pace of the area.

(A) Looking south through main saddle toward Waimea.

(B) Along the Kohakohau Stream bed.

(C) Looking toward Waimea from Waimea-Kohala Airport area.

FIGURE: 13
KOHAKOHAU EIS

PHYSICAL SETTING

For purposes of identifying existing physical conditions in the potential project area, the study area as shown in Figure 4 has been divided into the five sub-areas shown in Figure 14. These sub-areas correspond with potential zones of construction as follows:

Sub-Area 1: The potential Upper Hamakua Ditch (UHD) Diversion channel location, a section approximately 20 feet wide and 7,000 feet long.

Sub Area 2: The zone of inundation and fill, approximately 135 acres in the ultimate development alternative and 90 acres in the initial development alternative. Includes the areas filled for the main and saddle dams.

Sub Area 3: The area below the primary dam in which the spillway and access roads would be constructed. Includes strips in a gross area of approximately 80 acres.

Sub Area 4: The potential outlet pipe area, a section approximately 20 feet wide and 4,000 feet long.

Sub Area 5: The potential rock quarry area of approximately 40 acres.

Discussions of existing physical conditions refer to these sub-areas as follows.

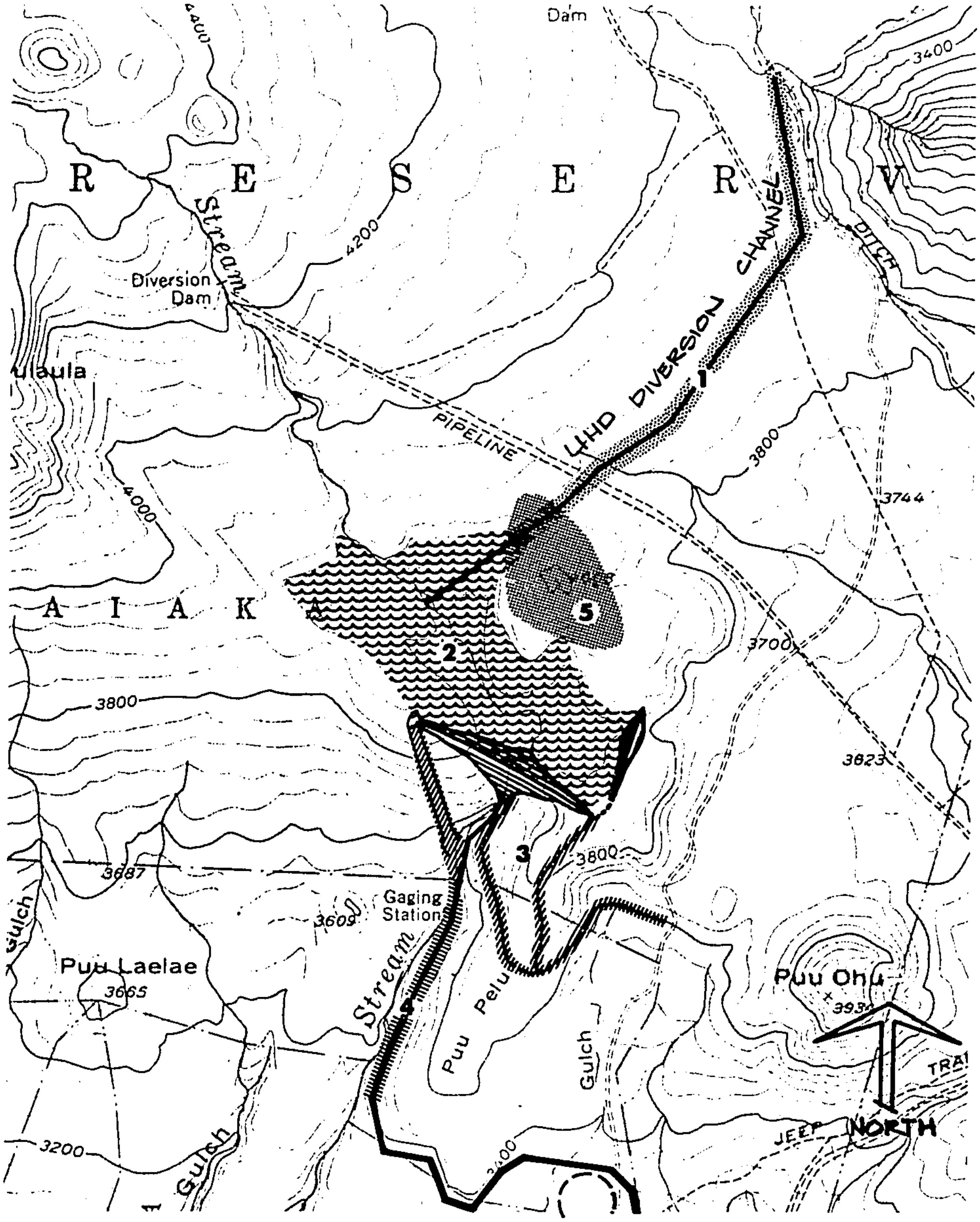


FIGURE: 14 PROJECT SUB-AREAS

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

500 0 500 1500 FEET

8 - Topography, Geology, and Soils

A - Topography

Figure 15 shows elevation contours and locations of prominent topographic features on the island of Hawaii. Located on the southern slopes of the Kohala Mountains, the study area exhibits relatively steep slopes in the higher elevations and gentle slopes and rolling hills in the lower elevations near Waimea town. The Kohakohau Stream flows on fairly low gradients in the upper reaches as it enters the study area, exhibits a series of small pools and waterfalls as it flows through the potential reservoir area, and then changes its course and flows over much steeper gradients and waterfalls between the potential damsite location and the existing Kohakohau Diversion (see Figure 5).

B - Regional Geology

The island of Hawaii was formed by the action of the five volcanoes shown in Figure 15: Kohala and Mauna Kea, which have not erupted in historic time; Mauna Loa and Kilauea, which are still active, and Hualalai, which last erupted in 1801. Each volcano has an independent geologic history which explains many currently observable characteristics. The older southern slopes of Kohala Mountain have been buried beneath Mauna Kea lavas, resulting in the reduction in area covered by Kohala lavas to the present 5.8 per cent of the island's total acreage.

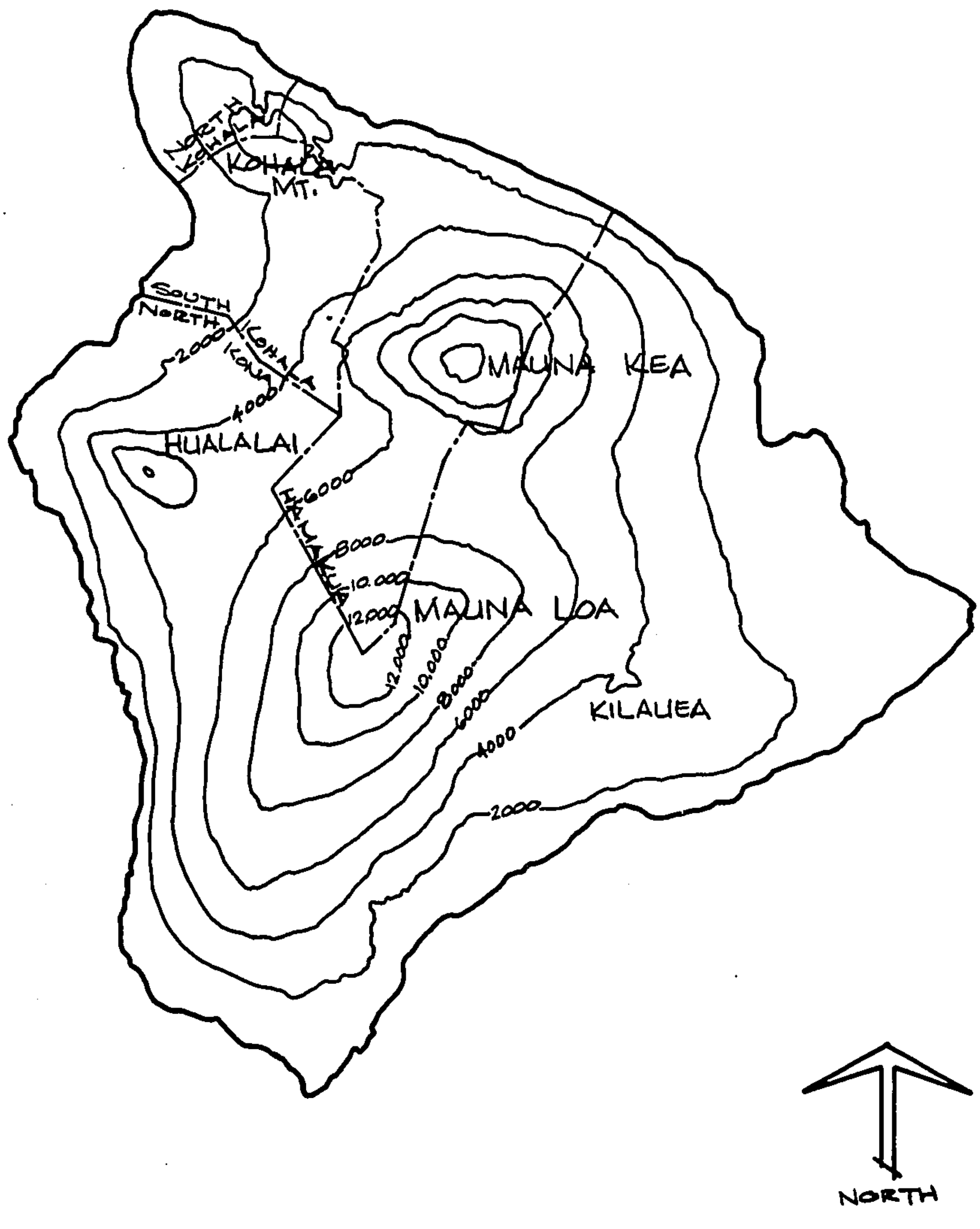


FIGURE: 15 TOPOGRAPHY, ISLAND OF HAWAII

KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII

10 5 0 5 10 15 MILES

Kohala Mountain was built up by the rapid outpouring of Pololu series lavas during Tertiary time. These lavas left rocks which are predominantly olivine basalt. After the eruption of this series, the windward (northeastern) slopes of Kohala Volcano were deeply eroded, leaving deep gorges which include Waipio Valley. Renewed activity resulted in the eruption of andesite and trachyte lavas known as the Hawi series. These flows rest on the soils formed on top of the Pololu Series lavas and are found in the windward valleys cut by earlier erosion. Subsequent erosion and weathering have cut relatively shallow valleys into the lee (southern) slopes of Kohala Mountains and deeper valleys in the previously eroded windward slopes, and have formed existing soils.

Numerous dikes are suspected to cut the lavas in the central part of the mountain. The extensive erosion on the windward slopes has exposed these dikes in the deep valleys, but the limited erosion on the southern slopes has not exposed such dikes. The older (Pololu) lava beds are generally highly permeable, while the later (Hawi) lava beds are generally hard and dense, with shallow soil cover.

C - Study Area Geology

The potential project area was studied in 1964 and a report 32/ was prepared based on a series of test borings made in the study area. The 1970 Feasibility Report 33/ interpreted those findings and presented the following summary of geologic conditions at the potential damsite.

> "The damsite and reservoir area are covered by dense tropical vegetation. Swampy areas are prevalent throughout the reservoir area. The existence of perennial ponds in Kohakohau Stream and the saturated swampy areas in the reservoir indicate low permeability of the soil cover and underlying rock. The stream lies above the natural groundwater table and, consequently, the water table will not provide a source of water for the reservoir.
>
> The right (west) abutment is a long narrow ridge of trachyte which forms a very steep gorge within 100 feet in elevation of the streambed. This portion of the abutment was too steep to be accessible during the field reconnaissance. The rock should be generally hard and dense with joint spacing averaging about one foot. Overburden on the upper slope above elevation 3,720 feet is estimated to be between three and six feet deep.
>
> The valley bottom at (the site) is very narrow with steepwalled sides. The stream competely fills the gorge, and there is a waterfall just downstream of the dam axis. At the dam axis and downstream, sound and hard trachyte-andesite will be exposed for the dam structure. Upstream from the dam axis, overburden consisting of residual soil and recent alluvium occurs to an estimated depth of five to 20 feet. A fault is thought to occur in the streambed, but is not expected to adversely affect a dam at this site.
>
> The left (east) abutment of the dam is on dense, sound trachyte. Overburden is absent or very shallow below elevation 3,760 feet, while above this elevation overburden may be as much as 20 feet of organic swampy, saturated, residual soil.

32/ Reference 37.
33/ Reference 36.

A saddle dike is required on the left abutment for any dam higher than an elevation of 3,820 feet. The dike foundation would be sound to moderately-weathered trachyte. Organic, swampy soil varying from three to 20 feet deep overlays the bedrock. A fault is thought to cross the dike axis near its left side, but it is considered to have no effect on the stability of the dike." 34/

Generalized geology at the potential project site is shown in Figure 16. Seepage would be expected to occur at various rock outcrops in the reservoir area, and the abutments would require grouting to limit leakage. No known mineral resources are located in the area.

34/ Ibid, page III-7.

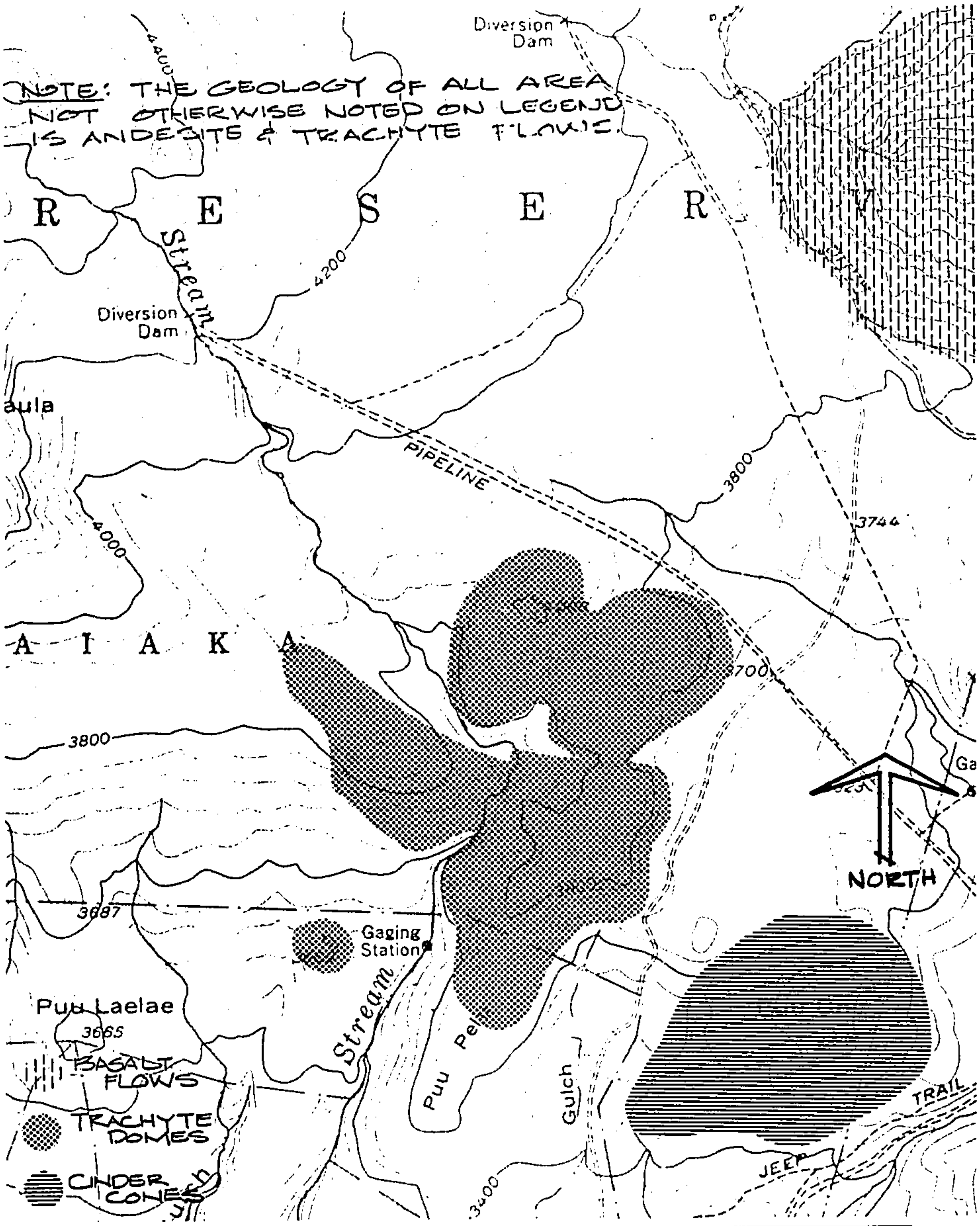


FIGURE: 16 GEOLOGY OF STUDY AREA

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

500 0 500 1500 FEET

D - Soils

Overburden in the study area ranges in depth from a few feet to over twenty feet. Overburden in the valley floor consists primarily of highly organic, saturated soils which are thought to average 2 to 3 feet in depth. Overburden occurring in the Kohakohau Stream bed consists of boulders, cobbles, gravel, and alluvium. Swampy areas, as shown in Figure 23, exhibit deeper overburden mantles. The right and left dam abutments are overlain with variable depths of similar materials.

Soil in the area has been identified as a clay silt with a low relative permeability. Short periods of high rainfall and runoff have resulted in somewhat alluviated streambed conditions. The grass cover in these reaches is perennial.

No significant erosion or sedimentation is present along the Kohakohau Stream bed or below the potential damsite location. During intense rainstorms, however, peaty and organic material is washed from the drainage shed and discolors the stream waters, as is discussed later.

E - Seismicity

The island of Hawaii is geologically young and active. Two of the five Big Island volcanoes, Mauna Loa and Kilauea, are still active and a third, Hualalai, last erupted in 1801. This recent and continuing volcanic activity is located in the southern half of the island and is constantly forming and changing the geologic characteristics of the island. The northern part of the island was formed by the action of the two remaining volcanoes, Kohala and Mauna Kea, which have not erupted in historic time. Being the least active area on the Big Island, the Kohala-Hamakua region is the safest from the standpoint of potential earthquakes. However, recent events have demonstrated that a seismic occurrence of any significant magnitude is not likely to be greatly damped in its impact on other areas of the island.

Sizeable earthquakes have occurred in 1951, 1962, and 1973 on the island of Hawaii. The 1951 earthquake, registering about 7.0 on the Richter scale, caused extensive damage with its epicenter located south of Kailua. The April 1973 earthquake caused an estimated $5.5 million total damage, much occurring along the Hamakua Coast as the epicenter was located north of Hilo. Although the epicenter of that earthquake was located near Hilo, the Mauna Kea Beach Hotel, located on the western coast approximately 40-50 miles from Hilo, reportedly sustained appreciable structural damage.

The island of Hawaii (as well as the entire archipelago) has been designated as a Zone III (most severe of the four zones used) earthquake hazard area by the U.S. Geological Survey. This designation is used by the Federal Government and others to prescribe adequate design considerations for structural projects to ensure structural integrity and to preserve the safety of the public.

The seismic activities on the island of Hawaii appear to be on the order of those which might be expected along the San Andreas fault system in California, although the Big Island has experienced no earthquakes comparable in magnitude or effect to the more well-known of California's large earthquakes. Seismic design criteria used for large-scale projects in California are more stringent and comprehensive than those employed by most other Federal agencies and jurisdictions and were therefore consulted and applied in preliminary analysis of the Kohakohau Dam Project.

9 - Climatology, Air, and Noise

A - Climatology

The highest average rainfall in northern Hawaii occurs at the summit of Kohala Mountain, as shown in Figure 17. Within the vicinity of the study area, a number of rainfall gaging stations have been installed since 1950 but many were removed or suffered equipment failures. Consequently, no long-term record of rainfall is available for the Kohakohau Stream watershed. A rainfall gaging station with a relatively long record (27 years) is located on the Waikoloa Stream approximately one mile from the proposed dam site, and other stations with reliable records are located near Waimea and the summit of Kohala Mountain. From these stations of long record were inferred the iso-hyetal lines (lines showing locations of equal annual rainfall) for the northwest portion of the island of Hawaii shown in Figure 18. As shown, the project study area receives about 75 inches of rainfall annually.

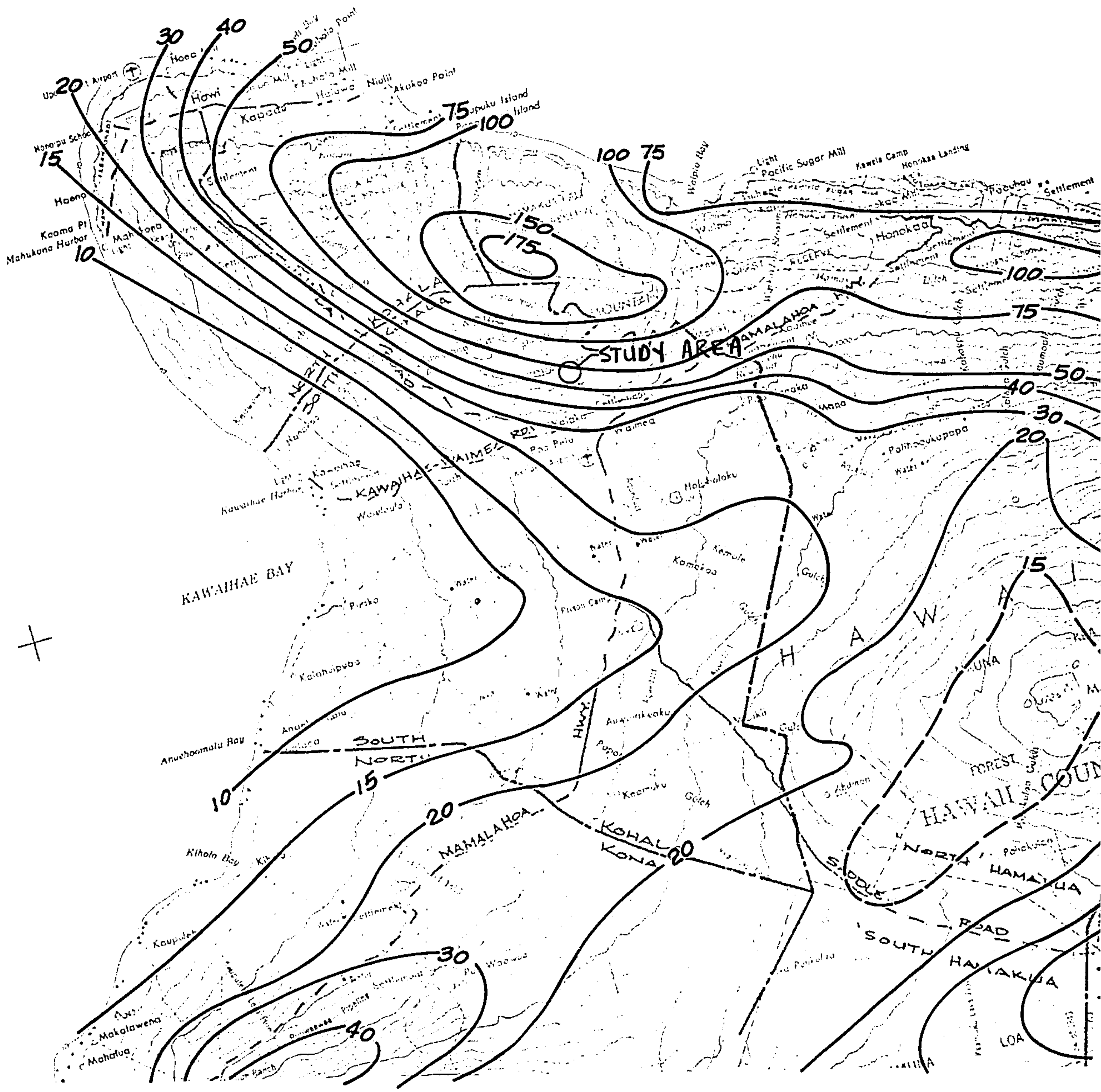
B - Air Quality and Noise

The atmosphere in the immediate vicinity of the potential project area is virtually unaffected by human activities. No background noise or air pollution levels are noticeable within the Kohala Forest Reserve area north of Waimea. The town of Waimea and immediate surroundings exhibit similar conditions, only slightly influenced primarily by automobile traffic and airport activities. No air emmission or noise monitoring stations are located in the district.

FIGURE: 17 MEDIAN ANNUAL RAINFALL, ISLAND OF HAWAII

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

5 0 5 10 15 20 MILES



STUDY AREA
KAWAIHAE BAY
Kawaihae Harbor
Mahukona Harbor
Kaoma Pt
Hawi
Kapaau
Waipio Bay
Pacific Sugar Mill
Honokaa
Kawela Camp
Honokaa Landing
Waimea
Holoholoku
Anaehoomalu Bay
Kiholo Bay
Makalawena
Mahaiula
SOUTH
NORTH
KOHALA
KONA
MAMALAHOA
HWY.
SADDLE
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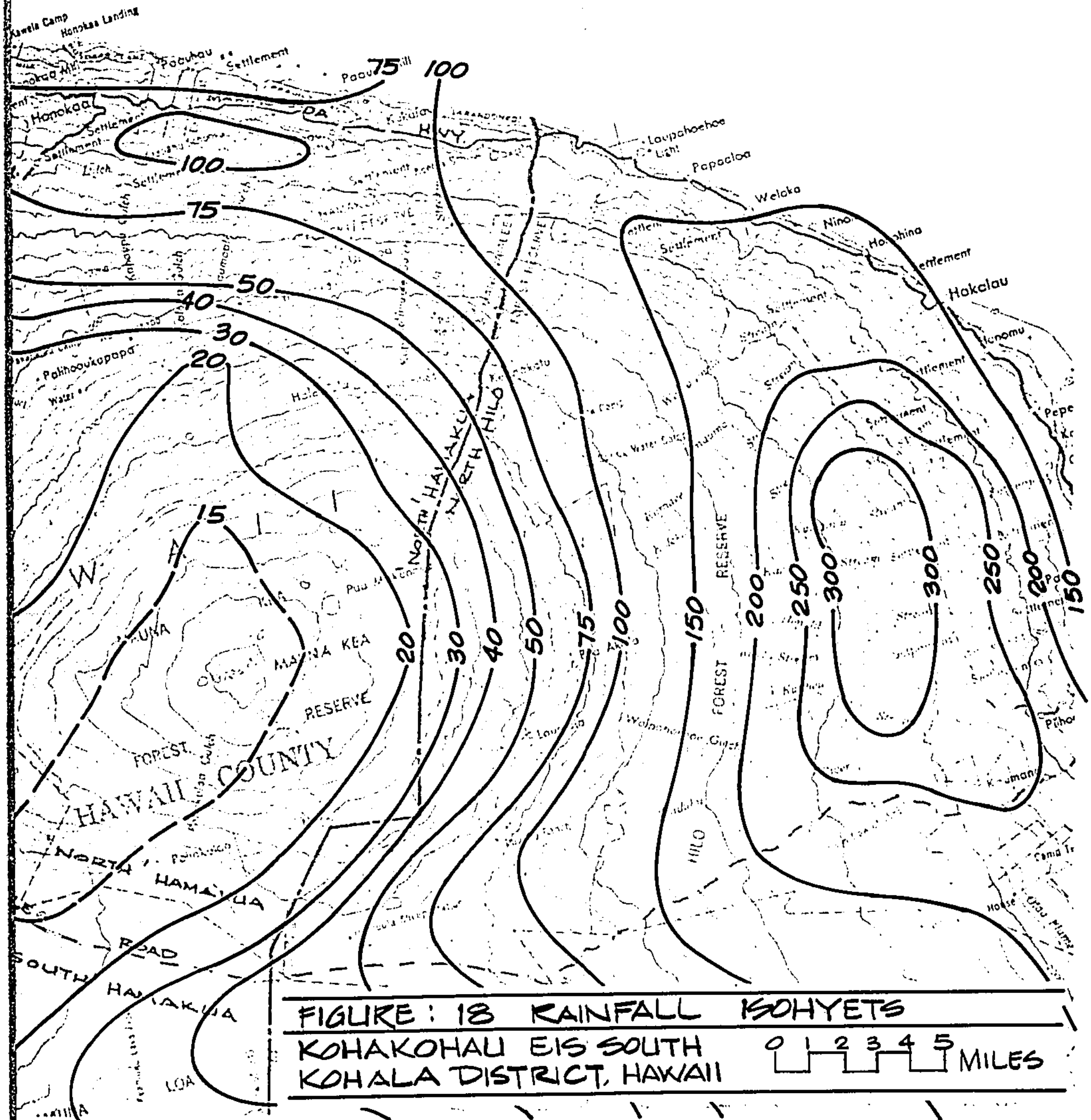


FIGURE: 18 RAINFALL ISOHYETS
KOHAKOHAU EIS SOUTH KOHALA DISTRICT, HAWAII

10 - Floral Features of the Ecosystem

A study of vegetation in the study area has been conducted by Dr. Derral Herbst, assistant researcher at the Harold L. Lyon Arboretum in Honolulu, Hawaii. His complete report is presented in Appendix A, from which the following remarks are taken.

In Sub-Area 1, the proposed Upper Hamakua Ditch (UHD) Diversion Channel would pass through an open boggy region of low trees and shrubs. Stunted *Metrosideros* and *Cheirodendron* with *Vaccinium calycinum*, tree ferns, *Clermontia* and *Styphelia* are the dominant shrubs. *Sphagnum* moss covers the ground and forms humps around the bases of the shrubs. Disturbance, primarily by pigs, has allowed hilo grass, *Juncus* and other exotic weeds to gain a foothold in the area, and are now a very common component of the vegetation.

The proposed Kohakohau Reservoir (Sub-Area 2) lies in a middle elevation, wet forest. In general, the vegetation can be characterized as a sparse growth of tree ferns, shrubs and stunted trees. The ground cover consists of a great number of species of ferns, grasses, sedges and herbs, the majority of which are weeds of wide distribution. The moss, *Sphagnum palustre*, is abundant, forming thick mats on the ground and hummocks at the bases of the trees.

The dominant trees are *Metrosideros* and *Cheirodendron*, two of the most common genera in our native forests. Along the steep banks of the Kohakohau Stream, which roughly bisects the reservoir site, there is a luxuriant stand of these trees, most reaching 25-30 feet in height. At the other extreme, those on the flat bottom land of the reservoir are sparse and stunted, while the ones growing on the slopes of the puus and ridges enclosing the area are somewhat intermediate in size and number.

Tree ferns and occasional small trees and shrubs grow throughout the area. These form a sparse understory along the banks of the stream; elsewhere they are usually about the same height as the *Metrosideros* and *Cheirodendron*. The native *Rubus*, *Vaccinium* and two species of *Myrsine* are the most common shrubs and small trees. Less common are *Coprosma*, *Ilex*, *Gouldia*, *Pelea*, and *Clermontia*.

The ground cover is comprised primarily of *Sphagnum* moss and exotic herbs. Pig damage in the area is quite extensive. The disturbance they have created and, it is suspected, the seeds they have carried, have resulted in a nearly totally exotic groundcover vegetation. Ginger, probably washed down by the stream, forms a dense, rank growth along the streams' steep slopes. Weedy herbaceous plants and native and exotic grasses and sedges are found in and along the stream. An aquatic moss grows abundantly among the rocks in the stream bed. *Juncus* and clumps of grasses and sedges are common in the bottom lands of the reservoir where the ground is covered by a thick mat of *Sphagnum*. The slopes of the enclosing ridges have patches of *Dicranopteris*; other ferns are scattered throughtout the area. Hilo grass is one of the main ground covers and is mixed with other grasses, sedges, *Juncus*, *Hydrocotyle*, *Erechtites*, *Eupatorium*, *Veronica* and other herbs. The wetter, more protected, areas have large pathces of Sphagnum while Cuphea, Drymaria, Vaccinium berberifolium and Hypochoeris replaces the moss on barer, more exposed slopes. Polygonum is common in shallow, muddy pig "wallows."

In summary, the trees and shrubs in Sub-Area 2 are all native, but common, species, while the ground cover consists primarily of Sphagnum and common weeds of disturbed areas.

In Sub-Area 3, the proposed access road passes from the existing jeep trail into a narrow strip comprised primarily of exotic trees: Eucalyptus, Alnus, and Melaleuca with an occasional Metrosideros or Cheirodendron mixed in. Just after starting into the native Metrosideros-Cheirodendron forest, the road turns abruptly southward into a cleared pasture.

The right fork of the access road passes through the grassland and back into the riprap area. It first passes through a small Cryptomeria grove, then enters a native forest similar to that along the northern side of the area.

The left fork continues through the pasture, then along the west slope of Puu Pelu to the axis of the proposed dam. The western slope of Puu Pelu supports the best native forest sampled, Metrosideros and Cheirodendron are the dominant trees. The shrub and small tree story is botanically richest here. Cyrtandra and Couldia hillebrandii are included along with Ilex, Coprosma, Couldia terminalis, Vaccinium, Cibotium and others. The ground may be bare or have a light litter cover or it may have a rich covering of native ferns, mosses, sedges or liverworts. Occasionally a small patch of exotic herbs is encountered.

Dicranopteris covers the strip along the fence line in many places, and is common near the crest of the puu. The epiphytic flora is very rich: Ophigolossum and Psilotum complanatum are common as is Astelia, Elaphoglossum spp. and filmy ferns. Polypodium pellucidum is a common epiphytic and terrestrial species in this area, especially along the top of the steep bank of the stream.

The proposed spillway would descend the steep bank to the Kohakohau Stream from the western side of the proposed Kohakohau Dam axis. The vegetation of this area consists of a tall (± 40 feet), open Metrosideros and Cheirodendron forest. Cibotium is common and ginger, palm grass and some Eupatorium cover the lower part of the bank and line the stream.

The proposed outlet pipe (Sub-Area 4) would follow the Kohakohau Stream. The vegetation of the stream banks is as that described above.

In Sub-Area 5, the vegetation of the south and south-western slopes is similar to that found on the upper slopes in Sub-Area 2. Metrosideros and Cheirodendron are present in intermediate size and number.

In conclusion, the study area has for years been a buffer zone between cleared, planted pasture land and the bogs of Kohala. Forestry plantings have been made within the site. A jeep road passes through it. A lane for a pipeline was cleared along its northern side and a row of Eucalyptus was planted in the lane. Pig damage is extensive throughout the site. An introduced ornamental (ginger) has heavily infested the stream banks.

In general, the dominant arborescent vegetation consists of a sparse, stunted stand of *Metrosideros* and *Cheirodendron trigynum* trees. *Metrosideros* is the most abundant tree in the Hawaiian Islands, while *Cheirodendron trigynum* is a very common species found on all of the main islands except Kauai. The shrubs and small trees as *Cibotium*, *Ilex*, *Vaccinium*, *Sadleria* and *Gouldia* are common on all or most of the main islands. No varieties or forms of these species ae restricted to this small area or to its immediate environs. Some of the species, as the *Cyrtandra*, are endemic to the Island of Hawaii but are rather widespread throughout the island or throughout the Kohala Mountains. The native ferns, epiphytes and groundcovers are mostly rather commons sorts. The groundcover consists primarily of weedy herbaceous plants, indicating the amount of disturbance which has occurred in the area.

None of the native species observed is rare in the islands today. No species listed on the tentative rare and endangered species list for the State was observed in the study area. A checklist of species observed is presented in Appendix A.

11 - Faunal Features of the Ecosystem

A study of birds and mammals in the study area has been conducted by Dr. C. R. Eddinger, Instructor in Biology, Honolulu Community College. A study of aquatic life in the study area has been completed by the State of Hawaii, Department of Land and Natural Resources, Division of Fish and Game. These complete reports are presented in Appendix A, from which the following remarks are taken.

A - Birds

Seven species of birds were observed in the study area: (1) Apapane, (2) Hawaii Amakihi, (3) Hawaii Elepaio, (4) Koloa, or Hawaiian Duck, (5) Japanese White-eye, (6) Chinese Thrush and (7) Ring-necked Pheasant.

The Apapane (*Himatione sanguinea sanguinea*) is the most common of the surviving species of Hawaiian Honeycreepers. Today the Apapane is rare at elevations below 2,800 feet, and typically prefers trees that are at least 25 feet high.

The Hawaii Amakihi (*Loxops virens virens*) is endemic to the island of Hawaii and is the second most common living honeycreeper. The Amakihi is abundant on Hawaii, Maui, and Kauai, and is typically found in forests of mixed endemic and introduced trees.

The Hawaii Elepaio (*Chasiempis sandwichensis sandwichensis*) is endemic to the island of Hawaii, and, like the Amakihi, can be found in forests of mixed endemic and introduced trees.

The Koloa or Hawaiian Duck (Anas wyvilliana) was originally found on all the main islands except Lanai and Kahoolawe. The Koloa became extinct on all of the islands except Kauai, probably as a result of the introduction of the mongoose, and is now considered an endangered species. A propagation program at Pohakuloa has resulted in a number of pen-reared birds being released on Oahu and Hawaii.

The Japanese White-eye (Zosterops japonica japonica) was imported from Japan in 1929 and spread from Oahu to the neighbor islands. The White-eye can inhabit almost any habitat type and is by far the most abundant species of any in the islands. White-eyes may actually compete with endemic birds and may be responsible for the spread of bird malaria.

The Chinese Thrush (Garrulax canorus) was introduced to Hawaii in about 1900. The Chinese Thrush prefers low dense vegetation and is at home in many introduced plant thickets.

The Ring-necked Pheasant (Phasianus colchicus torquatus) was introduced as a game bird in about 1865 and is primarily found in open grasslands.

Sub-Area 1, along the proposed UHD Diversion Channel, is not an abundant wildlife area. The Japanese White-eye was the only species observed.

The most common birds in the proposed reservoir area (Sub-Area 2) are, again, the Japanese White-eyes. Two Koloa Ducks were observed in flight over the area but did not alight within the potential zone of inundation. Because the vegetation is generally scrubby within the area, the Apapane, Amakihi, and

and Elepaio are considered uncommon.

Sub-Areas 3 and 4 exhibit mixed vegetation and are inhabited mainly by Japanese White-eyes.

Sub-Area 5 contains mixed vegetation and is inhabited by Japanese White-eyes and a few Apapanes and Amakihis.

In summary, the most commonly observed bird species was the Japanese White-eye, which is abundant throughout the islands. Some Apapanes, Amakihis, and Elepaios, the three endemic species, were observed in the study area and are typically found in areas of mixed endemic and introduced vegetation. These species were observed in greater numbers in the ridges and high slopes surrounding the potential project area. Two Koloas, the only species considered rare or endangered, were observed passing over the study area. Chinese Thrushes and a Ring-necked Pheasant were also observed in the peripheral areas.

The area of greatest concern for wildlife preservation should be the upper slopes and ridges surrounding the dam. These areas are the richest areas in terms of abundance of endemic species, largely because of the height of the vegetation. All species observed, with the exception of the Koloa, are considered common the island of Hawaii and throughout the islands.

B - Mammals

Four mammal species are thought to inhabit the study area: (1) Feral pig (*Sus Scrofa*), (2) Mongoose (*Herpestes auroduncatus*), (3) Black rat (*Ratus rattus*), and (4) House mouse (*Mus musculus*). Of these species, none was observed in the potential reservoir area (Sub - Area 2). All of these mammals were introduced to Hawaii by man. The black rat and mongoose are often predators on birds and their eggs and are considered pests. Rats, mice, and pigs may carry diseases that can be transmitted to man. Extensive damage to native ground cover in the study area has been caused by pigs. None of the species is rare or endangered.

C - Aquatic Life

The aquatic field survey was conducted on March 20, 1974. The stream was in a mild freshet stage at the time (USGS gaging station records show a peak flow of 217 cfs at 1630 hours on March 19, and a flow of 9.2 cfs at 1000 hours on March 20). Collecting materials included a fine-meshed seine and handnet, and a small quantity of rotenone. The use of face-masks for underwater observation was precluded by the turbid waters.

Collecting efforts were confined to a pool and riffles section located just mauka of the potential dam site. Repeated sets of the seine and use of the handnet, and poisoning of a very small pocket of water with rotenone resulted in the collection of only a few chironomid larvae, caddisfly larvae, damselfly nymphs and snails. No other aquatic fauna were collected or observed.

There is no basis for expecting any changes in aquatic faunal conditions without the Project.

Creation of the impoundment will change approximately 3,000 to 4,000 feet of the Kohakohau Stream from a lotic to a lacustrine habitat for aquatic organisms. This change from a small free-flowing stream to a relatively large area of deep standing water will undoubtedly effect marked qualitative and quantitative alteration of the present aquatic faunal populations. This modification is not, however, deemed to be significantly either detrimental or beneficial.

A potential benefit that may be realized from this Project is the development of a recreational fishery.

D. Summary of the Study Area Ecosystem

The study area supports mixed native and introduced vegetal species which provide habitats for some species of birds and mammals as previously identified. Vegetation in the potential project area is typical of the Kohala area and the islands. Species present are common to most of the islands, and disturbances by pigs and the buffer zone nature of the area detract from its botanical value. Mammals and birds present are also common to the islands with the exception of the Koloa (duck). No fish life is present in the Kohakohau Stream system. Insect species have not been indentified or otherwise catalogued, as the proposed reservoir would provide an equivalent or expanded habitat for them.

Figure 19 shows primary ecological zones in the study area, generally corresponding to the upper slopes and ridges surrounding the potential dam and reservoir. Vegetation is generally higher and less disturbed in these zones, which represent primary wildlife areas as well. The total area shown is approximately 75 acres, representing 7.5 percent of the gross study area and less than one percent of the total area of the Kohala Forest Reserve. Based on the evaluations performed, vegetation and habitats in the study area are not considered unique, and the present ecosystem is capable of absorbing disturbances and maintaining present populations by replacement of wildlife species to adjacent habitat areas.

Impacts of the Kohakohau Dam Project to the ecosystem of the study area are identified in following discussions in terms of changes in existing surface conditions, effects on vegetation and habitat areas, and resulting impacts to faunal species.

12 - Surface Waters

A - Drainage and Stream Flow

The lee slopes of the Kohala Mountains are drained by several intermittent streams which flow through the Waimea area and turn westward toward Kawaihae across the permeable lava flows of Mauna Kea. Primary streams in the study area vicinity are the Kohakohau, Alakahi, and Waikoloa Streams as shown in Figure 20. The Waikoloa Stream has caused flooding within the town of Waimea during high intensity storms when runoff overflows the narrow and winding stream channel. The Kohakohau Stream exhibits similar tendencies but has caused only minor damage in the past.

Figure 20 shows the locations of stream gaging stations in the vicinity of the study area, and a summary of records since 1950 is presented in Table 6. Data for station 7560 give the best indication of normal Kohakohau Stream flows, although a pipeline diverts water at an elevation of approximately 4,250 feet for the Parker Ranch System (see Figure 9). As is indicated in Table 6, mean annual streamflow in the Kohakohau Stream is 6.17 MGD at station 7560 and 6.94 MGD at station 7565, but the variation between years is quite high. Figure 21 gives a historic comparison of rainfall and streamflow at station 7570 on the Waikoloa Stream. As shown, the streamflow pattern generally corresponds with the rainfall pattern over the same period, and the extreme variations in rainfall and streamflow can occur within periods of one or a few years. Variations in flows of Kohakohau

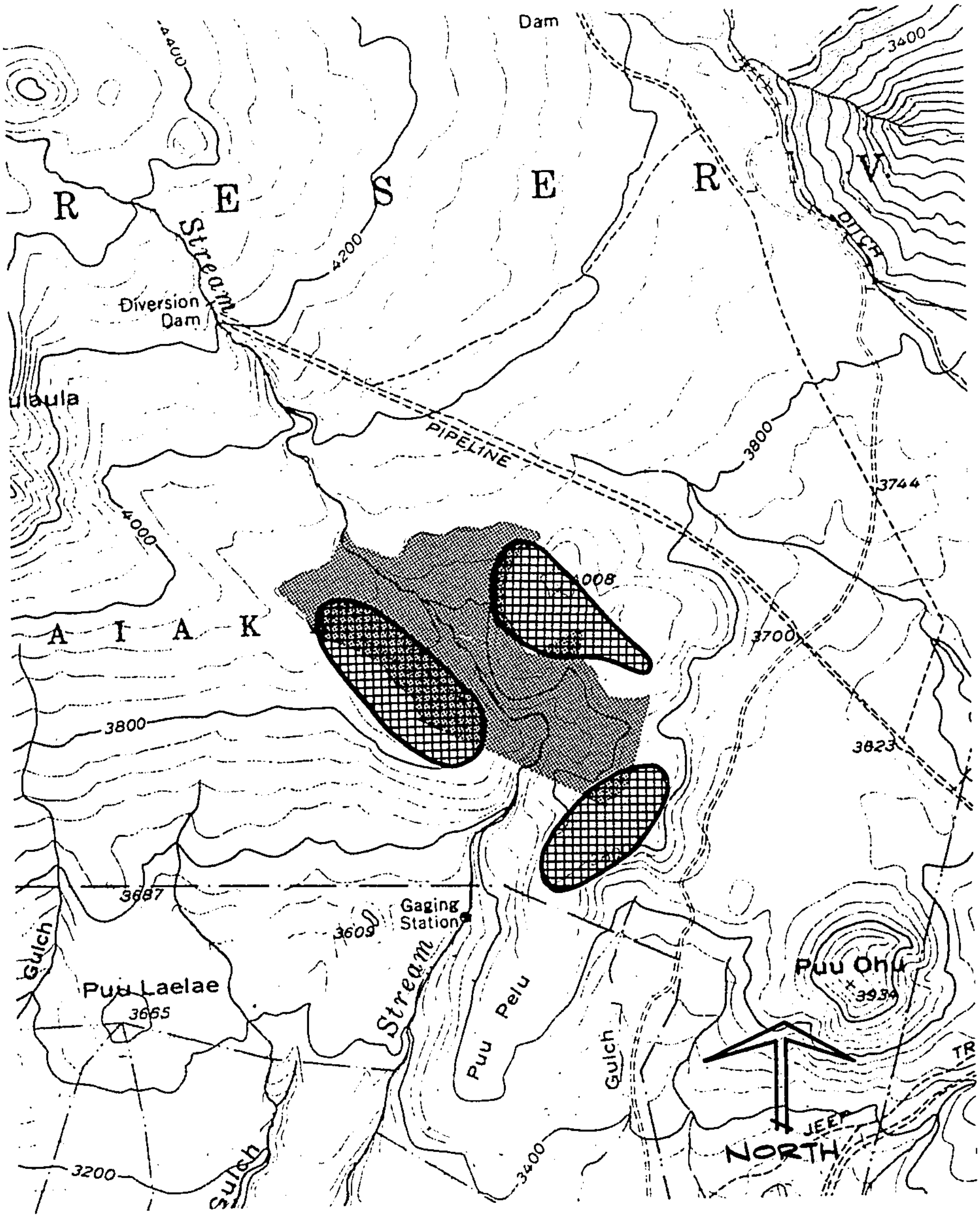


FIGURE: 19 PRIMARY ECOLOGICAL ZONES

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

500 0 500 1500 FEET

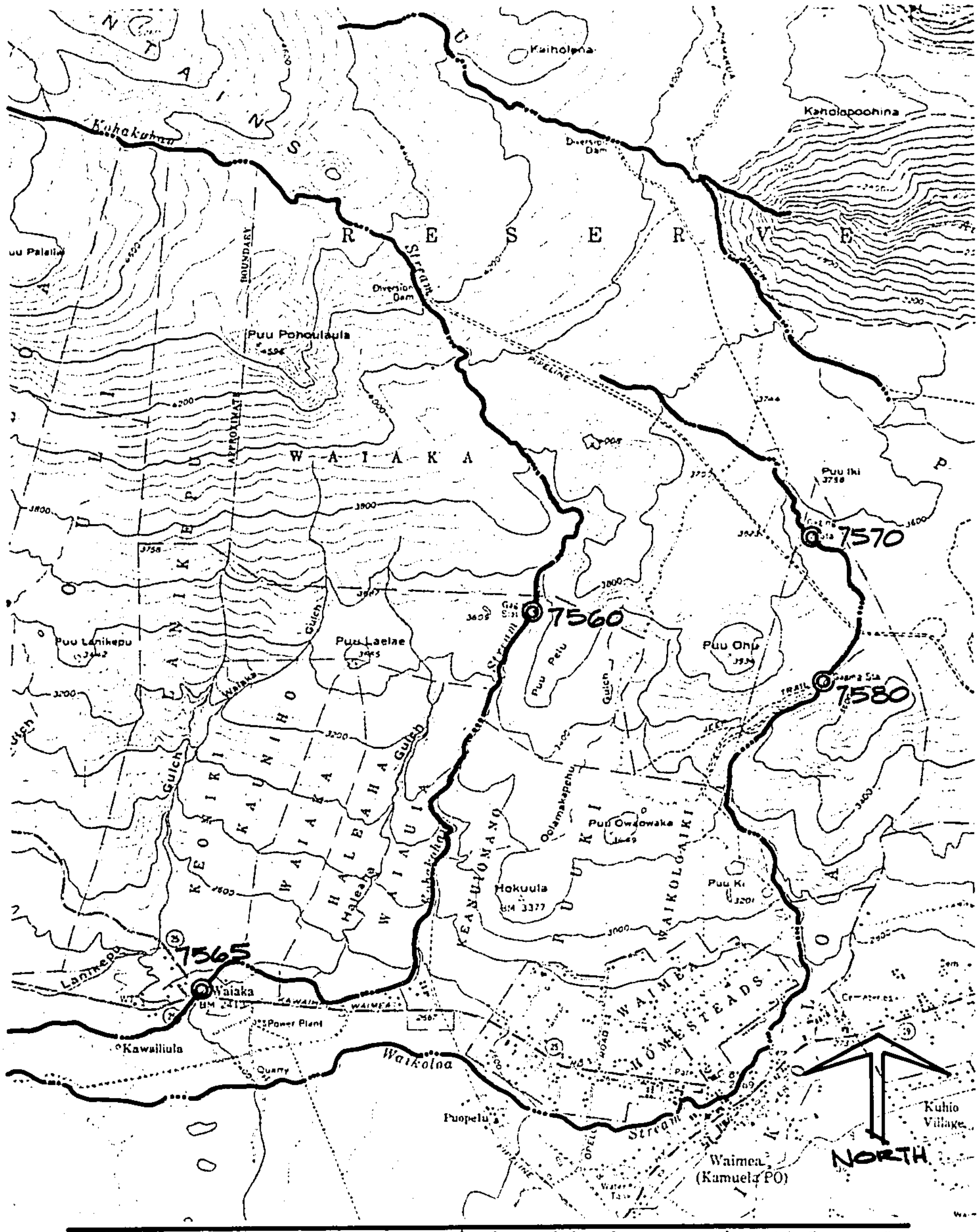


FIGURE: 20 STREAMS & GAGING STATION LOCATIONS

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

1000 0 1000 3000 FEET

Table 6

Streamflow Summary, 1950-1970

	Kohakohau Stream		Waikoloa Stream	
Station Number	7560	7565	7570	7580
Drainage Area (Mi^2)	2.51	4.30	0.78	1.18
Elevation	3,273	2,410	3,570	3,460
Average Annual Streamflow (mgd) 1950	--	--	5.94	7.62
51	--	--	3.46	4.22
52	--	--	5.58	7.59
53	--	--	4.19	5.07
54	--	--	5.50	6.66
55	--	--	4.98	6.14
56	--	--	4.87	6.74
57	6.14	--	4.79	6.44
58	11.05	--	6.60	8.80
59	8.34	--	5.31	7.04
1960	8.05	--	5.14	6.47
61	4.65	--	3.15	3.76
62	1.91	--	2.17	2.50
63	4.33	--	3.97	4.62
64	6.19	8.02	4.82	5.65
65	3.11	2.82	2.71	3.05
66	5.43	5.30	4.33	5.25
67	6.45	6.65	4.04	5.00
68	5.01	6.20	3.80	5.02
69	7.05	8.23	5.24	6.78
1970	8.54	11.38	5.74	7.78
Mean annual (mgd)	6.17	6.94	4.59	5.82
Mean daily (cfs)	9.13	10.1	7.13	8.38
Max daily (cfs)	3880	3540	1930	3390
Min daily (cfs)	0	0	0.74	0.59

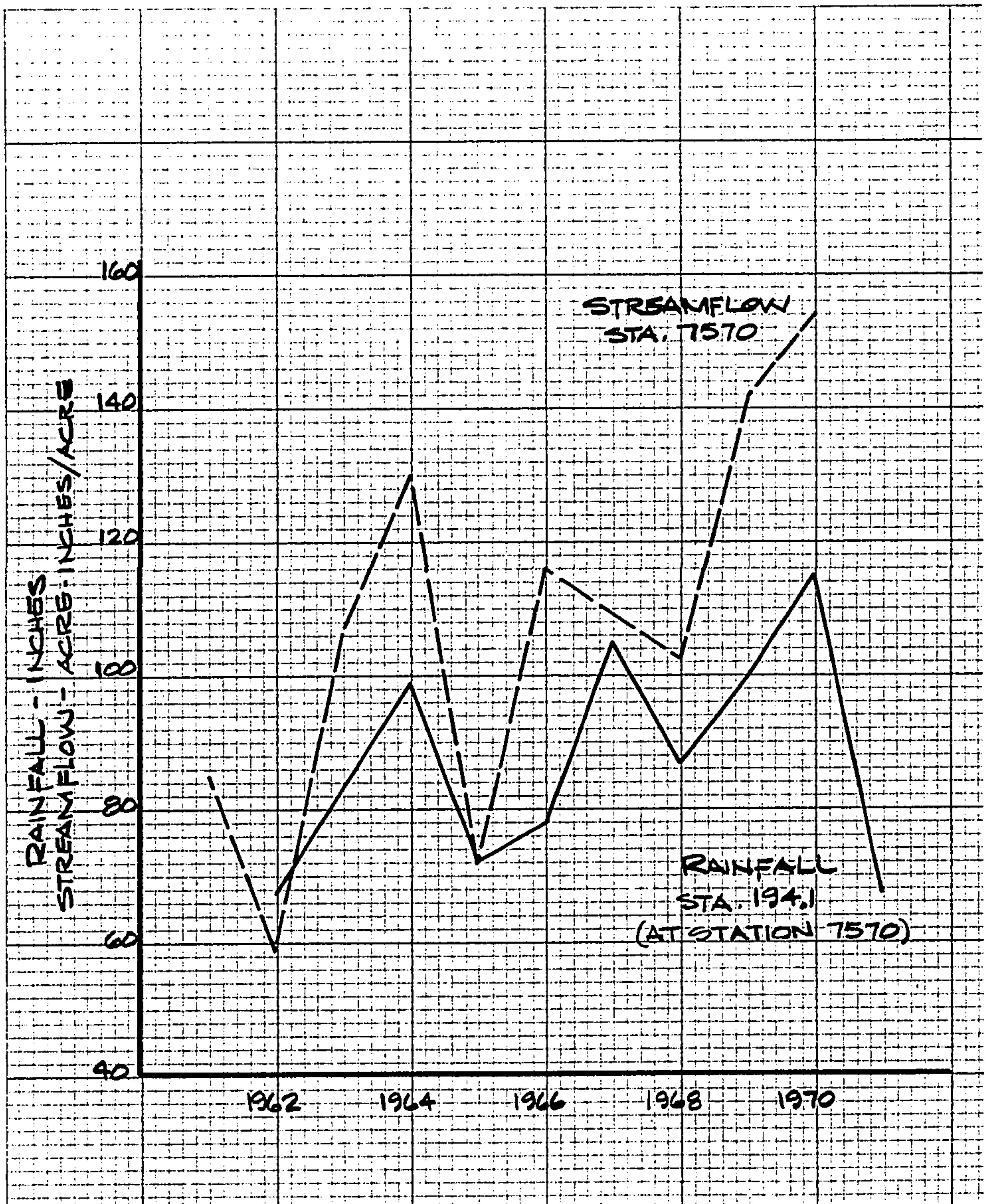


FIGURE: 21

RAINFALL & STREAMFLOW, UPPER WAIKOLOA STATION, 1960-1970

KOHAKOHAU EIS-SOUTH
KOHALA DISTRICT, HAWAII

Stream are similar.

The Kohakohau Stream watershed extends to about elevation 5,100 feet near the summit of Kohala Mountain. The main channel is above known groundwater levels and does not receive dike-confined water. Ground cover in the watershed consists of brush, trees, and sphagnum moss in the higher elevations and contributes to high runoff. At about elevation 3,600 feet the ground cover changes to primarily grass, which increases infiltration and decreases runoff.

B - Water Quality

Waters of the streams in South Kohala generally exhibit high water qualities suitable for potable waters with the exception of conditions of high color and peaty taste. Although inland surface waters in Hawaii are not individually classified by the State, all surface waters used for water supplies fall into the Class I category, as does the Kohakohau Stream. It is the objective of this class of domestic waters that sources remain in as nearly the natural state as possible with minimal pollution from any source. 35/ Table 7 gives Hawaii State water quality standards for Class I waters. 36/

Kohakohau Stream waters are treated at the County plant below the existing Kohakohau Stream Diversion and storage reservoirs (see Figure 8). The County Department of Water Supply makes periodic chemical analyses of water sources in use for domestic supplies, from which the representative sampling profile of water quality in the Kohakohau Stream given in Table 8 is taken.

35/ Reference 29.
36/ Ibid.

Table 7

Class I Water Quality Standards, Hawaii

Parameter	Standard
1. Coliform Bacteria	The median coliform bacteria shall not exceed 1000 per 100 ml, nor shall more than 10% of the samples exceed 2,400 per 100 ml during any 30-day period.
2. Fecal Coliforms	Fecal coliform content shall not exceed an arithmetic average of 200 per 100 ml during any 30-day period nor shall more than 10% of the samples exceed 400 per 100 ml in the same time period. For such portion of Class 1 waters from which water is withdrawn for distribution for drinking water or food processing following simple chlorination, the fecal coliform content shall not exceed an arithmetic average of 20 per 100 ml during any calendar month.
3. PH	Not more than ½ unit difference from natural conditions but not lower than 7.0 nor higher than 8.5 from other than natural causes.
4. Nutrient Materials	Total phosphorus, not greater than 0.20 mg/l; except not greater than 0.05 mg/l for waters entering lakes or reservoirs.
5. Dissolved Oxygen	Not less than 6.0 mg/l.
6. Temperature	Temperature of receiving waters shall not change more than 1.5^{o} from natural conditions.
7. Turbidity	Secchi disc or secchi disc equivalent as "extinction coefficient" determinations shall not be altered from natural conditions more than 5%.
8. Radionuclides	Concentrations of radioactive materials shall not exceed minimum concentrations which are feasible to achieve. In no case shall such material exceed the limits established in the 1962 Public Health Service Drinking Water Standards (or later amendments) or 1/30th of the MPCw values given for continuous occupational exposure in the National Bureau of Standards Handbook No. 69. The concentrations in water shall not result in accumulation of radioactivity in plants or animals that result in a hazard to humans or harm to aquatic life.

Table 8

Summary of Water Quality Characteristics, Kohakohau and Waikoloa Streams

Parameter	Unit	Stream and Sampling Date	
		Kohakohau 6/21/72	Waikoloa Range from 1966 - 1968
pH @ 30°C	---	---	5.8 to 7.9
Color	---	---	22 to 320
Odor	---	---	---
Turbidity	---	---	0 to 100+
NO_2	ppm	0.01*	---
NO_3	ppm	0.01	0.5 average
Hydroxide Alkalinity	ppm as $CaCO_3$	---	---
Carbonate Alkalinity	" " "	---	---
Bicarbonate Alkalintiy	" " "	---	---
Total Alkalinity	" " "	---	10.0 to 24.0
Total Hardness	ppm	50	12.0 to 28.0
Total Solids	"	20	60.0 to 360.0
Loss on Ignition	"	2.0	---
SI_2	"	0.41	12.0 average
Fe	"	0.16	0.12 average
Ca	"	3.2	2.1 average
Al	"	2.0	---
Mg	"	2.6	2.4 average
SO_4	"	4	---
Na	"	0.2	---
K	"	7.0	---
Chlorides	"	0.005*	5.0 average
As	"	0.10	---
F	"	0.03*	---
Mn	"	0.005*	---
Pb	"	0.02*	---
Cu	"	0.02	---
Zn	"	0.01	---
Se	"	---	---
Phenols			---

*Less Than

Also shown in Table 8 are ranges in water quality parameters observed in the Waikoloa Stream from 1966 to 1968, which are typical of conditions in Kohakohau Stream as well.

Although no specific standards regulating temporary disruptions of water qualities, such as could occur during construction activities, exist for inland waters in Hawaii, it is well to consider Class I standards as objectives in limiting discharges from any sources.

13 - Ground Water

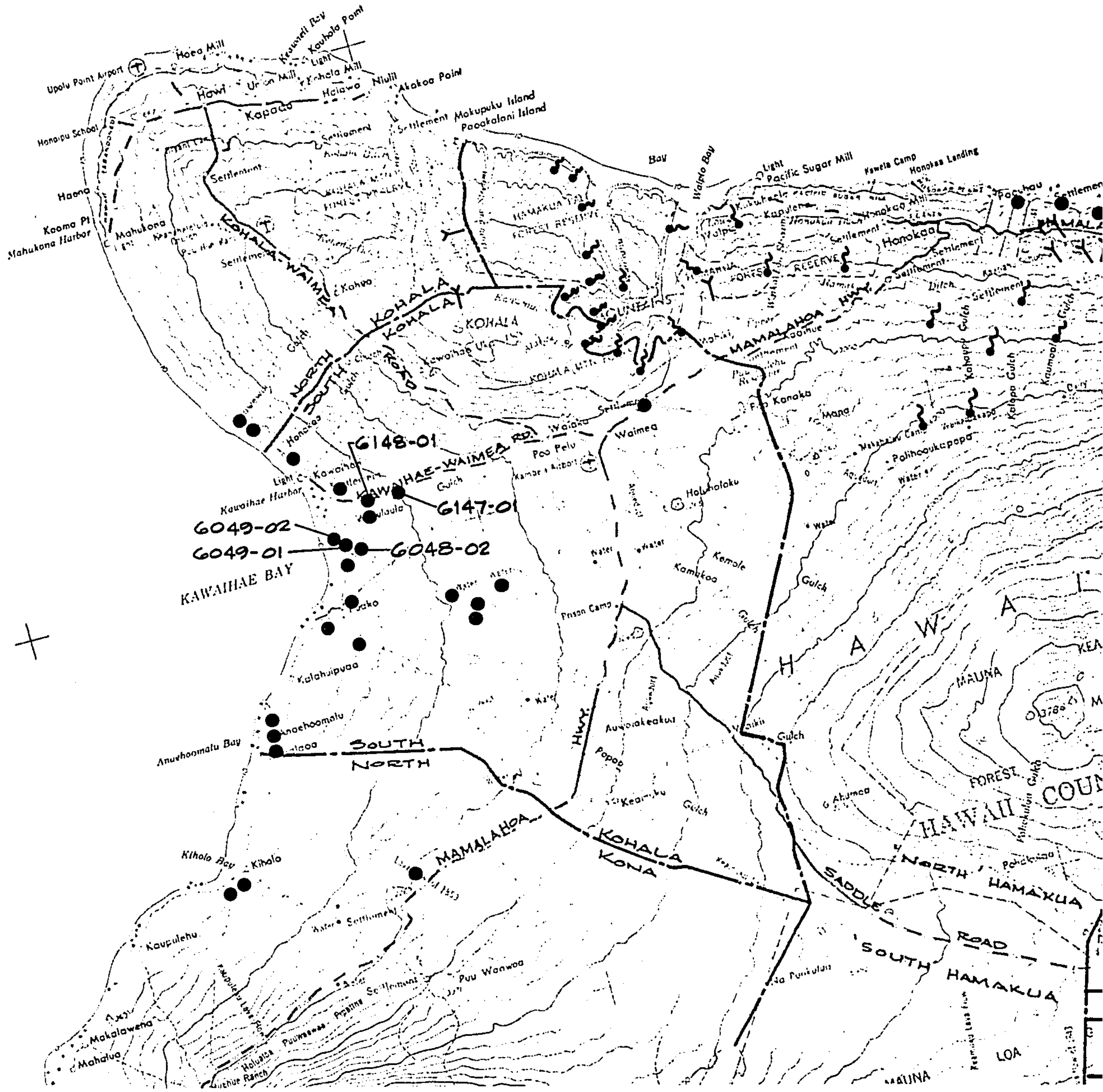
Ground water on Hawaii occurs in three distinct forms: (1) high-level perched ground water, (2) high-level ground water impounded by dikes, and (3) low-level, or basal, ground water. Occurrences of ground water are closely associated with geologic characteristics of an area. On the windward slopes of Kohala Mountain, high-level ground water is released by numerous springs flowing in the deep canyons. Although high-level ground water is also thought to underly the southern slopes of Kohala Mountain, little physical evidence supporting those predictions has been documented to date. Basal ground water is considered extensive in both areas. Figure 22 shows existing wells, tunnels, and springs in Kohala and Hamakua. 37/

A - Ground Water in the Potential Reservoir Area

Beds of ash and soil and dense lava flows generally have low permeability and are barriers to the downward movement of water. Ground water perched on these barriers occurs in discontinous, generally thin zones that supply springs and seeps on slopes and outcrops. Volumes and discharges of perched ground water bodies fluctuate greatly with rainfall. Swamps are bodies of perched ground water which are poorly drained and are typified by spongy and saturated masses of muck and vegetation.

Swampy areas were identified in the study area as shown on Figure 23. Based on information obtained from a 1964 boring program in the study area, 38/ the general reservoir

37/ Based on data from References 32 and 41.
38/ See Reference 37.


6148-01
6147-01
6049-02
6049-01
6048-02
KAWAIHAE BAY
Kawaihae Harbor
KAWAIHAE-WAIMEA RD.
NORTH KOHALA
SOUTH KOHALA
KOHALA-WAIMEA
SOUTH
NORTH
KOHALA
KONA
MAMALAHOA
HWY.
MAMALAHOA HWY.
SADDLE ROAD
NORTH HAMAKUA
SOUTH HAMAKUA
HAWAII COUN
H A W A I
Upolu Point Airport
Hoea Mill
Hawi
Kapaau
Halawa
Niulii
Akakoa Point
Kauhola Point
Kohala Mill
Union Mill
Mokupuku Island
Paaakalani Island
Honoipu School
Haena
Kaoma Pt
Mahukona
Mahukona Harbor
Settlement
Bay
Waipio Bay
Pacific Sugar Mill
Kawela Camp
Honokaa Landing
Honokaa
Paauhau
Waimea
Poo Pelu
Holoholoku
Kemole
Kamakoa
Gulch
Puako
Kalahuipuaa
Anaehoomalu
Anaehoomalu Bay
Kiholo Bay
Kiholo
Kaupulehu
Makalawena
Mahaiula
Puu Wanwaa
Prison Camp
Auwaiakeakua
Popoo
Keamuku
Ahumoa
Na Puukulua
Polihooukapapa
Mana
FOREST
MAUNA
LOA
MAUNA

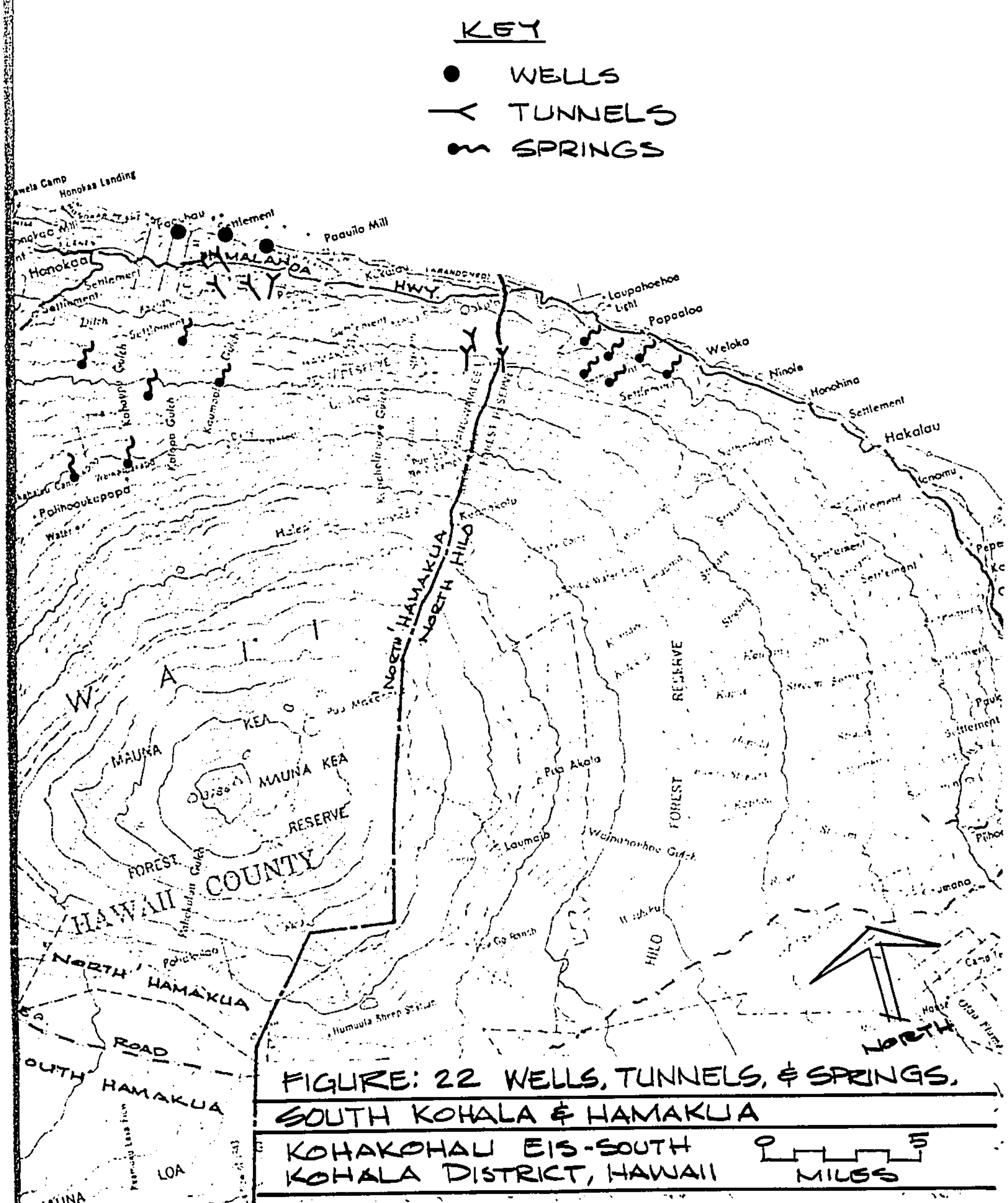


FIGURE: 22 WELLS, TUNNELS, & SPRINGS.
SOUTH KOHALA & HAMAKUA
KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII

area is believed to be situated in the valley of a stream which contributes water to the zone of ground water below stream level.

The identification of possible zones of permeable materials underlying surface soils and vegetation, and the knowledge that the general water table is well below the Kohakohau Stream elevation, indicate that there is expected to be some reservoir leakage to the ground water table.

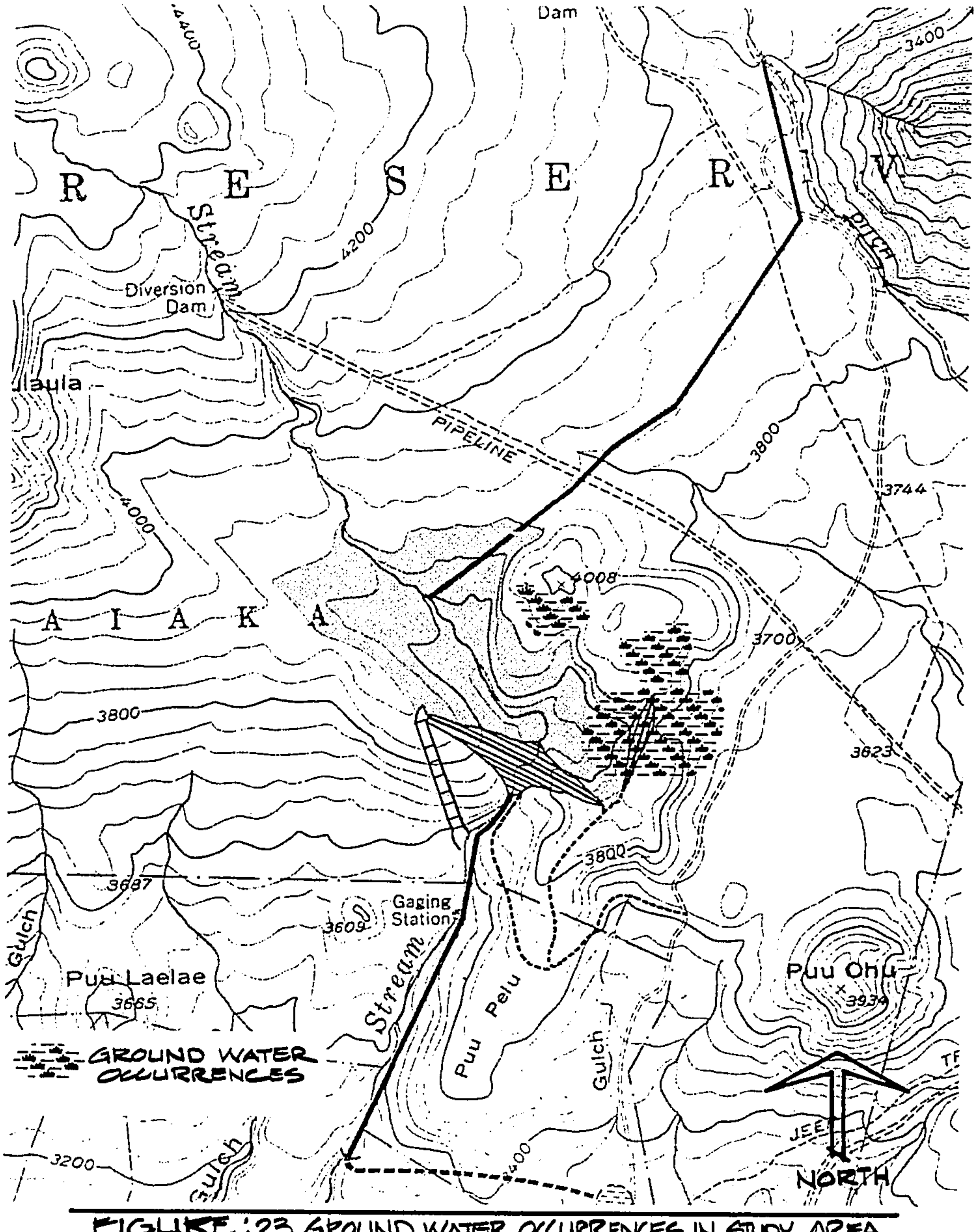


FIGURE: 23 GROUND WATER OCCURRENCES IN STUDY AREA

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

500 0 500 1500 FEET

B- Ground Water Impounded by Dikes

Dikes cutting the lavas underlying the upper slopes of Kohala Mountain impound large quantities of ground water. On the windward slopes, the water appears at springs in valleys eroded into the dike compartments. On the lee slopes, however, erosion has not been so severe, and, because deep valleys have not been formed to intersect the suspected dike compartments, visible evidence of the existence of diked ground water is not present.

It is thought that a large volume of water may be stored on the southern side of Kohala Mountain. 39/ A well drilled near Waimea at approximate elevation 2,600 feet, however, intercepted no high-level ground water in a drilling depth of about 800 to 1000 feet. Other wells drilled near Waimea have similarly encountered no dike-confined ground water to depths approaching elevation 1500 to 1800 feet. Additional discussion of dike-impounded water is presented in the comparison of alternatives to the Kohakohau Dam Project.

C - Basal Ground Water

Basal ground water is the large body of water that lies near sea level, below the upper water table. The upper zone of basal water is a lens of fresh to brackish water which floats on the heavier sea water. The fresh lens is generally maintained by infiltration from rainfall on the land area overlying the lens.

As shown on Figure 22, numerous wells in western South

39/ Reference 39.

Kohala have been drilled to tap basal water. Wells located within one to two miles of the coastline generally yield brackish water (above 250 ppm chlorides), but two wells drilled at approximate elevation 1,200 feet by Boise-Cascade have yielded waters with much lower (20-30 ppm) chloride contents. Basal ground water is less likely to be affected by saltwater intrusion with increased distance from the coastline, but accessibility in inland areas is limited by great pumping head requirements.

D - Ground Water Quality

High-level ground water typically exhibits high qualities. The color and peaty taste of surface waters have been removed by infiltration processes. Basal ground water in coastal areas, however, is susceptible to contamination from salt water intrusion.

Table 9 presents water quality profiles for selected sampling points in South Kohala, 40/ corresponding with well numbers shown on Figure 22. Supplies obtained from brackish wells generally contain between 250 and 500 ppm chlorides, compared with the County of Hawaii Department of Water Supply potable limit of 180 ppm.

40/ From Reference 32.

Table 9

Summary of Ground Water Quality Characteristics

Parameter	Sampling Site*and Date				
	No. 6048-02 1968	No. 6049-01 1968	No. 6049-02 1968	No. 6147-01 1963	No. 6148-01 1972
pH 25°C	--	--	--	7.3	--
pH 30°C	--	--	--	--	--
Color	--	--	--	5	--
Odor	--	--	--	--	--
Turbidity	--	--	--	1	--
Nitrates	--	--	--	.001	Nil
Nitrites	--	--	--	2.89	.78
Hydroxide Alkalinity	--	--	--	--	--
Bicarbonate Alkalinity	--	--	--	89	--
Total Alkalinity	--	--	--	89	--
Total Hardness	188	204	466	214	180
Toatal Solids	868	973	2322	796	860
Loss on Ignition	--	--	--	240	220
Silica	12.5	12.6	12.4	89.2	8.8
Iron	Nil	.22	Nil	.04	.68
Aluminum	--	--	--	.05	.14
Calcium	27	28	52	31.5	32
Magnesium	27	33	82	32.8	30
Sulfate	82	91	192	54	70
Sodium	239	274	695	135	175
Chlorides	383	443	1180	250	340
Arsenic	--	--	--	Nil	Nil
Fluoride	--	--	--	.20	.26
Manganese	Nil	Nil	Nil	.05	.03
Lead	--	--	--	Nil	Nil
Copper	--	--	--	.13	.02
Zinc	--	--	--	.10	.08
Salenium	--	--	--	Nil	Nil
Phenols	--	--	--	Nil	--

* See Figure 22 for location of sampling site.

14 - Water Supplies and Demands

As shown in Figure 7, existing domestic water systems in South Kohala and Hamakua include the Kawaihae - Puako, Waimea - Puukapu, and Hamakua Systems. These facilities have been constructed to meet expanding demands as required. At present, there is a slight surplus of domestic supply over current demands; however, recent years have seen temporary shortages in supplies, particularly in the Waimea and Kawaihae areas, in late summer months and other periods of unreliable rainfall. The upper 50-million gallon reservoir, when completed, will serve to provide greater reliability, as well as additional quantity, to the yield of the South Kohala system.

Of the three major agricultural systems shown in Figure 8, only the Hawaiian Irrigation Company system enjoys generally surplus supplies. The Parker Ranch and Lalamilo Irrigation Systems experience droughts corresponding with dry periods in the South Kohala domestic system.

In summary, existing domestic and agricultural water supplies in South Kohala and Hamakua are, with periodic improvements, adequate to meet current levels of domestic and agricultural uses in the districts. Any major increase in demand could not, however, be comfortably accommodated by existing systems.

III. FUTURE ENVIRONMENT WITHOUT THE PROJECT

SOCIO-ECONOMIC CONDITIONS

1 - Historicand Archaeologic Potential

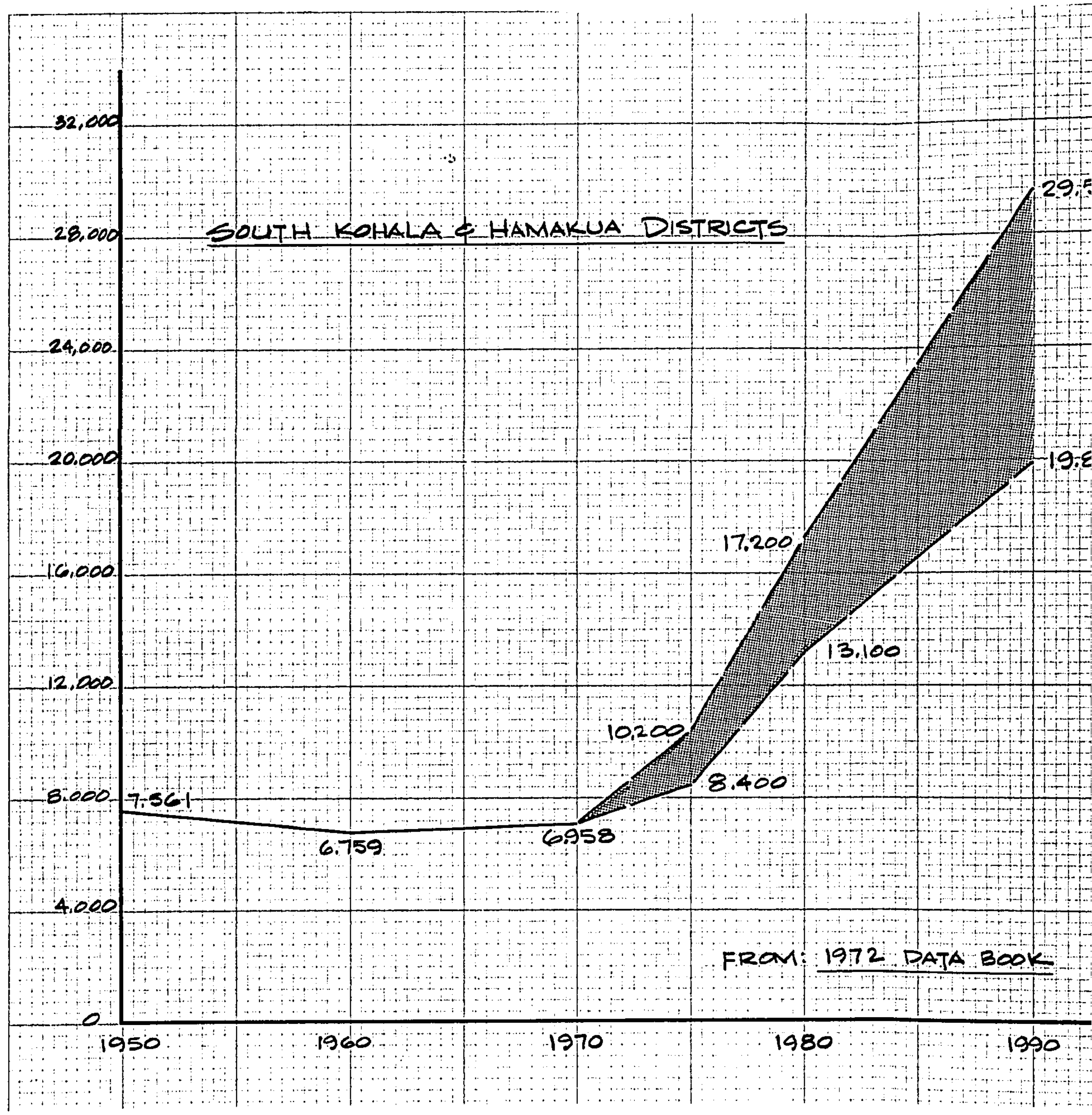
As no historic or archaeologic sites have been identified in the study area, and as the study area is restricted from public access, no change in the historic and archaeologic character of the study area is expected to occur in the future without the Kohakohau Dam Project.

2 - General Development Patterns

It is expected that the future will see significant growth in the South Kohala District and little change in conditions in the Hamakua District. Conclusions presented in the 1963 General Plan for the Kohala-Hamakua Region, Island of Hawaii 41/ for the 1960's have remained valid today. At that time it was predicted that the sugar industry would continue to decrease employment, the ranching industry would maintain its competitive status, macadamia nut production would increase, diversified farming would substantially increase, industrial activities would grow moderately (primarily at Kawaihae), and the visitor industry would greatly increase in size and influence.

These projections have been generally valid and appear also to apply to the future. Little new activity is

41/ Reference 4.



SOUTH KOHALA & HAMAKUA DISTRICTS
32,000
28,000
24,000
20,000
16,000
12,000
8,000
4,000
0
1950
1960
1970
1980
1990
7,561
6,759
6,958
10,200
8,400
17,200
13,100
FROM: 1972 DATA BOOK

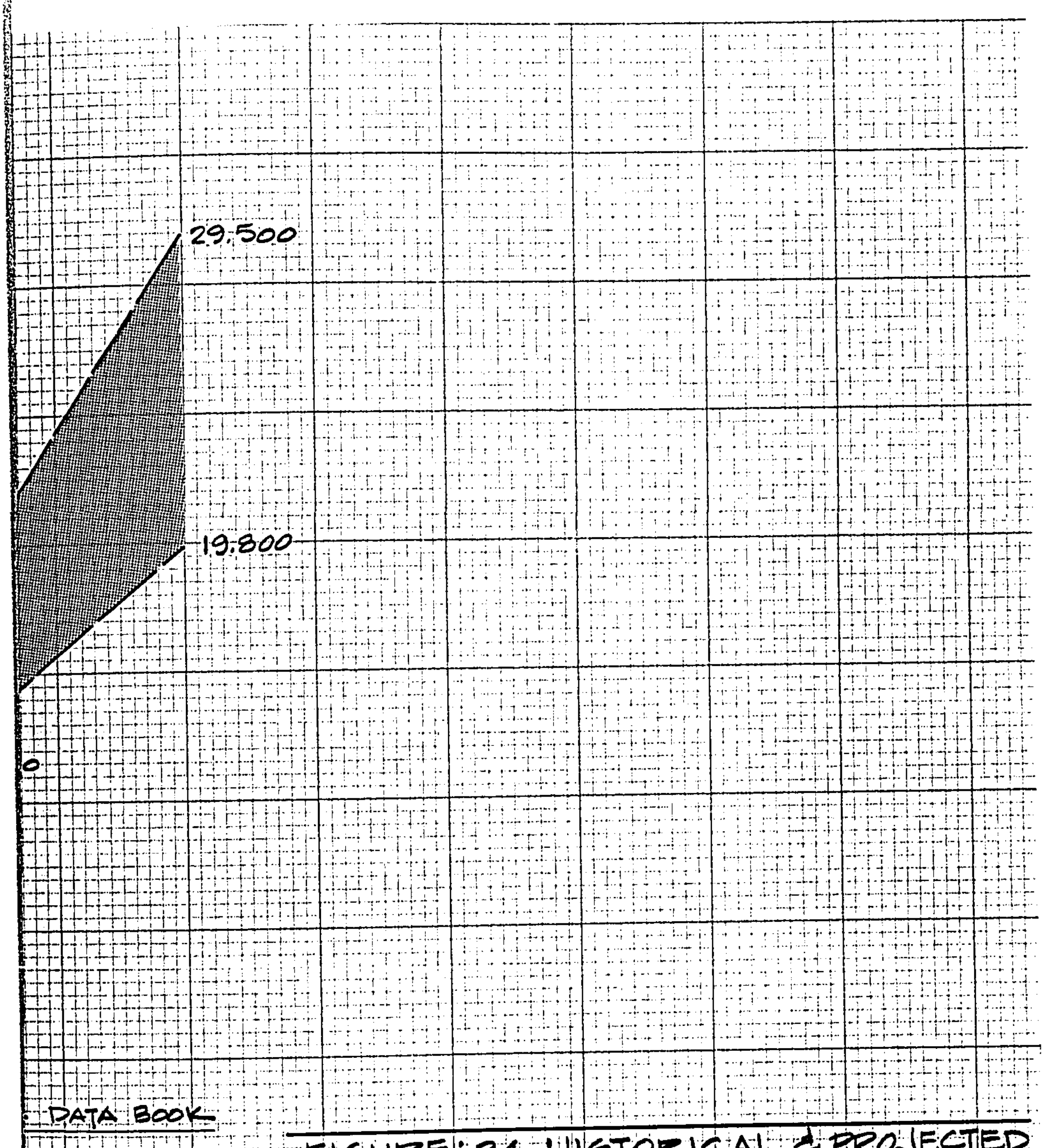
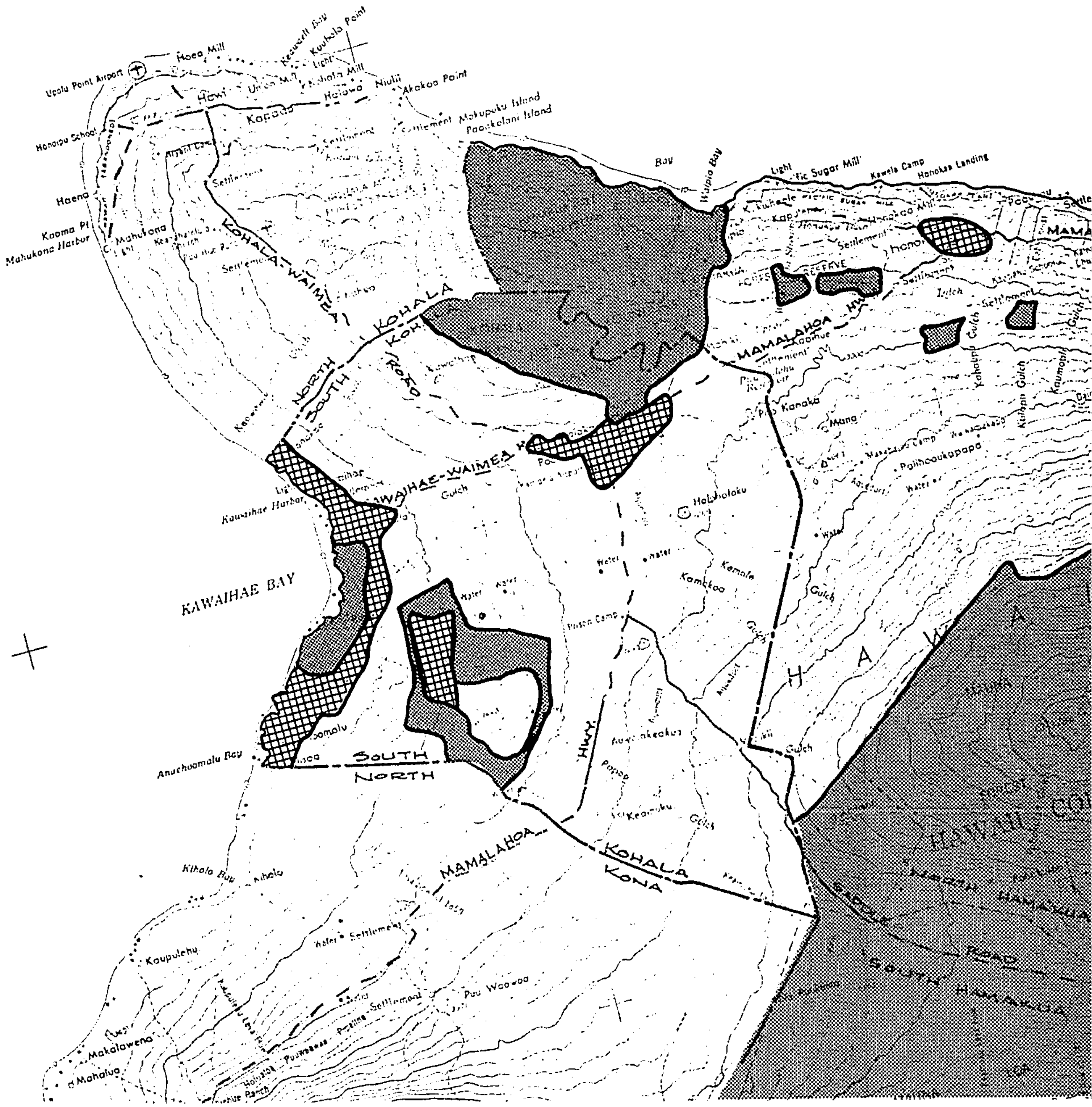


FIGURE: 24 HISTORICAL & PROJECTED POPULATION, SOUTH KOHALA & HAMAKUA

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII



Upolu Point Airport
Hoea Mill
Kauhola Point
Hawi
Kapaau
Halawa
Niulii
Akakoa Point
Mokupuku Island
Honoipu School
Haena
Kaoma Pt
Mahukona Harbor
Mahukona
KOHALA-WAIMEA
NORTH
SOUTH
KOHALA
Bay
Waipio Bay
Light
Kawela Camp
Honokaa Landing
MAMALAHOA HWY
KAWAIHAE-WAIMEA
Kawaihae Harbor
KAWAIHAE BAY
Gulch
Mana
Anaehoomalu Bay
SOUTH
NORTH
HWY
MAMALAHOA
KOHALA
KONA
Kiholo Bay
Kaupulehu
Makalawena
Mahaiula
Puu Waawaa
SADDLE ROAD
NORTH HAMAKUA
SOUTH HAMAKUA

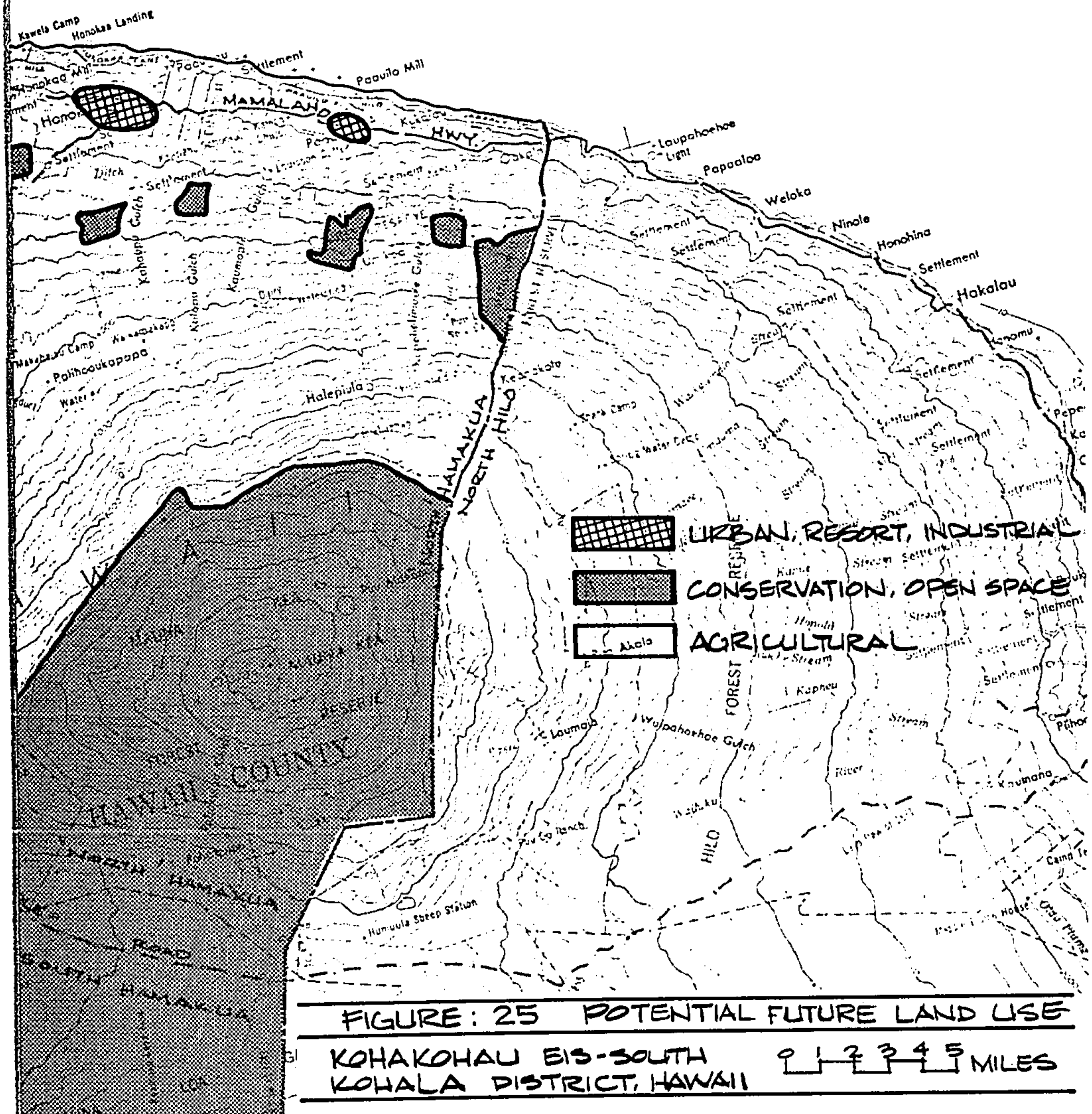


FIGURE: 25 POTENTIAL FUTURE LAND USE

KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII

an unprecedented increase in South Kohala and Hamakua. Although the range in projections is large, the envelope shown on Figure 24 represents the most accurate estimates of future population available to date.

Figure 25 shows generalized land use as presented in the General Plan 44/ for the ultimate future condition. When interpreted together, the population projections shown in Figure 24 and the land use projections shown in Figure 25 indicate the general magnitude and direction of growth expected in the South Kohala-Hamakua Region.

Several large developments are planned or are being constructed on private lands within the South Kohala District, primarily along the lee coast south of Kawaihae. In addition to potential private resort and residential developments, there has been substantial interest on the part of various groups in locating other developments in South Kohala. A college facility or branch of the University of Hawaii has been proposed, as well as private and governmental business and research centers. Development of any of these possibilities would significantly affect land use and population trends and distributions within the district.

4 - Economy and Employment

Economic conditions in Hamakua are not expected to change significantly in the short-term future. Agriculture is expected to dominate employment and income characteristics.

44/ Reference 6.

Potential growth in South Kohala can be expected to spur economic activity in the area and shift labor and income away from agricultural patterns. Realization of (1) the inter-island terminal at Kawaihae, (2) large-scale coastal residential and resort developments, (3) the location of a college branch or research center at Waimea, or other possibilities would dramatically stimulate employment and income in South Kohala. In the absence of substantive plans, however, no preliminary projections can be made.

5 - Power and Transportation

Power consumption and costs are expected to increase in the future from growth in population in the region and increasing fuel costs. The relatively small size and decentralized nature of the population in the South Kohala and Hamakua Districts, coupled with increasingly stringent pollution control standards and rising fuel costs, will mean continued high power costs.

The Waimea-Kona Highway is nearing completion and, when finished, will provide greatly improved accessibility between the two commercial and residential centers. It is expected that a new alignment for the existing Waimea-Kawaihae Road will be completed before 1980.

6 - Recreation

It has been recognized that as development of coastal lands continues, inland parks will be required to

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6 - Recreation

It has been recognized that as development of coastal lands continues, inland parks will be required to complement heavily used shoreline areas to satisfy both resident and tourist demands. Although the geography and decentralized population distribution in the island of Hawaii limit the accessibility of resource areas, and the use potential of inland areas is not presently realized, future expected growth will open some areas for feasible use. The County of Hawaii Department of Parks and Recreation is preparing a recreation plan for the County of Hawaii which will outline plans for future facilities to complement the resources identified in Table 5 and Figure 12.

7 - Aesthetic / Amenity Considerations

Characterized by natural beauty and serenity, the Waimea area and the Kohala Mountain region offer the privacy and attractiveness of a small community within a diversified natural setting. No significant changes in that condition are expected in the short-term; however, potential long-term growth and development in the South Kohala District would be expected to alter that character to some degree.

PHYSICAL CONDITIONS

8 - Topography, Geology, and Soils

No noticeable changes in existing geologic conditions are expected to occur in the future. Seismic events can be expected to occur in unpredictable frequency and magnitude.

9 - Climatology, Air, and Noise

No significant changes in existing climatological, atmospheric, or background noise conditions are expected in the Waimea area, and no change of any kind is expected in the study area due to access restrictions.

10 - Floral Features of the Ecosystem

No distinct trends in vegetational patterns have been identified in the study area; however, it is thought that the destruction of vegetation by pigs in the study area and the abundance and infestation of exotic, weed-type species will continue to detract from the value of the area as a middle elevation, native forest resource.

11 - Faunal Features of the Ecosystem

Birds and wildlife populations are expected to remain generally stable without the Kohakohau Dam Project, as access to the area is restricted. Continued damage to vegetation by pigs in the area may reduce habitats for other mammals and birds.

12 - Surface Waters

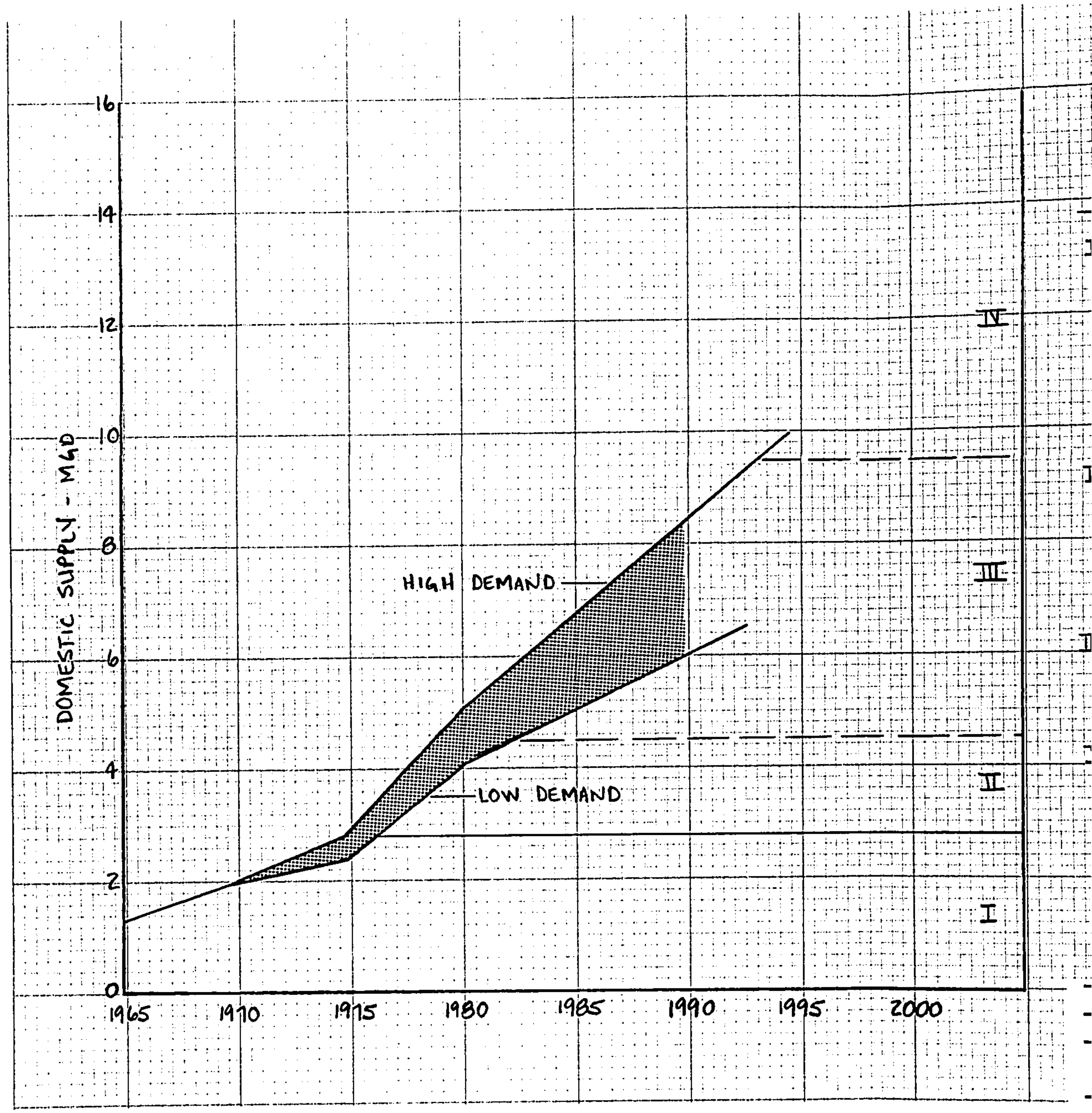
No long-term natural trends in hydrologic conditions have been identified which would predict future changes in surface water conditions. However, expected development of surface water resources by alternatives to the Kohakohau Dam Project to meet increasing domestic water demands would result in reductions in available surface water supplies and possible deterioration of surface water qualities.

13 - Ground Water

No noticeable changes in qualities, volumes, or discharges of existing ground water bodies are expected to occur in the future. The total estimated draw from wells tapping basal ground water is not expected to result in a reduction in available supplies in the fresh water lens and aquifers, and supplies taken from the more brackish lens will not deplete the reliable yield.

14. Water Supplies and Demands

Figure 26 shows the accumulated development of domestic water supplies in South Kohala and Hamakua, the effects of future water resource development increments and the proposed Kohakohau Dam Project on the total available domestic water supply, and the ranges in projected demands to 1990, based on


DOMESTIC SUPPLY - MGD
16
14
12
10
8
6
4
2
0
1965
1970
1975
1980
1985
1990
1995
2000
HIGH DEMAND
LOW DEMAND
IV
III
II
I

DEVELOPMENT INCREMENT	YIELD (MGD)
I. EXISTING	
A) WAIKOLOA DIVERSION	1.05
~~B) KAWAIHAE WELLS~~	.33
C) 50-MG RESERVOIR	1.00
D) KOHAKOHAU DIVERSION	.40
SUB-TOTAL	2.18
II. FUTURE	
A) 50-MG RESERVOIR	.10
~~B) MIXING WITH COASTAL~~ WELL WATER	1.00
SUB-TOTAL	1.10
III. KOHAKOHAU DAM INITIAL STAGE	5.00
ACCUMULATED TOTAL	9.48
IV. KOHAKOHAU DAM ULTIMATE STAGE	5.00
ACCUMULATED TOTAL	14.48

IV

III

II

I

2000

FIGURE: 26 DOMESTIC WATER SUPPLY DEVELOPMENT, SOUTH KOHALA

KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII

the projected population range shown in Table 10 and Figure 24. As indicated in Increment II, it is intended that the completion of the upper 50 - million gallon reservoir (expected in early 1975) would be followed by the mixing of fresh waters with brackish waters from coastal wells to meet increasing demands.

Without implementation of the Kohakohau Dam Project, long-term average daily demands for domestic waters would be expected to be met with existing and planned supplies for a few years. Beyond that time, existing supplies would be insufficient to meet increasing demands, unless alternatives to the Kohakohau Dam Project are implemented.

IV. PROBABLE IMPACT ON THE ENVIRONMENT

Primary and secondary impacts resulting from the Kohakohau Dam Project are discussed for each aspect of the existing environment of the study area and the South Kohala-Hamakua region as follows. The ranking of impacts, following discussions of separate impacts, considers the anticipated magnitude and significance of indirect, as well as direct, impacts.

PRIMARY AND SECONDARY IMPACTS: SOCIO-ECONOMIC

1 - Historic and Archaeologic Potential

No primary or secondary impacts will result to historic or archaeologic sites as there are no such sites in the study area.

2 - General Development Patterns

The Kohakohau Dam Project will, as a secondary effect of the provision of additional domestic waters, enable the development of planned growth areas in South Kohala and Hamakua as described in the County of Hawaii General Plan.[45/] The project will not induce growth which is incompatible with the General Plan[46/]; rather, it will provide an element of the infrastructure of public services required by planned growth in South Kohala and Hamakua. The ultimate level of expected growth and development in South Kohala and Hamakua will not be altered by the Kohakohau Dam Project; however, the provision of a significant surplus in domestic water supply in South Kohala and Hamakua at one time may slightly accelerate the time frame of expected growth.

In support of the development of South Kohala and Hamakua, the project would make available an aggregate average supply of about 12 million gallons daily from the Kohala Mountain watershed. If the pattern of development follows that

45/ Reference 6.
46/ Ibid.

envisaged in the County's General Plan and the current State Land Use designations, the total water supply would be able to support a total population of roughly 33,000 people, distributed as follows:

General Area	Population Supportable No.	Percent
Hamakua	8,100	25
Waimea	5,200	16
Kawaihae	19,400	59
Total	32,700	100

Primarily affected by the Kohakohau Dam Project would be the land developments planned or proposed for the coastal South Kohala lands stretching from Kawaihae southward to Kiholo Bay. This general area contains about 75 percent of all the urban-zoned lands in the South Kohala-Hamakua Districts. Major existing developments include the Kawaihae Harbor terminal facilities, the State parks systems at Hapuna and Kawaihae, Olohana Corporation's Mauna Kea Beach Hotel complex, and Boise Cascade's Waikoloa Village. Continued interest exists for additional land developments along the coastline. Relatively firm proposals include the further urbanizing of Olohana Corporation lands centered about the Mauna Kea Beach Hotel complex; the resort complex at Anaehoomalu by Boise Cascade; and, further south beyond the South Kohala-North Kona boundary, the expansion by Hualalai Development Corporation of the Kona Village resort complex at Kaupulehu. Lesser-size developments by others have also been advanced. The location of the major land developments proposed along the coast is shown in Figure 26a.

The impact of the project on the growth of potential urban areas lying further south beyond the South Kohala District is difficult to measure. Present land developments in these outlying areas, including the above-mentioned Kaupulehu lands, rely on independently developed water systems. The prospect of Kohakohau waters being piped to those North Kona lands in the foreseeable future is uncertain. Much hinges on the growth rate and development patterns within the South Kohala area, as these factors would determine the sufficiency of the project waters to support outlying lands.

3 - Population and Land Use

A short term increase in population will occur in South Kohala and Hamakua as a result of the construction period. This increase is considered small (less than 5 percent in Waimea or less than 1 percent in South Kohala and Hamakua) and will probably occur primarily in the Waimea area. A total of approximately 100 to 150 acres of land in the Kohala Forest Reserve will be converted from the existing condition to a reservoir with attendant facilities, representing less than 1 percent of the total Forest Reserve acreage and approximately 1.5 percent of the total Kohala Watershed Reserve acreage. No persons or structures will be displaced by the project.

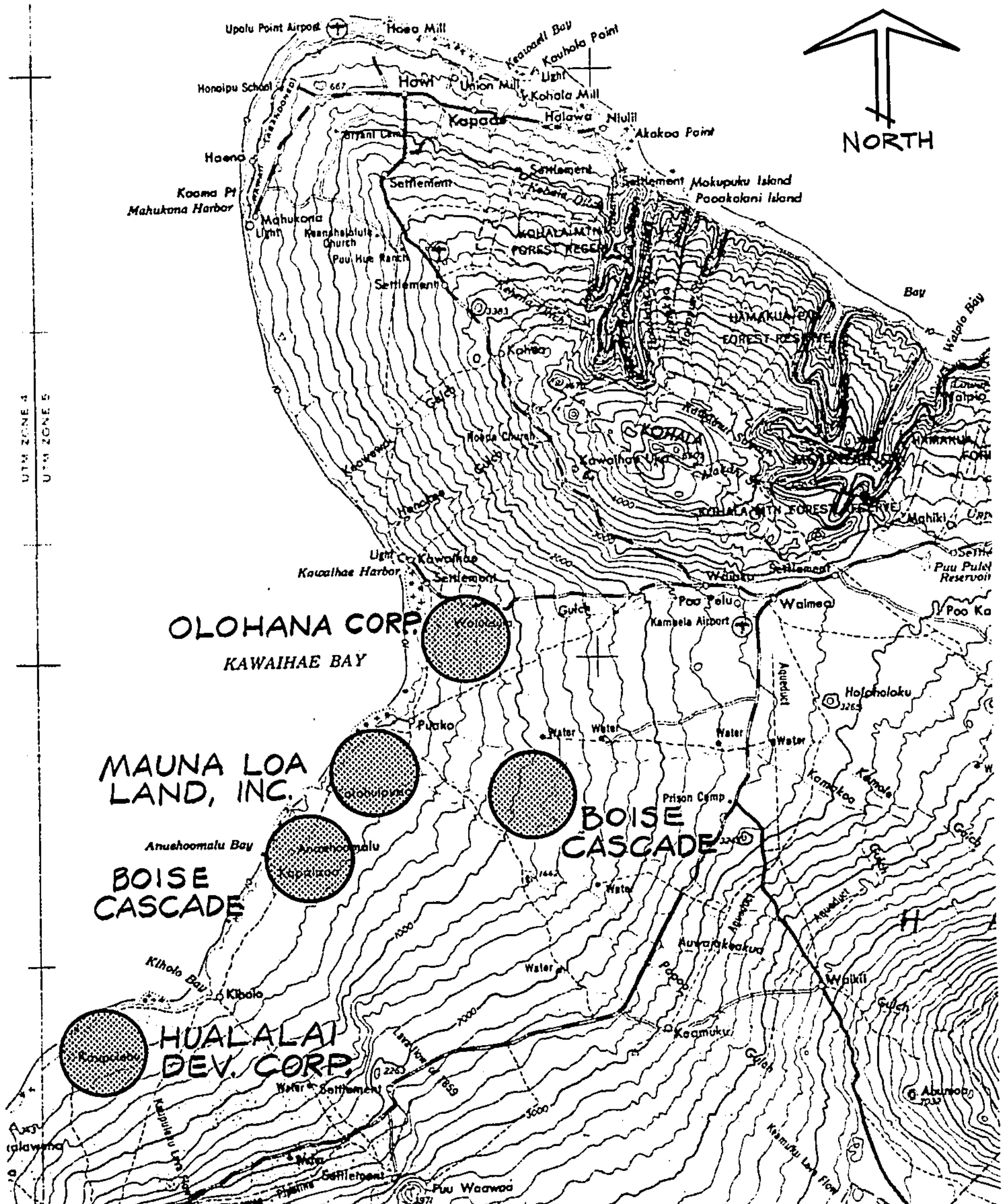


FIGURE: 26a MAJOR PLANNED LAND DEVELOPMENTS ALONG KAWAIHAE COAST

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

2 1 0 2 4 6 MILES

4 - Economy and Employment

The project will provide a small number of new jobs for local residents and a small percentage increase (estimated as less than 5 percent) in the existing consumer output level in South Kohala and Hamakua as a result of the temporary construction period. A short-term increase in housing demand in Waimea and South Kohala will result, and the South Kohala unemployment rate will decrease somewhat during that period.

Industrial activity will increase on a small scale, particularly in construction related industries. Requirements for imported materials and equipment may serve to accelerate development of the proposed Kawaihae harbor and port.

5 - Power and Transportation

The Kohakohau Dam Project will have a direct effect on the electric power system in South Kohala and Hamakua if potential hydroelectric facilities are incorporated. No substantive plans or decisions have been developed at this time, however, and the effects on power sources and rates cannot be predicted. No significant effect on transportation systems will result directly or indirectly from the project.

6 - Recreation

The project as currently proposed will have no significant adverse effect on the recreational facilities, uses and potentials of the study area or the South Kohala-Hamakua region.

Approximately 80 to 120 acres of recreational hunting area will be lost by inundation, representing 0.1 to 0.2 percent of the Kohala Forest Reserve (0.8 to 1.2 percent of the Kohala Watershed Reserve). However, the creation of a large body of water behind the dam facility opens the possibility of using the project for water recreation, particularly fishing. Despite the recognized problems connected with such a proposal--problems relating to water safety, liability, sanitation and water pollution--the project will offer the opportunity for establishing a water recreational program for the area. This potential and its related problems will be continually evaluated to determine the feasibility of initiating a sport fishery program.

7 - Aesthetic/Amenity Considerations

Although the natural visual character of 3,000 to 4,000 feet of the Kohakohau Stream system will be lost by inundation, present access to the area is so limited that no major effect on public awareness will occur. The project will have a small effect on visual conditions in South Kohala and the Waimea area. As shown in Figures 27 and 28, the puu's (hills) behind Waimea restrict view of the project area in nearly the entire vicinity of Waimea south to a distance of three or four miles, and revegetation of the disturbed areas would not be discernable from that distance. The proposed primary dam would be visible from a small area near the Waimea power plant at a distance of about 2.5 miles (corres-

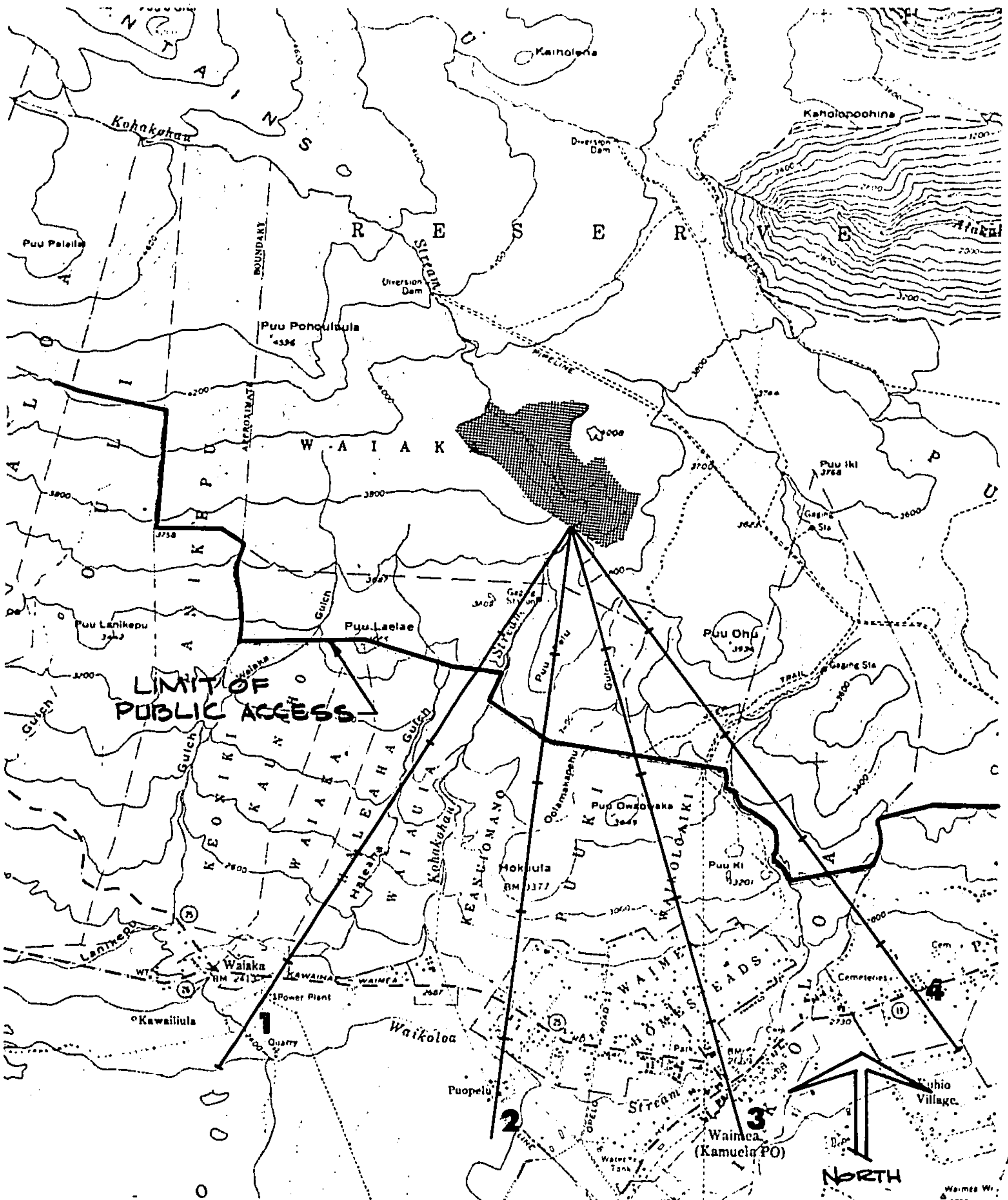


FIGURE: 27 STUDY AREA SIGHT LINES

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

1000 0 1000 4000 FEET

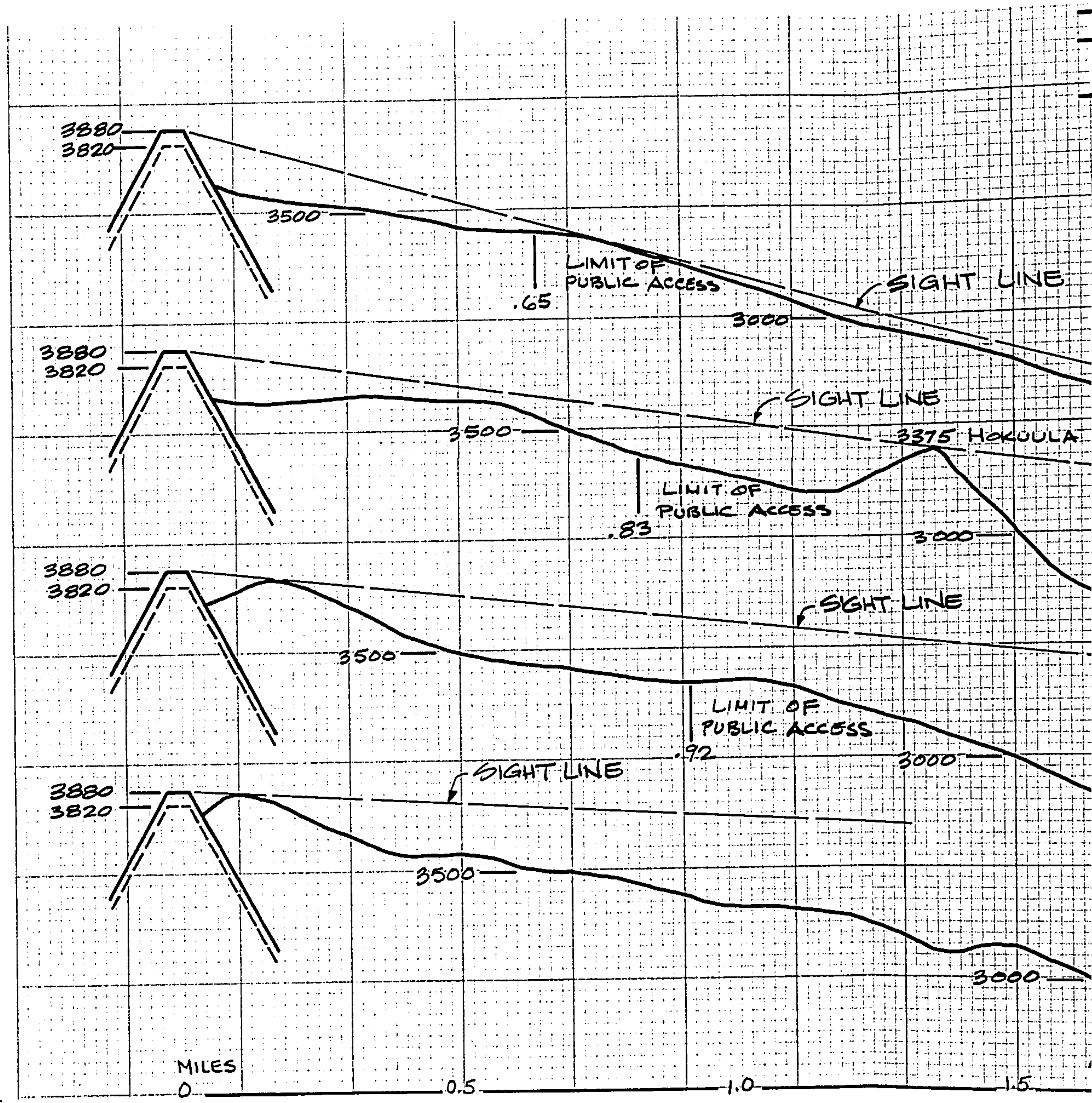
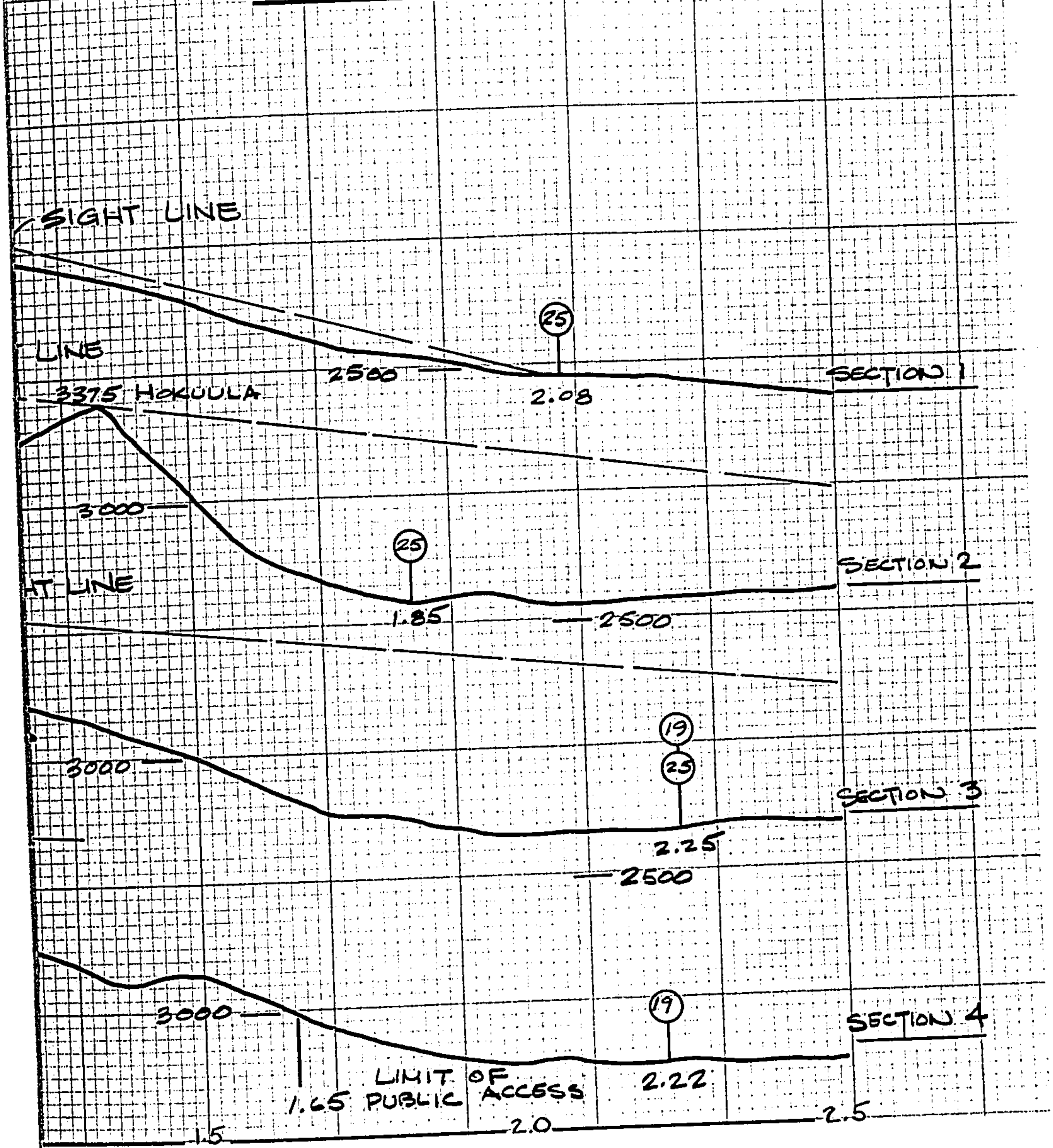

3880
3820
3500
LIMIT OF PUBLIC ACCESS
.65
SIGHT LINE
3000
3880
3820
SIGHT LINE
3500
3375 HOKUULA
LIMIT OF PUBLIC ACCESS
.83
3000
3880
3820
SIGHT LINE
3500
LIMIT OF PUBLIC ACCESS
.92
3000
3880
3820
SIGHT LINE
3500
3000
MILES
0
0.5
1.0
1.5

FIGURE: 28 VISUAL SECTIONS

KOHAKOHAU EIS - SOUTH
KOHALA DISTRICT, HAWAII



ponding to Section 1 shown on Figures 27 and 28), which represents the greatest visual impact of proposed facilities to the Waimea area.

Flows in Kohakohau Stream below the project area are intermittent today and seldom reach the coastal plain much beyond the Waimea-Kawaihae Road except during flood incidents. Although flood discharges will be regulated by the dam and releases will be made whenever practicable, such releases are subject to natural losses in the stream system, and some overall reduction in stream-flow, on an average annual basis, is expected below the project area. The effect of the dam and reservoir on the average number of low-flow days in the Kohakohau Stream system cannot be precisely predicted, but it is expected that the number of days in the year when there is no flow or low flow in the stream below the project area will not be appreciably increased. The importance and desirability of maintaining stream flow, when practical and depending on water availability, is recognized by the Division of Water and Land Development. Hence, during the operational management of the project, the importance of protecting the visual and aesthetic aspects by providing flow, when practical, will become an operational criterion.

Construction activities will temporarily change, in some measure, the natural remoteness and tranquility of the Waimea town area.

PRIMARY AND SECONDARY IMPACTS: PHYSICAL

8 - Topography, Geology, and Soils

General topographic and subsurface conditions will not be affected by the Kohakohau Dam Project. Surface conditions will, however, be disturbed in the five Sub-Areas shown on Figure 14. The total estimated area disturbed in the ultimate development alternative is 200 acres. No mineral resources will be affected by the project other than construction materials. An estimated 500,000 to 1 million cubic yards of rock and borrow materials will be required for the dam structures. To the extent possible and practicable, fill materials may be taken from the potential inundated area (Sub-Area 2 on Figure 14)to reduce surface disturbances and rehabilitation requirements. If no suitable materials can be found in that sub-area, excavation in the quarry area (Sub-Area 5) could reach an average depth of 20 feet (assuming an average overburden consisting of unsuitable soil and organic cover of 5 feet). Stripped soil cover would be replaced after completion of excavation for support of revegetation. All materials excavated would be used in the dam fill or would be returned to the quarry area.

Intermittent erosion and siltation during high runoff periods, although infrequent and not serious below the damsite location, will be remedied in the long term by the impoundment. During construction, however, increases in erosion and siltation will occur in disturbed areas. In areas where construction of roads and access trails may result in severe local erosion and sedimentation, especially during periods of high rainfall, the contractor will be required to control such erosion by the incorporation of sedimentation ponds or other appropriate measures.

As the project would be located in a seismically active area comparable in earthquake hazard potential to Southern California, criteria used in analysis of stability of the dam were generally adopted from the design practice of the California Department of Water Resources for the design of embankment dams for the State Water Project.

In the event of a strong earthquake, a slight readjustment of the rockfill will be experienced in the dam. In the last few years the use of heavy vibrating rollers for compacting rockfill has reduced settlement and cracking to relatively small amounts and essentially eliminated the membrane cracking problem. Use of reinforcing steel in the concrete membrance also helps to spread out cracking, reducing the potential for development of large cracks. An analysis of the stability of the dam was, however, made for the improbable event of large cracks developing in the membrane. The analysis indicated that following such cracking of the membrane, the rockfill will retain its integrity while passing the leakage from a full reservoir. The evaluations indicate that the Kohakohau Dam is safe under seismic loadings and that a severe leakage rate exceeding the flood of record and equal to the maximum probable flow of the stream will not displace the rockfill. Since the probable leakage from the reservoir under the most severe and least probable conditions (i.e., maximum potential earthquake with a full reservoir, resulting in settlement of the dam and cracking of the impervious concrete membrane) is no greater than the maximum probable flow of Kohakohau Stream which can be contained by the downstream channel, the impact of the Kohakohau Dam Project on the downstream hazard is slight.

9 - Climatology, Air, and Noise

No significant changes in the micro-climate of the project area are expected, although small changes in winds and air currents, evaporation, and water temperature will occur in the reservoir vicinity. The Kohakohau Dam Project will, however, result in moderate short-term increases in air pollution and noise levels during construction. Emissions and noise from construction equipment will cause localized atmospheric disturbances in the immediate project area. These disturbances are not expected to significantly affect conditions in populated areas of Waimea and vicinity.

10 - Floral Features of the Ecosystem

Disturbances of existing vegetation in the project area will result from construction activities and new facilities as follows:

Sub-Area 1: Construction of the Upper Hamakua Ditch (UHD) Diversion will temporarily disturb the stunted and boggy vegetation in this area. Natural revegetation will occur after the channel is constructed.

Sub-Area 2: The impounded water and dam fill will inundate approximately 135 acres of mixed and disturbed vegetation in the ultimate development case or approximately 90 acres in the initial development stage. Trees, shrubs, and ground cover in this area are native and common species and typify a disturbed forest zone.

Sub-Area 3: The richest botanical zone in the entire project area occurs on the west slope of Puu Pelu in this sub-area and will be disturbed to a small extent by potential access road locations. Other portions of the sub-area exhibit vegetation common to the entire project area both in variety and quality.

Sub-Area 4: Construction of the outlet pipe will temporarily disturb a strip along the Kohakohau Stream bed which exhibits vegetation like that of Sub-Area 2. Revegetation after construction will occur.

Sub-Area 5: Excavation for desired subsurface materials will damage surface vegetation in the approximately 40-acre area. Revegetation will be difficult in stripped areas.

No rare or endangered botanical species will be affected by the Kohakohau Dam Project. The most valuable zones of vegetation are on the upper slopes in Sub-Area 5 and surrounding Sub-Area 2, and in Sub-Area 3 may be disturbed by peripheral construction activities.

11 - Faunal Features of the Ecosystem

The Kohakohau Dam Project will permanently remove approximately 90 or 135 acres (depending upon the development stage) of mixed endemic and introduced vegetation from wildlife support in Sub-Areas 2 and 3. This area presently supports primarily Japanese White-eyes, pigs, and pests which are common to all the islands. The upper slopes and ridges surrounding the damsite support larger numbers of endemic species and are more valuable for preservation. No rare or endangered species of birds or mammals will be adversely affected by the project. Conversely, the reservoir area will provide an enhanced habitat for the endangered Koloa (Hawaiian duck).

The project will adversely affect no fish species, as none were identified in field surveys or are believed to exist in the Kohakohau Stream system.

12 - Surface Waters

Approximately 3,000 to 4,000 feet of the natural Kohakohau Stream bed will be inundated by the Kohakohau Dam Project. As is previously mentioned, flows in the Kohakohau Stream below the damsite will probably be reduced during filling of the reservoir and operation of the water supply system. At the same time, floodwaters will be impounded by the dam. Because Kohakohau Stream waters seldom reach the coast, if at all, no measurable effects on coastal waters will result from the project.

Water quality parameters will be affected by temporary increased erosion and sedimentation during construction of project facilities. Waters diverted at the Kohakohau Diversion below the damsite will be treated in existing facilities. No significant adverse effects will result from temporary increases in turbidity and suspended solid concentrations. A slight improvement in the long-term water quality of Kohakohau Stream waters is expected to result from impoundment, particularly in color and taste.

13 - Ground Water

Some seepage will occur from the reservoir and contribute to high-level ground water tables. The leakage will probably contribute to ground water occuring in dike compartments or in valleys on the northern slopes of the Kohala Mountains. The basal water table will not be affected by the project.

14 - Water Supplies and Demands

The Kohakohau Dam Project will provide an addition of 10 or 5 mgd (depending upon development alternative) to the estimated current total public domestic supply of 4 mgd in the South Kohala and Hamakua Districts. By mixing the fresh waters with brackish well-waters along the lee coast on a variable basis, the effective demand served by the project will be multiplied in those areas.

RANKING OF SIGNIFICANT IMPACTS

Table 11 presents a ranking of the impacts previously discussed. Beneficial and adverse impacts are shown. Magnitude and significance of expected impacts are considered in this ranking.

Table 11

Ranking of Significant Impacts

1. Provision of 5 or 10 mgd (depending upon development stage) to the domestic water supply in South Kohala and Hamakua.

2. Excavation in, and removal of 500,000 to 1 million cubic yards of material from, Sub-Area 5.

3. Reduction in average annual flows in Kohakohau Stream.

4. Provision of a new habitat for the endangered Koloa (Hawaiian duck).

5. Disturbance (inundation, stripping, construction) of about 150 to 200 acres of surface vegetation and soils, corresponding with initial and ultimate development alternatives.

6. Disturbance of primary vegetative and wildlife habitat areas on the west slope of Puu Pelu (Sub-Area 3) and the upper slopes and ridges surrounding the impoundment.

7. Permanent loss of visual quality of 3,000 to 4,000 feet of the Kohakohau Stream system by inundation.

8. Temporary increases in air and noise pollution levels in immediate project area during dam construction.

9. Adverse effect of dam structure on visual quality of southern slopes of Kohala Mountains.

10. Control of flooding and erosion from high runoff periods.

11. Temporary decrease in quality of Kohakohau Stream waters (increased turbidity, suspended solids) during dam construction.

12. Slight improvement in long-term quality of Kohakohau Stream waters.

13. Permanent removal of approximately 100 to 150 acres of land in the Kohala Forest and Watershed Reserves from the natural state (i.e., the "natural state" refers to the existing condition which exhibits some disturbances). Represents approximately one per cent of the total Kohala Forest Reserve acreage.

14. Temporary disturbance of tranquility in Waimea Town during dam construction.

15. Temporary increase in population in Waimea-South Kohala area during dam construction. Estimated as less than 5 per cent change in Waimea or less than 1 per cent change in South Kohala.

16. Temporary increase in employment and consumer output in Waimea-South Kohala area during dam construction. Estimated as less than 5 per cent change.

17. Slight acceleration in development trends in South Kohala-Hamakua region.

18. Potential provision of a new energy source in South Kohala and Hamakua by incorporation of hydroelectric facilities in the Kohakohau Dam Project.

19. Negligible increased hazard to downstream areas from failure of the dam in a seismic event.

V. MITIGATION AND RECOMMENDATIONS

In addition to the completion of comprehensive engineering studies (including geologic dam stability, structural, earthwork, diversion, and other analyses and designs) prior to construction of the Kohakohau Dam Project, other preventive and remedial measures can be incorporated in the planning, design, and construction of the project to mitigate many potential adverse impacts. Presented as follows are measures suggested to minimize adverse effects of impacts identified in Table 11.

1. No mitigation required.
2. Stripped and excavated areas should be regraded and should be replanted with native species of local vegetational populations or assisted in revegetating with such species.
3. Periodic and steady releases from the impoundment will minimize adverse effects of streamflow reduction below the damsite; however, a net decrease in streamflow is unavoidable.
4. No mitigation required.
5. Areas devoted to new facilities in Sub-Areas 1 through 4 should be revegetated, wherever possible, after construction. A slight visual impact of new facilities is considered unavoidable.
6. Disturbances of the upper ridges and slopes in the project area (Sub-Areas 2, 3, and 5) should be minimized and avoided, if at all possible, during construction. Access routes should be located strictly within

the zone of inundation (Sub-Area 2) and should not extend above the ultimate water level.

7. The inundation of 3,000 to 4,000 feet of the Kohakohau Stream bed is unavoidable.
8. It is not expected that increased air and noise pollution in the immediate project area will affect nearby residents. However, construction specifications should require the use of air and noise pollution-reducing equipment for the safety of workers and the assurance that no outside areas will be affected.
9. The southern side of the primary and saddle dams should be planted with suitable vegetation to reduce the adverse visual impact. A slight adverse impact is considered unavoidable.
10. No mitigation required.
11. Temporary water quality degradation can be minimized by controlling runoff from areas disturbed by construction activities. Streamwaters should be diverted around excavation areas, and sedimentation basins can be employed to remove suspended materials. A slight increase in turbidity and suspended solids is considered unavoidable.
12. No mitigation required.
13. The change of about 100 to 150 acres of land from the previous natural condition is unavoidable.
14. No mitigation required; the significance of a change in the existing social nature of Waimea Town is a subjective judgement.

15. No mitigation required.

16. No mitigation required.

17. No mitigation required.

18. No mitigation required.

19. Comprehensive planning, design, and construction measures appropriate to the Zone III seismicity classification of the area will reduce the potential hazard of flooding during a seismic event to a level resulting in no appreciable damage to downstream areas. Investigation of the use of a rubber membrane to complement the concrete dam surface membrane is encouraged in the design of the dam structures. Some success has been reported in the use of rubber membranes to reduce leakage from reservoirs and to provide added protection against erosion and leakage through cracks in the concrete membrane caused by readjustment of rock fill in a seismic event.

VI. UNAVOIDABLE ADVERSE IMPACTS

Table 12 summarizes the adverse impacts expected to be unavoidable,with available and suggested preventive and remedial measures.

Table 12

Unavoidable Adverse Impacts

1. The expected decrease in streamflow below the damsite is considered a moderate impact, as existing diversions already have reduced flows to minimal or nonexistent levels.

2. Stripping and excavation for construction materials in Sub-Area 5 is considered a moderate impact, as the area is not clearly visible from publicly accessible areas and revegetation will occur.

3. The resulting visual impact of the dam structures is considered slight.

4. The resulting visual impact of new facilities in Sub-Areas 1 through 4 is considered slight, as access to these areas is severely restricted.

5. Inundation of 3,000 to 4,000 feet of the Kohakohau Stream bed is considered a moderate impact, as access to the stream is severely restricted.

6. Disturbance of the natural (previous) condition of about 150 to 200 acres of land is considered a slight impact, as the gross project area is already disturbed in many cases and natural revegetation will occur.

7. The temporary decrease in quality of stream waters below the project area is considered a slight impact.

8. The permanent change of 100 to 150 acres of land in the Kohala Forest and Watershed Reserves from the previous condition to accessory uses is considered a slight impact, as the accessory uses will promote the intended objective of the water supply watershed, and the area represents less than one percent of the total acreage of the Kohala Forest Reserve.

VII. SHORT-TERM USES OF THE ENVIRONMENT AND LONG-TERM PRODUCTIVITY

Short-term uses of the study area environment will include tapping of surface water resources for domestic water supply purposes and devotion of surface areas for storage and transmission facilities. Benefits realized by the present generation will remain intact for future generations. Short and long-term productivities of the affected areas will not be changed from the current state of restricted conservation land use unless (1) recreational facilities are incorporated in the project, or (2) the restricted status of the area is changed in the future. Benefits accrued from the increased water supply, flooding control, increased Koloa habitat, and potential hydroelectric power generation are permanent returns from the proposed change in the nature of the study area.

VIII. IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

Approximately 90 or 135 acres (depending upon development alternative) of mixed native and introduced vegetation and wildlife habitat and 3,000 to 4,000 feet of natural stream bed will be lost by inundation of the reservoir and filling for the dam structures. Future reclamation of these resources, if desired, would be virtually impossible. Excavation of quarry materials in Sub Area 5 will permanently alter the subsurface characteristics of the area; however, future compatible uses would not be prevented. Construction of facilities in the other areas will commit the land surface to proposed uses; however, these commitments will not be irretrievable.

Commitment of surface waters to water supply uses will not be irreversible.

Commitments of raw materials, excavation, and labor in construction of the project are considered permanent.

IX. ALTERNATIVES TO THE KOHAKOHAU DAM PROJECT

In order to investigate and evaluate all options and possibilities in meeting the objectives of the proposed Kohakohau Dam Project, other water development alternatives considered to have potential feasibility were evaluated in terms of relative engineering, economic, and environmental aspects. Some schemes were suggested in the past; others were considered for the first time in this study.

The five alternatives addressed in the Draft Environmental Impact Statement have been expanded to eight alternatives in this final report and are outlined as follows:

(1) High Level Ground Water. (Tunneling for dike-confined ground water above elevation 2,000 feet).

(2) Surface Water - Alternative A. (Pumping of Waipio Valley waters to Waimea).

(3) Surface Water - Alternative B. (Diversion of Kehena Ditch waters to Waimea).

(4) Low Level Ground Water - Alternative A. (Drilling for fresh basal water at elevation 2,700 feet).

(5) Low Level Ground Water - Alternative B. (Drilling for basal water at elevation 1,200 feet).

(6) Desalination. (Construction of a desalination plant along the West Hawaii coast).

(7) Successive Use of Existing Water. (Collection and treatment of wastewaters).

(8) Other Suggestions. (Construction of a lined reservoir below the Waimea town vicinity, development of incremental storage capacity near existing reservoirs as needed, or development of high level surface water system and low level well system).

(9) No Action.

Each of these alternatives is presented and considered in preliminary and general form only for purposes of this evaluation and comparison.

A - Engineering Criteria

The eight alternatives considered are compared with the proposed Kohakohau Dam Project and are evaluated with respect to the following general criteria:

1. capability to provide a sustained yield of 10 mgd with consistently high water qualities.
2. capability to provide at least 5 mgd at elevation 2,700 feet (the Waimea town vicinity), and
3. capability to provide the remainder (10 mgd less at least 5 mgd) at elevation 1,000 feet for coastal use.

Alternatives which do not meet these three criteria are considered as partial solutions and are evaluated in that regard. Alternatives which do, or can be made to, meet these criteria are analyzed in the form which would meet these criteria in order to provide a standard basis for comparison with the Kohakohau Dam Project.

Anticipated facilities which would be required to implement alternatives are presented in a tentative manner and are discussed in the general categories of: (a) exploration requirements, including research and design, (b) water collection facilities, (c) pumping facilities (if required) and (d) system operation.

B - Estimated Costs

Cost estimates for the alternatives considered are necessarily preliminary and imprecise. Estimates are based on experience with similar projects in other areas as well as on general information and historic records of the South Kohala-Hamakua region. A general outline of principal costs anticipated with alternative water resource developments is presented as follows:

1. Surface Water Alternatives
   (a) Exploration
   (b) Surface construction
   (c) Operation

2. High Level Ground Water Alternatives
   (a) Exploration
   (b) Tunneling
   (c) Pumping facilities
   (d) Operation

3. Low Level Ground Water Alternatives
   (a) Exploration
   (b) Well drilling
   (c) Pumping facilities
   (d) Operation

Alternatives not included in these three general categories typically exhibit the same elements of cost: (a) exploration costs, including research and design, (b) construction costs for major facilities, (c) construction costs for pumping facilities, and (d) operation costs.

Common to some of the alternatives are well-drilling, pumping, tunneling, and transmission requirements. For economic comparisons, unit costs for those requirements are estimated as follows:

1. Well-Drilling. The 1974 cost of well-drilling on the island of Hawaii is estimated as $12.25 per inch casing diameter per foot depth.47/ Thus, a 16-inch well of 500 foot depth is estimated to cost $98,000.00.

2. Pumping. Figure 29 presents the estimated 1974 curve of pumping costs on the island of Hawaii for wells of 2 to 5 mgd capacities. This curve incorporates increased power costs since 1970 on the island of Hawaii and updates estimates made by the Division of Water and Land Development in 1970.48/ From the curve, the annual cost of pumping an average 1.0 mgd flow a total of 600 feet is $35,000.

3. Tunneling. Estimated costs for horizontal tunneling are based on recent costs experienced in construction of a tunnel near Koko Head, Oahu, with an approximate 9-foot diameter section and on bids received in March, 1974 for the inclined and horizontal shafts under construction in Kona, Hawaii. The range in costs for the Koko Head tunnel was $415 to $655 per linear foot, and the ranges in bids of unit costs for the Kona shafts (with approximate 10-foot diameter sections) were about $500 to $750 per linear foot for horizontal sections and $600 to $1000 per linear foot for inclined sections. 49/ In this comparison of

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47/ Based on recent estimates from the Division of Water and Land Development for other projects.

48/ Reference 33.

49/ Information extracted from Division of Water and Land Development files.

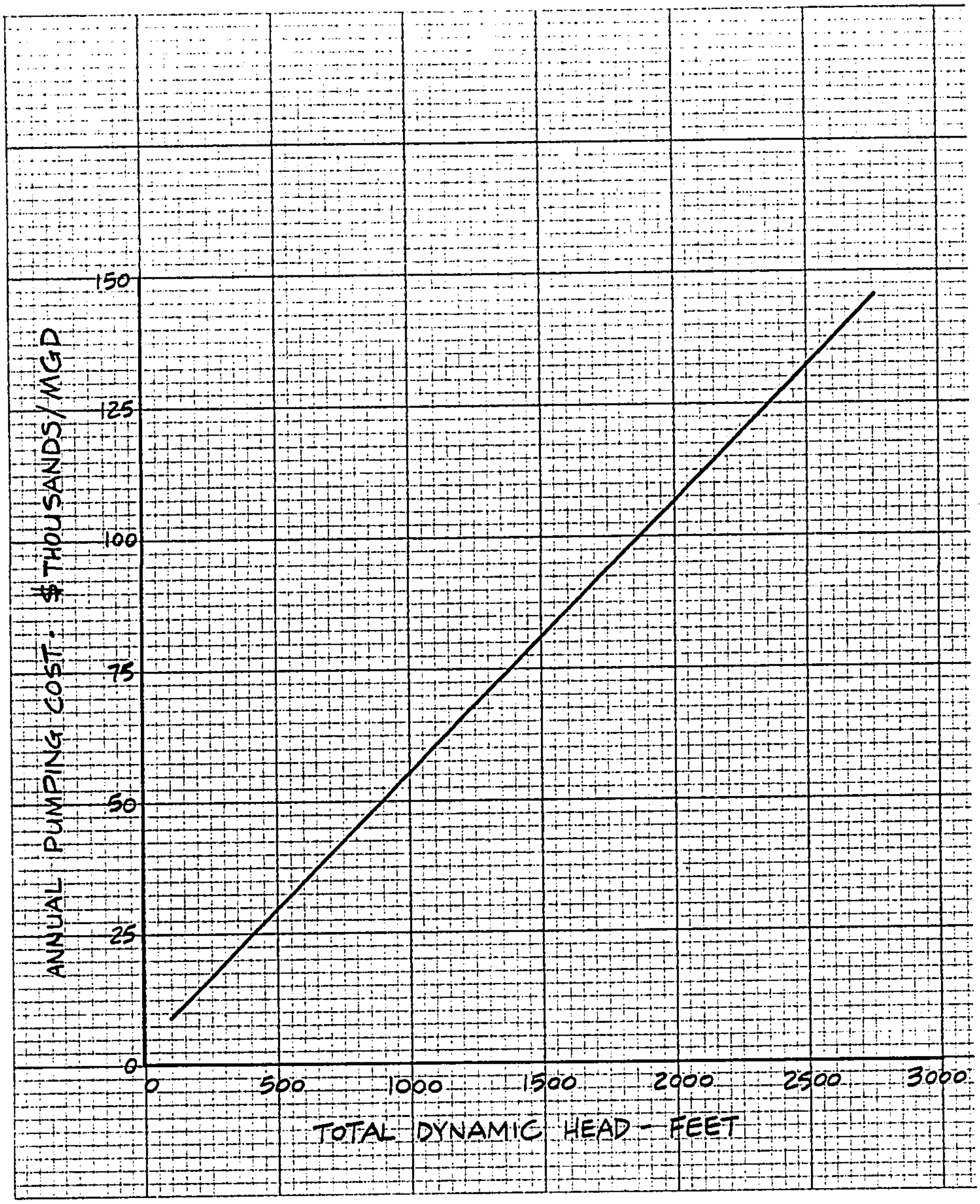

FIGURE: 29 ESTIMATED PUMPING COSTS

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

alternatives, the unit cost for horizontal tunneling (with approximate 10-foot diameter sections) is assumed to be $600 per linear foot.

4. Pumping Facilities. Estimated costs for pumping facilities are based on a unit cost of $500 per horsepower required and a 12-hour pumping day. 50/

Economic comparisons of alternatives are based on annual costs and assume an interest rate of 7 percent and a facility life of 50 years. Costs associated with the procurement and purchase of required land or right-of-way, which could be significant for all alternatives to the Kohakohau Dam Project considered, have not been estimated in this analysis.

50/ Assumed, based on typical construction costs for similar projects.

C - Environmental Effects

Effects on socio-economic conditions are considered to be equivalent for all alternatives. Impacts to the physical environment are addressed according to the following general outline:

1. Surface Water Alternatives
   (a) surface disturbances
   (b) depletion of surface water sources
2. High Level Ground Water Alternatives
   (a) underground disturbances
   (b) surface disturbances
   (c) depletion of ground water sources
3. Low Level Ground Water Alternatives
   (a) underground disturbances
   (b) surface disturbances
   (c) depletion of ground water sources

Alternatives not included in these three general categories are addressed as to their unique effects on surface and subsurface conditions.

1 - High-Level Ground Water

Alternative No. 1 proposes tunneling for suspected ground water confined by dikes above elevation 2,000 feet. In the 1940's this possibility was suggested by Dr. G. A. MacDonald as a source of water for the Waimea Plain.[51] Later studies noted the possibility that substantial quantities of dike-confined water could be developed northwest of Waimea under the upper part of Kohala Mountain.[52] Later test borings near Waimea, however, encountered no water to a depth approaching the 2,000 foot elevation level. The compartments of suspected dike-confined water, therefore, must be discontinuous and cannot be located without preliminary test borings. It was suggested by MacDonald[53] that any tunnel should be at least two or three hundred feet below the level of the confined water in order to ensure sufficient storage at tunnel level. It was predicted that the sustained yield of a tunnel driven well below water level in the saturated inter-dike compartments would be at least 4 mgd per mile of tunnel.

It is unlikely that extensive saturated inter-dike compartments lie above the 2,000 foot elevation level as evidenced by the failure of test borings near Waimea town to discover such compartments. Assuming, however, that such inter-dike compartments do exist and would yield the 4 mgd per mile of tunnel expected by MacDonald,[54] an extensive exploration program would be required to precisely locate these compartments and determine the optimal tunnel alignment.

51/ Reference 23.
52/ Reference 39.
53/ Reference 23.
54/ Ibid.

A - Engineering Requirements

Assuming that the suspected compartments of dike-confined water exist and are adequate in yield (which assumption is made for purposes of this analysis and comparison only), Alternative No. 1 would meet the three general criteria established with the provision for pumping 5 mgd from the 2,000 foot elevation to the 2,700 foot elevation (Waimea town vicinity). Anticipated engineering and facility requirements would be:

1. Exploration Program. Requires an assumed minimum of 5 test wells of average 750-foot depth and 3-inch diameter; preliminary studies and design.
2. Tunnel Construction. Requires an assumed 2.5 mile tunnel for a sustained 10 mgd yield and an access tunnel of a 2.0-mile minimum length.
3. Pumping Facilities. Requires facilities for pumping of 5 mgd from the 2,000 foot to 2,700 foot elevation.
4. Operation. Requires continuous pumping of 5 mgd over a 700-foot head.

B - Estimated Costs

Corresponding estimated costs would be:

1. Exploration Program.

Test wells	$ 140,000
Preliminary studies	50,000

2. Tunnel Construction.

Tunnel	14,260,000

3. Pumping Facilities.

Pumping	880,000

TOTAL CAPITAL COST = $ 15,330,000

ANNUAL COST = $ 1.11 million

4. Operation

   Annual pumping cost = $200,000

5. TOTAL ESTIMATED ANNUAL COST = $ 1.31 Million

C - Environmental Impact

Construction of a 4.5 mile tunnel in Kohala Mountain may disturb geologic conditions and ground water hydrology. Tapping of suspected dike-confined water at elevation 2,000 feet could be expected to reduce flows in springs and seeps below that level. A large volume of tunneling spoils (estimated 70,000 cubic yards) would require disposal, creating potential problems of nuisance, pollution, and visual degradation. Surface disturbances would result at the portal, where supporting structures and equipment would be required.

2 - Surface Water - Alternative A

Alternative No. 2 proposes pumping of Waipio Valley waters to Waimea. Large quantities of water are lost to the sea from seeps, springs, and dikes in Waipio Valley. Below the existting Lower Hamakua Ditch (approximate elevation 1,000 feet), it is thought that a 10 mgd source could be developed but at a location well below the Ditch. It is assumed that such a supply is available at approximate elevation 500 feet, well into the main section of Waipio Valley. The minimum lift would be from elevation 500 feet to approximate elevation 3,550 feet, or 3,050 feet. From the summit of the lift the water could flow by gravity to the existing Waimea treatment facilities.

A - Engineering Requirements

Requirements would be:

1. Planning and Preliminary Studies.
2. Collection System Facilities.
3. Pumping Facilities.
4. Operation. Requires continuous pumping of 10 mgd over a 3,050-foot head.

B - Estimated Costs

Corresponding estimated costs would be:

1.	Planning and Preliminary Studies	$ 50,000
2.	Collection System Facilities	
	(Estimate)	100,000
3.	Pumping Facilities	
	Pumping	7,630,000
	TOTAL CAPITAL COST =	$ 7,780,000
	ANNUAL COST =	$ 0.56 Million
4.	Operation	
	Annual pumping cost	$ 1.67 Million
5.	TOTAL ESTIMATED ANNUAL COST =	$ 2.22 Million

C - Environmental Impact

Construction of pipelines would affect a strip approximately 4 to 6 miles in length, and large pumping facilities would be required in Waipio Valley. Access problems during construction could be expected to result in disturbances of a much larger total area. Surface water sources on the windward side of Kohala Mountain would be depleted. The magnitude of this effect cannot be determined precisely, but would be significant, as the total average flow in the Wailoa Stream near Waipio is about 48 mgd (less than 5 times the proposed yield of Alternative No. 2).

3 - Surface Water - Alternative B

Alternative No. 3 suggests diverting waters from the Kehena Ditch (located on north side of Kohala Mountain) to the Kohakohau Stream watershed. As shown, the Kehena Ditch is located on the northern slopes of Kohala Mountain, where normal annual rainfall varies from 125 to 150 inches. In a 1969 report prepared by the Division of Water and Land Development, 55/ the ditch source was considered as a potential supply for the Kawaihae - Mahukona area. At that time it was found that investment of about $2.2 million in required facilities would provide a dependable supply of approximately 1.2 mgd.

The Kehena Ditch is located at approximate elevation 4,300 feet, and could be diverted to the Kohakohau Stream watershed by pumping or a channel skirting the summit of Kohala Mountain. The estimated yield is so low, however, that Alternative No. 3 is not considered feasible as a substitute for the Kohakohau Dam Project. In addition, current construction on Kehena Ditch is intended to develop those waters for use in North Kohala.

The impact of transporting Kenhena Ditch waters to the Kohakohau Stream watershed would be the depletion of water supplies in North Kohala which has limited surface and ground water resources. For these reasons Alternative No. 3 has been dismissed from further evaluation.

55/ Reference 35.

4 - Low Level Ground Water - Alternative A

Alternative No. 4 suggests the drilling of wells at elevation 2,700 feet (in the Waimea town vicinity) to tap fresh basal water. It is certain that such basal water would be of high and consistent quality, being located at significant distance from the influence of seawater intrusion.

A - Engineering Requirements

It is assumed that most efficient well operation would result from five wells of 2 mgd capacity each. Anticipated requirements would be:

1. Planning and Preliminary Studies
2. Well Drilling. Requires 5 wells of 16-inch diameter and 2,7000 - foot depth.
3. Pumping Facilities.
4. Operation. Requires continuous pumping of 10 mgd over a 2,700 - foot head.

B - Estimated Costs

Corresponding estimated costs would be:

1.	Planning and Preliminary Studies.	$ 50,000
2.	Well Drilling.	
	Wells	2,650,000
3.	Pumping Facilities.	
	Pumps	6,750,000
	TOTAL CAPITAL COST =	$9,450,000
	ANNUAL COST =	$ 0.68 Million
4.	Operation.	
	Annual pumping cost	$ 1.48 Million
5.	TOTAL ESTIMATED ANNUAL COST =	$ 2.16 Million

C - Environmental Impact

The drilling of wells at the 2,700 foot elevation would not be expected to disturb any sensitive geologic conditions. The existing hydrologic balance would be affected in some manner, but at the distance inland proposed by the wells drilled at 2,700 feet such an effect is considered minimal. The total ground water resource would not be significantly depleted. Surface disturbances would likewise be minimal, as no large-scale overland transmission facilities would be required.

5 - Low Level Ground Water - Alternative B

Alternative No. 7 suggests the drilling of wells at the 1,200 foot elevation level to tap the potential fresh water basal lens. Wells drilled by Boise-Cascade (see Figure 7) at elevation 1,200 feet have tapped a source of unusually high quality water. The extent and recharge characteristics of this lens or aquifer are presently unknown and cannot be assumed. The two Boise-Cascade wells presently provide a combined 2 mgd yield under a 15-foot head. It is not known what the limit in sustained yield nor the probability of locating similar low-level aquifers may be.

It is, however, doubtful that a sustained 10 mgd yield of high-quality water (less than 100 ppm chlorides) can be obtained from the Boise-Cascade aquifer or other low-level ground water sources at the 1,000 to 1,200 foot elevation. Assuming (for purposes of this comparison only) that such a source does exist, it is possible that, after exploration and planning, about five wells of 2 mgd capacity each could provide the 10 mgd supply.

A - Engineering Requirements

Alternative No. 7 would require the pumping of 5 mgd to the 1,200 foot level for distribution in lower elevation and the pumping and transmission of 5 mgd to the 2,700 foot level of Waimea town. Anticipated requirements would be:

1. Exploration Program. Requires minimum 5 test wells of average 1,200 foot depth and 3-inch diameter; preliminary studies and design.

2. Well Drilling. Requires 5 wells of 16-inch diameter and 1200 foot depth.

3. Pumping Facilities.

4. Operation. Requires continuous pumping of 5 mgd over 2,700-foot head to Waimea and 5 mgd over 1,200-foot head.

B - Estimated Costs

Corresponding estimated costs would be:

1. Exploration Program.	
Test wells	$ 220,000
Preliminary studies	50,000
2. Well Drilling.	
Wells	1,180,000
3. Pumping Facilities.	
Pumps	4,880,000
TOTAL CAPITAL COST =	$ 6,330,000
ANNUAL COST =	$ 460,000
4. Operation.	
Annual pumping cost	$ 1,040,000
5. TOTAL ESTIMATED ANNUAL COST =	$ 1.50 Million

C - Environmental Impact

The drilling of wells at the 1,200 foot elevation would not be expected to disturb any sensitive geologic conditions. The total ground water resource available in the freshwater lens could, however, be significantly depleted by a large and steady draw such as is proposed. Surface disturbances would result at the well site and from the estimated 7 miles of transmission facilities to the Waimea town vicinity.

6 - Desalination

Desalination of brackish ground water has been considered a potential alternative to surface and fresh ground water developments for some time. A current study by the Division of Water and Land Development is investigating the feasibility of desalination installations in Hawaii, and has identified the Kiholo - Puako area (along the coast south of Kawaihae) as one of two sites in the islands to receive detailed study.

A - Engineering Requirements

Desalted water available along the coast would require pumping to desired service areas at the 1,000 and 2,700-foot elevations. Engineering requirements would be:

1. Planning and Preliminary Studies.
2. Desalination Plant.
3. Pumping Facilities.
4. Operation. Requires continuous plant operation and pumping of 5 mgd over a 1,000-foot head and 5 mgd over a 2,700-foot head.

B - Estimated Costs

Preliminary data in the current feasibility study of desalination indicate that the range in cost of desalted water at the plant is about $0.60 to $1.00 per thousand gallons. For a 10 mgd plant, or a couple of smaller plants, this unit cost would represent a total annual cost of $2.19 to $3.65 million for water available at the coast. Assuming (for this comparison only) that the lower figure would prevail, the total annual cost for delivering that water to the 1,000 and 2,700-foot elevations is estimated as follows:

1. Desalted Water - Capital Costs and Operation.

ANNUAL COST =	$	2.19 Million

2. Pumping Facilities.

Pumps	$	4.63 Million
TOTAL CAPITAL COST =	$	4.63 Million
ANNUAL COST =	$	0.34 Million

3. Operation

Annual pumping cost =	$	0.97 Million

4. TOTAL ESTIMATED ANNUAL COST = $ 3.50 Million

C - Environmental Impact

Principal environmental considerations would include the location and layout of such an installation, the physical and chemical natures of effluents and waste products, and the locations of effluent discharge points. Other effects would have to be considered if nuclear power was used in place of existing power sources in the study area. Surface disturbances would result from the plant and attendant facilities at the coastal site and from the estimated total of 21 miles of pipeline.

7 - Successive Use of Existing Waters

Successive use (i.e., treatment of domestic or irrigation wastewaters to levels suitable for domestic or lower uses) has been considered feasible in many highly-populated mainland areas where fresh water supplies are limited and wastewater flows are great. By collecting and treating domestic and agricultural wastewaters to levels suitable for irrigation and industrial uses, the initial demands for fresh water supplies can be dramatically reduced. In South Kohala and Hamakua, however, no centralized domestic or agricultural collection and treatment systems exist in already developed areas. New residential developments are being required to incorporate sewage collection and treatment systems, and it is possible that treatment of domestic wastewater for irrigation or industrial uses may become feasible in the future, primarily along the coastal strip expected to see large developments. In the short term, reclamation of waters in a quantity comparable to the yield of the Kohakohau Dam Project is unrealistic. Successive use of existing waters in the South Kohala-Hamakua region is therefore dismissed as a viable alternative to the Kohakohau Dam Project at this time.

Conservation of all natural resources and reclamation of wastewater supplies are, however, to be encouraged as a part of any water development plan to minimize depletion of remaining supplies and to optimize benefits from those resources tapped. Economies of scale realized in future urban developments in

South Kohala may provide the base for implementation of programs for successive use and conservation of presently developed water supplies.

8 - Other Suggestions

Other alternatives have been suggested for incremental development of domestic water supplies for the South Kohala - Hamakua region which propose modifications to the existing domestic water supply system, to the proposed plan for the Kohakohau Dam Project, or to the role of the Kohakohau Dam Project in the existing domestic water systems and future water resource development plans. Three principal suggestions are considered together since they all relate in some detail to the Kohakohau Dam Project and address in some manner the approach to water resources development proposed by the Kohakohau Dam Project and should then be interpreted in that regard.

A - Reservoir Below Waimea Town

Construction of a reservoir below the Waimea town could be technically accomplished but would probably require (a) a tremendous excavation, (b) rechannelization of sections of Kohakohau Stream to limit seepage losses, (c) lining of the reservoir to prevent seepage losses, (d) covering of the reservoir to prevent evaporation losses, and (e) pumping of impounded waters uphill to the Waimea service area. The most likely surface water sources for the reservoir would be those incorported in the Kohakohau Dam Project (i.e., Kawainui, Kawaiki, Alakahi, and Kohakohau Streams), and the hydrologic characteristics of those sources would be identical for the lower reservoir. Therefore, a total storage capacity comparable to that provided by the

Kohakohau Dam Project (1,780 mg) would be required to ensure the 10 mgd reliable yield. A storage capacity of that magnitude (1,780 mg or 5,460 acre-feet) would require a reservoir on the order of 100 acres in area excavated to a 55-foot depth if no natural sites could be found. Below the Waimea town vicinity the topography is generally flat and no significant relief from that excavation requirement would be expected. Costs for excavation alone could be unrealistic. In addition, the impact of such a facility, even if economically feasible, would be significant. Because of the requirement for covering to reduce evaporation losses, there would be no recreational uses associated with such a facility.

B - Improvements to Existing Facilities

Development of incremental storage capacity in existing and new facilities could be accomplished to the extent that adequate land would be available for expansion of storage facilities. With omission of the proposed Kohakohau Dam, development of surface waters on the southern slopes of Kohala Mountain would probably require diversion of upper streams (as is proposed in the Kohakohau Dam Project) and would eventually result in the following impacts (related to the impacts of the Kohakohau Dam Project);

1. acquisition and use of more private land to provide the same reliable yield,
2. disturbances closer to the Waimea town area,
3. similar effects on stream flow, and
4. greater complexity and inefficiency in operation of the total system.

In addition, incremental development of a total system capable of providing the 10 mgd yield assured by the Kohakohau Dam Project would result in a greater total cost than would be incurred in the Kohakohau Dam Project for these reasons:

1. land required would represent an additional cost,
2. provision of many small storage facilities would be more expensive than one large facility, and
3. inflationary trends would result in expenses proportional to the length of time required to complete the facilities.

It is unlikely that a total storage capacity equivalent to the proposed Kohakohau Dam impoundment could ever be provided by incremental facility developments since the requirements for land and structures would be prohibitive. Clearly, then, the sole advantage to developing incremental storage would be the slow and orderly provision of additional water when required, which could be accomplished at the expense of greater surface disturbances and higher costs (for an equivalent total domestic water yield). With projections for increasing demands in South Kohala and Hamakua, however, it appears unlikely that a net benefit would accrue from continual construction of new facilities to catch up with increasing demands.

C - Combined System

Development of a combined system which would use surface waters at higher elevations and well waters at lower elevations is a concept that has been considered in the past and is, in fact, intended as a future operational plan with the proposed Kohakohau Dam Project. Current plans outline mixing of fresh waters provided by the upper 50 mgd reservoir (near completion) with coastal brackish waters to stretch the effective supply (see Figure 26 and accompanying discussion). In the same manner, waters impounded by the Kohakohau Dam could be mixed with brackish well waters to extend the effective ultimate supply provided in the proposed Kohakohau Dam Project.

A combined system providing surface and well waters without mixing would only be possible if sustained quantities of high quality well water could be located at the lower elevations. As is discussed in Alternative No. 5, there is inconclusive evidence that such sustained supplies are available at middle elevations.

Clearly the advantage of developing a combined system is in enabling precious surface waters to be extended as far as possible to meet increasing demands. The proposed Kohakohau Dam Project would be developed to meet the objective of conserving surface waters by an accompanying program of mixing with brackish well water in coastal areas.

For these reasons the alternative of a combined system is considered an integrated part of the Kohakohau Dam Project and is not evaluated separately.

9 - No Action

Effects of a decision not to implement the Kohakohau Dam Project cannot be assessed precisely because future development and growth patterns in South Kohala and Hamakua cannot be accurately predicted. Figure 26 and the accompanying discussion of projected water sources and demands indicate that existing and planned supplies (other than the Kohakohau Dam impoundment) may be sufficient to meet future demands for 1 to 5 years. Beyond that time, however, some new source of fresh waters would have to be developed. Any major change in land use and development patterns could shift that time frame significantly. In addition to base water demands, periodic droughts in the Waimea-Kawaihae area can be expected to further deplete water supplies unless new or back-up facilities are built.

Additional discussion of expected effects of the no-action alternative are presented for specific features in the section FUTURE ENVIRONMENT WITHOUT THE PROJECT. In summary, existing conditions would be expected to endure until a critical water shortage developed (perhaps in the near future). Beyond that time, existing and planned land uses in the South Kohala and parts of the Hamakua Districts could not be served.

In the short term, although a critical water shortage would not be expected to occur within a few years, planning for future developments as presented in the General Plan 56/

56/ Reference 6.

for the County of Hawaii would be impeded unless local sources of water, either public or private, could be found and developed.

10 - Alternative Dam Sites

Figure 30 presents the six alternative dam sites for the proposed Kohakohau Dam considered in previous investigations and evaluated in the 1970 Feasibility Report. 57/ Criteria applied to the alternative sites included hydrologic, geologic, and topographic considerations. Differences in hydrologic and geologic conditions for the six sites were insignificant, and topographic factors governed selection of the preferred dam site. The principal topographic consideration was the relationship between the dam fill volume required and the storage volume provided by each site. Sites 5 and 6 exhibited significant advantages over the other four sites in dam fill volume required for high storage capacity provided. Site 3 afforded a slightly better relationship of fill to storage but was limited to a low ultimate storage capacity available. The slightly lower dam fill volume required by Site 5 for an equivalent storage capacity led to its selection as the proposed site.

The dam fill volume-to-storage capacity relationship generally serves to indicate relative costs associated with development of alternative dam sites. The low ratio exhibited by Site 5 means that costs to develop the desired water supply would be lower for that site than for the other five sites. In addition, less excavation and surface disturbance would be required in the development of Site 5 than in the development of the other sites. Differences in other effects would be insignificant for the six sites.

57/ Reference 36.

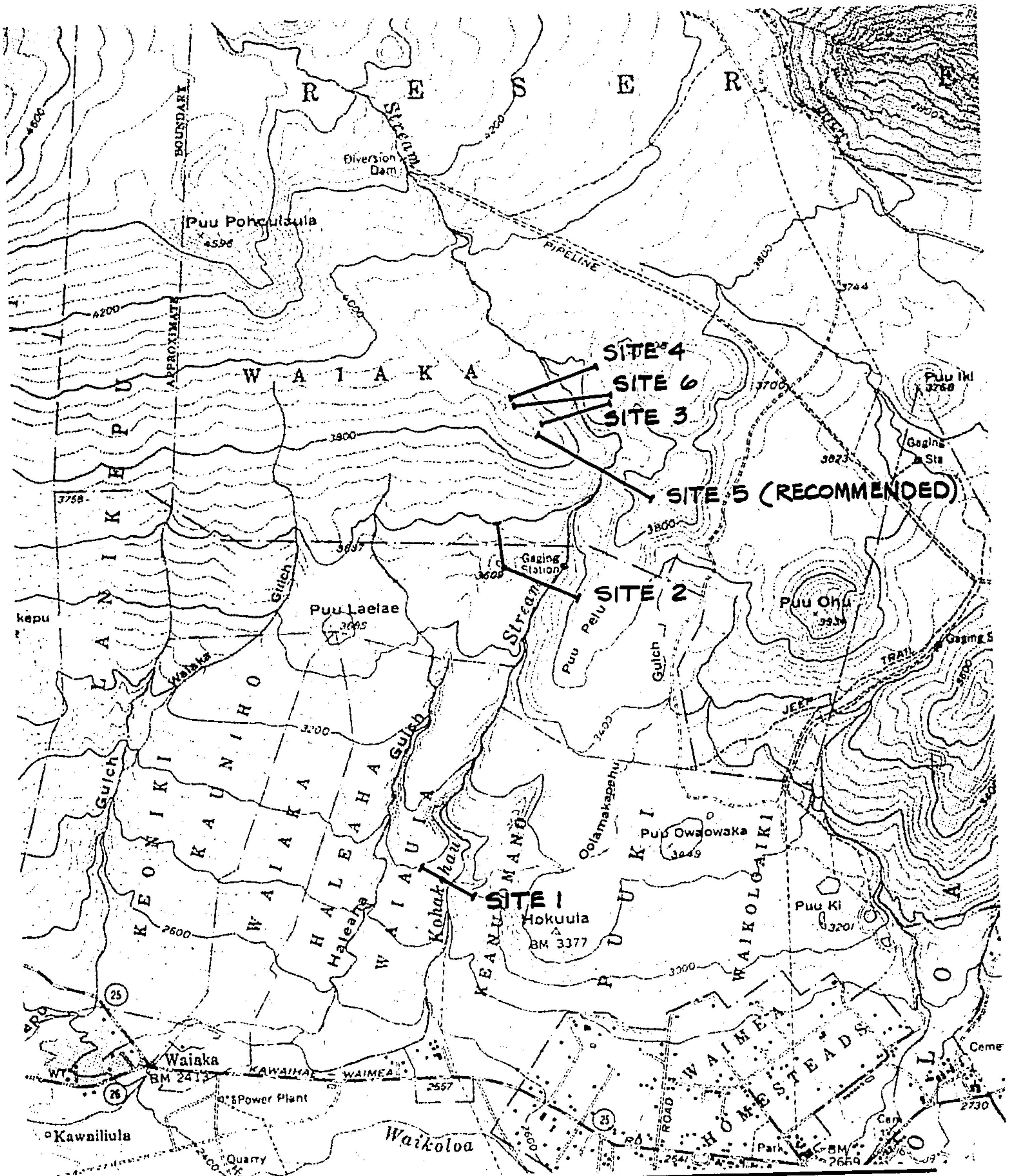

FIGURE: 30 ALTERNATIVE DAM SITES

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

0 1000 2000 4000 FEET

11 - Comparison and Summary

Table 13 summarizes principal features of the alternatives considered in relation to the proposed Kohakohau Dam Project. The most practicable and reliable alternatives from an engineering standpoint are (a) the Kohakohau Dam Project, (b) the pumping of Waipio Valley surface waters, and (c) the drilling for fresh basal water at high elevations (near 2,700 feet). Tunneling for suspected dike-confined ground water involves uncertainty and risks, as does the drilling for suspected fresh water at lower elevations. Desalination and successive use of existing waters may be feasible in the future.

Cost estimates indicate that the Kohakohau Dam Project appears to exhibit lowest total costs. Estimates for other alternatives are based on the assumption that suspected sources exist and could be located, and ignore potential land acquisition costs which could be significant. Operation costs associated with the ground water and other potential alternatives tend to increase with increases in energy costs, which is eliminated by the gravity flow feature of the Kohakohau Dam Project.

Potential environmental impacts would be minimal in the Kohakohau Dam Project and the well-drilling alternatives. Alternatives which require pumping of large quantities of water over great distances would result in significant surface disturbances.

TABLE 13

Comparison of Alternatives

Alternative No.	Engineering feasibility	Estimated Annual Costs from 1974	Environmental Impact
Kohakohau Dam	Known; predictable.	$ 1.3 million	Slight - Moderate
No. 1	Assumed; unpredictable.	1.3	Moderate
2	Known; predictable.	2.2	Moderate
3	Inadequate; disqualified	----	-------
4	Known; predictable.	2.2	Slight
5	Assumed; unpredictable.	1.5	Slight - Moderate
6	Assumed; premature.	3.5	Moderate
7	Not feasible; disqualified.	----	-------
8	Incremental.	----	Moderate
9	No action.	----	-------
Best Alternatives:	Kohakohau Dam, A-2, A-4	Kohakohau Dam, A-1	Kohakohau Dam, A-4, A-5

The Kohakohau Dam Project exhibits advantages in all three categories of comparison: (a) engineering feasibility, (b) estimated costs, and (c) potential impacts. No other alternative affords comparable advantages.

X. AGENCY AND CITIZEN PARTICIPATION

1 - Contributions During the Environmental Impact Studies

During the course of environmental impact studies of the Kohakohau Dam Project, contacts were made with private citizens and groups and Federal, State and County governmental agencies to provide opportunities to participate in those analyses. Listed as follows are the groups, agencies, and individuals contacted. In addition, summaries are included of the two public information meetings held in February and June, 1974. Representative questions and comments from these meetings are presented.

A - Federal Agencies

1. Environmental Protection Agency (EPA)
2. Department of Interior, U.S. Geological Survey
3. U. S. Army, Corps of Engineers

B - Hawaii State Agencies

1. Department of Hawaiian Home Lands
2. Department of Health
3. Department of Land and Natural Resources, Fish and Game Division
4. Department of Land and Natural Resources, Forestry Division
5. Department of Land and Natural Resources, Land Management Division.
6. Department of Land and Natural Resources State Parks Division.
7. Department of Land and Natural Resources, Water Resources Regional Study
8. Office of the Governor, Office of Environmental Quality Control (OEQC)
9. University of Hawaii, Environmental Center
10. University of Hawaii, Water Resources Research Center
11. University of Hawaii, Hilo, Social Science Department
12. University of Hawaii, Manoa, Anthropology Department

C - County of Hawaii Agencies

1. Department of Planning
2. Department of Parks and Recreation

3. Department of Public Works

4. Department of Research and Development

5. Department of Water Supply

D - Citizens and Citizen Groups

1. Public Informational Meeting in Waimea, Hawaii, February 19, 1974.

Summary: An informational meeting was held at 7:30 P.M. in Kuhio Hall in Waimea and was attended by about 30 persons. Notice of the meeting was given through the Waimea-Kawaihae Community Association, the single body representing most residents of the area. An informational handout was distributed and views were exchanged during the meeting. Responses and comments primarily addressed aspects of local water sources and demands, land use and planning, dam safety and stability, protection of the Kohakohau Stream system, and releases from the proposed dam during development and operation.

Representative Questions and Comments:

Q: To whom will the impounded water go:

A: Primarily to the Waimea, Honokaa, and Kawaihae-Puako areas.

Q: If a hotel is built behind Puako, where will its water come from?

A: From the Waimea-Kawaihae-Honokaa water system.

Q: How will downstream reaches of the Kohakohau Stream be affected?

A: Because of the impoundment, downstream flows will necessarily decrease; however, there may be releases of waters during and after the stage of reservoir filling.

C: The 16-inch pipeline which takes water from the diversion dam on the Kohakohau Stream to feed the 50 million gallon storage reservoirs significantly affects the normal stream flow below that point. I would like to see an operation which catches only flood waters and allows the normal stream flow to pass.

A: A dam which would catch only flood waters would not provide an appreciable increase in available water supplies. Some portion of the normal stream flow must be impounded.

Q: Is it possible to construct a reservoir in the drier areas toward Kawaihae and create a useable lake?

A: The geology of that area, the intermittent streamflows, and losses from evaporation limit the practicality of such a proposal.

C: The Kohakohau Stream environment, as a tropical stream system becoming a desert stream system, is perhaps unique from the standpoints of aesthetics and vegetation, and should be protected as such.

A. All possible measures will be incorporated in the Kohakohau Dam Project to protect the Kohakohau Stream environment.

Q. Will the water from the Kohakohau Reservoir be supplied to the Kohala Estates area?

A. No.

C: The level of flow in Kohakohau Stream used to be much higher than it is today or has been in the past 10-20 years.

A: The total flow in Kohakohau Stream has not decreased significantly over the years; however, diversions of Kohakohau Stream waters by the State, Parker Ranch, and other users at high elevations have reduced the flows in Kohakohau Stream near Waimea.

Q: What is the chance that the dam would break and result in a catastrophe?

A: A rock-fill dam with a reinforced concrete surface membrane is much more flexible in an earthquake than is a more rigid structure. (Earth or rock-fill dams normally fail only when flood waters erode the abutments.) A detailed geologic safety and stability analysis would be completed in future design efforts.

Q: What is the possibility of tapping water in the Kohala Mountains as an alternative to the dam?

A: Such plans have been suggested in the past and will be considered in the E.I.S. Tunnelling for diked water is a gamble.

2. <u>Public Information Meeting in Waimea, Hawaii, June 13, 1974.</u>

<u>Summary:</u> An informational meeting was held at 7:30 P.M. in the Waimea Elementary and Intermediate School and was attended by about 40 persons. Notice of the meeting was given in local news media and by letter to numerous community groups and associations in Waimea. An informational handout, summarizing the studies completed and preliminary conclusions, was distributed during the meeting. A presentation outlining the environmental impact study process, the technical studies completed, and the results obtained was given. Responses and questions primarily addressed aspects of streamflow maintenance, dam safety, and potential alternative water sources.

E - Historical Foundations and Conservation Groups

1. Bishop Museum
2. Conservation Council of Hawaii
3. Friends of the Earth
4. Hawaii Audubon Society
5. Kamuela Museum, Kamuela, Hawaii
6. Kona Conservation Group
7. Life of the Land
8. Sierra Club Foundation

F - Private Interests

No private interests were exclusively contacted during the environmental impact studies; however, notices of the public meeting held in February and June, 1974 in public media represented indirect contacts resulting in the expression of comments and concerns by private interests in the public meetings.

2 - Review Process Comments on the Draft Environmental Impact Statement

The Kohakohau Draft Environmental Impact Statement was submitted to the State of Hawaii, Office of Environmental Quality Control on July 5, 1974 and was distributed to the agencies and parties listed in Table 14 on July 10, 1974. Twelve letters with comments were received from July 10 to September 1, 1974 and are presented with corresponding responses and discussions in Appendix B. Certain comments made were common to a number of letters, and complete responses to those categorical comments are presented in a following section as is indicated.

Table 14

Tabulation of Review Process Comments

Draft EIS sent to:	Response Received	Substantive Comment	Approval Received	Page
Federal Agencies				
Environmental Protection Agency	No			
U.S. Army Corps of Engineers	Yes	Yes		208
Bureau of Sport Fisheries and Wildlife	No			
U.S. Department of Interior	No			
Soil Conservation Service	No			
Air Force Command	Yes	No	Yes	211
Army Command	Yes	No	Yes	212
Navy Command	No			
State Agencies (Departments)				
Accounting and General Services	No			
Agriculture	Yes	Yes	Yes	213
Education	No			
Health	Yes	Yes	Yes	215
Office of Environmental Quality Control	Yes	Yes		217
Planning and Economic Development	Yes	No	Yes	224
Social Services and Housing	No			
Transportation	Yes	Yes		225
University of Hawaii				
Environmental Center	Yes	No	Yes	226
Water Resources Research Center	No			
Hawaii County Agencies (Departments)				
Parks and Recreation	Yes	No	Yes	227
Planning	Yes	Yes	Yes	228
Public Works	Yes	No	Yes	231
Research and Development	No			
Water Supply	No			
Others				
Conservation Council of Hawaii	No			
Hawaii Audubon Society	No			
Kamuela Young Farmers Assn.	No			
Kona Conservation Group	No			
Life of the Land	Yes	Yes		232
Sierra Club Foundation	No			
Waimea - Kawaihae Community Assoc.	No			

3 - Public Hearing

The public hearing was held in Waimea, island of Hawaii, on August 22, 1974 at 7:30 P.M. in the Waimea Elementary and Intermediate School and was attended by about 80 persons. The hearing was publicized in local news media. An informational handout was again distributed, and a brief presentation given, at the hearing. Representative comments, as listed below, were registered during the hearing. Those attending were urged to submit written statements to the Division of Water and Land Development until September 6, 1974, the identified deadline.

Representative Comments from Public Hearing:

In Opposition to Project or Adequacy of Draft EIS:

1. Not assured of safety of dam in earthquake.
2. Would like to see other alternatives investigated further.
3. Object to reduction in streamflow.
4. Development of more water will mean growth in South Kohala; save the Kohala water for Waimea.
5. Would like to see development of agricultural water supply.

In Support of Project or Adequacy of EIS:

1. Need storage to catch fluctuating rainfall in Kohala Mountains.
2. Present site seems to be the best and most economical location for new water supply facility.
3. Need to keep ahead of population in planning for public facilities.

4 - Written Statements and Testimony on the Draft EIS

Written statements and testimony were received by the Division of Water and Land Development from July 10, 1974 to September 10, 1974. Table 15 lists the eleven letters received. Responses to those letters are presented in Appendix B. Responses to categorical comments are presented in the following section as is indicated.

Table 15

Tabulation of Written Statements Received

Author	Page
1. Alexander G. Budge, Jr.	258
2. Charles T. Campbell	260
3. A. D. Johnson	262
4. Ethel M. Kilpatrick	264
5. Richard Penhallow	266
6. Richard P. Schulze, Jr.	270
7. Toni Schulze	280
8. Antony P. Smart	284
9. Diana Damon Smart	289
10. Alan Tyler (Friends of the Earth)	292
11. Alan Tyler (Friends of the Earth)	296

5 - Responses to Categorical Comments

Statements made in public meetings and in submitted written review comments and testimony expressed certain concerns and opinions commonly held by those persons expressing interest in the Kohakohau Dam Project and the Draft Environmental Impact Statement. Those common or categorical concerns are listed below and are presented with corresponding responses as follows.

Table 16

List of Categorical Comments

Comment Number	Issue	Page
1.	Earthquake hazard and dam safety.	147
2.	Maintenance of flow in Kohakohau Stream.	152
3.	Alternatives to the project.	155
4.	Purpose of the project and socio-economic impacts.	157
5.	Preservation of Kohala water resources for use in Kamuela area.	161

COMMENT NO. 1

Recognizing that the island of Hawaii is an active volcanic island and is designated by the U.S. Geological Survey as a Zone III earthquake hazard area, construction of a dam on Kohakohau Stream above the town of Waimea is a dangerous undertaking and would represent a continuous threat to the safety of downstream residents and property owners.

RESPONSE

Planning and preliminary investigative efforts in the Kohakohau Dam Project have recognized the presence and importance of seismic design considerations. Extensive analyses to date have indicated that there would be no substantive danger with comprehensive design and careful construction of an earth- and rock-fill dam on Kohakohau Stream. This conclusion has been founded on field reconnaissance and testing, comparison with similar situations and historical knowledge, and preliminary design tests and checks. As is pointed out in the Draft EIS (page 17), additional studies would be required and more checks and tests completed, before final design and construction of the project could begin. Summarized as follows are the primary elements considered in the analysis of the seismic effects on the proposed Kohakohau Dam Project.

A - History of Seismicity on the Big Island

The island of Hawaii is geologically young and active. Two of the five Big Island volcanoes, Mauna Loa and Kilauea, are still active and a third, Hualalai, last erupted in 1801. This recent and continuing volcanic activity is located in the southern half of the island and is constantly forming and changing the geologic characteristics of the island. The northern part of the island was formed by the action of the two remaining volcanoes, Kohala and Mauna Kea, which have not erupted in historic time. Being the least active area on the Big Island, the Kohala-Hamakua region is the safest from the standpoint of potential earthquakes. However, recent events have demonstrated that a seismic occurrence of any significant magnitude is not likely to be greatly damped in its impact on other areas of the island.

Sizeable earthquakes have occurred in 1951, 1962, and 1973 on the island of Hawaii. The 1951 earthquake, registering about 7.0 on the Richter scale, caused extensive damage with its epicenter located south of Kailua. The April 1973 earthquake caused an estimated $5.5 million total damage, much occurring along the Hamakua Coast as the epicenter was located north of Hilo. Although the epicenter of that earthquake was located near Hilo, the Mauna Kea Beach Hotel, located on the western coast approximately 40-50 miles from Hilo, reportedly sustained appreciable structural damage (pages 42 and 43, Draft EIS).

The island of Hawaii (as well as the entire archipelago) has been designated as a Zone III (most severe of the four zones used) earthquake hazard area by the U.S. Geological Survey. This designation is used by the Federal Government and others to prescribe adequate design considerations for structural projects to ensure structural integrity and to preserve the safety of the public.

The seismic activities on the island of Hawaii appear to be on the order of those which might be expected along the San Andreas fault system in California, although the Big Island has experienced no earthquakes comparable in magnitude or effect to the more well-known of California's large earthquakes. Seismic design criteria used for large-scale projects in California are more stringent and comprehensive than those employed by most other agencies and jurisdictions and were therefore consulted and applied in preliminary analysis of the Kohakohau Dam Project.

There is no proven method for predicting future seismic occurrences or effects in California, Hawaii, or anywhere. Criteria now in use in the design of structures susceptible to potential seismic events do, however, adequately and reasonably protect the safety and interests of involved and affected parties.

B - Seismic Phenomena and Effects on Dam Structures

The effects of earthquake forces on man-made objects can be predicted and modeled. As more information on the performance of structures in seismic events becomes available, design criteria for new structures are modified.

Failures of dams in earthquakes can be particularly catastrophic in comparison with other structures because of the devastation which can result from the release of impounded waters. Failure of earth dams usually occurs when a small crack or leak is developed and subsequent erosive action wears away the rest of the face. Severe ground motion in an earthquake can shatter a brittle structure which cannot readjust to the forces. Examples of such brittle structures are concrete dams and concrete highway bridges. A flexible structure is much better suited to withstand ground motion and can "bend" with the forces. New steel-framed highrise buildings, for example, are designed to "sway" with ground forces rather than to "withstand" the earthquake forces. In much the same way, earth- and rock-fill dams are designed to readjust in seismic events without sustaining fracturing or cracking. The proposed Kohakohau Dam is such an earth- and rock-fill structure.

C - The Record of Earth-Fill Dams

Earth- and rock-fill dams have been around and withstood earthquake forces for a long time. Older dams were sometimes designed to withstand lateral forces of 0.05 to 0.10 g (5 to 10 percent of the force of gravity). In comparison, the design loading currently prescribed by the Corps of Engineers for a Zone III area is 0.15 g.

The behavior of dams in the vicinity of the epicenter of the San Fernando earthquake of February 9, 1971 is enlightening with regard to the historical development of earthquake design criteria. The following statements are taken from a report[58/] which evaluated the effects of the San Fernando earthquake on structures, including dams, in the vicinity of the epicenter. The earthquake registered a magnitude of 6.6, and caused an estimated $500 million in damage.

> The Pacoima dam (concrete arch) in the center of the earthquake was not damaged by ground shaking, but one abutment showed evidences of movement and distortion during the earthquake, and it was reported that the chord distance between abutments had shortened by about one inch. There were many earth dams in the region of moderately strong to strong shaking (15% g or greater), and the new dams designed during recent years withstood the earthquakes very well. Some of these showed evidence of having deformed during the earthquake, but they had no significant damage. On the other hand, the old dams behaved badly. The two old hydraulic earth-fill dams at the Van Norman reservoirs both were in the process of failing during the earthquake, and had the shaking been stronger or of longer duration, one or both of the dams almost certainly would have released the water in the reservoir. This experience emphasizes again *the hazard of the old dams that have not been designed* with earthquakes in mind. All old dams in California should be brought up to modern standards of safety.
>
> The modern 200-ft high Santa Felicia earth dam, 20 miles northwest of Pacoima dam, experienced maximum crest accelerations of 20%g. The dam was undamaged except for a narrow meandering crack across the crest at the east abutment, apparently shallow. The Hansen flood control dam, an earth structure, was not damaged.
>
> (In summary,) the nearly catastrophic failure of the two San Fernando dams endangered the lives of tens of thousands of people. Risks of this magnitude are clearly unacceptable and it is imperative that existing dams be brought up to modern safety standards. Such structures, in all parts of the country, should be examined thoroughly and strengthened or replaced where necessary to reduce the hazards to acceptable levels. The successful performance of a new earth-fill dam at the Van Norman site shows that modern earth-fill construction can withstand strong ground shaking estimated to have been in the 30-50%g range.

The two older dams which sustained appreciable damage were not designed by current methods and standards and incorporated none of the safety features which are discussed later.

58/ Reference 81, pages 44, 482.

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The two older dams which sustained appreciable damage were not designed by current methods and standards and incorporated none of the safety features which are discussed later.

58/ Reference 81, pages 44, 482.

D - The Kohakohau Dam Prelminary Design

Preliminary plans and design elements for the proposed Kohakohau Dam have recognized the requirement for accommodating potential earthquake forces and have incorporated appropriate safety measures. The crest thickness of the dam (at the top) would be 15 feet and the base thickness would be more than 500 feet. The dam structures would consist of compacted rockfill with an impervious concrete membrane (1 to 2.5 feet thick) on the upstream face of the dam.

Reinforcing steel would be placed in the concrete membrane to evenly distribute the water bearing pressure and spread out any cracking. Heavy vibrating rollers would be used to compact the rockfill during construction to reduce settlement and cracking. The dam has been conceived to withstand a ground acceleration of 0.50 g. The worst damage that such an earthquake could cause to the proposed dam would be to create cracks in the membrane. Through these cracks a controlled release can be estimated. At its worst, the water released could equal,but not exceed the natural flooding of the Stream without the dam. (See page 82 in the Draft EIS).

In brief, the preliminary design and plan incorporate the following safety features:

(1) a rockfill structure, which can internally adjust to earthquake forces without damage to the structure,

(2) the use of heavy vibrating rollers to compact the fill and reduce settlement,

(3) flat side-slopes which prevent slipping of the dam face,

(4) a reinforced concrete membrane which limits leakage and cracking, and

(5) an internal core which would restrict releases to less than the natural stream maximum probable flood flow in Kohakohau Stream should membrane cracks develop in the worst of earthquakes.

In addition, several other features can be included and modified to provide increased portection. These measures will be evaluated in the final design stage of the project and include:

(1) the inclusion of a bench on the dam face to further care for slope slippage,

(2) modifications of side slopes as required, and

(3) the use of a rubber or other flexible membrane in addition to the concrete membrane to improve the flexibility and readjustment capability in the event of any shifting of the rockfill core.

E - Final Design Criteria and Methodology

Final design of the proposed Kohakohau Dam will include comprehensive analysis and testing of stability under potential earthquake effects. Modifications and additions to the preliminary design will be made where appropriate to ensure that all reasonable precautions are incorporated.

The design and review phase will utilize all available expertise and techniques to analyze response of the structure to potential seismic events. A review of other structures and records of performance would contribute to this analysis.

Scale model tests can be used to demonstrate structural characteristics and responses to controlled forces. "Shake table" tests are examples of these scale model testing techniques which would be used, if necessary, in the evaluation of the proposed structure.

F - Summary and Conclusion

In light of the record of seismic activity on the Big Island, the current knowledge of effects of earthquake forces on brittle and flexible structures, the history of performance of earth- and rockfill dams in areas of comparable seismic activity, the safety factors and measures incorporated in the preliminary dam design, and the extensive and comprehensive phase of final testing and design to be completed before actual construction would begin, there is sufficient evidence at this time to show that the proposed Kohakohau Dam Project can be completed responsibly and safely without introducing hazard or threat to the residents and landowners of the Waimea town vicinity.

COMMENT NO. 2

Recognizing that the Kohakohau Stream is the last running stream in Waimea, the Kohakohau Dam Project should not be constructed if it will result in the reduction of streamflow below the dam to an unacceptable level.

RESPONSE

As is discussed in the Draft EIS, present flows in the Kohakohau Stream are intermittent and highly variable, since they are almost directly related to rainfall patterns. Flows during the wet months are characteristic of flooding conditions, and the stream is typically dry during summer months and periods of extended drought. The average flow in the stream near the highway crossing is about 7 mgd (page 57 in the Draft EIS), but there is a long period during the year when there is no flow or low flow in the stream. The Kohakohau Dam Project would impound waters collected from the Kawainui, Kawaiki, and Alakahi Streams in addition to Kohakohau Stream waters (see response to letter from the County of Hawaii Planning Department on page); therefore, flows in all four of the streams were considered in determining the probable yield of the dam and potential water surpluses. There is some possibility that the project would collect, on an average annual basis, some surplus above the desired yield (5 mgd or 10 mgd) of the dam, which could be regulated and released as desired to provide continuous stream flow below the dam. The probability of this occurrence is based on hydrologic variations which are not accurately modeled to date. The Kohakohau Dam Project would reduce the average annual stream flow below the dam, but it is expected that the number of days in the year when there is no flow or low flow in the stream below the project area will not be appreciably increased. The importance and desirability of maintaining stream flow, when practicable and depending on water availability, is recognized by the Division of Water and Land Development. Hence, during the operational management of the project, the importance of the visual and aesthetic aspects by providing flow, when practicable, will become an operational criterion.

A - The Current Stream Flow Situation

Although the average flow in Kohakohau Stream near the highway is about 7 mgd, much of the flow occurs during heavy rains and the stream is dry or nearly dry many days in the year. The average number of no-flow or low-flow days (less than 0.5 mgd flow) is about (120) per year. Thus, the potential use and enjoyment of an average 7 mgd flow is lost during the rainy season and is irretrievable during the dry season.

The proposed Kohakohau Dam would impound waters from the Kawainui, Kawaiki, Alakahi, and Kohakohau Streams to provide a reliable yield of 5 or 10 mgd (depending upon development alternative). The short period of record indicates that the combined average flows of the four streams would be 15 to 20 mgd. Some portion of that total would be lost or taken each by (a) other water rights, (b) stream and channel losses, and (c) reservoir losses. Some surplus (over the 10 mgd yield) may result, but cannot precisely be predicted at this time from available records.

B - Effect of the Dam

The proposed dam would regulate the Kohakohau Stream flow by catching the "flood" flows and releasing a more constant flow. If no net surplus of water from the four sources is available, the dam can be expected to reduce by some unpredictable amount the downstream flows. Flood flows would be reduced and "low" flows could either be enhanced (if surplus water is available), unaffected (if low flows would not be useful), or reduced (during extreme droughts).

On an average flow basis, the present 7 mgd flow would be reduced in any case to some lower average flow, and the clear advantage would be in the recovery of flood flows while the disadvantage would be in the overall stream flow reduction.

C - Possible Solutions

It is the objective in development of the proposed Kohakohau Dam Project to provide continuous releases to the Kohakohau Stream when practicable, and it is thought that this objective can become an operational criterion when supported by more information on expected stream flow in the four Kohakohau Dam sources, desired yield of the dam, and actual reservoir losses. Three possible approaches in the provision of continuous streamflow are:

(1) If the combined yield of the four sources provides a surplus (above the 10 mgd reservoir yield) sufficient to ensure continuous streamflow, no additional provisions would be required. The release of excess waters would be by overflow and automatic during high rainfall periods and could become an operational criterion during dry periods.

(2) If the combined yield of the four stream sources as presently planned does not provide a sufficient surplus to maintain continuous streamflow, other measures might be taken to tap or divert other sources (such as from the Upper Hamakua Ditch below the Alakahi Stream crossing) or the reservoir could be operated at a lower efficiency to provide releases.

(3) If combined sources and other diversions do not provide a yield sufficient to allow continuous releases, the yield of the dam could be reduced to a lower level or the project could be constructed in only the 5 mgd initial stage.

A precise determination of the water balance of the proposed reservoir (the reliable sources, the desired yield, the reservoir losses, and the remaining surplus or deficit) cannot be made at this time. Stream flow records are too short to support accurate predictions of probable mean flows, and potential reservoir losses cannot be accurately modeled. Such determinations, which would be prerequisite for an accurate prediction of the quantity and schedule of releases practicable, would be made during further studies and initial operation of the dam and should include an analysis of the desired minimum effective flow in the downstream channel. When accurately determined, the rate and quantity of releases would become an operational criterion for the dam.

COMMENT No. 3

The Draft Environmental Impact Statement does not reflect an adequate evaluation of alternatives to the proposed Kohakohau Dam Project. Alternatives are dismissed as 'infeasible' or 'prohibitively expensive'. A dual system or high level water for Waimea and low level water for coastal areas should be discussed.

RESPONSE

The discussion of alternatives has been expanded in the Final Environmental Impact Statement to include a comparative evaluation of eight more specific alternatives and a discussion of other suggestions for development of water resources for domestic water supplies (see pages 102 to 133). Anticipated engineering requirements, estimated costs, and environmental impacts are outlined for these alternatives:

1. High Level Ground Water. (Tunneling for dike-confined ground water above elevation 2,000).
2. Surface Water - Alternative A. (Pumping of Waipio valley waters to Waimea).
3. Surface Water - Alternative B. (Diversion of Kehena Ditch waters to Waimea).
4. Low Level Ground Water - Alternative A. (Drilling for fresh basal water at elevation 2,700 feet).
5. Low Level Ground Water - Alternative B. (Drilling for basal water at elevation 1,200 feet).
6. Desalination. (Construction of a desalination plant along the West Hawaii coast).
7. Successive Use of Existing Water. (Collection and treatment of wastewaters).
8. Other Suggestions. (Construction of a lined reservoir below the Waimea town vicinity, development of incremental storage capacity near existing reservoirs as needed, or development of high level surface water system and low level well system.)

In addition, the no action alternative is discussed and alternative dam sites considered in preliminary planning for the Kohakohau Dam Project are outlined.

Table 13 (page 133) summarizes the principal features of the alternatives and compares the relative engineering, economic, and environmental considerations. The most practicable and reliable alternatives from an engineering standpoint are (a) the Kohakohau Dam Project, (b) the pumping of Waipio Valley surface waters, and (c) the drilling for fresh basal water at high elevations (near 2,700 feet). Tunneling for suspected dike-confined ground water involves uncertainty and risks, as does the drilling for suspected fresh water at lower elevations. Cost estimates indicate that the Kohakohau Dam Project appears to exhibit lowest total costs. Estimates for other alternatives are based on the assumption that suspected sources exist and could be located and ignore potential land acquisition costs which could be significant. Potential environmental impacts would be minimal in the Kohakohau Dam Project and the well-drilling alternatives. Clearly the Kohakohau Dam Project exhibits advantages in all three categories of comparison: (a) engineering feasibility, (b) estimated costs, and (c) potential impacts. No other alternative affords comparable advantages.

COMMENT NO. 4

The Kohakohau Dam Project appears to be intended to encourage large-scale development in West Hawaii, and implementation of the project will commit the service areas to urban uses. The Draft EIS does not discuss in detail the extent of development and urbanization that will occur.

RESPONSE

The Kohakohau Dam Project was conceived as a part of the 1964 program developed for long-range water resource development in South Kohala and Hamakua. That program provided improved reliability and water quality as well as increased supplies in the 1960's. After the upper 50-mg reservoir is completed in 1974 or 1975, the Kohakohau Dam Project will be the last element of that program left uncompleted. During the years since 1964, new facilities were provided ahead of projected demand increases to ensure the adequacy of supplies when needed. In the same manner, planning for the proposed Kohakohau Dam Project has recognized the stated objectives and projections of the County of Hawaii and led to current planning and studies in a timely effort to stay ahead of increasing domestic water demands in the South Kohala-Hamakua region. Current studies and efforts have relied upon the most recent stated objectives and projections of the appropriate County of Hawaii agencies in determining potential water service demands. The mandate to provide required public services requires such long-range planning and reliance on the democratic planning process. Implementation of the proposed Kohakohau Dam Project would provide a significant increase in the current total domestic water supply in South Kohala and Hamakua which would serve planned service areas. The socio-economic impact of the project would be the temporary effect of construction activities on employment, population, and economic activity in the Waimea town area. This impact is slight and can easily be accommodated by the existing socio-economic structure.

A - Need for the Kohakohau Dam Project

In the early 1960's the domestic water supply facilities in South Kohala and Hamakua were unable to meet demand requirements during drought periods and generally exhibited substandard water qualities. With concern for the improvement of the reliability and quality of existing water supplies and in recognition of the potential for increased domestic water demands in South Kohala and Hamakua, the Hawaii State Legislature in 1963 requested and funded initial studies of the water resources of the Kohala-Hamakua region. The proposed Kohakohau Dam was first conceived in these 1963 studies as a promising source of additional water for future demands:

Possible surface reservoir sites should be investigated, both on the Hilo-Hamakua coast and in Kohala Mountain. In Kohala Mountain, a site at an altitude of about 3,680 feet on Kohakohau Stream seems especially favorable at this stage. A reservoir having a capacity of several hundred million gallons appears feasible here on potentially tight soil within the wet forest area, where losses from evaporation would be minimized. Water from the upper reaches of the Upper Hamakua Ditch could be diverted to flow by gravity into the reservoir, to supplement water from Kohakohau and Waikoloa Streams. 59/

In 1964 the State of Hawaii, Division of Water and Land Development undertook a comprehensive analysis of the existing water supplies and projected needs of South Kohala and Hamakua and prepared a water development plan which would serve the twofold purpose of (A) improving the reliability and quality of existing supplies and (B) providing a logical and efficient scheme for the development of water supplies to meet the demands of the foreseeable future. In this comprehensive program, the Kohakohau Dam was proposed as a final means of augmenting the supply available from the other facilities. No time schedule for development was outlined other than the objective to keep ahead of demand increases.

During the late 1960's other features of that program were completed and by 1970 only the upper 50-mg reservoir (now nearing completion) and the proposed Kohakohau Dam were left to be completed. All other improvements and new facilities were finished in the program, which provided increased domestic supplies as well as improved reliability and water quality. The completion of the upper 50-mg reservoir (expected in 1974) will again mean that supplies will be maintained at a level slightly above current demands. Within a few years, however, the slight surplus available today will be insufficient to meet gradually increasing demands (see Figure 26 in the Draft EIS). For that reason, successive studies in preparation for the Kohakohau Dam Project were completed in the 1960's and in 1970, and the current process of environmental impact studies is intended to evaluate and finalize plans for future water supply developments.

Throughout this water development program the State has succeeded in staying ahead of gradually increasing water demands and has relied upon information and projections from the County of Hawaii in planning for these required facilities. In the same manner, planning for the proposed Kohakohau Dam Project has been attentive to trends and occurrences in the County and has relied upon stated objectives and projections of the County. The most recent objectives of the County were promulgated in the General Plan (1971) and the most recent projections for future needs were prepared in conjunction with the

59/ Reference 39, page 37.

General Plan (see Table 10). These projections indicate that the official County of Hawaii agencies expected a significant increase in population in the South Kohala-Hamakua region in the next 10 to 20 years, which implies a corresponding increase in utility demands and public service needs.

The State and the Hawaii County Department of Water Supply have an obligation to provide high-quality water in reliable systems as an element in the infrastructure of public utilities and services required to support planned and orderly development in the County. The Kohakohau Dam Project is therefore under consideration at this time in a responsive and timely effort to stay ahead of increasing demands in the South Kohala-Hamakua region.

B - Land Use Planning on the Big Island

Planning for the proposed Kohakohau Dam Project has intended to serve no special interests and plays no part in committing potential service areas to specific uses. If any areas in the South Kohala-Hamakua region are committed to urban or other land uses they are already so designated by County planning, land use, and zoning procedures or will be so designated in the future by the same procedures. The water supply provided in the proposed Kohakohau Dam Project is intended to meet the needs of the County as interpreted by the General Plan and County guidelines.

Formulation and enactment of the General Plan were conducted under established statutory procedures with public meetings, workshops, and other inputs. The population projections used in the EIS studies to indicate the necessity for timely water development planning were prepared by the County of Hawaii in conjunction with these procedures.

Land use planning and zoning procedures are overseen by the County. Changes in the General Plan or in land use and zoning boundaries can be initiated and completed under those procedures. Until such time as current objectives and expectations of the County are changed, there exists the mandate to plan for additional public facilities and services needed by planned growth areas as defined in the most recent official documents and policies.

C - Role and Impact of the Kohakohau Dam Project

The Kohakohau Dam Project would provide an increase in domestic water yield of 5 or 10 mgd (depending upon development alternative). This significant increase in water supplies in South Kohala and Hamakua would meet projected domestic demand increases well into the future (see Figure 26). With proper management of that resource in accordance with short- and long-range planning and land use objectives in the County, no incompatibility with current County land use plans and future orderly development will occur.

Construction of the project would create a small number of new jobs and would result in a slight surge in population and economic activity in the Waimea town vicinity. These impacts are slight and can be easily accommodated by the existing socio-economic structure in the area.

Socio-economic impacts to the South Kohala-Hamakua region resulting from planned urban and other developments can no more be related to the provision of domestic water service (which is proposed by the Kohakohau Dam Project) than to the provision of electricity or telephone service in those areas. Each of these services is a utility element of the supporting infrastructure provided for intended expansion areas determined by planning processes. Therefore implementation of the Kohakohau Dam Project would result in a slight and temporary increase in population and economic activity in the Waimea town area during construction, but would not result in other socio-economic impacts inconsistent with stated objectives and plans of the County.

COMMENT NO. 5

Surface water resources in the Kohala Mountains near Waimea should be reserved for the needs of users in the Waimea vicinity. Transmission of water supplies originating in the Waimea area to other service areas should not be allowed.

RESPONSE

The Kohakohau Dam Project is intended primarily to meet the increasing domestic water needs of the Kamuela area; however, the obligation of State and County of Hawaii agencies to provide high quality potable water to other planned service areas requires that the most efficient and economical sources available be developed to meet increasing service area demands. The opportunity to provide a significant and economical increased domestic water supply in South Kohala and Hamakua through the Kohakohau Dam Project is advantageous to the conservation and management of all resources in the region. Waters impounded in the Kohakohau Dam would be conserved and mixed with brackish well water where possible to extend the effective reach of the precious fresh water. The proposed Kohakohau Dam Project affords the unique chance to ensure in an efficient and economical manner the provision of an adequate domestic water supply for the South Kohala-Hamakua region in the foreseeable future while ensuring the comprehensive management and conservation of surface water resources in the most efficient manner possible. Under no circumstances would transmissions of the Kohakohau Dam supply reach a level which could threaten the supply reserved for high-level demands in the Waimea vicinity.

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APPENDIX A. ANALYSES AND FIELD SURVEYS

Presented as follows are the complete consultants' reports on vegetation, wildlife, and aquatic life in the area of the proposed Kohakohau Dam Project. Reports on vegetation and wildlife address the potential project areas shown in Figures 31 and 32 (following pages 195 and 203). It should be noted that the potential riprap and borrow areas shown in those figures and discussed in the following reports on vegetation and wildlife have been rejected as unfavorable from environmental considerations. Figure 14 (following page 37) shows the area which will be considered for riprap materials to be used in the dam. Discussions of the existing environment and probable impacts to the environment presented in the main body of the report address conditions in that project sub-area only.

1 - Study of Flora

REPORT ON VEGETATION AND FLORA OF THE PROPOSED KOHAKOHAU DAM SITE, SOUTH KOHALA DISTRICT, HAWAII

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INTRODUCTION

This report has been prepared for Parsons Brinckerhoff - Hirota Associates according to the agreement entered into on February 5, 1974. The report is based upon a visit to the proposed Kohakohau Dam Site made on February 16-18, of that year. On these dates I hiked through the site to make general observations on the flora and vegetation of the area.

To my knowledge, no previous report which deals specifically with the botany of the dam site exists. However, several earlier publications mention briefly, in general terms, the vegetation of the Kohala Mountains.

W. T. Brigham (1868) states that "Mauna Kohála . . . is well wooded, and several trees grow there that are not found elsewhere on the islands, and some that grow only on Kauaì . . . at their bases, and on their slopes, the soil is often dry and barren." He also notes the presence of "crateriform marshes" and states that its summit "is swampy . . . and full of dangerous bog holes."

J. F. Rock, in July, 1909 and June, 1910, made several trips into the Kohala Mountains to collect botanical specimens. Unfortunately, Rock had almost total recall, hence whatever notes he made of his field trips are scimpy and incomplete. Judging from a map he sketched (Rock, 1909), he probably touched upon the lower limits of the potential borrow area (before it was put into forestry plantings), and he may have explored part of Puu Pelu (along the lower part of the access road and perhaps the extreme southern tip of the riprap area). However, his collections which may have come from these areas are listed merely as being from "the woods and swamps above Waimea, Hawaii" (Rock, 1910). Rock

(1913, later translated into the German, Rock, 1915) states that "It is only recently that this part of the land (the mountains of Kohala) was made accessible through the so-called upper Hamakua ditch trail, which leads to the headwaters of Kawainui gorge, opening to the botanist a most interesting field." Doubtless he was the first professional botanist in the area. C. Hitchcock, O. Degener, C. Forbes, F. R. Fosberg and others have since collected in the Kohala Mountains, but most appear to have followed the main jeep road to the higher elevations, where they did their work. It is doubtful if any collections were made, except along the jeep road, in the dam site. Rock states that "the vegetation is indeed rich, though inclined to be shruby" (Rock, 1909), and lists several plant species -- most of which were seen during my February visit. His is the best description of the area.

O. H. Selling (1948) briefly summarizes the literature concerning the Kohala Mountains. But, as he was interested in the pollen deposits of high elevation bogs, little is applicable to this report.

F. R. Fosberg (1961) produced a trail guide leading from Kailua, Kona, to the head of Alakahi Gorge. He lists the common plants seen along the main jeep road to the upper Hamakua Ditch.

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SUMMARY OF THE VEGETATION

The following paragraphs briefly describe the present vegetation of the 400 plus acre proposed Kohakohau Dam Site. This information is the outcome of the observations made while hiking through the area. The routes taken while sampling the vegetation are denoted on map no. 1. The subdivisions of the dam site (sub-headings below) are recorded on the same map.

Reservoir

The proposed Kohakohau Reservoir lies in a middle elevation, wet forest. In general the vegetation can be characterized as a sparse growth of tree ferns, shrubs and stunted trees. The ground cover consists of a great number of species of ferns, grasses, sedges and herbs, the majority of which are weeds of wide distribution. The moss, _Sphagnum palustre_, is abundant, forming thick mats on the ground and hummocks at the bases of the trees.

The dominant trees are _Metrosideros_ and _Cheirodendron_, two of the most common genera in our native forests. Along the steep banks of the Kohakohau Stream, which roughly bisects the reservoir site, there is a luxuriant stand of these trees, most reaching 25-30 feet in height. At the other extreme, those on the flat bottom land of the reservoir are sparse and stunted, while the ones growing on the slopes of the puus and ridges enclosing the area are somewhat intermediate in size and number.

Tree ferns and occasional small trees and shrubs grow throughout the area. These form a sparse understory along the banks of the stream; elsewhere they are usually about the same height as the _Metrosideros_ and Cheirodendron. The native Rubus, Vaccinium and two species of Myrsine are the most common shrubs and small trees. Less common are Coprosma, Ilex, Gouldia, Pelea and Clermontia.

The ground cover is comprised primarily of Sphagnum moss and exotic herbs. Pig damage in the area is quite extensive. The disturbance they have created and, I suspect, the seeds they have carried, have resulted in a nearly totally exotic groundcover vegetation. Ginger, probably washed down by the stream, forms a dense, rank growth along the streams' steep slopes. Weedy herbaceous plants and native and exotic grasses and sedges are found in and along the stream. An aquatic moss grows abundantly among the rocks in the stream bed. Juncus and clumps of grasses and sedges are common in the bottom lands of the reservoir where the ground is covered by a thick mat of Sphagnum. The slopes of the enclosing ridges have patches of Dicranopteris; other ferns are scattered throughout the area. Hilo grass is one of the main ground covers and is mixed with other grasses, sedges, Juncus, Hydrocotyle, Erechtites, Eupatorium, Veronica and other herbs. The wetter more protected areas have large patches of Sphagnum while Cuphea, Drymaria, Vaccinium berberifolium and Hypochoeris replaces the moss on barer, more exposed slopes. Polygonum is common in shallow, muddy pig "wallows."

To summarize: the trees and shrubs of the area are all native, but common species, while the ground cover consists primarily of Sphagnum and common weeds of disburbed areas.

Potential Riprap Area

The vegetation of the northeastern slope, following the axis of the saddle dam, is very similar to the slope vegetation described above. As one approaches the top of the puu, the vegetation becomes denser and epiphytic species are much more common. The top of the puu is covered by a small patch of nearly pure native forest. Again the dominant trees are Metrosideros and Cheirodendron with occasional small trees and shrubs of Ilex, Gouldia, Vaccinium, Broussaisia, Pelea, Myrsine, Cyrtandra and Rubus. An occasional Freycinetia and Smilax vine may be seen. Epiphytes are common here: Astelia, Peperomia, Elaphoglossum, Adenophorus. The ground cover consists of about 50% litter and 50% mosses with an occasional clump of Elaphoglossum or Astelia. Descending the southeast ridge of the puu, dense stands of Dicronopteris, Eupatorium and other weedy species are soon encountered.

Potential Borrow Area

This area is covered with Forestry plantings; Cryptomeria is the main species.

Access Roads

After leaving the main jeep road, the access road passes through a narrow strip comprised primarily of exotic trees: Eucalyptus, Alnus, and Melaleuca with an occasional Metrosideros or Cheirodendron mixed in. Just after starting into the native Metrosideros-Cheirodendron forest, the road turns abruptly southward into a cleared pasture.

The right fork of the access road passes through the grassland and back into the riprap area. It first passes through a small Cryptomeria grove, then enters a native forest similar to that along the northern side of the area.

The left fork continues through the pasture, then along the west slope of Puu Pelu to the axis of the proposed dam. The western slope of Puu Pelu supports the best native forest that I observed in the study site. As in the other parts of the area sampled, Metrosideros and Cheirodendron are the dominant trees. The shrub and small tree story is botanically richest here. Cyrtandra and Gouldia hillebrandii are included along with Ilex, Coprosma, Gouldia terminalis, Vaccinium, Cibotium and others. The ground may be bare or have a light litter cover or it may have a rich covering of native ferns, mosses, sedges or liverworts. Occasionally a small patch of exotic herbs is encountered. Dicranopteris covers the strip along the fence line in many places, and is common near the crest of the puu. The epiphytic flora is very rich: Ophioglossum and Psilotum complanatum are common as is Astelia, Elaphoglossum spp. and filmy ferns. Polypodium pellucidum is a common epiphytic and terrestrial species in this area, especially along the top of the steep bank of the stream.

Spillway

The spillway will descend the steep bank to the Kohakohau Stream from the western side of the proposed Kohakohau Dam axis. The vegetation of this area consists of a tall (± 40 feet), open Metrosideros and Cheirodendron forest. Cibotium is common and ginger, palm grass and some Eupatorium cover the lower part of the bank and line the stream.

Outlet Pipe

The outlet pipe will follow the Kohakohau Stream. The vegetation of the stream banks is described above.

Main Jeep Road

A jeep road from Waimea town skirts the western side of the potential borrow area, passes between the borrow area and the potential riprap area and continues on to the Upper Hamakua Ditch and the head of the UHD diversion channel. The vegetation adjacent to and between the tire tracks is comprised almost entirely of exotic weedy species. In the study area, the road is lined with Alnus and Eucalyptus trees. Introduced weeds and a few common indigenous plants as Pennisetum, Paspalum conjugatum, P. urvillei, Eupatorium, Commelina, Geranium, Cuphea, Nephrolepis, Axonopus, clover and Carex are abundant both between and along the tracks. Dicranopteris frequently forms a buffer zone between the vegetation of the disturbed area and that of the native stand. Holcus, Axonopus and Sphagnum with Hypericum, Hydrocotyle and other low, boggy species become more common as one approaches the end of the road.

UHD Diversion Channel

The diversion channel passes through an open boggy region of low trees and shrubs. Stunted Metrosideros and Cheirodendron with Vaccinium calycinum, tree ferns, Clermontia and Styphelia are the dominant shrubs. Sphagnum moss covers the ground and forms humps around the bases of the shrubs. Disturbance, primarily by pigs, has allowed hilo grass, Juncus and other exotic weeds to gain a foothold in the area, and are now a very common component of the vegetation.

CONCLUSIONS

The vegetation of approximately 217 acres (53%) of the proposed Kohakohau Dam site will be completely and permanently destroyed by the construction of the dam and the subsequent inundation of the reservoir area. These are the shaded areas on map no. 1. The plants under the UHD diversion channel, spillway, outlet pipe and access roads, of course, also will be destroyed. The remainder of the site will be badly damaged by the construction activities and by the lanes of invasion opened by the construction of the new roads and channels. It all comes down to the fact that the vegetation of the entire site will be dealt a blow from which it probably never will recover.

Is the vegetation worth saving? I believe that all stands of Hawaii's unique native plants are of great value. However, what we have here is not a good example of native vegetation. For years it has been a buffer zone between cleared, planted pasture land and the bogs of Kohala. Forestry plantings have been made within the site. A jeep road passes through it. A lane for a pipeline was cleared along its northern side and a row of Eucalyptus was planted in the lane. Pig damage is extensive throughout the site. An introduced ornamental (ginger) has heavily infested the stream banks. It is indeed a sad example of a wet, middle elevation forest.

In general, the dominant arborescent vegetation consists of a sparse, stunted stand of Metrosideros and Cheirodendron trigynum trees. Metrosideros is the most abundant tree in the Hawaiian Islands, while Cheirodendron trigynum is a very common species found on all of the main islands except Kauai. The shrubs and small trees as Cibotium, Ilex, Vaccinium, Sadleria and _Gouldia_ are common on all or most of the main islands. To my knowledge, there are no varieties or forms of these species which are restricted to this small area or to its immediate environs. Some of the species, as the _Cyrtandra_, are endemic to the Island of Hawaii but are rather widespread throughout the island or throughout the Kohala Mountains. The native ferns, epiphytes and groundcovers are mostly rather common sorts. Actually, the groundcover consists primarily of weedy herbaceous plants, indicating the amount of disturbance which has occurred in the area.

I saw no taxon which is listed on the tentative rare and endangered species list for the state.

In other words, in my opinion, none of the native species that I observed is rare in the islands today. I doubt if the construction of the dam would cause any significant damage to the total island population of any of the species involved. If the dam is to be constructed, placing it in this particular site probably would cause the least amount of damage to the native vegetation.

Possible long term effects on the flora and vegetation of the area are difficult to assess. One immediate effect would be to push the buffer zone of mixed native and exotic species northward a half mile or so. As the area above the site has been disturbed by pipeline and flume construction in the past, and by pig damage, this would be a rather qualitative effect. The possible long term effects must be viewed in the light of various practical considerations that are not related to my specialty of systematic botany; care, planning and foresight for the whole South Kohala District should be employed in their implementation.

CHECKLIST OF THE VASCULAR PLANTS OF THE PROPOSED KOHAKOHAU DAM SITE, KOHALA, HAWAII

This checklist is based entirely upon my observations of February 16-18, 1974. A search of the Herbarium of the Bishop Museum, of the note-books of botanists known to have done field work in the Kohala Mountains, and of specimen citations in various botanical monographs, has not revealed any collection with data specific enough to ascertain that it was collected within or about the 409 acres included in this study. J. F. Rock probably touched upon the lower limits of the potential borrow area and the access roads. O. Degener, F. R. Fosberg and others have traversed the main jeep road to the Upper Hamakua Ditch. None, however, have specifically cited specimens collected from the area which falls within the scope of this study.

As the primary objective of the study was to survey the proposed dam site and to sample the various plant associations, rather than to make an exhaustive search solely for plant species, the list is not to be considered complete. In many cases determinations at the specific level could not be made as no specimens were found with flowers or fruit. The list does not include trees planted by the Forestry Department.

The following information is included for each species:

1) Scientific name.
2) Common or Hawaiian name, when known.
3) Distributional range of the species. This is indicated by the following symbols:

    E - taxon endemic to the Hawaiian Islands, _i.e_. occurring naturally nowhere else in the world.

I - indigenous, i.e. native to the Hawaiian Islands but also occurring naturally (without the aid of man) elsewhere.

X - taxon of deliberate or accidental introduction after the Western discovery of the Islands.

4) Relative abundance and approximate distribution within the study site. A subjective five-point scale is used to record this information. A species which was seen once, or perhaps two or three times at the most, is ranked "rare." At the other extreme, the few most common species are ranked "abundant." The progression of the scale is as follows:

   Rare

   Uncommon

   Occasional

   Common

   Abundant

   The distribution may be qualified if the plant was found to be restricted primarily to one place. Restriction may be due to environment, disturbance, dispersal mechanisms, etc. The rank is based entirely upon a comparison of the frequency with which a species occurs, as compared to all other species, within the study site. It does not denote, necessarily, the abundance of that particular species in the Hawaiian Islands.

The total area sampled is shown on map no. 1 and is referred to as "study site" or "proposed Kohakohou Dam Site" in the checklist.

Family assignments follow J. C. Willis, A Dictionary of the Flowering Plants and Ferns, 8th ed. All taxa are arranged alphabetically.

PTERIODOPHYTA

ASPIDIACEAE - Shieldfern Family

Dryopteris paleacea (Sw.) C. Chr. (lau-kahi) I

Uncommon; on Puu Pelu.

ASPLENIACEAE - Spleenwort Family

Asplenium lobulatum Mett. (pi'ipi'i-lau manamana) I

Occasional, mostly on Puu Pelu.

Asplenium sp.

Occasional, most frequently seen on reservoir site.

Asplenium sp.

Uncommon.

ATHYRIACEAE - Athyrium Family

Athyrium japonicum (Thunb.) Copel E

Common along jeep road.

Athyrium sandwichianum Presl. (ho'i'o) E

Occasional to locally common on Puu Pelu.

BLECHNACEAE - Blechnum Family

Sadleria spp. ('ama'uma'u, 'ama'u) E

Abundant.

DENNSTAEDTIACEAE - Dennstaedtia Family

Microlepia strigosa? (Thunb.) Presl. (palapalai) I

Occasional.

DICKSONIACEAE - Tree Fern Family

Cibotium chamissoi Kaulf. (hapu'u 'i'i) E

Occasional.

Cibotium splendens (Gaud.) Krajina (hapu'u) E

Common.

GLEICHENIACEAE - Gleichenia Family

Dicranopteris emarginata (Brack.) Robinson (hairy uluhe) E

Common.

Dicranopteris linearis (Burm. f.) Underw. (uluhe, false staghorn fern) I

Occasional to locally common.

Hicriopteris pinnata (G. Kunze) Ching (uluhe-lau-nui) I

Uncommon.

GRAMMITIDACEAE - Grammitis Family

Adenophorus haalilioanus (Brack.) K. A. Wilson E

Rare.

Adenophorus sarmentosus (Brack.) K. A. Wilson E

Uncommon.

Adenophorus tamariscinus Hook. & Grev. (wahine-noho-mauna) E

Uncommon to occasional.

Grammitis tenella Kaulf. (kolokolo) E

Uncommon.

Xiphopteris saffordii (Maxon) Copel. (kihi) E

Uncommon.

HYMENOPHYLLACEAE - Filmy Fern Family

Mecodium recurvum (Gaud.) Copel. ('ohi'a-ku) E

Common epiphyte especially in riprap area and on Puu Pelu.

Sphaerocionium lanceolatum (H. & A.) Copel. (palai-hinahina) E

Common epiphyte in riprap area and on Puu Pelu.

Vandenboschia cyrtotheca (Hillebr.) Copel. E

Uncommon; a few specimens noted in riprap area.

LINDSAEACEAE - Lindsaea Family

Sphenomeris chinensis (L.) Maxon ex Kramer (palapala'a) I

Occasional; in disburbed areas only.

LOMARIOPSIDACEAE - Lomariopsis Family

Elaphoglossum alatum Gaud. ('ekaha) E

Common, especially in riprap area and on Puu Pelu.

Elaphoglossum hirtum var. micans (Mett.) C. Chr. ('ekaha) E

Occasional, mainly on Puu Pelu.

Elaphoglossum pellucidum Gaud. ('ekaha) E

Rare; few specimens seen in riprap area.

LYCOPODIACEAE - Club Moss Family

Lycopodium cernuum L. (wawae'iole) I

Common.

Lycopodium venustulum Gaud. (wawae'iole) I

Uncommon to occasional around upper end of UHD diversional channel.

OLEANDRACEAE - Oleandra Family

Nephrolepis exaltata (L.) Schott (ni'ani'au, sword fern) I

Common along jeep road; uncommon elsewhere.

OPHIOGLOSSACEAE - Adder's Tongue Family

Ophioglossum pendulum subsp. falcatum (Presl) Clausen (puapua-moa) I

Common on west side of Puu Pelu; rare elsewhere.

POLYPODIACEAE - Polypody Family

Pleopeltis thunbergiana Kaulf. ('ekaha-'akolea) I

Uncommon.

Polypodium pellucidum Kaulf. ('ae) E

Occasional throughout area except for west side of Puu Pelu where the species was common.

PSILOTACEAE - Psilotum Family

Psilotum complanatum Sw. (moa) I

Occasional; common on west side of Puu Pelu.

THELYPTERIDACEAE - Thelypteris Family

Cyclosorus dentatus (Forsk.) Ching (pai'i'iha, downy wood fern) I

Uncommon.

Cyclosorus sandwicensis (Brack.) Copel. (ho'i'o-kula) E

Occasional in Puu Pelu area.

MONOCOTYLEDONAE

COMMELINACEAE - Spiderwort Family

Commelina diffusa Burm. f. (honohono, day flower) X

Uncommon weed along main jeep road.

CYPERACEAE - Sedge Family

Carex aff. alligata F. Boott (Hawaiian sedge) E

Common. As only the bare floral culms remained, I was not able to determine if it was indeed this species or the closely allied C. pluvia.

Cyperus brevifolius (Rottb.) Hassk. (kyllinga, kili'o'opu) X

Occasional throughout area; locally common in certain open areas.

Cyperus polystachus Rottb. I

Common along jeep road and in other disturbed areas; occasional elsewhere.

Cyperus sp.

Uncommon; flat bottom land of reservoir.

Cyperus sp.

Rare; on main jeep road.

Machaerina angustifolia (Gaud.) Koyama ('uki) I

Occasional to common near upper end of UHD diversional channel.

Machaerina mariscoides subsp. meyenii (Kunth) Koyama ('uki) I

Rare on Puu Pelu.

Uncinia uncinata (L. f.) Kuek. I

Rare on east slope of Puu Pelu, not seen elsewhere.

GRAMINEAE - Grass Family

<u>Andropogon</u> <u>virginicus</u> L.	(broomsedge)	X
Rare in this area.		
<u>Axonopus</u> <u>compressus</u> (Sw.) Beauv.	(carpetgrass)	X
Occasional to common along upper part of UHD diversional channel.		
<u>Deschampsia</u> <u>australis</u> Nees ex Steud.		E
Occasional to common at upper part of UHD diversional channel.		
<u>Holcus</u> <u>lanatus</u> L.	(velvetgrass, Yorkshire fog)	X
Occasional at upper end of UHD diversional channel, in disturbed areas.		
<u>Isachne</u> <u>distichophylla</u> Munro ex Hillebr.	('ohe, ma'ohe'ohe)	E
Rare; single small colony seen on slope above Kohakohau Stream in inundation area.		
<u>Paspalum</u> <u>conjugatum</u> Berg.	(Hilo grass)	X
Abundant.		
<u>Paspalum</u> <u>urvillei</u> Steud.	(vasey grass)	X
Uncommon; only along jeep road.		
<u>Pennisetum</u> <u>cladestinum</u> Hochst. ex Chiov.	(kikuyu grass)	X
Common along main jeep road.		
<u>Poa</u> <u>annua</u> L.	(annual bluegrass)	X
Common along jeep road, uncommon elsewhere.		
<u>Sacciolepis</u> <u>indica</u> (L.) Chase	(glenwoodgrass)	X
Common, especially in open, disturbed areas.		
<u>Setaria</u> <u>geniculata</u> (Poir.) Beauv.	(perennial foxtail)	X
Occasional only along jeep road.		
<u>Setaria</u> <u>palmaefolia</u> (Koen.) Stapf	(palmgrass)	X
Occasional throughout area.		

JUNCACEAE - Rush Family

Juncus planifolius R. Br. X

Common in open, wet areas.

Juncus effusus? L. (Japanese mat rush) X

Uncommon; several large clumps seen, none in flower or fruit, but appear to be this species.

LILIACEAE - Lily Family

Astelia menziesiana Sm. (pa'iniu) E

Common; very common epiphyte on west side of Puu Pelu.

PANDANACEAE - Screw Pine Family

Freycinetia arborea Gaud. (ie'ie) E

Rare throughout most of area; occasional on Puu Pelu.

SMILACACEAE - Smilax Family

Smilax sandwicensis Kunth (hoi-kuahiwi, aka'awa) E

Uncommon; most plants on Puu Pelu.

ZINGIBERACEAE - Ginger Family

Hedychium sp. ('awapuhi) X

Abundant at upper end of UHD diversional channel and on steep banks of Kohakohau Stream; uncommon elsewhere. As the plant was not in flower, I could not determine if it was the common white or yellow ginger.

DICOTYLEDONAE

APOCYNACEAE - Periwinkle Family

Alyxia olivaeformis Gaud. (maile) E

Uncommon in reservoir area to occasional in riprap area and on western slopes of Puu Pelu.

AQUIFOLIACEAE - Holly Family

Ilex anomala H. & A. (kawa'u) E

Occasional throughout entire study site.

ARALIACEAE - Ginseng Family

Cheirodendron trigynum (Gaud.) Heller (olapa, olapalapa) E

Second most abundant species of tree in the area.

Tetraplasandra sp. ('ohe) E

Rare; a single specimen seen near upper end of UHD diversion channel.

BORAGINACEAE - Heliotrope Family

Myosotis azorica H. C. Wats. ex Hook. (forget-me-not) X

Occasional along main jeep road.

CAMPANULACEAE - Bell Flower Family

Clermontia kohalae Rock ('oha-wai, 'oha, haha) E

Uncommon in entire area except along the UHD diversional channel where it becomes occasional. A single flowering plant was seen, but vegetatively all specimens appeared to belong to the same taxon.

Cyanea pilosa? Gray E

Rare, a single small colony was seen near UHD diversion channel at about 3880 feet (elevation). The plant was not in flower, but vegetatively it resembled C. pilosa.

Trematolobelia grandifolia (Rock?) Deg. E

Occasional along the UHD diversion channel; uncommon in the rest of the study site.

CARYOPHYLLACEAE - Pink Family

Drymaria cordata (L.) Willd. ex R. & S. (drymaria, pipili) X

Common in reservoir and disturbed areas.

COMPOSITAE - Sunflower Family

Erechtites valerianaefolia (Wolf) DC. X

Uncommon in open, more disturbed areas to rare in riprap area and on western slopes of Puu Pelu.

Eupatorium riparium Regel. (spreading mist flower) X

Abundant, especially in open areas.

Hypochoeris radicata L. (gosmore, hairy cats-ear) X

Occasional, mostly in open, disturbed places.

EPACRIDACEAE - Epacris Family

Styphelia tameiameiae (Cham.) F. Muell. (pukiawe) I

Occasional; mostly along UHD diversion channel.

ERICACEAE - Heath Family

Vaccinium berberifolium (Gray) Skottsb. (barbery-leaved 'ohelo) E

Uncommon.

Vaccinium calycinum Sm. ('ohelo-kau-la'au) E

Common throughout area, especially so along UHD diversion channel.

GERANIACEAE - Geranium Family

Geranium carolinianum L. (Carolina crane's bill) X

Occasional in open areas.

GESNERIACEAE - Gloxinia Family

Cyrtandra platyphylla var. membranacea? Rock E

Rare throughout all of area except Puu Pelu where it is occasional.

GUTTIFERAE - Mangosteen Family

Hypericum degeneri Fosb. X

Occasional in open disturbed places as along jeep road and trails.

HYDROCOTYLACEAE - Hydrocotyle Family

Hydrocotyle sibthorpioides var. oedipoda Degs. & Greenwell (thick-rooted hydrocotyle) X

Rare; seen only at upper end of UHD diversional channel.

Hydrocotyle verticillata Thunb. (marsh pennywort, pohe) X

Occasional throughout study site.

HYDRANGEACEAE - Hydrangea Family

Broussaisia arguta Gaud. (kanawao, nawao, pu'aha-nui) E

Uncommon to occasional on Puu Pelu.

LABIATAE - Mint Family

Stenogyne calaminthoides Gray E

Rare; a single specimen seen near upper end of UHD diversion channel.

LEGUMINOSAE - Bean Family

Lotus sp. X

Uncommon along main jeep road.

Trifolium repens L. (white clover) X

Occasional along main jeep road.

LYTHRACEAE - Loosestrife Family

Cuphea carthagenensis (Jacq.) MacBride (puakamoli, Colombian cuphea) X

Uncommon; in open, exposed place in reservoir and along jeep road.

MYRSINACEAE - Myrsine Family

Myrsine lessertiana A. DC. (kolea-lau-nui) E

Occasional throughout area.

Myrsine sandwicensis A. DC. (kolea-lau-li'i) E

Occasional.

MYRTACEAE - Myrtle Family

Metrosideros collina subsp. polymorpha (Gaud.) Rock ('ohi'a-lehua, lehua) E

Most abundant arborescent species of study area.

Psidium cattleianum Sabine (strawberry guava) X

Uncommon; no mature plants observed, but a few seedlings were noted on Puu Pelu.

PEPEROMIACEAE - Peperomia Family

Peperomia lilifolia C. DC. ('ala'ala-wai-nui) E

Rare; on west slope of Puu Pelu.

Peperomia hypoleuca? Miq. ('ala'ala-wai-nui) E

Occasional, mostly on Puu Pelu and in riprap area.

Peperomia sp. ('ala'ala-wai-nui) E

Uncommon in riprap area and on Puu Pelu.

POLYGONACEAE - Buckwheat Family

Polygonum glabrum Willd. (kamole, knotweed) X

Common, especially in muddy, pig-disturbed areas.

ROSACEAE - Rose Family

Rubus hawaiiensis Gray ('akala, 'akalakala) E

Occasional.

Rubus rosaefolius Sm. (thimbleberry) X

Uncommon on Puu Pelu.

RUBIACEAE - Coffee Family

Coprosma rhynchocarpa? Gray (pilo) E

Uncommon. None in flower or fruit, but had vegetative characteristics of this species.

Gouldia hillebrandii Fosb. (manono) E

Rare; on Puu Pelu.

Gouldia terminalis (H. & A.) Hillebr. (manono) E

Uncommon.

Sherardia arvensis L. (spurwort) X

Uncommon; along the main jeep road.

RUTACEAE - Citrus Family

Pelea clusiaefolia Gray (alani) E

Uncommon; most specimens seen in riprap area and on Puu Pelu.

SCROPHULARIACEAE - Figwort Family

Veronica arvensis L. (corn speedwell) X

Uncommon; mostly at upper end of UHD diversion channel.

Veronica serpyllifolia L. (thyme-leaved speedwell) X

Occasional.

URTICACEAE - Nettle Family

Pipturus sp. (mamaki, mamake) E

Rare; a plant or two seen in riprap area.

SUMMARY OF THE FLORA

One hundred four species were recorded during the sampling. Of these, 34 taxa were ferns, 27 were monocots and 43 were dicots. About 2/3 (66.3%) of the plants observed are native to the Hawaiian Islands. Endemic species represent about 49% of the total.

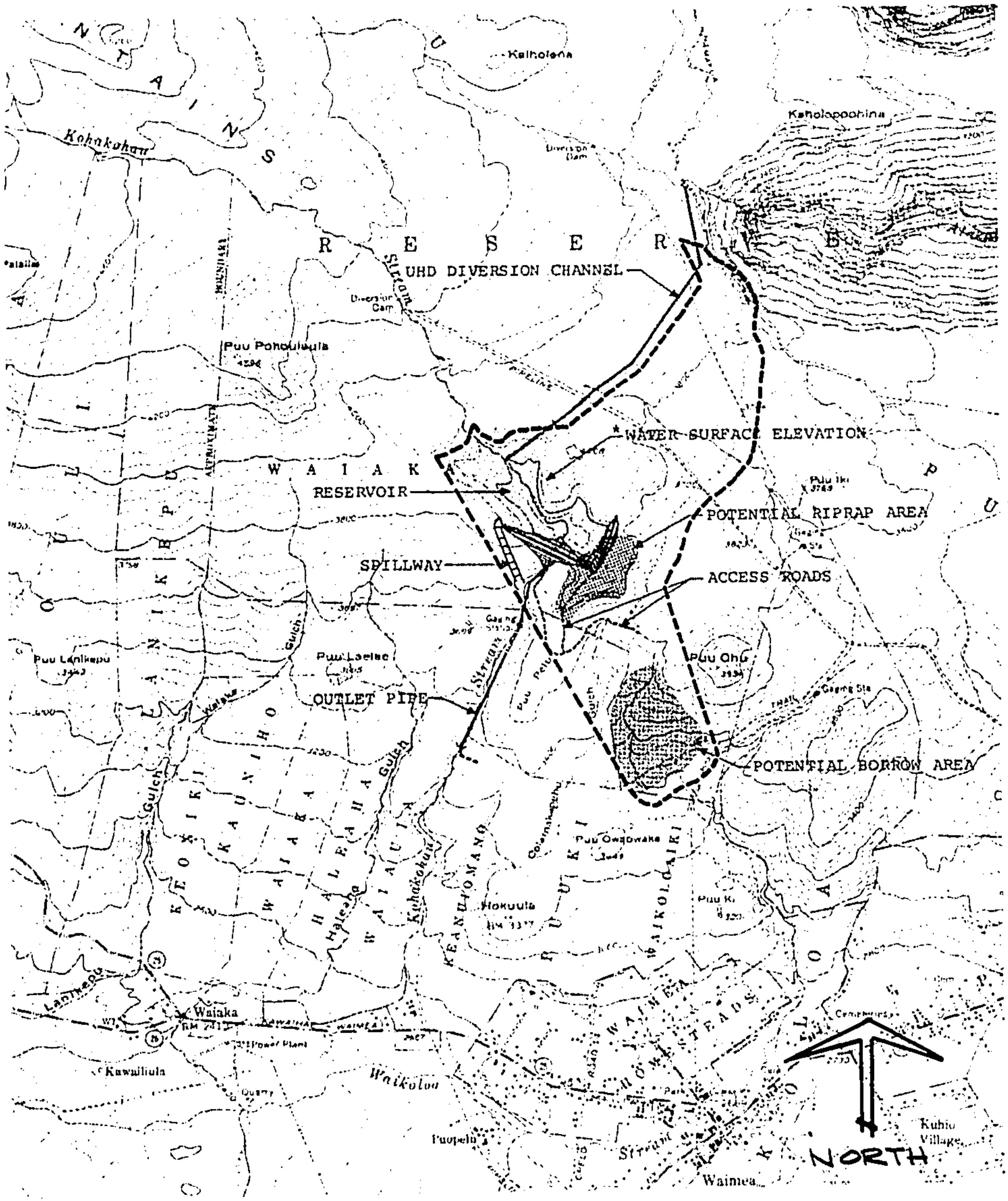

FIGURE: 31 STUDY AREA FOR VEGETATION SURVEY
KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

2 - Study of Birds and Mammals

REPORT ON BIRDS AND MAMMALS OF THE PROPOSED KOHAKOHAU DAM SITE, SOUTH KOHALA, HAWAII

DR. C. ROBERT EDDINGER
INSTRUCTOR OF BIOLOGY
HONOLULU COMMUNTIY COLLEGE
HONOLULU, HAWAII

February 25, 1974

INTRODUCTION

The following report is the result of three days of intensive field work (February 16, 17, and 18, 1974) conducted by Dr. D. Herbst and myself in the area of the proposed Kohakohau Dam project, and a review of related literature.

I. THE STUDY SITE

The areas investigated in the study site are:

A. The acres (approximately 120) to be inundated by dammed waters, to elevation 3880 feet.

B. The potential riprap source area, comprising approximately 30 acres.

C. The potential borrow area, comprising approximately 70 acres.

D. Other areas included in the boundary of construction activities.

E. The 4000-foot strip along the proposed outlet pipe, from elevation 3620 feet to 3260 feet.

F. The 7000-foot strip along the proposed Upper Hamakua Ditch (UHD) Diversion Channel.

II. METHOD OF STUDY

Transects were walked throughout the first four mentioned areas. The inundated area was looked at in major detail and the borrow areas and construction areas also received considerable attention. The lengths of the UHD Diversion and Outlet pipe were hiked.

This study includes a checklist of the birds and mammals within the area, an indication of their relative abundance, notes on whether they are endemic, indigeneous, or introduced, and estimates of the effects of the proposed project on their populations.

III. CHECKLIST OF BIRDS AND MAMMALS

A. Birds:

1. Apapane (Himatione sanguinea sanguinea). One race inhabits Hawaii, Maui, Lanai, Molokai, Oahu, and Kauai. This is the most common of the surviving species of Hawaiian Honeycreepers. Perkins (1903: 407) wrote that the Apapane once visited the coastal areas of the main islands. Today the Apapane is rare at elevations lower than 2,800 feet. The Apapane typically prefers trees that are at least 25 feet high.

2. Hawaii Amakihi (Loxops virens virens). This subspecies is endemic to the island of Hawaii; three other subspecies are endemic to Kauai (L. v. stejnegeri), Oahu (L. v. chloris), and Maui, Molokai, and Lanai (L. v. wilsoni). This is the second most common living honeycreeper. The Amakihi is abundant on Hawaii, Maui, and Kauai. Richardson and Bowles (1964) commented that "like the elepaio, the amakihi seems able to tolerate some vegetational or other human disturbances of the native forest." The Amakihi can thus be found feeding in forests of mixed endemic and introduced trees.

3. Hawaii Elepaio (Chasiempis sandwichensis sandwichensis). This subspecies is endemic to the island of Hawaii; two other subspecies are endemic to Oahu (C. s. gayi) and to Kauai (C. s. sclateri). Perkins (1893: 109) found the Elepaio to be one of the commonest birds in Kona, "extending its range from about 1400 feet to the limits of the proper forest on Mauna Loa, and also high up Hualalai." Like the Amakihi the Elepaio can be found feeding in forests of mixed endemic and introduced trees.

4. Koloa or Hawaiian Duck (Anas wyvilliana). This species was originally found on all of the main islands except Lanai and Kahoolawe. The Koloa became extinct on all of the islands except Kauai, probably as a result of the introduction of the mongoose. A propagation program at Pohakuloa has resulted in a number of pen-reared birds being released on Oahu and Hawaii.

5. Japanese White-eye (Zosterops japonica japonica). This species was imported from Japan in 1929 (Caum, 1933). This species has spread from Oahu to all of the inhabited islands. The White-eye can inhabit almost any habitat-type within the islands and is by far the most abundant bird, native or introduced, in the islands. There are as yet no studies on the relationships between the White-eyes and endemic birds. White-eyes may actually compete with our

endemic birds and they may be responsible for the spread of bird malaria.

6. Chinese Thrush (Garrulax canorus). This species was introduced to Oahu around 1900 and later to Molokai, Maui, Hawaii and Kauai. The Chinese Thrush prefers low dense vegetation and is at home in many introduced plant thickets. Ord (1967) said that the Chinese Thrush was "abundant on Hawaii, Maui, and Oahu, from 400 feet up to the tree limit."

7. Ring-necked Pheasant (Phasianus colchicus torquatus). The species was introduced as a game bird about 1865. The Ring-necked Pheasant prefers open grasslands.

B. Mammals:

1. Feral pig (Sus scrofa)
2. Black rat (Ratus rattus)
3. House mouse (Mus muculus)
4. Mongoose (Herpestes auropunctatus)

All of the mammals were introduced to Hawaii by man. The black rate and the mongoose are definite pests--both are often predators on birds and their eggs. In my study of native birds on Kauai the black rat was a major predator. The mongoose is a known predator on ground nesting birds and is probably responsible for the extinction of the Koloa on all of the islands except Kauai. Rats, mice, and pigs may also carry diseases that can be transmitted to man. Pigs are also responsible for the destruction of some of our native ground cover. None of these species of mammals should be considered worth saving from an ecological viewpoint.

IV. WHAT WILL HAPPEN TO THE WILDLIFE AS A RESULT OF PROPOSED DAM CONSTRUCTION?

Refer to Section I for area descriptions.

A. The 120 acres to be inundated:

Apapane, Amakihi and Elepaio are very uncommon within the area to be inundated by the proposed Kohakohau Dam, largely because the vegetation is too scrubby. I found a few Apapane and Amakihi in the tall trees along Kohakohau Stream. These birds would probably relocate in the higher vegetation along the ridges. The most common birds in this area are Japanese White-eyes which we could very well do without. We did see two Koloa fly over this area but they did not alight within the area to be inundated. The construction of the dam may actually enhance this area for duck feeding and breeding.

B. and C. The 30 acres considered for potential riprap sources and the 70 acres considered for potential borrow sources:

These areas contain a mixture of endemic and introducted vegetation and correspondingly are inhabited by species that can tolerate disturbances. The Japanes White-eye is again the most common species, but Amakihi and

Elepaio also visit this area. A few Apapane come here to feed but the trees are not suitable for nesting. I heard several Chinese Thrush singing from within dense undergrowth in this area. One Ring-necked Pheasant was here but no doubt came from the nearby meadow where they are common. A disturbance in this area will delete some feeding areas for the three endemic passerines.

D. The remaining areas included in the outer boundary of construction activities: The ridges and high slopes that surround the construction area are the most vital areas to preserve as far as wildlife is concerned. It is here that Amakihi, Apapane, and Elepaio are quite abundant.

E. and F. The 400 foot strip along the proposed outlet pipe and the 7000 foot strip along the upper Hamakua Ditch. Both of these areas are very poor wildlife areas--inhabited mainly by Japanese White-eyes.

V. RECOMMENDATIONS

The area of greatest concern for wildlife preservation should be the upper slopes and ridges surrounding the dam. These areas are the richest areas in terms of abundance of endemic species, largely because of the height of the vegetation.

My investigations on Kauai have shown that the endemic Apapane, Amakihi and Elepaio are still common in disturbed areas, as round the Kalalau Lookout at Kokee, as long as the suitable native vegetation is preserved. I would therefore encourage preservation of the larger native trees on the slopes and ridges surrounding the dam. We can have the dam and still have suitable wildlife areas for our native birds with the preservation of these slopes and ridges.

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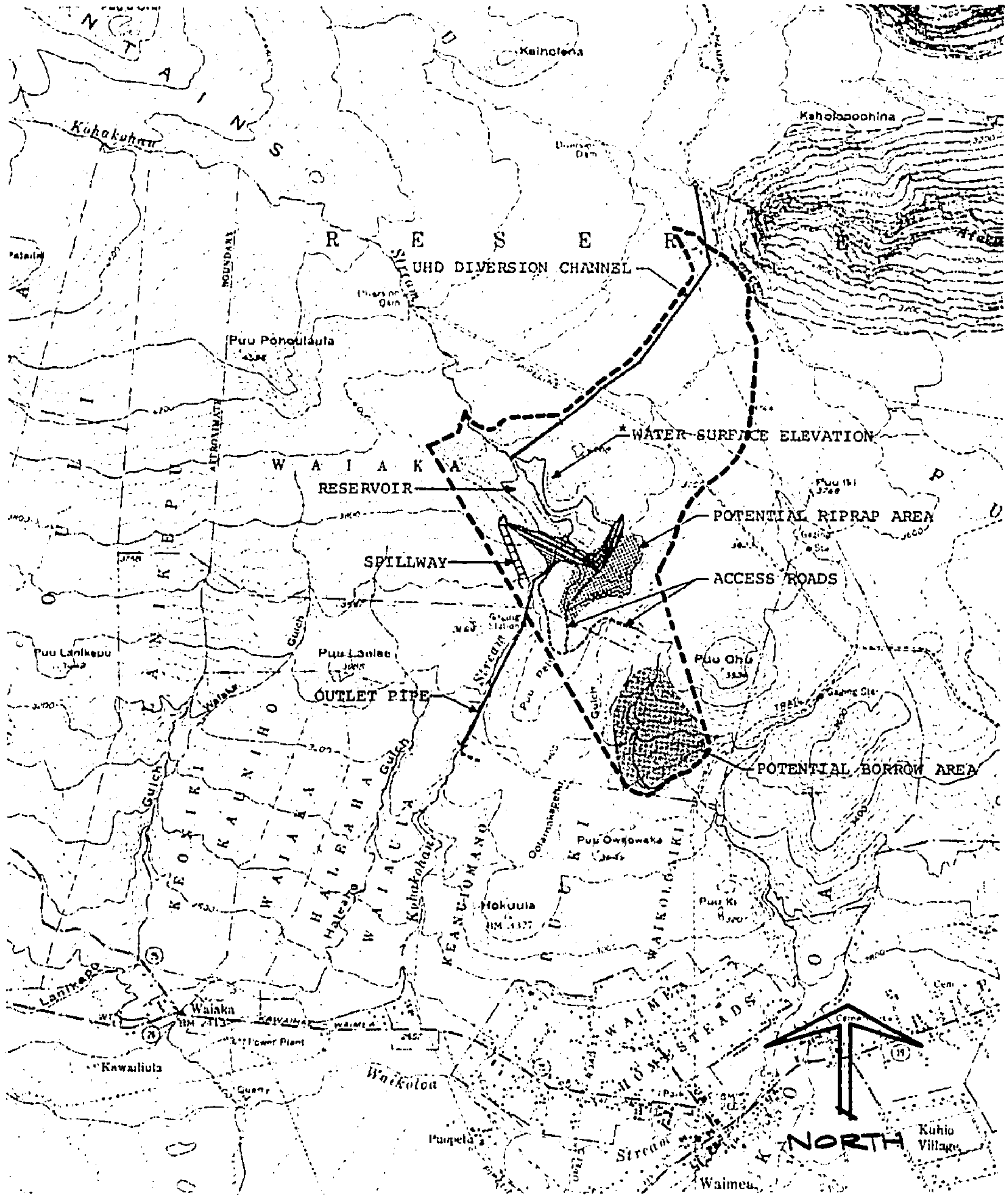

FIGURE: 32 STUDY AREA FOR FAUNAL SURVEY
KOHAKOHAU EIS-SOUTH KOHALA DISTRICT, HAWAII
1000 0 1000 3000 FEET

3 - Study of Aquatic Life

Prepared by the State of Hawaii, Department of Land and Natural Resources, Division of Fish and Game.

JOHN A. BURNS
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FISH AND GAME
1179 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

June 27, 1974

RECEIVED
DIV. OF WATER & LAND DEVELOPMENT
JUN 27 12 03 PM '74

Mr. Robert T. Chuck
Manager-Chief Engineer
Division of Water and
Land Development
Department of Land and
Natural Resources

Dear Bob:

On March 20, 1974, George Matsumoto of your staff and Kenji Ego, Richard Yoshida and Stanley Shima of the Division of Fish and Game visited the proposed Kohakohau Dam and Reservoir Project site in Kohala, Hawaii, with the objective of evaluating potential environmental effects of the Project on fisheries values in the area. The following is our report on this activity, using the format recommended by your consultant.

* * * * * * * * * *

1. Previous Studies

We are not aware of any previous studies relating to fisheries values in the Project site.

2. Existing Environment.

The field survey was conducted between 1000 and 1130 hours on March 20, 1974. It should be noted that conditions were less than ideal for the observation and collection of aquatic life in that the stream was in a mild freshet stage at the time (USGS gaging station records show a peak flow of 217 cfs at 1630 hours on March 19, and a flow of 9.2 cfs at 1000 hours on March 20). Collecting materials included a fine-meshed seine and handnet, and a small quantity of rotenone. The use of face-masks for underwater observation was precluded by the turbid waters.

Collecting efforts were confined to a pool and riffles section located just mauka of the recommended dam site (Site 5 in the Feasibility Study). Repeated sets of the seine and use of the handnet, and poisoning of a very small pocket of water with rotenone resulted in the collection of only a few chironomid larvae, caddisfly larvae, damselfly nymphs and snails. No other aquatic fauna were collected or observed.

3. Probable Future Conditions without the Project.

We have no basis for expecting any changes in aquatic faunal conditions without the Project.

4. Impact on the Environment.

Creation of the impoundment will change approximately 3,000 to 4,000 feet of the Kohakohau Stream from a lotic to a lacustrine habitat for aquatic organisms. This change from a small free-flowing stream to a relatively large area of deep standing water will undoubtedly effect marked qualitative and quantitative alteration of the present aquatic faunal populations. From our perspective, however, this modification is not deemed to be significantly either detrimental or beneficial.

A potential benefit that may be realized from this Project is the development of a recreational fishery.

5. Mitigation and Recommendations.

In view of our comments in the first paragraph of the preceding section, and our understanding that the Kohakohau Stream is normally dry makai of the existing diversions, we do not feel that any measures for mitigation of damage to fisheries values are necessary.

Exploration of the feasibility of establishing a recreational fishery should be seriously pursued.

6. Unavoidable Adverse Impacts.

None, from our standpoint.

7. Sources Consulted.

Kohakohau Dam Engineering Feasibility study, February, 1970.

* * * * * * * * * * *

I trust that this report will suffice for your purposes. Otherwise, please let me know.

Yours truly,

Michio Takata

MICHIO TAKATA, Director
Division of Fish & Game

APPENDIX B. REVIEW PROCESS COMMENTS AND WRITTEN STATEMENTS ON THE DRAFT EIS

Presented as follows are letters received in the process of review of the Draft EIS, written statements and testimony received on the Draft EIS, and responses to those review process comments and written statements. Letters are printed in entirety and are proceeded by written responses.

DEPARTMENT OF THE ARMY
HONOLULU DISTRICT, CORPS OF ENGINEERS
BUILDING 96, FORT ARMSTRONG
HONOLULU, HAWAII 96813

PODED-P

19 August 1974

Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control
550 Halekauwila Street
Honolulu, Hawaii 96813

Dear Dr. Marland:

We have reviewed the draft environmental statement for the Kokakohau Dam Project, South Kohala Water Project, island of Hawaii, and have the following comments:

a. It is noted several times in the statement that this project has a flood control capability; however, there is not sufficient data on the nature of the flooding or the degree of protection provided to adequately evaluate the statements.

b. The impacts on aquatic life should address the effect of the dam on the entire stream length rather than only in the vicinity of the damsite.

c. Implementation of this project will commit the service area to urban uses. The loss of these lands to other uses such as agriculture should be discussed in more detail and evaluated in comparison to benefits derived from domestic utilization.

Thank you for the opportunity to comment on this statement. We would appreciate a copy of the final statement when it becomes available.

Sincerely yours,

Elroy Chinn

ELROY CHINN
Acting Chief, Engineering Division

Comment 1: "It is noted several times in the statement that this project has a flood control capability; however, there is not sufficient data on the nature of the flooding or the degree of protection provided to adequately evaluate the statements."

Response: Pertinent statements in the Draft EIS are: "Intermittent flooding occurs during intense rainfall periods, but downstream damage has been minimal." (page ii). "The Waikoloa Stream has caused flooding within the town of Waimea during high intensity storms when runoff overflows the narrow and winding stream channel. The Kohakohau Stream exhibits similar tendencies but has caused only minor damage in the past." (Page 56). "Floodwaters (in Kohakohau Stream) will be impounded by the dam." (Page 85). "Control of flooding and erosion from high runoff periods." (Impact No. 10, page 89).

Although these statements suggest a slight flood control capability of the proposed dam without providing data on the frequency of flooding nor the extent of historical damages, such information has not, to our knowledge, been compiled for the Kohakohau Stream and would not, if collected, be necessary to determine that some floodwaters will be impounded by the dam which would represent a slight beneficial impact. The dam would provide 270 mg flood storage capacity, which is sufficient to store a volume of water equal to more than 6 inches of rainfall covering the 2.5 square-mile drainage area above the dam.

Comment 2: "The impacts on aquatic life should address the effect of the dam on the entire stream length rather than only in the vicinity of the damsite."

Response: The report of the Division of Fish and Game on aquatic life in Kohakohau Stream (pages 163 and 164 in the Draft EIS) states that "creation of the impoundment will change approximately 3,000 to 4,000 feet of the Kohakohau Stream from a lotic to a lacustrine habitat for aquatic organisms. This change from a small free-flowing stream to a relatively large area of deep standing water will undoubtedly effect marked qualitative and quantitative alteration of the present aquatic faunal populations. From our perspective, however, this modification is not deemed to be significantly either detrimental or beneficial. . . . In view of our comments in the first paragraph of the preceding section, and our understanding that the Kohakohau Stream is normally dry makai of the existing diversions, we do not feel that any measures for mitigation of damage to fisheries values are necessary."

Aquatic conditions above the reservoir will not be appreciably changed and the slight effect would represent neither a significant beneficial nor detrimental impact. Since the Kohakohau Stream is normally dry below the damsite and existing Kohakohau Diversion Dam, significant flows generally result from heavy rains, and no appreciable aquatic life is believed to exist in the downstream reaches in such variable streamflow conditions. The decrease in flood flows (during heavy rains) in the downstream reaches resulting from the impoundment will result in no identifiable impact to aquatic life in those reaches.

Comment 3: "Implementation of this project will commit the service area to urban uses. The loss of these lands to other uses such as agriculture should be discussed in more detail and evaluated in comparison to benefits derived from domestic utilization."

Response: Potential service areas are already planned for appropriate uses as described in the County of Hawaii General Plan. The Kohakohau Dam Project is intended to meet the requirement for adequate water supplies as an essential element of the infrastructure of public utilities supporting planned land uses. See response to Comment No. 4 on page 157 .

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 16th AIR BASE WING (PACAF)
APO SAN FRANCISCO 96553

7 AUG 1974

REPLY TO ATTN OF: DEEE (Mr Kimura, 4492158)

SUBJECT: Draft Environmental Impact Statement

TO: Office of Environmental Quality Control
Office of the Governor
550 Halekauwila Street
Tani Office Building, Third Floor
Honolulu, Hawaii 96813

We have no comment to render relative to the draft environmental impact statements for the following projects:

a. Realignment and Widening of Olohena Road, Kapaa, Kauai

b. Kohakohau Dam Project, South Kohala, Hawaii

c. East-West Center Facility, University of Hawaii

HENRY G. SNIDER, Colonel, USAF
Dep Comdr for Civil Engineering

Response: No response required.

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY SUPPORT COMMAND, HAWAII
APO San Francisco 96557

HCFE-PS

13 Aug 74

Office of Enviromnental Quality
Office of the Governor
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Gentlemen:

The following Draft Enviromnental Impact Statements have been reviewed:

a. Kohakohau Dam Project

b. East-West Center Facility, University of Hawaii

c. Weliweli Subdivision

We have no comments to offer.

Sincerely yours,

CHARLES S. VARNUM
Colonel, CE
Director of Facilities Engineering

Response: No response required.

JOHN A. BURNS
GOVERNOR

FREDERICK C. ERSKINE
CHAIRMAN, BOARD OF AGRICULTURE

WILLIAM E. FERNANDES
DEPUTY TO THE CHAIRMAN

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

August 13, 1974

MEMORANDUM

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

SUBJECT: Draft Environmental Impact Statement
Kohakohau Dam Project, South Kohala Water Project, DLNR

The Department of Agriculture appreciates the opportunity to review this draft statement. Completion of this project will be of significant supplemental benefit to agriculture. This part of the Kohala District, which contributes significantly to our diversified agricultural production, vitally needs improved water supply. This project will improve domestic supplies and in turn may benefit this agricultural sector.

Effects on the environment are addressed adequately. No adverse effects on agriculture can be determined. The Department supports this project as part of integrated development of our water resources in Kohala.

Frederick C. Erskine
Chairman, Board of Agriculture

cc: Sunao Kido, DLNR

Comment 1: "Completion of this project will be of significant supplemental benefit to agriculture. This part of the Kohala District, which contributes significantly to our diversified agricultural production, vitally needs improved water supply. This project will improve domestic supplies and in turn may benefit this agricultural sector.

Response: As is stated in the EIS, waters impounded by the Kohakohau Dam would serve domestic needs only and are not intended for agricultural uses. However, the provision of this supplementary source may benefit agriculture indirectly by releasing other untapped water sources for potential agricultural development and by ensuring that agricultural supplies would no longer be vulnerable to domestic needs during periods of irregular and insufficient rainfall.

JOHN A. BURNS
GOVERNOR OF HAWAII

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

WALTER B. QUISENBERRY, M.P.H., M.D.
DIRECTOR OF HEALTH

WILBUR S. LUMMIS JR., M.S., M.D.
DEPUTY DIRECTOR OF HEALTH

RALPH B. BERRY, M.P.H., M.D.
DEPUTY DIRECTOR OF HEALTH

HENRI P. MINETTE, M.P.H., DR.P.H.
DEPUTY DIRECTOR OF HEALTH

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

August 13, 1974

To: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

From: Director of Health

Subject: Draft Environmental Impact Statement for Kohakohau Dam Project on Hawaii

Thank you for the opportunity to review and comment on the above referenced Environmental Impact Statement. The engineering staff of the Pollution Technical Review Branch has reviewed the proposed project and has no objections to its construction.

Please be informed that should construction be granted, all public health regulations applicable to air, water, noise and solid waste shall be followed.

Walter B. Quisenberry

WALTER B. QUISENBERRY, M.D.

Comment 1: "Please be informed that should construction be granted, all public health regulations applicable to air, water, noise and solid waste shall be followed."

Response: If the decision is made to proceed with the project, all applicable regulations of the Department of Health and other appropriate agencies will be consulted and incorporated in documents prepared for design and construction phases of the project.

JOHN A. BURNS
GOVERNOR

RECEIVED

SEP 30 AM 10:22

RICHARD E. MARLAND, PH.D.
INTERIM DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
OFFICE OF THE GOVERNOR
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813.

September 27, 1974

MEMORANDUM

TO: Sunao Kido, Chairman
Department of Land and Natural Resources

FROM: Richard E. Marland, Interim Director
Office of Environmental Quality Control Raymond S. Tabata

SUBJECT: Draft EIS, Kohakohau Dam, South Kohala, Hawaii

Under separate cover, we previously forwarded comments received from a number of agencies:

State Agencies

Department of Agriculture - (August 13, 1974)
Department of Health - (August 13, 1974)
Department of Planning & Economic Development - (Aug. 5, 1974
Department of Transportation - (August 15, 1974)
University of Hawaii/Environmental Center - (Aug. 13, 1974)

Federal Agencies

U.S. Army, Corps of Engineers - (August 19, 1974)
U.S. Air Force, 15 ABWG - (August 7, 1974)
Hq. U.S. Army Support Command, Hawaii - (August 13, 1974)

Hawaii County

Planning Department - (July 19, 1974)
Public Works Department - (July 18, 1974)
Parks and Recreation Department - (August 2, 1974)

Private Organizations

Life of the Land - (August 23, 1974)
Friends of the Earth - (August 21 & 22)
Norman C. Moeller - (August 1, 1974)

Our review of the draft EIS (dEIS) indicates several areas which should be further addressed.

PROJECT DESCRIPTION

Although the project costs are adequately described, it would be helpful if the proposed financing arrangement was also discussed. For example, how much money is being provided by the County, State, and Federal governments -- and in what manner?

All necessary approvals from governmental agencies should be outlined in the final EIS in order that the reader will comprehend the entire decision-making process relevant to the project.

The dEIS does not mention ownership of the affected lands. As land acquisition is not mentioned anywhere in the dEIS, is the reader to presume that all affected land is publicly-owned?

Project description should include more discussion of how the proposed dam system will actually operate. There should be a concise outline of how Kohakohau Stream water will be distributed to the South Kohala-Hamakua water systems; also, the diversion of water from Kohakohau and Alakahi Streams should be better described in terms of relative contribution to the system. Finally, it would be useful to include discussion of the relationship between the Kohakohau and Waikoloa diversions, upper and lower 50 MG reservoirs, and the domestic water distribution system. Figure 8 of the dEIS indicates that waters from Kohakohau and Alakahi Streams will be impounded in the proposed dam reservoir, routed through the Kohakohau Diversion, held in the Lower 50 MG Reservoir, processed through the Filtration Plant, and distributed to Kawaihae and Hamakua. Figure 7 further suggests that water will be distributed westward toward Kaiulaula at some future date. The flow of water in the proposed system, therefore, should be explained.

FUTURE DOMESTIC DEMAND

The phrase, "future domestic demands", deserves considerably more discussion, particularly with respect to the nature of "domestic demands." We note that a 1965 study, "A Water Development Plan for South Kohala-Hamakua, Report R25" provided estimates of municipal water requirements based on DPED projections. In Table 3-A, 1985 maximum monthly consumption was projected to be 5.19 mgd (including 15% system losses). The final EIS should include updated information regarding population projections, water requirements for various water uses (domestic & public, lawn irrigation, hotel, and industrial), and system loss estimates which were used to estimate water requirements of 9.48 mgd and 14.48 mgd shown in figure 26 of the dEIS. Water requirements projections should receive more emphasis in the final EIS because the justification for the proposed dam is largely based on a substantial increase in demand for domestic water.

SECONDARY EFFECTS

Although the dEIS includes a brief discussion on secondary impacts on pages 77-96, there is no elaboration of the environmental consequences from the "development of planned growth areas" in the service regions. Water is one of the critical limiting factors in allowing urbanization to proceed. The statement that the project ".....will provide an element of the infrastructure of public services required by planned growth" does not satisfactorily describe resulting air pollution, increased surface runoff, increased demand for other public services and facilities (parks, schools, roads, drainage, flood control, recreational facilities).

The projections which justify water development should be utilized in estimating the kind and degree of environmental consequences which will result from the realization of population projections.

The proposed dam is based upon a self-fulfilling prophecy; i.e., in providing for increased water demand, the water demand is thereby increased. Therefore, the EIS must go beyond stating that the project "will enable the development of planned growth areas" and that the "ultimate level of expected growth...will not be altered." The final EIS must focus on the long-range secondary impacts which will result from increased development.

ALTERNATIVES

The Alternatives section should include discussion on the other dam sites studied and reported in the engineering feasibility report (February 1970). Figure 3 of that report indicates six alternative sites in three general locations. The final EIS should discuss the relative impacts, advantages, and disadvantages of each site with respect to the selected site.

RECOMMENDATIONS

We hope that our brief comments will assist you in preparation of the final statement. We recommend that a written response be sent to each commentor, including this Office, which documents your evaluation, consideration, and disposition of substantive comments. A copy of the final EIS should be provided to commentors for their review. Again, thank you for the opportunity to review the draft EIS.

Comment 1: "Although the project costs are adequately described, it would be helpful if the proposed financing arrangement was also discussed. For example, how much money is being provided by the County, State and Federal governments -- and in what manner?"

Response: Various sources of public funds -- Federal, State, and County -- and private monies can be sought to finance the project. The State Department of Land and Natural Resources has asked for legislative appropriations in its 6-year Capital Improvements Program. As yet, no construction funds from any source have been committed. A State appropriation for design plans, however, is presently available.

Comment 2: "All necessary approvals from governmental agencies should be outlined in the final EIS in order that the reader will comprehend the entire decision-making process relevant to the project."

Response: See Table 14 - "Tabulation of Review Process Comments." Approvals and funding procedures vary, and it is impossible at this time to diagram all possible agencies and approval procedures which may be involved. The next step in planning for the Kohakohau Dam Project would be the design stage, which would involve various agencies and approvals. The decision-making process for the Kohakohau Dam Project will continue to include public, as well as governmental, participation.

Comment 3: "The dEIS does not mention ownership of the affected lands. As land acquisition is not mentioned anywhere in the dEIS, is the reader to presume that all affected land is publicly-owned?"

Response: Areas which may be affected by the Kohakohau Dam Project lie wholly within public (Kohala Forest Reserve or Hawaiian Homes Commission) lands.

Comment 4: "Project description should include discussion of how the proposed dam system will actually operate. There should be a concise outline of how Kohakohau Stream water will be distributed to the South Kohala-Hamakua water systems; also, the diversion of water from Kohakohau and Alakahi Streams should be better described in terms of relative contribution to the system. Finally, it would be useful to include discussion of the relationship between the Kohakohau and Waikoloa diversions, upper and lower 50 MG reservoirs, and the domestic water distribution system.

Figure 8 of the dEIS indicates that waters from Kohakohau and Alakahi Streams will be impounded in the proposed dam reservoir, routed through the Kohakohau Diversion, held in the Lower 50 MG Reservoir, processed through the Filtration Plant, and distributed to Kawaihae and Hamakua. Figure 7 further suggests that water will be distributed westward toward Kaiulaula at some future date. The flow of water in the proposed system, therefore, should be explained."

Response: Figures 7, 8, and 9 illustrate the relationships of the proposed Kohakohau Dam to the South Kohala and Hamakua Domestic Water Systems (Figure 7), the Waimea collection and treatment facilities (Figure 8), and the web of irrigation systems in South Kohala and Hamakua (Figure 9). The Kohakohau Diversion pipeline is shown in Figure 8.

Comment 5: "The phrase, 'future domestic demands', deserves considerably more discussion, particularly with respect to the nature of 'domestic demands'. We note that a 1965 study, 'A Water Development Plan for South Kohala-Hamakua, Report R25' provided estimates of municipal water requirements based on DPED projections. In Table 3-A, 1985 maximum monthly consumption was projected to be 5.19 mgd (including 15% system losses). The final EIS should include updated information regarding population projectinns, water requirements for various water uses (domestic & public, lawn irrigation, hotel, and industrial), and system loss estimates which were used to estimate water requirements of 9.48 mgd and 14.48 mgd shown in figure 26 of the dEIS. Water requirements projections should receive more emphasis in the final EIS because the justification for the proposed dam is largely based on a substantial increase in demand for domestic water."

Response: Projected future domestic water demands depicted by the curves in Figure 26 are based on the population projections presented in Table 10 and assume a unit consumption rate of 250 gpcd for the range in population shown plus a hotel room requirement of 500 gpd/room applied with an assumed 75 percent occupancy rate to the following schedule of projected hotel rooms:

Year	No. Hotel Rooms in South Kohala-Hamakua
1974	400
1980	2000
1990	3000

This schedule was derived from a 1971 report on the expected trends in the visitor industry in South Kohala. 60/

The figures "9.48" and "14.48" shown in Figure 26 indicate the total supply available upon completion of the initial and ultimate stages of the proposed Kohakohau Dam Project. The curves shown indicate the potential range in domestic water demands anticipated with the increases in population and hotel rooms indicated. It should be noted that the effect of the additional estimated hotel room demand in relation to the base demand represents less than 20 percent of the lower demand values for 1980 and 1990 and less than 15 percent of the upper demand values for 1980 and 1990.

These projected water demands are not precise and could not be precise based on available demographic information. They do, however, satisfy the intended purpose of illustrating the likely and expected trends in domestic water demand increases in South Kohala and Hamakua in the next 5 to 15 years.

Comment 6: "Although the dEIS includes a brief discussion on secondary impacts on pages 77-96, there is no elaboration of the environmental consequences from the 'development of planned growth areas' in the service regions. Water is one of the critical limiting factors in allowing urbanizing to proceed. The statementment that the project '...will provide an element of the infrastructure of public services required by planned growth' does not satisfactorily describe resulting air pollution, increased surface runoff, increased demand for other public services and facilities (parks, schools, roads, drainage, flood control, recreational facilities).

60/ Reference 2.

"The projections which justify water development should be utilized in estimating the kind and degree of environmental consequences which will result from the realization of population projections.

"The proposed dam is based upon a self-fulfilling prophecy; i.e., in providing for increased water demand, the water demand is thereby increased. Therefore, the EIS must go beyond stating that the project 'will enable the development of planned growth areas' and that the 'ultimate level of expected growth... will not be altered.' The final EIS must focus on the long-range secondary impacts which will result from increased development."

Response: It would be inappropriate for an environmental impact statement on a public works project to comment on or preclude the implementation of planning process goals and objectives unless the project is inconsistent and incompatible with those objectives. A project which provides the services required by planned growth areas does not exhibit a causal relationship with that growth. The provision of domestic water service to planned growth areas no more causes that development than does the provision of telephone or sewerage service. The Kohakohau Dam Project is intended to meet the objectives of the South Kohala and Hamakua Districts by providing a water supply sufficient to meet the needs of the next 5 to 15 years. See response to Comment No. 4 on page 157.

Comment 7: "The Alternatives section should include discussion on the other dam sites studied and reported in the engineering feasibility report (February 1970). Figure 3 of that report indicates six alternative sites in three general locations. The final EIS should discuss the relative impacts, advantages, and disadvantages of each site with respect to the selected site."

Response: The discussion of alternatives to the Kohakohau Dam Project has been expanded accordingly. See response to Comment No. 3 on page 155.

DEPARTMENT OF PLANNING
AND ECONOMIC DEVELOPMENT

JOHN A. BURNS
Governor

SHELLEY M. MARK
Director

EDWARD J. GREANEY, JR.
Deputy Director

250 South King St. / Honolulu, Hawaii 96813 / P. O. Box 2359 / Honolulu, Hawaii 96804

Ref. No. 1442

August 5, 1974

MEMORANDUM

TO: Dr. Richard E. Marland, Interim Director
Office of Environmental Quality Control

FROM: Shelley M. Mark, Director

SUBJECT: Draft Environmental Impact Statement for Kohakohau Dam Project, South Kohala District, Island of Hawaii

We have reviewed this draft environmental statement for the proposed construction of the Kohakohau Dam at an approximate elevation of 3,700 feet on the Kohakohau Stream near Waimea, Hawaii.

This environmental statement appears to be comprehensive in its assessment of the primary as well as secondary effects of the proposed action and alternatives. Physical as well as socio-economic impacts of the proposal seem to be well considered.

Thank you for the opportunity to review this document.

Response: No response required.

JOHN A. BURNS
GOVERNOR

STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813

E. ALVEY WRIGHT
DIRECTOR

LAWRENCE F. O. CHUN
DEPUTY DIRECTOR

MUNNY Y. M. LEE
DEPUTY DIRECTOR

DOUGLAS S. SAKAMOTO
DEPUTY DIRECTOR

IN REPLY REFER TO:

ATP 8.2693

August 15, 1974

Dr. Richard E. Marland
Interim Director
Office of Environmental
Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Dr. Marland:

Subject: Draft Environmental Impact Statement
Kohakohau Dam Project

We have reviewed the subject draft statement and have the following comments to make:

1. Page 19 and Figure 10 - correct spelling is "Puukohola Heiau"

2. Table 5: Item 11 - under construction? No. Historic site
Item 24 - correct spelling is "Honokaia"
Add Waiakoloa Golf Course

3. Page 36: Change "Kamuela Airport" to "Waimea-Kohala Airport"

Sincerely,

Douglas S. Sakamoto
for E. ALVEY WRIGHT
Director

Response: Suggested changes have been made in the Final EIS.

University of Hawaii at Manoa

Environmental Center
Maile Bldg. 10 • 2540 Maile Way
Honolulu, Hawaii 96822
Telephone (808) 948-7361

Office of the Director

August 13, 1974

MEMORANDUM

TO: Richard Marland

FROM: Jerry M. Johnson

SUBJECT: Kohakohau Dam Project, Hawaii

We have no comments on this draft EIS.

Jerry M. Johnson/
Jerry M. Johnson
Assistant Director

Response: No response required.

TELEPHONE 935-5721, EXT. 311

Bruce McCall
MAYOR

~~BRUCE C. McCALL~~

ROBERT T. FUKUDA
DIRECTOR

DEPARTMENT OF PARKS & RECREATION
COUNTY OF HAWAII
HAWAII COUNTY BLDG.
25 AUPUNI STREET
HILO, HAWAII 96720

August 2, 1974

Office of Environmental Quality Control
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Subject: Draft EIS - Kohakohau Dam Project

We have no comments on the draft statement other than to inform you that the County Recreation Plan mentioned on page 72 has been completed and is presently before the County Council for adoption.

Thank you for the opportunity to comment on the project.

R. T. Fukuda

ROBERT T. FUKUDA
Director

Response: No response required.

COUNTY OF
HAWAII

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720

SHUNICHI KIMURA
Mayor

RAYMOND H. SUEFUJI
Director

July 19, 1974

Dr. Richard Marland
Office of Environmental Quality Control
550 Halekauila Street
Room 301
Honolulu, Hawaii 96813

Re: Draft Environmental Impact Statement - Kohakohau Dam Project
Division of Water and Land Development
Department of Land and Natural Resources

Thank you for the opportunity to review and comment on the subject draft impact statement. It is well organized and has covered most of the environmental considerations thoroughly.

We would, however, appreciate a discussion of the effect of the Upper Hamakua Ditch diversion system upon the water supply in Waipio Valley. While the Upper Ditch system does not feed directly into the Valley, indirectly though through leakages and overflows, it does. Under drought circumstances in the windward area, what then is the projected effect.

Other than this discussion, we feel that the statement has adequately considered all impacts.

Raymond Suefuji

RAYMOND H. SUEFUJI
Director

VG:mn

Comment 1: "We would, however, appreciate a discussion of the effect of the Upper Hamakua Ditch diversion system upon the water supply in Waipio Valley. While the Upper Ditch system does not feed directly into the Valley, indirectly though through leakages and overflows, it does. Under drought circumstances in the windward area, what then is the projected effect."

Response: Construction of the proposed Upper Hamakua Ditch (UHD) Diversion Channel (see Figure 5 in the Draft EIS) would include the rehabilitation of the Upper Hamakua Ditch upstream from the Alakahi Stream crossing (the proposed point of diversion. This rehabilitation would require the relining of about 7,3000 feet and the enlarging of about 9,700 feet of the Upper Hamakua Ditch above that point to limit seepage losses. The section to be rehabilitated includes the reach lying principally between gaging stations 7205 and 7248 as shown on Figure 33.

Effects of fluctuations in Upper Hamakua Ditch flows have been noted in flows in the Lower Hamakua Ditch in the past; however, no accurate measurements nor reliable observations are available to generalize the effects noted. A study is currently underway by the University of Hawaii on the Upper Hamakua Ditch system which may, when completed, provide some additional data on the relationship between flows in the Upper and Lower Hamakua Ditches. It is presently known only that losses by seepage in sections of the Upper Hamakua Ditch are significant and that some notice has been made of reductions in Lower Hamakua Ditch flows when maintenance on leaky sections of the Upper Hamakua Ditch has been completed.

A gross estimate of current losses in the Upper Hamakua Ditch can be made from an analysis and extrapolation of available flow records. For the period 1969 to 1972, the mean flow in the UHD at Station 7205 was 6.3 mgd and at Station 7248 4.5 mgd, representing a loss by seepage of 1.8 mgd or 28 percent. For this discussion it can be assumed that the average seepage loss is 2 mgd in that section or about 30 percent of the flow at Station 7205. The Alakahi Stream contributes a mean flow of about 4 mgd to the UHD, resulting in a combined net flow below the Alakahi Stream crossing of about 8 mgd. Seepage losses in the UHD below that point are grossly estimated as about 50 percent of the flow or 4 mgd. The total current seepage loss from the Upper Hamakua Ditch near the Waipio Valley rim is therefore estimated as an average 6 mgd (2 mgd above, and 4 mgd below, the Alakahi Stream crossing). Under low flow conditions, combined flows in the Kawainui, Kawaiki, and Alakahi streams comprise less than 1 mgd, and nearly all of the flow is expected to be lost by seepage.

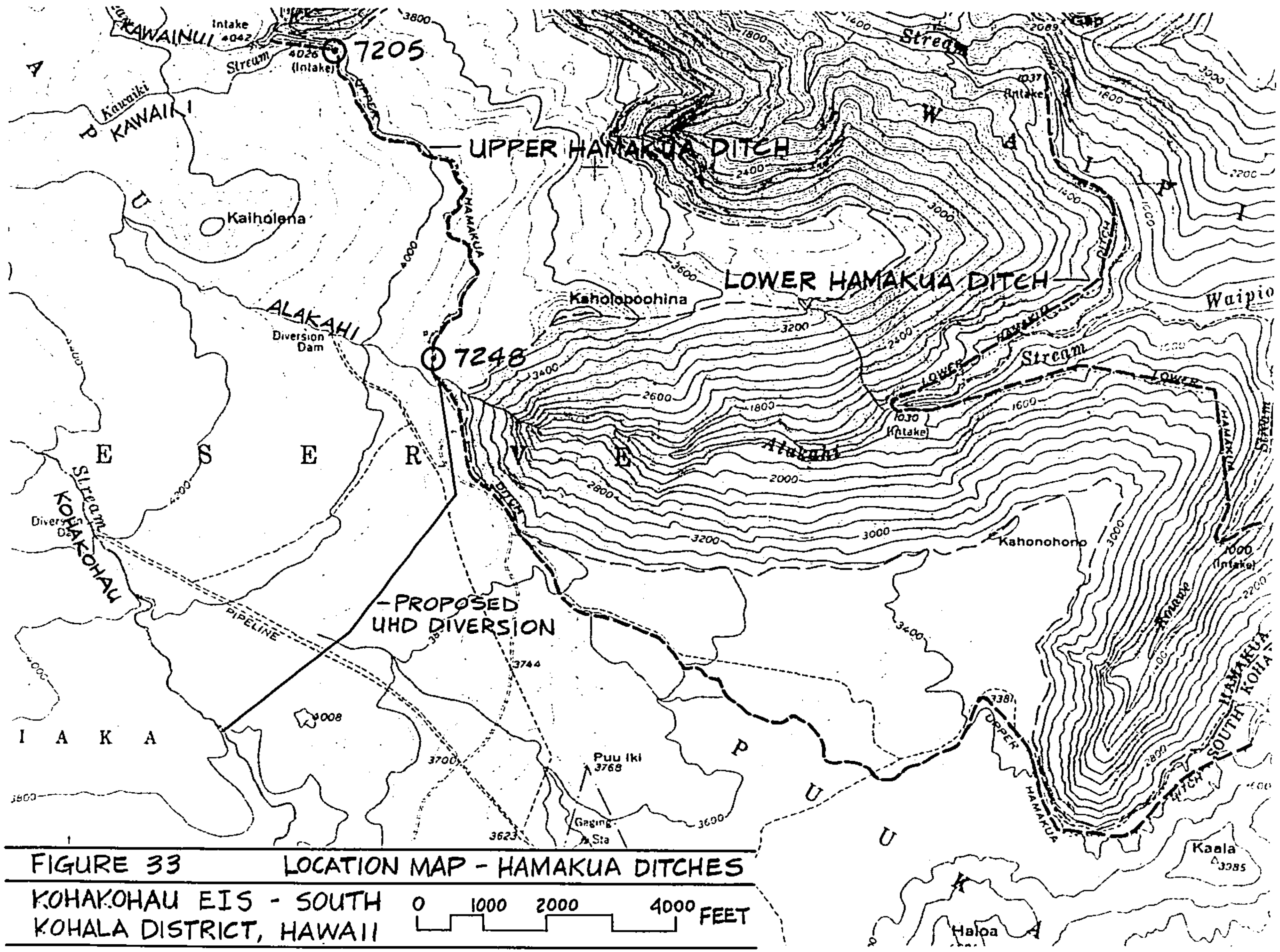

FIGURE 33 LOCATION MAP - HAMAKUA DITCHES

KOHAKOHAU EIS - SOUTH KOHALA DISTRICT, HAWAII

The portion of Upper Hamakua Ditch seepage losses which is or may be currently recovered in the Lower Hamakua Ditch cannot be estimated with any accuracy. During normal flow conditions, portions of the estimated 6 mgd average seepage loss from the UHD would contribute to (1) vegetative consumption, (2) dike-confined water, and (3) infiltration to springs and other ground water in addition to (4) Lower Hamakua Ditch flows. It is expected that no more than half (3 mgd) of seepage losses in the Upper Hamakua Ditch is recovered in Lower Hamakua Ditch flows, which gross estimate is sufficient for this brief analysis.

With completion of the proposed Kohakohau Dam Project and rehabilitation of the Upper Hamakua Ditch above the Alakahi Stream crossing, the mean flow in that section of the UHD is projected to be about 10 mgd. About 50 to 60 percent of this mean flow would be diverted to the Kohakohau reservoir, with the remainder (4 to 5 mgd) proceeding down the UHD past the Alakahi Stream crossing. Current losses in this upper reach (estimated 2 mgd) would be eliminated. When added to the 4 mgd average flow in Alakahi Stream, the total average flow in the Ditch below the crossing would be 8 to 9 mgd. Assuming the same 50 percent seepage loss below Alakahi Stream, the altered total seepage loss would be 4 to 4.5 mgd (all occurring below the Alakahi Stream crossing). Assuming the same LHD recovery factor (one-half), the altered recovery would be 2 to 2.25 mgd in the Lower Hamakua Ditch. Under low flow conditions, all available water would be diverted to the reservoir.

The effect of the Kohakohau Dam Project, then, would be the reduction in estimated recovery in the Lower Hamakua Ditch from 3 mgd to 2 to 2.25 mgd (25 to 30 percent loss) under normal flow conditions and the loss of recovery (perhaps 0.5 mgd) under low flow conditions. When compared with the average flows in the Lower Hamakua Ditch near Kukuihaele and in Wailoa Stream near Waipio (31 mgd and 48 mgd, respectively), these reductions in assumed seepage losses and Lower Hamakua Ditch recoveries are not significant. Under low flow conditions, the loss of an assumed 0.5 mgd in recovered groundwater is small in comparison with the suspected reserves of dike-confined ground water feeding seeps and springs in Waipio Valley.

Without the Kohakohau Dam Project, rehabilitation of the Upper Hamakua Ditch (above Alakahi Stream) to reduce seepage losses could be expected to occur at such time as the costs to water right holders (principally the State and Parker Ranch) would be justified by the improved recovery. Rehabilitation of the Ditch below the Alakahi Stream crossing could serve to supplement the supply of Waimea reservoir.

BRUCE MCCALL
~~SHUNICHI KIMURA~~
MAYOR

EDWARD K. HARADA
CHIEF ENGINEER

BUREAUS AND DIVISIONS:
AUTOMOTIVE EQUIPMENT & MOTOR POOL
BUILDING CONSTRUCTION AND INSPECTION
PLANS AND SURVEYS
ROAD CONSTRUCTION AND MAINTENANCE
SEWERS AND SANITATION
TRAFFIC SAFETY AND CONTROL

COUNTY OF HAWAII
DEPARTMENT OF PUBLIC WORKS
25 AUPUNI STREET
HILO, HAWAII 96720

July 18, 1974

Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

SUBJECT: Draft EIS for Kohakohau Dam Project
South Kohala Water Project

We have reviewed the draft EIS. Our concerns were noted on the preliminary EIS and they have been responded to by the Department of Land and Natural Resources. We have no additional comments.

EDWARD HARADA
Chief Engineer

Response: No response required.

August 23, 1974
Land Board Members
Department of Land and Natural Resources
Honolulu, Hawaii
and

LIFE OF THE LAND

Office of Environmental
Quality Control
Honolulu, Hawaii

Gentlemen,

Subject: Kohakohau EIS

Life of the Land is pleased to submit comments on the Kohakohau Dam Project environmental impact statement. Life of the Land has noted several shortcomings of the environmental impact statement. Essentially, we found that the statement did not detail or analyze the project's impact upon urban growth in South Kohala.

Although the statement recognizes the dam's impact upon urban development, the statement does not describe developments the dam will sustain, enable, or promote. The statement acknowledges that "The Kohakohau Dam Project will, as a secondary effect of the provision of additional domestic waters, enable the development of planned growth areas in South Kohala and Hamakua...". Yet, the statement does not discu. how much development - numbers of homes, condominiums, and hotel rooms - the dam will enable; nor does it discuss the timing and location of the development. Additionally, the statement should give some idea of magnitude of the investor interest that the dam project would spur. How may millions of dollars would be invested in South Kohala if the dam project went ahead?

It is nice to know that this dam is provided for in the County of Hawaii <u>General Plan</u> and is thus considered part of a "planned growth" development. But that knowledge is merely a platitude or euphemism to the effect of this dam upon promoting urban development. An environmental impact statement would describe the environmental effects of this dam project. So far, this statement has recognized that the dam will affect urban development. But, the statement has not detailed or examined potential significant environmental effects of related urban developments planned within the region.

Sincerely,

RW Gould
for James Hughes
Life of the Land Staff Member

404 PIIKOI STREET HONOLULU HAWAII 96814 TELEPHONE 521 1 [illegible]

Comment 1: "Although the statement recognizes the dam's impact upon urban development, the statement does not describe developments the dam will sustain, enable, or promote. The statement acknowledges that 'The Kohakohau Dam Project will, as a secondary effect of the provision of additional domestic waters, enable the development of planned growth areas in South Kohala and Hamakua...'. Yet, the statement does not discuss how much development - numbers of homes, condominiums, and hotel rooms - the dam will enable; nor does it discuss the timing and location of the development. Additionally, the statement should give some idea of magnitude of the investor interest that the dam project would spur. How many millions of dollars would be invested in South Kohala if the dam project went ahead?

"It is nice to know that this dam is provided for in the County of Hawaii General Plan and is thus considered part of a 'planned growth' development. But that knowledge is merely a platitude or euphemism to the effect of this dam upon promoting urban development. An environmental impact statement would describe the environmental effects of this dam project. So far, this statement has recognized that the dam will affect urban development. But, the statement has not detailed or examined potential significant environmental effects of related urban developments planned within the region."

Response: The Kohakohau Dam Project is intended to meet the objectives of the County of Hawaii General Plan in providing domestic water as an element of the infrastructure of public utilities required for planned and controlled growth. The Project will result in no modification to the long-range planning objectives in the Country. See response to Comment No.4 on page 157. The environmental effects of the Kohakohau Dam Project are identified, discussed, and ranked according to relative importance in the Draft EIS.

Draft Environmental Impact Statement (7/74) RECEIVED
Dept. of Land and Natural Resources
KOHAKOHAU DAM PROJECT
South Kohala Water Project, Island of Hawaii 8:48

LIFE OF THE LAND A GROUP FOR ECOLOGICAL RESEARCH AND ACTION

RECEIVED

September 1, 1974

Members of the Board of Land and Natural Resources

We have reviewed the Kohakohau Dam Project Environmental Impact Statement. While there are many areas we feel the EIS was lacking, either in detail or in total neglect, we have limited our comments to the basic NEED for the project. If the project is not needed, or is needed only for things which are not in the county, state and community's best interests, it is hardly worth mentioning that were the dam to be built, there is a great likelyhood it would collapse, that were it built, it would not provide a habitat for the shallow, moving stream-water endangered Koloa ducks, etc.

We see the dam's needs based upon eronious population figures which in turn are based on only one, and that a discredited one, of the growth policies the State has to choose from. We see the EIS trying to minimize the social impact of the dam by myopic underplaying of the vast changes the Dam's resources would bring to rural South Kohala and Waimea.

We see the discussion of economic costs not only misleading, but totally ignoring such basic factors as transmission costs, water right procurement costs, legal costs, maintenance costs, all of which directly relate to the total project costs, and without which little accurate assessment of economic alternatives can be made. In fact, the only time costs of transmission are referred to, they are used to inflate the costs of the alternatives mentioned. Nowhere in the EIS does it state where these funds, for the dam as well as for alternative systems, will come from.

We see an obvious total lack of sympathetic discussion given to the alternatives mentioned. They are sluffed off as being prohibitively expensive without giving just what these expenses are.

And lastly, we see several viable alternatives that would solve the problem of lack of water for the desireable goal of providing water for agricultural needs and possible expansion of agriculture. Undoubtedly there can be yet more viable alternatives, and, as is repeatedly pointed out in the EIS, little is known of water resources in the directly affected districts. Obviously more study is merited. In any case, the Kohakohau Dam Project seems a collosal boondoggle for the developers of South Kohala and Hamakua who should not be subsidized by taxpayer monies to develop resorts which will likely never pay their fair share either in tax revenues or in improving the quality of life on the Big Island.

Projected population figures for the South Kohala district are NOT, as the EIS contrarily claims (p. 70), "the most accurage estimates of future population available to date." The EIS states, "these projections were prepared in conjunction with the General Plan in 1971 (p. 69)." These projected figures are not incorporated or mentioned in the General Plan of the County of Hawaii. Nor do these figures appear in the 1971 Vol. I and II of The Land Use Report, Planning Department, County of Hawaii, information that was gathered to produce the General Plan. No population projections are made in these reports. However, these projections are found in the County Department of Research and Development (hereafter

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copies sent to all Board members

referred to as R&D) 1972 Data Book in table form only. We do not know how and why these projections were chosen and who was involved in drawing up these projections.

However, according to more reliable sources, these population projections are inaccurate. The State General Plan Revision Program, 1967, Volume IV, Population (DPED), contains projections which differ dramatically from those offered in the EIS. DPED projected a population for South Kohala of 3523 by 1985, whereas the EIS projects a population of 22,200 only five years later in 1990. A comparison of the two sources show the following population projections for the districts of South Kohala and Hamakua:

		1975	1980	1985	1990
South Kohala	EIS	3700-5300	8000-11,700		13,900-22,200
	DPED	2578	3044	3523	
Hamakua	EIS	4700-4900	5100-5500		5900-7300
	DPED	5441	5714	5978	

When compared to population growth over the decades, the above projections become much more significant. R&D Data Book 1974 lists the Resident Population of Counties and Districts, Table 1:

	1920	1930	1940	1950	1960	1970	1973	Percent Change
Hamakua	9122	8864	8244	6056	5221	4648	4549	
South Kohala	1304	1250	1352	1505	1538	2310	2820	
Waimea					657	756		+15
Other					881	1554		+76.4

These historical population counts show roughly a 50 percent decline in Hamakua District population and less than a doubling of growth in South Kohala District population over a 50 year period. The EIS predicts that construction of the dam will increase the South Kohala District population 687 percent over the next 17 years. It points out that "there is presently a considerable amount of investor interest in South Kohala, and several large resort and residential development projects are planned south of Waimea and along the Coast" (p. 21). "The Kawaihae area and existing and proposed developments along the coast south of Kawaihae are expected to contain other commercial facilities"(p. 28). And, "with anticipation of additional domestic water demands from new coastal development, concerns grew for the need for additional and reliable water supply facilities in the districts" (p. 12). Because the dam is being proposed to accommodate these developments and because population will increase dramatically with the construction of the dam, information relating to where and why population changes in the past have occured, what effect these changes had on the community, where the expected future population is to be located, and how that population will effect the community, is basic to the proper and critical evaluation of the Kohakohau Dam Project and to the total overall planning processes that this dam project should come under the jurisdiction of.

One of DPED's most recent reports, the State of Hawaii Growth Policies Plan: 1974-1984, General Plan Revision Program, 1974, emphasizes the need for State policies to reduce the past and current rate of growth of the State. This report states that (p. 10):

> In recent years, people have begun to question the value of continued rapid growth. Evidence of this new growth ethic includes the establishment of

a Commission on Population Stabilization; State funding of the study, Immigration as a Component of Hawaiian Population: Its Legal Implication, (which dealt with the legal controls designed to slow migration); recommendations by the Temporary Commission on Environmental Planning to slow the rate of population growth, and recommendations of the Governor's Temporary Visitor Industry Council to slow economic and population growth by imposing controls on the hotel industry. THIS SHIFT IN ATTITUDE reflects a concern that the costs of rapid growth may outweigh the benefits, and a belief that a more moderate growth policy that would achieve a reasonable balance between the benefits and the problems, should be developed. This concern suggests a re-evaluation of the State's policies that affect the rate, type and general location of population and economic growth.

This shift in attitude has not been reflected in the EIS of the Kohakohau Dam Project. This project has been in the works for almost 20 years, dating back to the USGS report in 1946, Development of Water for the Waimea Plain from Dike Complex in Kohala Mountain, Island of Hawaii. Even the latest dam reports are based on the needs of coastal developments that have been in the works for years, possibly even decades, before enough capital was found and plans drawn up and approved by the large corporations who propose these developments which call for rapid growth in South Kohala.

The EIS claims that the dam (p. 77) will not alter the ultimate level of this expected growth and will probably even accelerate the time frame of that growth. This is a lie, for the water the dam would supply is a vital preliminary to that growth. The dam will make the expected growth possible in the first place. Because of this, the recommendations and warnings of the Growth Policies Plan most certainly apply to this "old" state policy and a new re-evaluation should be instituted focused on the affect this dam will have on the rate, type and general location of population and economic growth. According to the Growth Policies Plan, EIS projections are based on the discredited growth alternative of continued or more rapid growth of 2.5-4.5% while other, more desireable policies can be implemented bringing from 0-2% growth.

The Growth Policies Plan goes on to list many dangers involved with rapid population increase. First it states that (p.4) "existing information indicates that the faster the rate of population growth, the higher the per capita costs of government facilities and services and the smaller the take home pay of wage earners. Furthermore, a state tax increase would likely be necessary if rapid population growth continues and if the current level and quality of government services were to be maintained." Even the General Plan of the County, which contains the official goals and policies of residents of the county, (p. 16) recognizes that the "people of the County of Hawaii live in a quality environment that other areas have long since lost" and that "economic expansion and population growth in the county are bringing about more demand for products, transportation services, energy and other government services which could easily contribute towards the pollution of the environment."

The Growth Policies Plan goes into great detail on the dangers of the dependent economy. "With less self sufficiency and heavy dependence on just one or two export industries, the State's vulnerability to a severe state recession is increased whenever there is a slump in one of these major industries. Of major concern is the possibility that state policies favoring rapid growth would result in an excessive dependence on tourism (p. 15)." It warns (p. 19) that "the resulting 1985 State population is projected to be about 1,110,000 (including 127,000 estimated military and their dependents). The de facto population is expected to grow even faster than the civilian population because this number includes tourists--estimated to average about 84,000 daily visitors in 1975, 144,000 in 1980, and 214,000 in 1985. This last figure is almost 26% of the 1973 State population." The report calls for a diversification of the economy and a decreased emphasis on tourism. It must be realized that the private developments planned for South Kohala include major large resort centers which were not planned to diversify the State's already dependent economy. These plans benefit only private profit and not the public and State's well-being.

The EIS (p. 68) recognizes that "potential growth in South Kohala can be expected to spur economic activity in the area and shift labor and income away from agricultural patterns." This anti-agricultural shift that the dam would cause endangers the County of Hawaii's General Plan proposals where it is recorded (p. 13) that "the agricultural industry faced with competition for resources from tourism and other urban forces needs governmental assistance." The courses of action proposed (p. 14) require the County to assist the development of agriculture in South Kohala by protecting prime agricultural land from urbanization and to restrict resort development to an orderly fashion "consistent with the physical and social goals of the people of the area... and to best meet the needs of the county."

Even DPED's 1985 projected population in the Growth Policies Plan of 1,110,000 is a noticeable decrease over the projection of 1,217,344 in the 1967 State General Plan Revision Program, or a decline of over 107,000, or 8 per cent. Our state planning agencies are now contemplating a major revision in state growth policies, from those that encourage rapid growth to those that discourage rapid growth and accommodate moderate growth! The Kohakohau Dam Project would subvert these policies and discourage comprehensive state planning efforts.

A third danger the report lists is that "competition for jobs, especially professional ones, is becoming increasingly intense: in 1972, 65 per cent of the 44,000 civilian in-migrants were white collar workers (p. 13)." That Hawaii will be taken over by "outsiders" is an economical and psychological blow to the local worker-resident. Not only is the younger, university educated generation having to compete even harder for the white collar jobs available, but the movement of the middle aged worker into the better paying position and easier working conditions is being jeopardized by the younger, more experienced newcomer from the mainland.

The first generation of especially Japanese and Chinese people of our islands have worked hard and been able to put the second generation through formal education and into white collar jobs. Is the second generation going to be able to see the third generation attain an even higher, at least equal, status with the present Haole, without the problems of an increasingly overwhelming Caucasian population?

There is no reliable data in the EIS on the social impact of the dam project and the development it will generate. Since there will be such a significant impact upon the social structure, this information is desperately needed in the evaluation of the Kohakohau Dam.

With an increased population, there will be a major shift in ethnic population in South Kohala. The present population percentages of Hawaiian race of the districts of the Big Island show that the two areas with the largest percentages of Hawaiian people, South Kohala (26.4%) and North Kona (19.3%) (R&D Data Book 1974) are being proposed by these "investor interests" for rapid population growth.

The overall county percentage of persons of Hawaiian race is 12.3%. With many of the last outposts of Hawaiian lifestyle now under attack, South Kohala represents a possible center for the flourishment of the Hawaiian culture. The proposed dam would destroy this possibility.

There will be major shifts in the distribution of population on the Big Island. As of 1973, South Kohala represented the second to the smallest district in the County. If the Kohakohau Dam Project were to implement the projections of the EIS, population centers of the island would shift to the following (projections based on R&D 1972 Data Book, from which EIS projections were obtained) from most to least populated:

1973		1990
South Hilo	1	South Hilo
North Kona	2	South Kohala
Puna	3	North Kona
Hamakua	4	Ka'u
South Kona	5	Puna
Kau	6	Hamakua
North Kohala	7	South Kona
South Kohala	8	North Kohala
North Hilo	9	North Hilo

For such a change to be allowed to occur, the planning 'weapons' must be fully disclosed, publicly scrutinized and then implemented in such a way as to afford the community the decision making powers as to its future growth. That one major project such as the dam could force and stimulate these changes requires that the project be openly discussed in these terms. Because the supplying of water is a planning tool, it should be developed as one and used the same way as land use zonings. Water has not been used as a regulatory control for the various planned uses of our lands, although it is often needed before development takes place, much in the way highways function. Instead, when there is a projected cry for water, the S tate steps in and supplies the projected demand. If we do not stop now and look at our water systems and supplies, we will face water supply and quality problems. For example, the Board of Water Supply of the City and County of Honolulu published in 1970 the 2020 P lan, which outlines the water resources, supplies and usage of Oahu and states that after the year 2020, there will be no more fresh water available on that island. Oahu has neglected to plan adequately and has issued the use of water to wherever a demand was heard. We hope to avoid these problems with the implementation of far-sighted, community goal oriented planning provisions.

The Growth Policies Plan (p. 30) states that "although certain governmental agencies are directly responsible for implementing and operating the programs relating to these choices, the direction of those programs is fundamentally an external matter, subject to public policymaking." It would seem that the purpose of this draft EIS is to accommodate for much of this public input, yet page 17 of the EIS states that "it is intended that after this EIS is completed and analyzed, a decision will be made on whether or not to proceed with the project as presently proposed or in a modified form." These seem to be the only alternatives open to public scrutiny. The purpose of the EIS is to discuss all the alternatives so as to be able to choose that which is of greatest benefit to the taxpayer /resident. At present there has been inadequate discussion on alternatives. Those discussed were very poorly explained and very effectively dismissed as "prohibitive". Of the proposed alternatives, the EIS concludes the following:

1. High level ground water--prohibitive expense for exploration, discusses only Waipio Valley as a water source.

2. Low level ground water--would involve pumping to 2600' elevation, therefore prohibitively expensive (Boise Cascade well is at 1200' elevation).

3. Surface water--discussed only in terms of Waipio Valley, high pumping rates would make the cost prohibitive.

4. Desalination--prohibitively expensive.

5. Successive Use of Existing Waters (Recycling)--in the short term reclamation of waters in a quantity comparable to the dam yield is unrealistic. "Successive use of existing waters ~~in a quantity comparable to the dam yield is~~ in the South Kohala-Hamakua region is therefore dismissed as a viable alternative at this time (p. 106)."

6. No action--"Existing conditions would be expected to endure until a critical water shortage developed (perhaps in the near future)" (p. 108)

Water usage estimates in the EIS conflict with those in the <u>General Plan</u> (p. 71) where the 1971 actual average daily consumption of the water systems was .945 mgd, compared to the 2.0 to 2.2 mgd charted in the EIS, over double the county figures. According to the EIS figures (Figure 26), after the completion of the second 50 million gallon reservoir, now under construction, the supply will be 4.48 mgd, or more than quadruple the 1971 usage as recorded in the <u>General Plan</u>. According to the EIS, present systems cannot comfortably adopt any major demand increase of domestic and agricultural water supplies (p. 67). Reliable information should be included in the next impact statement clarifying what the projected demand and supply time scale for the two 50 million gallon reservoirs and filtration plant were when approved, and what the present use and rate of increase of both agricultural and domestic demand and supply is and in what specific locality.

Although the alternatives presented in the EIS were dismissed as prohibitive, no cost figures were ever laid out.To make this statement, P arsons, the consultants for the EIS, must know what these costs are and since these cost figures are available, we would like to have them included in the EIS so we can really look at these alternatives.

Present support projects surrounding the dam are not being discussed as a total unit. The two reservoirs, filtration plant and proposed 20" waterline that will be installed inthe new road alignment from Waimea to Kawaihae are vital parts of the dam project, but are being considered separately. This separation allows the EIS to quote only a portion of the <u>actual</u> cost of the dam project. However, the water lines and other support facilities <u>are</u> considered in the cost analysis of the alternatives presented and are used <u>only</u> to discredit the alternatives. A true picture of the total project would include all these costs in evaluation of dam and the alternatives.

Instead, the EIS leads us to believe there is comparatively no significant costs involved in the dam and that that cost will be determined at a later date when all the other studies and approvals have been awarded so that a great deal of public funds and time would have already been committed to the dam project and there would almost in effect, be no way out.

Right now a cost/benefit analysis is needed for each of the proposed alternatives, including the dam, with a breakdown of all the costs (social, environmental, and economic) to include construction, research, planning, maintanance, operating, interest, insurance, land and relocation, settlement of water rights, value of natural resources that would be lost, wildlife that would be lost, degredation of quality of life, life styles, & social values, and who is paying each of these costs, weighed against all the benefits and who is receiving each of these benefits.

To begin with, the General Plan of the county offers an alternative (p. 57): "Despite rather poor results of exploration to date there is a reasonable expectation that adequate quantities of basal water can be developed in the general coastal area from Kawaihae to Puako. This would have an economic advantage over water stored above Waimea village and transported to the coastal areas by a transmission system." The county obviously feels that this type of system would be of less cost to its residents and those of the state. This alternative deserves to be fully explored.

There is a legitimate need for water supplies for agricultural purposes. If the state is to develop its agricultural potential, it needs, according to the County of Hawaii: land, water, labor, capital, and marketing. These are the basics for agricultural expansion.

The State must develop its capability to supply its own food needs. Anyone keeping up with the American government's selling of its wheat, soy bean, and other resources to foreign governments at the expense of American and Hawaiian consum ers, knows we can only beat the cost of government spawned inflation and food scarcities by controlling agricultural products locally. Shipping strikes and America's governmental indifference to local consumers further point to our needs to become less dependent on people and areas whose concerns are not for keeping Hawaii fed at reasonable cost.

Governmental concerns for farmers' needs are mainly retorical. The available agricultural lands are far from protected while their fate rests in the hands of the big development oriented State Land Use Commission, which has already rezoned thousands of acres of prime agricultural land on central Oahu to urban use, and the Department of Land and Natural Resources, which has shown little regard for the release of state land to small ranchers and farmers.

Water resources are a key to development of many areas for the kinds of crops that are needed for Hawaiian markets. Yet time after time the farmers find this resource eroded by urban development which consumes water meant and needed for their crops. The farmer is the first to feel the effect of any shortages as water is conserved for hotel and domestic uses that have moved into agricultural areas.

The Kohakohau Dam Project is yet another example of a resource that is initially to be available to farmers, yet planned for future distribution to everyone but the farmer. Because, as admitted in the EIS, water, like highways, is a required precedent to development, and once in, will encourage and speed urban, anti-agricultural development. It must be controlled so it can only be used for the use it is really needed, i.e., agricultural irrigation.

The appropriate alternatives, then, to a dam whose resources are meant to subsidize big resort development in the South Kohala coast and in Waimea itself, are systems which cannot be tapped by these sort of destructive developments yet which will fulfill the agricultural needs. Several alternatives are:

1. Localized Water resources: Water systems should be no larger than the surrounding area's peak needs. This means private or public reservoirs should be placed only in the areas of agricultural needs. Pipe lines to proposed or planned urban anti-agricultural developments should not be permitted. The planned 20" pipe to Puako belies any pronounced attempts to help farmers meet Hawaii's agricultural needs.

2. Irrigation Quality water: The County and State should not combine the two basically different uses of water. Farm water systems should permit lower quality semi-potable water which is suitable for crop rather than human needs. Such systems already exist in the ParkerRanch, Hawaiian Irrigation Co, and Lalamilo Irrigation system. These are the type of systems that need expansion.

3. No further big urban, anti-agricultural development be permitted: In the case that county and state policy should finally recognize the economic, social and environmental destruction brought by further rural urban development and its accompanying population and anti-agricultural pressures, such further development would be stopped. In this case, a single water system would be acceptable to meet the farmers needs. However, if such were the case, there would still be no need for such a dangerous and collosal undertaking as the dam. The magnitude of the dam dwarfs even extensively increased agricultural needs for a long time to come. In the meantime money would best be spent in finding and tapping more localized, less expensive, less dangerous, more aesthetic sources which would not have such a permanent and irreversible (possibly contaminating) effect in the precious Restricted Watershed of Kohala.

We hope discussion on these additional alternatives will be included in the next EIS and that a more complete planning process be immediately instituted with the involvement of community residents, county and state planners, decision making agencies and other interested persons. The EIS must reflect the Kohakohau Dam Project in its totality and include a detailed outline of the water needs, a cost/benefit analysis of each of the alternatives that would meet those needs, and any social and environmental changes that system will and might bring upon the area.

Water is precious and the quality of life is equally precious, if not more so. Again, to quote the County General P lan, "The people of the County of Hawaii life in a quality environment that other areas have long since lost." Please help us to protect that quality environment.

We hope that the Board in its review of the dam project will take our comments and especially those of the Growth Policies Plan into deep consideration. We hope we have provided you with information that shows the magnitude of this project and its effect upon the community. We would like answers to our comments and questions either in the next environmental impact statement or by separate lette r.

Sincerely,

Jenny Parijs

Jenny Parijs
Big Island C hapter
Life of the Land
General Delivery
P ahoa, Hawaii 96778

Comment 1: "We see the dam's needs based upon erronious population figures which in turn are based on only one, and that a discredited one, of the growth policies the State has to choose from. We see the EIS trying to minimize the social impact of the dam by myopic underplaying of the vast changes the Dam's resources would bring to rural South Kohala and Waimea."

Response: The Draft EIS attempts not to minimize any impacts but rather to identify impacts in the context of the long range planning policies of the Big Island. See response to Comment No. 4 on page 157.

Comment 2: "We see the discussion of economic costs not only misleading, but totally ignoring such basic factors as transmission costs, water right procurement costs, legal costs, maintenance costs, all of which directly relate to the total project costs, and without which little accurate assessment of economic alternatives can be made. In fact, the only time costs of transmission are referred to, they are used to inflate the costs of the alternatives mentioned. Nowhere in the EIS does it state where these funds, for the dam as well as for alternative systems, will come from."

Response: See response to Comment No. 3 on page 155. The Draft EIS has been expanded to incorporate a comparison of development costs for alternatives, in which the basic assumptions and criteria used in comparison are identified. There is no cost associated with the procurement of water rights since, as is stated on page 15 of the Draft EIS, written agreements have been completed and the State presently holds all water rights required for completion of the Kohakohau Dam Project. Legal counsel in the completion of the Project will be incidental.

Comment 3: "We see an obvious total lack of sympathetic discussion given to the alternatives mentioned. They are sluffed off as being prohibitively expensive without giving just what these expenses are."

Response: See response to Comment No. 3 on page 155 and expanded discussion of alternatives.

Comment 4: "And lastly, we see several viable alternatives that would solve the problem of lack of water for the desireable goal of providing water for agricultural needs and possible expansion of agriculture. Undoubtedly there can be yet more viable alternatives, and, as is repeatedly pointed out in the EIS, little is known of water resources in the directly affected districts."

Response: As is stated in the Draft EIS, the Kohakohau Dam Project is intended primarily to serve increased domestic needs in the South Kohala-Hamakua region. The Environmental Impact Statement makes no attempt to evaluate, nor is the Kohakohau Dam Project or the alternatives considered intended to meet, agricultural needs in the area.

Comment 5: "In any case, the Kohakohau Dam Project seems a collosal boondoggle for the developers of South Kohala and Hamakua who should not be subsidized by taxpayer monies to develop resorts which will likely never pay their fair share either in tax revenues or in improving the quality of life on the Big Island."

Response: See response to Comment No. 4 on page 157 .

Comment 6: "Projected population figures for the South Kohala district are NOT, as the EIS contrarily claims (p. 70), "the most accurate estimates of future population available to date." The EIS states, "these projections were prepared in conjunction with the General Plan in 1971 (p. 69)." These projected figures are not incorporated or mentioned in the General Plan of the County of Hawaii. Nor do these figures appear in the 1971 Vol. I and II of The Land Use Report, Planning Department, County of Hawaii, information that was gathered to produce the General Plan. No population projections are made in these reports. However, these projections are found in the County Department of Research and Development (hereafter referred to as R&D) 1972 Data Book in table form only. We do not know how and why these projections were chosen and who was involved in drawing up these projections."

Response: The figures for projected popluation in South Kohala and Hamakua cited in the Draft EIS (Table 10, page 69) are taken from the 1972 Data Book prepared by the County of Hawaii Department of Research and Development (Reference No. 8 in the Draft EIS). As reported by the County of Hawaii Departments of Planning and Research and Development, these ranges in projected population were developed in the preparation of the General Plan in 1971 and are based on assumed relationships between economic activity, employment, and population. Although the General Plan does not incorporate these figures, it outlines the methodology which considered "alternative futures" for the County of Hawaii and led to these population ranges (page 6). These projected figures, according to the County, still represent the best estimates available for the expected County population.

Comment 7: "However, according to more reliable sources, these population projections are inaccurate. The State General Plan Revision Program, 1967, Volume IV, Population (DPED), contains projections which differ dramatically from those offered in the EIS. DPED projected a population for South Kohala of 3523 by 1985, whereas the EIS projects a population of 22,200 only five years later in 1990. A comparison of the two sources show the following population projections for the districts of South Kohala and Hamakua:"

Response: These projections were made in 1967, before the more current work by the County, and do not reflect recent economic and other influences in South Kohala nor the objectives enunciated in the General Plan.

Comment 8: "When compared to population growth over the decades, the above projections become much more significant. R&D Data Book 1974 lists the Resident Population of Counties and Districts, Table 1:

"These historical population counts show roughly a 50 percent decline in Hamakua District population and less than a doubling of growth in South Kohala District population over a 50 year period."

Response: These historical figures are shown in Table 2 of the Draft EIS and are considered in the exploration of the significance of future population projections (page 70).

Comment 9: "The EIS predicts that construction of the dam will increase the South Kohala District population 687 percent over the next 17 years."

Response: The Draft EIS presents the projections for expected future population in South Kohala and Hamakua prepared by the County of Hawaii in 1970-1971. These figures (see Table 10 in the Draft EIS) are discussed in the section entitled Future Environment Without the Project. See response to Comment 4 on page 157.

Comment 10: "It (the EIS) points out that 'there is presently a considerable amount of investor interest in South Kohala, and several large resort and residential development projects are planned south of Waimea and along the Coast' (p. 21). 'The Kawaihae area and existing and proposed developments along the coast south of Kawaihae are expected to contain other commercial facilities' (p. 28). And, 'with anticipation of additional domestic water demands from new coastal development, concerns grew for the need for additional and reliable water supply facilities in the districts' (p. 12)."

Response: No response required.

Comment 11: "Because the dam is being proposed to accommodate these developments and because population will increase dramatically with the construction of the dam, information relating to where and why population changes in the past have occured, what effect these changes had on the community, where the expected future population is to be located, and how that population will effect the community, is basic to the proper and critical evaluation of the Kohakohau Dam Project and to the total overall planning processes that this dam project should come under the jurisdiction of."

Response: The Kohakohau Dam Project is intended to meet the needs of the future as described by the planning policies and guidelines of the County of Hawaii. Population trends and effects were considered in the preparation of the General Plan for the County of Hawaii, which promulgates the needs and desires of the people in the County. The Kohakohau Dam Project will not preclude or obstruct implementation of that planning process. See response to Comment No. 4 on page 157.

Comment 12: "One of DPED's most recent reports, the State of Hawaii Growth Policies Plan: 1974-1984, General Plan Revision Program, 1974, emphasizes the need for State policies to reduce the past and current rate of growth of the State. This report states that (p. 10):

> In recent years, people have begun to question the value of continued growth. Evidence of this new growth ethic includes the establishment of a Commission on Population Stabilization; State funding of the study, Immigration as a Component of Hawaiian Population: Its Legal Implication, (which dealt with the legal controls designed to slow migration); recommendations by the Temporary Commission on Environmental Planning to slow the rate of population growth, and recommendations of the Governor's Temporary Visitor Industry

Council to slow economic and population growth by imposing controls on the hotel industry. THIS SHIFT IN ATTITUDE reflects a concern that the costs of rapid growth may outweigh the benefits, and a belief that a more moderate growth policy that would achieve a reasonable balance between the benefits and the problems, should be developed. This concern suggests a re-evaluation of the State's policies that affect the rate, type and general location of population and economic growth."

Response: No response required.

Comment 13: "This shift in attitude has not been reflected in the EIS of the Kohakohau Dam Project."

Response: The Kohakohau Dam Project is intended to respond to the need for additional future water supplies determined from analysis of the future population increase expected and accommodated by the planning process. Current planning estimates indicate a substantial increase in population in the South Kohala-Hamakua region in the next decades. See response to Comment No. 4 on page 157.

Comment 14: "This project has been in the works for almost 20 years, dating back to the USGS report in 1946, Development of Water for the Waimea Plain from Dike Complex in in Kohala Mountain, Island of Hawaii. Even the latest dam reports are based on the needs of coastal developments that have been in the works for years, possibly even decades, before enough capital was found and plans drawn up and approved by the large corporations who propose these developments which call for rapid growth in South Kohala."

Response: The Kohakohau Dam Project was first seriously considered as a potential source for future domestic water in the 1960's (see pages 1 and 12 of the Draft EIS). Damming of the Kohakohau Stream was proposed "as a means of augmenting the water supply when future demands exceed 3.3 million gallons a day." (page 13 of the Draft EIS). The project has been proposed to meet the expected increase in domestic demands associated with the population increase outlined in County of Hawaii planning documents. See response to Comment No. 4 on page 157.

Comment 15: "The EIS claims that the dam (p.77) will not alter the ultimate level of this expected growth and will probably even accelerate the time frame of that growth. This is a lie, for the water the dam would supply is a vital preliminary to that growth. The dam will make the expected growth possible in the first place."

Response: The provision of domestic water is required in the support of planned growth in any area. The Kohakohau Dam Project will "provide an element of the infrastructure of public services required by planned growth in South Kohala and Hamakua" (page 77 of the Draft EIS). Potential service areas are described and authorized in the General Plan. See response to Comment No. 4 on page 157.

Comment 16: "Because of this, the recommendations and warnings of the Growth Policies Plan most certainly apply to this 'old' state policy and a new re-evaluation should be instituted focused on the affect this dam will have on the rate, type and general location of population and economic growth. According to the Growth Policies Plan, EIS projections are based on the discredited growth alternative of continued or more rapid growth of 2.5-4.5% while other, more desireable policies can be implemented bringing from 0-2% growth."

Response: Population projections presented in the Draft EIS are based on no growth policy, but rather on expectations of the future as defined by the County of Hawaii Planning Department. See response to Comment No. 4 on page 157.

Comment 17: "The Growth Policies Plan goes on to list many dangers involved with rapid population increase. First it states that (p.4) 'existing information indicates that the faster the rate of population growth, the higher the per capita costs of government facilities and services and the smaller the take home pay of wage earners. Furthermore, a state tax increase would likely be necessary if rapid population growth continues and if the current level and quality of government services were to be maintained.' Even the General Plan of the County, which contains the official goals and policies of residents of the county, (p. 16) recognizes that the 'people of the County of Hawaii live in a quality environment that other areas have long since lost' and that 'economic expansion and population growth in the county are bringing about more demand for products, transportation services, energy and other government services which could easily contribute towards the pollution of the environment.'

"The Growth Policies Plan goes into great detail on the dangers of the dependent economy. 'With less self sufficiency and heavy dependence on just one or two export industries, the State's vulnerability to a severe state recession is increased whenever there is a slump in one of these major industries. Of major concern is the possibility that state policies favoring rapid growth would result in an excessive dependence on tourism (p. 15).' It warns (p. 19) that 'the resulting 1985 State population is projected to be about 1,110,000 (including 127,000 estimated military and their dependents). The de facto population is expected to grow even faster than the civilian population because this number includes tourists--estimated to average about 84,000 daily visitors in 1975, 144,000 in 1980, and 214,000 in 1985. This last figure is almost 26% of the 1973 State population.' The report calls for a diversificiation of the economy and a decreased emphasis on tourism. It must be realized that the private developments planned for South Kohala include major large resort centers which were not planned to diversify the State's already dependent economy. These plans benefit only private profit and not the public and State's well-being."

Response: These issues are in consideration by the County of Hawaii Planning Department as the appropriately mandated public agency.

Comment 18: "The EIS (p. 68) recognizes that 'potential growth in South Kohala can be expected to spur economic activity in the area and shift labor and income away from agricultural patterns.' This anti-agricultural shift that the dam would cause endangers the County of Hawaii's General Plan proposals where it is recorded (p. 13) that 'the agricultural industry faced with competition for resources from tourism and other urban forces needs governmental assistance.' The courses of action proposed (p. 14) require the County to assist the development of agriculture in South Kohala by protecting prime agricultural land from urbanization and to restrict resort development to an orderly fashion 'consistent with the physical and social goals of the people of the area... and to best meet the needs of the county.'"

Response: The statements cited from the Draft EIS are made in a discussion of the Future Environment Without the Project (page 68). The conditions described are present trends and future conditions expected to occur without the Kohakohau Dam Project. Other studies address agricultural needs and measures proposed to meet these needs.

Comment 19: "Even DPED's 1985 projected population in the Growth Policies Plan of 1,110,000 is a noticeable decrease over the projection of 1,217,344 in the 1967 State General Plan Revision Program, or a decline of over 107,000, or 8 percent. Our state planning agencies are now contemplating a major revision in state growth policies, from those that encourage rapid growth to those that discourage rapid growth and accommodate moderate growth. The Kohakohau Dam Project would subvert these policies and discourage comprehensive state planning efforts."

Response: The Kohakohau Dam Project will subvert no public planning policies. Were that the case, the County of Hawaii Planning Department and the State Department of Planning and Economic Development would surely have made it known in reviewing the Draft EIS (see letters on pages 232 and 240).

Comment 20: "A third danger the report lists is that 'competition for jobs, especially professional ones, is becoming increasingly intense: in 1972, 65 per cent of the 44,000 civilian in-migrants were white collar workers (p. 13).' That Hawaii will be taken over by 'outsiders' is an economical and psychological blow to the local worker-resident. Not only is the younger university educated generation having to compete even harder for the white collar jobs available, but the movement of the middle aged workers into the better paying positions and easier working conditions is being jeopardized by the younger, more experienced newcomer from the mainland.

"The first generation of especially Japanese and Chinese people of our islands have worked hard and been able to put the second generation through formal education and into white collar jobs. Is the second generation going to be able to see the third generation attain an even higher, at least equal, status with the present Haole, without the problems of an increasingly overwhelming Caucasian population?"

Response: These issues are properly addressed by public planning agencies.

Comment 21: "There is no reliable data in the EIS on the social impact of the dam project and the development it will generate. Since there will be such a significant impact upon the social structure, this information is desperately needed in the evaluation of the Kohakohau Dam."

Response: The Kohakohau Dam Project will meet the objectives of the County of Hawaii General Plan, which has described and enunciated the desires of the residents of the County. See response to Comment No. 4 on page 157.

Comment 22: "With an increased population, there will be a major shift in ethnic population in South Kohala. The present population percentages of Hawaiian race of the districts of the Big Island show that the two areas with the largest percentages of Hawaiian people, South Kohala (26.4%) and North Kona (19.3%) (R&D Data Book 1974) are being proposed by these "investor interests" for rapid population growth. The overall county percentages of persons of Hawaiian race is 12.3%. With many of the last outposts of Hawaiian lifestyle now under attack, South Kohala represents a possible center for the flourishment of the Hawaiian culture. The proposed dam would destroy this possibility."

Response: The Kohakohau Dam Project precludes no possibilities for flourishment of the Hawaiian culture. That issue is properly addressed by the appropriate planning agencies.

Comment 23: "There will be major shifts in the distribution of population on the Big Island. As of 1973, South Kohala represented the second to the smallest district in the County. If the Kohakohau Dam Project were to implement the projections of the EIS, population centers of the island would shift to the following (projections based on R&D 1972 Data Book, from which EIS projections were obtained) from most to least populated:"

Response: The Kohakohau Dam Project will neither ensure nor preclude the stated redistribution in population. See response to Comment No. 4 on page 157.

Comment 24: "For such a change to be allowed to occur, the planning 'weapons' must be fully disclosed, publicly scrutinized and then implemented in such a way as to afford the community the decision making powers as to its future growth. That one major project such as the dam could force and stimulate these changes requires that the project be openly discussed in these terms. Because the supplying of water is a planning tool it should be developed as one and used the same way as land use zonings. Water has not been used as a regulatory control for the various planned uses of our lands, although it is often needed before development takes place, much in the way highways function. Instead, when there is a projected cry for water, the State steps in and supplies the projected demand. If we do not stop now and look at our water systems and supplies, we will face water supply and quality problems. For example, the Board of Water Supply of the City and County of Honolulu published in 1970 the 2020 Plan, which outlines the water resources, supplies and usage of Oahu and states that after the year 2020, there will be no more fresh water available on that island. Oahu has neglected to plan adequately and has issued the use of water to wherever a demand was heard. We hope to avoid these problems with the implementation of far-sighted, community goal oriented planning provisions."

Response: The County of Hawaii General Plan represents the decisions of a far-sighted, community goal oriented planning process which included public hearings and meetings. The purpose of the Kohakohau Dam Project is not to become a "planning weapon" but is rather to meet the objectives of that democratic planning process. See response to Comment No. 4 on page 157.

Comment 25: "The Growth Policies Plan (p. 30) states that 'although certain governmental agencies are directly responsible for implementing and operating the programs relating to these choices, the direction of these programs is fundamentally an external matter, subject to public policymaking.' It would seem that the purpose of this draft EIS is to accommodate for much of this public input, yet page 17 of the EIS states that 'it is intended that after this EIS is completed and analyzed, a decision will be made on whether or not to proceed with the project as presently proposed or in a modified form.' These seem to be the only alternatives open to public scrutiny. The purpose of the EIS is to discuss all the alternatives so as to be able to choose that which is of greatest benefit to the taxpayer/resident. At present there has been inadequate discussion on alternatives. Those discussed were very poorly explained and very effectively dismissed as 'prohibitive'. Of the proposed alternatives, the EIS concludes the following:

1. High level ground water--prohibitive expense for exploration, discusses only Waipio Valley as a water source.

2. Low level ground water--would involve pumping to 2600' elevation, therefore prohibitively expensive (Boise Cascade well is at 1200' elevation).

3. Surface water--discussed only in terms of Waipio Valley, high pumping rates would make the cost prohibitive.

4. Desalination--prohibitively expensive.

5. Successive Use of Existing Waters (Recycling)--in the short term reclamation of waters in a quantity comparable to the dam yield is unrealistic. "Successive use of existing waters in the South Kohala-Hamakua region is therefore dismissed as a viable alternative at this time (p. 106)."

6. No action--'Existing conditons would be expected to endure until a critical water shortage developed (perhaps in the near future)' (p. 108)"

Response: The Draft EIS has been expanded to incorporate a comparison of development costs for alternatives, in which the basic assumptions and criteria used in comparison are identified. See response to Comment No. 3 on page 155.

Comment 26: "Water usage estimates in the EIS conflict with those in the General Plan (p. 71) where the 1971 actual average daily consumption of the water systems was .945 mgd, compared to the 2.0 to 2.2 mgd charted in the EIS, over double the county figures."

Response: The estimated current domestic water consumption in South Kohala and Hamakua is approximately 2 mgd:

System	Average Use - mgd
Kawaihae-Hapuna-Puako	0.9
Waimea-Hawaiian Homes-Kamuela	0.6
Ahualoa-Honokaa	0.3
Kukuihaele	0.1
Paauilo	0.1
Total	2.0

Comment 27: "According to the EIS figures (Figure 26), after the completion of the second 50 million gallon reservoir, now under construction, the supply will be 4.48 mgd, or more than quadruple the 1971 usage as recorded in the General Plan. According to the EIS, present systems cannot comfortably adopt any major demand increase of domestic and agriculture water supplies (p. 67). Reliable information should be included in the next impact statement clarifying what the projected demand and supply time scale for the two 50 million gallon reservoirs and filtration plant were when approved, and what the present use and rate of increase of both agricultural and domestic demand and supply is and in what specific locality."

Response: The Upper 50 mg Reservoir (see Figures 8 and 26 in the Draft EIS) is near completion and will provide a temporary surplus in water for a few years. As tabulated on Figure 26, the total available yield will be 3.48 mgd. Future mixing of the fresh water with brackish well water along the coast will stretch the yield to 4.48 mgd when necessary. Figure 26 presents the expected rate of increase in domestic consumption.

Comment 28: "Although the alternatives presented in the EIS were dismissed as prohibitive, no cost figures were ever laid out. To make this statement, Parsons, the consultants for the EIS, must know what these costs are and since these cost figures are available, we would like to have them included in the EIS so we can really look at these alternatives."

Response: See response to Comment No. 3 on page 155. The Draft EIS has been expanded to incorporate a comparison of development costs for the alternatives.

Comment 29: "Present support projects surrounding the dam are not being discussed as a total unit. The two reservoirs, filtration plant and proposed 20" waterline that will be installed in the new road alignment from Waimea to Kawaihae are vital parts of the dam project, but are being considered separately. This separation allows the EIS to quote only a portion of the actual cost of the dam project. However, the water lines and other support facilities are considered in the cost analysis of the alternatives presented and are used only to discredit the alternatives. A true picture of the total project would include all these costs in evaluation of dam and the alternatives.

"Instead, the EIS leads us to believe there is comparatively no significant costs involved in the dam and that that cost will be determined at a later date when all the other studies and approvals have been awarded so that a great deal of public funds and time would have already been committed to the dam project and there would almost in effect, be no way out.

"Right now a cost/benefit analysis is needed for each of the proposed alternatives, including the dam, with a breakdown of all the costs (social, environmental, and economic) to include construction, research, planning, maintenance, operating, interest, insurance, land and relocation, settlement of water rights, value of natural resources that would be lost, wildlife that would be lost, degredation of quality of life, life styles, and social values, and who is paying each of these costs, weighed against all the benefits and who is receiving each of these benefits."

Response: The expanded discussion of alternatives in the Draft EIS identifies the assumptions and criteria used in the comparison. Information sufficient in detail to support an evaluation of the relative engineering feasibility, economic feasibility, and environmental consequences of the alternatives is provided. See response to Comment No. 3 on page 155.

Comment 30: "To begin with, the General Plan of the county offers an alternative (p. 57): 'Despite rather poor results of exploration to date there is a reasonable expectation that adequate quantities of basal water can be developed in the general coastal area from Kawaihae to Puako. This would have an economic advantage over water stored above Waimea village and transported to the coastal areas by a transmission system.' The county obviously feels that this type of system would be of less cost to its residents and those of the state. This alternative deserves to be fully explored."

Response: See response to Comment No. 3 on page 155.

Comment 31: "There is a legitimate need for water supplies for agricultural purposes. If the state is to develop its agricultural potential, it needs, according to the County of Hawaii: land, water, labor, capital, and marketing. These are the basics for agricultural expansion.

"The State must develop its capability to supply its own food needs. Anyone keeping up with the American government's selling of its wheat, soy bean, and other resources to foreign governments at the expense of American and Hawaiian consumers, knows we can only beat the cost cf government spawned inflation and food scarcities by controlling agricultural products locally. Shipping strikes and America's governmental indifference to local consumers further point to our needs to become less dependent on people and areas whose concerns are not for keeping Hawaii fed at reasonable cost.

"Governmental concerns for farmer's needs are mainly retorical. The available agricultural lands are far from protected while their fate rests in the hands of the big development oriented State Land Use Commission, which has already rezoned thousands of acres of prime agricultural land on central Oahu to urban use, and the Department of Land and Natural Resources, which has shown little regard for the release of state land to small ranchers and farmers.

"Water resources are a key to development of many areas for the kinds of crops that are needed for Hawaiian markets. Yet time after time the farmers find this resource eroded by urban development which consumes water meant and needed for their crops. The farmer is the first to feel the effect of any shortages as water is conserved for hotel and domestic uses that have moved into agricultural areas.

"The Kohakohau Dam Project is yet another example of a resource that is initially to be available to farmers, yet planned for future distribution to everyone but the farmer.

"Because, as admitted in the EIS, water, like highways, is a required precedent to development, and once in, will encourage and speed urban, anti-agricultural development. It must be controlled so it can only be used for the use it is really needed, i.e., agricultural irrigation."

Response: It is recognized that adequate water supplies for agricultural needs must be ensured in the future. The Kohakohau Dam Project will indirectly benefit agricultural interests by releasing other untapped water sources for potential agricultural development and by ensuring that agricultural supplies would no longer be vulnerable to domestic needs during periods of irregular rainfall.

Comment 32: "The appropriate alternatives, then, to a dam whose resources are meant to subsidize big resort development in the South Kohala coast and in Waimea itself, are systems which cannot be tapped by these sort of destructive developments yet which will fulfill the agricultural needs."

Response: The water resources of the Kohala Mountains intended to be released for use by the Kohakohau Dam Project can only be used by legitimate and sanctioned areas in the County as determined by the appropriate County agencies. See response to Comment No. 4 on page 157.

Comment 33: "Several alternatives are:

1. Localized Water resources: Water systems should be no larger than the surrounding area's peak needs. This means private or public reservoirs should be placed only in the areas of agricultural needs. Pipe lines to proposed or planned urban anti-agricultural developments should not be permitted. The planned 20" pipe to Puako belies any pronounced attempts to help farmers meet Hawaii's agricultural needs."

Response: Fiscal responsibility in the development of needed water supplies requires that domestic and agricultural demands are satisfied consistently and economically in a continuing and long-range program. Localized and short-term solutions to regional water deficiencies (or projected deficiencies) would be inadequate and irresponsible. See response to Comment No. 3 on page 155.

Comment 34:

"2. Irrigation Quality water: The County and State should not combine the two basically different uses of water. Farm water systems should permit lower quality semi-potable which is suitable for crop rather than human needs. Such systems already exist in the Parker Ranch, Hawaiian Irrigation Co., and Lalamilo Irrigation system. These are the type of systems that need expansion."

Response: The County and State are aware of the advantages of using semi-potable waters for agricultural needs while reserving higher-quality waters for domestic needs. For that reason the Kohakohau Dam Project would serve to provide all required domestic waters at a high quality level while releasing other sources for agricultural needs.

Comment 35:

"3. No further big urban, anti-agricultural development be permitted: In the case that county and state policy should finally recognize the economic, social and environmental destruction brought by further urban development and its accompanying population and anti-agricultural pressures, such further development would be stopped. In this case, a single water system would be acceptable to meet the farmers needs. However, if such were the case, there would still be no need for such a dangerous and collosal undertaking as the dam. The magnitude of the dam dwarfs even extensively increased agricultural needs for a long time to come. In the meantime money would best be spent in finding and tapping more localized, less dangerous, more aesthetic sources which would not have such a permanent and irreversible (possibly contaminating) effect in the precious Restricted Watershed of Kohala."

Response: The county policy has been enunciated in the General Plan and followed in planning for the Kohakohau Dam Project, The Kohakohau Dam Project offers high quality, reliable, and inexpensive water in an ideal location for distribution. There is no evidence that the Project will "contaminate" the Kohala Watershed Reserve; conversely, the impoundment would improve the Kohakohau Stream water quality.

Comment 36: "We hope discussion on these additional alternatives will be included in the next EIS and that a more complete planning process be immediately instituted with the involvement of community residents, county and state planners, decision making agencies and other interested persons. The EIS must reflect the Kohakohau Dam Project in its totality and include a detailed outline of the water needs, a cost/benefit analysis of each of the alternatives that would meet those needs, and any social and environmental changes that system will and might bring upon the area."

Response: The discussion of alternatives presented in the Draft EIS has been expanded. Every reasonable effort has been made to solicit and encourage the involvement of interested agencies and citizens. Environmental impacts have been identified and evaluated.

Mrs. Alexander G. Budge, Jr.
Box 826
Kamuela, Hawaii 96743

Sept. 3, 1974

Dear Mr. Matsumoto,

Dams are built to be safe, but dams fail. Why shouldn't the State and men behind the project be held responsible should Kohakahau Dam fail?

The water provided by the Kohakahau Dam is mainly destined to support the visitor industry. People come to Hawaii because of her climate and beauty. Elimination of a stream eliminates some of that beauty. "No legal minumem flow requirement exists below the proposed damsite."

There must be a better way to provide water. A lined reservoir below the town, high level wells, low level wells, Waipio Stream for Honokaa, all should be looked into even at added cost.

Sincerely

Alexander G. Budge

Alexander G. Budge, Jr.

Comment 1: "Dams are built to be safe, but dams fail. Why shouldn't the State and men behind the project be held responsible should Kohakohau Dam fail?"

Response: See response to Comment No. 1 on page 147.

Comment 2: "The water provided by the Kohakohau Dam is mainly destined to support the visitor industry."

Response: The Kohakohau Dam Project is intended to provide the waters needed to support the planned development described by the County of Hawaii General Plan. See response to Comment No. 4 on page 157.

Comment 3: "People come to Hawaii because of her climate and beauty. Elimination of a stream eliminates some of that beauty. 'No legal minimum flow requirements exist below the proposed damsite.'"

Response: See response to Comment No. 2 on page 152.

Comment 4: "There must be a better way to provide water. A lined reservoir below the town, high level wells, low level wells, Waipio Stream for Honokaa, all should be looked into even at added cost."

Response: See response to Comment No. 3 on page 155.

P. O. Box 563
Kamuela, Hawaii 96743
September 3, 1974

Mr. George Matsumoto
State of Hawaii
Dept. of Land and Natural Resources
P. O. Box 373
Honolulu, Hawaii 96809

RE: KOHAKOHAU DAM

Dear Sir:

The proposed site of the Kohakahau Dam is within an earthquake 3 zone. Since this zone is the most hazardous, you would be ill advised to construct a 1.78 billion gallon reservoir above the town of Waimea.

The Environmental Impact Statement does not reflect adequate work done on alternate methods of water sources. What about the use of Kohala water? Kona and Boise Cascade are pumping water. What about 800-1200' wells for the lower elevations water needs. What about high-level wells for higher elevations. Two test drillings are not conclusive proof that water cannot be obtained in this manner.

The Waimea water catchment has enough water for Waimea town for the foreseeable future. If water from our catchment wasn't going as far as Honokaa and Pauuilo (which have adequate water resources of their own) and proposed to go to Keahole, we wouldn't need such a dangerous dam.

Sincerely,

Charles T. Campbell
Charles T. Campbell
Concerned resident of Waimea

Comment 1: "The proposed site of the Kohakohau Dam is within an earthquake 3 zone. Since this zone is the most hazardous, you would be ill advised to construct a 1.7 billion gallon reservoir above the town of Waimea."

Response: See response to Comment No. 1 on page 147.

Comment 2: "The Environmental Impact Statement does not reflect adequate work done on alternate methods of water sources. What about the use of Kohala water? Kona and Boise Cascade are pumping water. What about 800-1200' wells for the lower elevation's water needs. What about high-level wells for higher elevations. Two test drillings are not conclusive proof that water cannot be obtained in this manner."

Response: See response to Comment No. 3 on page 155

Comment 3: "The Waimea water catchment has enough water for Waimea town for the foreseeable future. If water from our catchment wasn't going as far as Honokaa and Pauuilo (which have adequate water resources of their own) and proposed to go to Keahole, we wouldn't need such a dangerous dam."

Response: See response to Comment No. 5 on page 161

RECEIVED
DIV. OF WATER &
LAND DEVELOPMENT

SEP 9 9 18 AM '74

September 5, 1974

Mr. George Matsumoto
State of Hawaii, Department of Land and Natural Resources
Division of Water and Land Development
P. O. Box 373
Honolulu, Hawaii

Dear Sir,

I am a resident of the Lalamilo section of Waimea and I object to the construction of a dam at 3700 ft. elevation of Kohakohau stream because of earthquakes. There are other ways to develop water in this area that would be much safer.

Very truly yours,

A. D. Johnson

A. D. Johnson

P. O. Box 818
Kamuela, Hawaii 96743

Comment 1: ". . . I object to the construction of a dam at 3700 ft. elevation of Kohakohau stream because of earthquakes. There are other ways to develop water in this area that would be much safer."

Response: See response to Comment No. 1 on page 147.

RECEIVED
... OF WATER &
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SEP 11 ... '74

September 6, 1974

Department of Land and Natural Resources
Division of Water and Land Development
465 S. King St.
Honolulu, Hawaii 96813

Attention: Mr. Chuck

Gentlemen:

I wish to go on record as being opposed to the proposed Kohakohau Dam. I do not believe that a dam should be built above any residential area on this island. Earthquakes are frequent and unpredictable here and a dam would always be a source of danger and worry.

I am also very much opposed to any further drying up of the Kohakohau Stream. It is Waimea's last running stream and it is a beautiful and important part of our community. Its loss would be keenly felt, not only because we would be deprived of its great natural beauty but also because there would surely be some resulting change in weather patterns.

There must be ways to obtain the water needed for Hamakua and the coastal areas of South Kohala that would not be so dangerous and destructive for our community.

Very truly yours,

Ethel M. Kilpatrick

Ethel M. Kilpatrick

P. O. Box 636
Kamuela, Hawaii 96743

Comment 1: "I wish to go on record as being opposed to the proposed Kohakohau Dam. I do not believe that a dam should be built above any residential area on this island. Earthquakes are frequent and unpredictable here and a dam would always be a source of danger and worry."

Response: See response to Comment No. 1 on page 147.

Comment 2: "I am also very much opposed to any further drying up of the Kohakohau Stream. It is Waimea's last running stream and it is a beautiful and important part of our community. Its loss would be keenly felt, not only because we would be deprived of its great natural beauty but also because there would surely be some resulting change in weather patterns."

Response: See response to Comment No. 2 on page 152.

Comment 3: "There must be ways to obtain the water needed for Hamakua and the coastal areas of South Kohala that would not be so dangerous and destructive for our community."

Response: See response to Comment No. 3 on page 155.

W/

RECEIVED
RICHARD PENHALLOW — Real Estate
Consultant
Broker
Appraisals
SEP 3 11 39 AM '74
ROOM 1 KAMUELA OFFICE CENTER
P. O. BOX 518
KAMUELA, HAWAII 96743
Phones
Office 885-4312
Residence 885-4045

RECEIVED
'74 ... 30 AM 10:
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

August 27, 1974

Mr. Sunao Kido, Chairman
Board of Land and Natural Resources
State Office Building
Honolulu, Hawaii, 96813.

Dear Sir:

Subject: Kohokohau Dam.

Because of previous personal plans which were made prior to any notice of a hearing in Kamuela relating to Kohokohau Dam on August 22, I was in Honolulu and not present at the hearing. It is my understanding that personal expressions which are pertinent to the dam project have been invited. My great interest in the progress of the region of Waimea and Kawaihae, and my past position as president of the Waimea-Kawaihae Community Association, motivate me to submit the following for the consideration of your Board and your Division of Land and Water Development.

It is a fact that throughout the existence of the Waimea-Kawaihae Community Association, the establishment and maintenance of an adequate water supply has been the public project rated as highest priority for support and action of the Association. The obvious reasons are that there can be no expansion of commerce or recreation without, and indeed the very continuance of population increase demands such.

I was disappointed to read in newspaper reports of the Waimea hearing of August 22, that a semblance of conflict between farmers and Lalamilo Housing residents was developed there. All Waimea and Hamakua residents who are dependent upon the public water supply surely favor a policy of adequacy.

Probably the concern of users who must rely upon this high elevation source can best be expressed as a need for assurance that users at the lower elevations and at remote locations will not continue to be added to our load to the point where our supply will not be enough for our own use. I have heard it proposed by others, and I personally have the same position, that local exploitation of the Ghyben-Hertzberg aquifer source should be resorted to at some future time to supply users below the 1,500 foot elevation. There are also low level stream sources and perched spring sources to exploit for Hamakua and Kohala users. Such reserve plans should be incorporated in public presentations and announcements in order to reassure Waimea and Upper Hamakua people that consideration is being given to their needs first in the distribution of the limited high level surface supply.

A suggestion in the field of public relations is offered. When Bob Chuck and his associates presented facts on the proposed dam in Waimea June 13, he was abrupt in his response to expressions of concern over water rights (Parker Ranch) and stream flow in the Waiauia-Haleaha to Lalamilo reaches of the Keanuiomano (Kohokohau) Stream. These two concerns do not involve large annual quantities of water, and should publicly be given courteous consideration. I feel certain that to insure continuous minimal flow in the stream bed as far as Puuiki would require an annual amount of water equal to the flow of only one single freshet for part of a day. As to the water rights of the established user (Parker Ranch), certainly some constructive accommodation can be worked out. The representation that a dam will dry up both of these possibilities was not a good public position.

Anent the concern for contiouous minimal stream flow: the benefits of such a flow are esthetic and environmental; perhaps ecological as well. A major attraction of the desert-like leeward Waimea has been the pleasant aspect of the Keanuiomano Stream. One reaction might be "so what?". But when such a small concession as a part of a single freshet will preserve this phenomenon, isn't it worth the attempt to do so? I have just read the concluding remarks of Jon Roush, the general chairman of a seminar at the Institute on Man and Science in Rensselaerville, New York, May 14 and 15 of this year. The theme was "The Land Protection Battle--Some Sparring Techniques". Mr. Roush, quoting from another source said "the first rule of intelligent tinkering is to save the pieces".

In this case, wouldn't it be wise to make a concession, agree to "crack" the outlet valve of any impounding dam or reservoir so that a trickle could be perpetuated,"save the pieces" so to speak, and avoid alienating that large segment of the populace who quite rightly cherish esthetic values in geography, as well as engineering solutions.

Considerable discussion seems to have revolved around the safety of the dam, if published reports of the August 23 meeting are accurate. Those expressing concern in this category are mainly the people who have settled in the State-sponsored Lalamilo Houselots. It should be recognized that their fear is relevant and personal because of their abode on the very banks of the channel through which a deluge such as might result from dam failure must necessarily flow. Every effort must be made to establish the infallible structural soundness of the proposed dam. If such cannot be established, those whose fears are so real should be bought out by condemnation; and those whose faith in the dam allows them to stay where they live should be required to hold the State harmless in the event of failure.

The foregoing has been prepared and is submitted with the constructive good intent that it may be helpful to you in your plans to achieve an adequate water system. I trust that you will receive my suggestions in the same spirit as they have been offered.

Respectfully yours,

Richard Penhallow

Richard Penhallow.

Comment 1: "Probably the concern of users who must rely upon this high elevation source can best be expressed as a need for assurance that users at the lower elevations and at remote locations will not continue to be added to our load to the point where our supply will not be enough for our own use. I have heard it proposed by others, and I personally have the same position, that local exploitation of the Ghyben-Hertzberg aquifer source should be resorted to at some future time to supply users below the 1,500 foot elevation. There are also low level stream sources and perched spring sources to exploit for Hamakua and Kohala users. Such reserve plans should be incorporated in public presentations and announcements in order to reassure Waimea and Upper Hamakua people that consideration is being given to their needs first in the distribution of the limited high level surface supply."

Response: The Kohakohau Dam Project is intended principally to meet the needs of the Waimea area and secondarily to meet increasing demands in other South Kohala and Hamakua areas. It has been long recognized that development of low-level ground water and mixing of fresh and brackish waters at the lower elevations should be encouraged to extend available sources and conserve the precious fresh water. This practice is mentioned in the Draft EIS as a future water resource management policy. See response to Comment No. 5 on page 161.

Comment 2: "A suggestion in the field of public relations is offered. When Bob Chuck and his associates presented facts on the proposed dam in Waimea June 13, he was abrupt in his response to expressions of concern over water rights (Parker Ranch) and stream flow in the Waiauia-Haleaha to Lalamilo reaches of the Keanuiomano (Kohakohau) Stream. These two concerns do not involve large annual quantities of water, and should publicly be given courteous consideration. I feel certain that to insure continuous minimal flow in the stream bed as far as Puuiki would require an annual amount of water equal to the flow of only one single freshet for part of a day. As to the water rights of the established user (Parker Ranch), certainly some constructive accommodation can be worked out. The representation that a dam will dry up both of these possibilities was not a good public position."

Response: The maintenance of minimal downstream flows for aesthetic reasons is discussed in Comment No. 2 on page 152. With regard to the use of Kohakohau Stream waters, the State, Parker Ranch, and others having a legal interest in the flows of the stream presently enjoy the benefit of a written agreement stipulating the limits of their water use privilege. Construction of the Kohakohau Dam will not divest Parker Ranch of any of its present legal privileges.

Comment 3: "About the concern for continuous minimal stream flow: the benefits of such a flow are esthetic and environmental; perhaps ecological as well. A major attraction of the desert-like leeward Waimea has been the pleasant aspect of the Keanuiomano Stream. One reaction might be "so what?". But when such a small concession as a part of a single freshet will preserve this phenomenon, isn't it worth the attempt to do so? I have just read the concluding remarks of Jon Roush, the general chairman of a seminar at the Institute on Man and Science in Rensselaerville, New York, May 14 and 15 of this year. The theme was "The Land Protection Battle--Some Sparring Techniques". Mr. Roush, quoting from another source said, 'the first rule of intelligent tinkering is to save the pieces'.

"In this case, wouldn't it be wise to make a concession, agree to 'crack' the outlet valve of any impounding dam or reservoir so that a trickle could be perpetuated, 'save the pieces' so to speak, and avoid alienating that large segment of the populace who quite rightly cherish esthetic values in geography, as well as engineering solutions."

Response: See response to Comment No.2 on page 152.

Comment 4: "Considerable discussion seems to have revolved around the safety of the dam, if published reports of the August 23 meeting are accurate. Those expressing concern in this category are mainly the people who have settled in the State-sponsored Lalamilo Houselots. It should be recognized that their fear is relevant and personal because of their abode on the very banks of the channel through which a deluge such as might result from dam failure must necessarily flow. Every effort must be made to establish the infallible structural soundness of the proposed dam. If such cannot be established, those whose fears are so real should be bought out by condemnation; and those whose faith in the dam allows them to stay where they live should be required to hold the State harmless in the event of failure."

Response: See response to Comment No. 1 on page 147.

RICHARD P. SCHULZE, JR.
ATTORNEY AT LAW
P. O. BOX 795
KAMUELA, HAWAII 96743

September 6, 1974

Department of Land and Natural Resources
Division of Water and Land Development
465 S. King St.
Honolulu, Hawaii 96813

Re: Kohakohau Dam

Gentlemen:

At the Public Hearing held on the Environmental Impact Statement for the Kohakohau Dam in Waimea, Hawaii on August 22, 1974, something over 80 people were present. That is a very large turnout for this small community, especially when it is considered that the hearing was held late in the summer at a time when most people are entertaining guests or on vacation and that virtually no public notice was given. Perhaps half of those present spoke and a great majority of those who spoke were strongly opposed to the dam. Two major objections appeared over and over again: a fear that no dam could be sufficiently earthquake proof to protect all those whose homes are beneath it, and a profound opposition to the drying up of Waimea's last running stream.

I do not pretend to speak for all of these people. But I do strongly object to the dam on both of these grounds and will give my objections in writing here as I did verbally at the meeting.

I. <u>Earthquake Danger</u>

There was a question from the floor in the August 22 public meeting. Mr. Chuck was asked whether dams of this design had been actually tested in earthquakes or whether we were to be guinea pigs. Mr. Chuck replied that the dam would be tested when the first earthquake occurred after its construction.

Of course Mr. Chuck is correct, if not very diplomatic. No one can be sure what any dam will do in an earthquake. And Hawaii is in a Zone III earthquake hazard area, the most severe rating given by the U. S. Geological Survey. Our island is still alive, still growing, and we will have earthquakes here as a way of life for hundreds of years to come. Furthermore any assumptions on the severity and frequency of earthquakes on this island is necessarily based on a very short prior history of observation. No one actually knows how severe earthquakes we can expect, or when we can expect them, or where they will be centered. Our island is so young geologically and so unlike any other area in the world that all such assumptions are essentially guesswork.

No assumptions or guesswork are needed to know that we have severe earthquakes and that we have had them recently. A 1973 earthquake, centered north of Hilo, shook every home in Waimea, some of them severely. In 1951 we had an earthquake that measured 7.0 on the Richter Scale.

Just for comparison's sake I would like to point out that the 1906 San Francisco earthquake which, along with the fires it created, destroyed 85% of that city, was estimated at 8.3 on the Richter Scale. And, of course, San Francisco was full of earthquake proof and fireproof buildings that had been solemnly so certified by reputable engineers.

A better comparison was the recent 1971 San Fernando earthquake. This quake left 64 dead and created about $500,000,000 in property damage. Both figures would have been substantially higher had the quake not struck at six in the morning when schools were out and business offices were not occupied. Pictures in Hawaii newspapers showed large sections of freeway thrown violently down and smashed against each other, but there was much more damage than that. William Bronson described it this way:

> Thirteen schools suffered severe structural damage. Hundreds of homes were smashed beyond repair, multi-storied steel and concrete buildings and freeways were thrown down, and the concrete facing of the huge Lower Van Norman Lake earth-fill dam

> collapsed to leave a 12 square-mile area 500 feet below it under the ominous threat of flood. Almost seven billion gallons of water were stored behind the dam, and until the reservoir could be lowered to a safe level 80,000 persons were evacuated from the imperiled section of the valley. (William Bronson, The Earth Shook, The Sky Burned, 1959, p. 288).

This San Fernando earthquake was only 6.6 on the Richter Scale. I am no expert on Richter comparisons but I believe that our 1951 earthquake would have been at least ten to fifteen times as powerful as that San Fernando quake.

I quote further from an article contained in the July 13, 1974 edition of Saturday Review World:

> One of the hazards of dam building is that the enormous weight of the impounded water may cause earthquakes. Detailed records of seismological activity in the region of the Koyna Dam south of here (Bombay) has led two Indian scientists to speculate that a serious earthquake may be imminent.
>
> Since the reservoir started to fill in 1962 - in a region where earthquake tremors had been unknown - there have been hundreds of minor shocks and four earthquakes above 5 on the Richter scale. The most serious, in December 1967, caused extensive damage and killed approximately 200 people. After 12 years, the underlying rock clearly has not settled permanently and there continues to be a direct correlation between seismic activity and the water level behind the dam. (p.35)

There are, obviously, a lot of things no one understands about earthquakes. We do know that the Big Island is one of the most active earthquake zones in the world. To build a dam here, immediately above homes and schools, is clearly dangerous. There can be no doubt that it will create serious risks to the people of Waimea and to their property.

II. The Stream

Throughout the Environmental Impact Statement, references are made to "potential reductions" in the stream flow. These are all virtual hogwash. No one at either of the public meetings denied what every resident of Waimea knows - that construction of the dam will dry up the stream permanently.

Kohakohau Stream is the last running stream in Waimea. Its water course is bordered by lovely trees, beautiful flowers and all kinds of flora and fauna that will no longer exist if the stream is dried up. A running stream is a magnificent thing. It provides a source of beauty and much needed tranquility for those who wish to sit at its banks. It provides swimming holes for children, bathing pools for adults. Along the stream's path are some of the most beautiful waterfalls in the State, several of them only a few steps from the highway.

A dried up stream bed, on the other hand, is like having a permanent skeleton stretching through our community. It is a pathway of exposed rock and dead or dying flora that no longer has sufficient water to survive. It is a depression in the earth that collects trash and debris. Its ugliness is a constant reminder of the beauty that once was; and it can never be filled in and used for any other purpose since it must remain forever as an emergency spillway for the dam.

The loss of the last running stream is a matter of great seriousness to the people who live here. It may not mean much to engineers who come here from Los Angeles or Honolulu where the natural beauty has long since been destroyed by other hastily designed projects sold on the grounds that they were essential to "progress". It simply will not do to take the word of engineers who do not even live here concerning the importance of our stream. Only the people who live here can know how important that is, and those people turned out in large numbers and made their feelings known very clearly.

III. Alternatives

Two things are so clear that even your engineers must understand them: 1) the building of a dam above Waimea town is risky and fraught with potential danger; 2) the drying up of our last running stream is a severe blow to the beauty of this now lovely community. Since these two conclusions are inescapable, then so is a third: the dam should not even be proposed unless it is both essential and there is no other feasible alternative. But the dam is not essential in any meaningful sense of that word, and almost no serious exploration of alternatives has ever been undertaken.

As to the need for the dam, there are now two reservoirs (one of them not quite finished) servicing this area. Their total capacity is one hundred million gallons. Even without the second reservoir, there is "a slight surplus of domestic supply over current demands" (p. 67). The Kohakohau reservoir has a planned capacity of one thousand seven hundred eighty seven million gallons. That is in addition to the existing reservoirs and is almost eighteen times as much water as they hold. Water needs simply do not expand eighteen fold overnight. They expand gradually. Any gradual expansion of existing supplies will fill the needs; the dam can be justified only as a huge, one-time project to take care of needs far into the future.

As for exploration of alternatives, we might look at page 39 of the draft E. I. S.: "numerous dikes are suspected to cut the Lavas in the central part of the mountain." And on page 100 the engineers say: "it is suspected that a substantial quantity of high level ground water may be stored in dike compartments on the southern slopes of Kohala Mountain. Tunneling for these suspected sources has been suggested in the past, as early as the 1940"s." There is later reference to "test borings" in the vicinity of Waimea producing no confined water, but a closer analysis of what "test borings" were involved reveals that there were only two such borings, that they were widely separated in time and in geographical location, and that they were unconnected to planning for this dam. In short no serious effort has ever been made to find this water. At page 101 the E. I. S. disposes of this alternative: "since locations of reliable high level ground water sources are not presently known, a significant, and <u>perhaps</u> prohibitive, expense would be incurred in the exploration of the Waimea vicinity for suitable sources." (emphasis added.)

Thus not only have there not been tests to explore this alternative, but it is discarded without even knowing whether the expense is prohibitive or not. The engineers and your department undoubtedly believe that even the possibility of greater expense is enough reason for disregarding alternatives to the dam.

Other alternatives are dismissed with even less justification. For example, this dam is not designed to provide water for Waimea. Waimea already has all of the water that it could possibly use in the foreseeable future. The difficulty is that Waimea's reservoirs, and this dam, are designed to service not only Waimea but all of South Kohala and Hamakua, including coastal and other areas at much lower altitudes than ours. Boise Cascade's project at Waikoloa, for example, receives its water from two wells which pump 2,000,000 gallons per day of extremely high quality water. This is one-fifth of the total amount which could be secured from the Kohakohau Dam. As every water engineer readily admits, there is substantial other underground water which can be pumped and which can supply all foreseeable needs at lower elevations. But this whole prospect is dismissed with this statement: "It is considered unlikely that a supply comparable in quantity to the identified resource available in the Kohakohau Stream exists in the Boise Cascade aquifer." (p. 102) But you do not know, and you have not tried to find out whether this is so. Further the Boise Cascade aquifer is not the only one. The report admits that there are even greater quantities of basal water available further inland. This prospect is dismissed quickly: "However, pumping lift requirements rise generally in proportion to distance from the coastline." The report goes on to dismiss low level ground water from basal wells and from Waipio Valley on the grounds that it would be extremely expensive to pump this water to the 2,600 foot altitude of Waimea. This, it seems to me, is nonsense. There is no need to pump water as high as Waimea. There is no need for water designed to service coastal and low lying areas to come from Waimea. Coastal areas can easily be supplied by wells drilled at much lower altitudes just as Boise Cascade's development has done.

IV. Conclusions

The following conclusions seem to me inescapable:

1. Construction of a dam must entail risks to both life and property. No amount of assurances could really guarantee otherwise.

2. The drying up of Kohakohau Stream, Waimea's last running stream, will turn what is now beautiful into an eyesore and will create serious disruption of our existing ecological balance.

3. The dam is proposed to hold nearly two billion gallons of water, a huge amount of water for this area, and far more than could possibly be necessary for many years to come.

4. The Department of Land and Natural Resources as well as the engineers who prepared the E. I. S. have throughout taken the position that only cost is to be considered. Any alternative which might require additional monies is summarily disregarded.

5. This kind of thinking is ten to twenty years outdated. No longer should Americans (and particularly Americans living in this State) have to put up with severe and ugly disruptions to their ecology simply because alternatives might cost a little more. Where the natural beauty of a community is concerned (to say nothing of the safety of its inhabitants), cheapness cannot be the only consideration.

6. It would be irresponsible to construct the dam as presently proposed and dry up Kohakohau Stream without extensive, serious and good faith investigation of all possible alternatives. If alternatives can be found which mitigate or eliminate some of the risks and evils in the proposed project, a serious evaluation of their feasibility and cost should be made.

7. Alternatives should not be disregarded by engineers simply because they cost more. The question whether the State can afford to spend a little more money to avoid risking the lives of its citizens and drying up its streams is a political decision and should be made by our representatives in the Legislature, not by water engineers. God did not build the Kohakohau Stream on a budget, and it sould not be destroyed because of a budget.

8. It is not necessary to find a single water source to

replace the Kohakohau Dam; the needs of the various areas which it is designed to service can be met by a number of different alternatives rather than just one.

Very truly yours,

Richard P. Schulze, Jr.

Comment 1: "Earthquake Danger"

Response: See response to Comment No. 1 on page 147.

Comment 2: "The Stream"

Response: See response to Comment No. 2 on page 152.

Comment 3: "Alternatives"

Response: See response to Comment No. 3 on page 155.

Comment 4: "As to the need for the dam, there are now two reservoirs (one of them not quite finished) servicing this area. Their total capacity is one hundred million gallons. Even without the second reservoir, there is "a slight surplus of domestic supply over current demands" (p. 67). The Kohakohau has a planned capacity of one thousand seven hundred eighty seven million gallons. That is in addition to the existing reservoirs and is almost eighteen times as much water as they hold. Water needs simply do not expand eighteen fold overnight. They expand gradually. Any gradual expansion of existing supplies will fill the needs; the dam can be justified only as a huge, one-time project to take care of needs far into the future."

Response: See response to Comment No. 4 on page 157.

Comment 5: "Construction of a dam must entail risks to both life and property. No amount of assurances could really guarantee otherwise."

Response: See response to Comment No. 1 on page 147.

Comment 6: "The drying up of Kohakohau Stream, Waimea's last running stream, will turn what is now beautiful into an eyesore and will create serious disruption of our existing ecological balance."

Response: See response to Comment No. 2 on page 152.

Comment 7: "The dam is proposed to hold nearly two billion gallons of water, a huge amount of water for this area, and far more than could possibly be necessary for many years to come."

Response: See response to Comment No. 4 on page 157.

Comment 8: "The Department of Land and Natural Resources as well as the engineers who prepared the E.I.S. have throughout taken the position that only cost is to be considered. Any alternative which might require additional monies is summarily disregarded.

"This kind of thinking is ten to twenty years outdated. No longer should Americans (and particularly Americans living in this State) have to put up with severe and ugly dirsuptions to their ecology simply because alternatives might cost a little more. Where the natural beauty of a community is concerned (to say nothing of the safety of its inhabitants), cheapness cannot be the only consideration.

"It would be irresponsible to construct the dam as presently proposed and dry up Kohakohau Stream without extensive serious and good faith investigation of all possible alternatives. If alternatives can be found which mitigate or eliminate some of the risks and evils in the proposed project, a serious evaluation of their feasibility and cost should by made.

"Alternatives should not be disregarded by engineers simply because they cost more. The question whether the State can afford to spend a little more money to avoid risking the lives of its citizens and drying up its streams is a political decision and should be made by our representatives in the Legislature, not by water engineers. God did not build the Kohakohau Stream on a budget, and it should not be destroyed because of a budget.

"It is not necessary to find a single water source to replace to Kohakohau Dam; the needs of the various areas which it is designed to service can be met by a number of different alternatives rather than just one."

Response: See response to Comment No. 3 on page 155.

RECEIVED
DIV. OF WATER &
LAND DEVELOPMENT

Sept. 5, 1974

74

Division of Water and Land Development
Department of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

Dear Sirs:

As a lifelong resident of this State and a resident of Waimea, I am totally opposed to the construction of the Kohakohau Dam.

Like my neighbors I oppose the dam for the following reasons:

--the site of the dam is one of the worst earthquake zones in Hawaii and the engineering of the dam is unproven. A break in the dam would wipe out half the town. None of the engineers who designed the dam live under it.

--the consultants and department engineers have not adequately studied the alternatives to the dam. One test drilling does not prove that no subsurface water exists. Surface waters of Waipio and the Hamakua coast were dismissed without any study.

--it is not fair to dry up Waimea's last stream to provide water for developments along the Kona coast. Nowhere did the study of the water needs inquire into the possibility of water development being paid for by land developers on the deserts of the Kona coast. Alternatives that were rejected as too costly could be paid for by developers.

-- the dam would create a scar on our beautiful hillside and defalcate a large area of land permantly.

But my primary objection to the dam is that it would cut off the last remaining stream in Waimea. Engineers from the Mainland and Honolulu, can not appreciate what it means to have a stream flowing through a community.

The stream ties us all together. We live on it and watch its ebb and flow. We swim in it and marvel at its waterfalls.. We walk along its banks and pick the flowers that grow in its moistness. Our children can learn about the ecology of stream life -- fish, frogs toads, algae, ginger, job's tears, ferns, lilys, moss and all the animals that drink from the stream, cattle, pigs, horses, dogs, birds (some of them of endangered species) -- all would disappear if the stream were to dry up. ~~[illegible]~~ None of these forms of life were taken into consideration in the Environmental Impact Statement. Nor was the historic system of awais (ancient Hawaiian aquaducts) that fed the homesteads of Waimea. One of the last remaining water systems will die too with the stream. The dam would also wipe out plans for a streamside park along the Kawaihae Road. All of the trees in the park site would die without the stream and return to desert.

Please, do not approve the dam. Please study the alternatives more. The dam is a cheap means to ~~[illegible]~~ solve an engineering problem, but it would create far greater human and environmental problems here in Waimea than your engineers can possibly emagine.

Sincerely,

Toni Schulze

Toni

Toni Schulze
P.O. Box 795
Kamuela, Hi 96743

Comment 1: ". . . the site of the dam is one of the worst earthquake zones in Hawaii and the engineering of the dam is unproven. A break in the dam would wipe out half the town. None of the engineers who designed the dam live under it."

Response: See response to Comment No. 1 on page 147.

Comment 2: ". . . the consultants and department engineers have not adequately studied the alternatives to the dam. One test drilling does not prove that no subsurface water exists. Surface waters of Waipio and the Hamakua coast were dismissed without any study."

Response: See response to Comment No. 3 on page 155.

Comment 3: ". . . it is not fair to dry up Waimea's last stream to provide water for developments along the Kona coast. Nowhere did the study of the water needs inquire into the possibility of water development being paid for by land developers on the deserts of the Kona coast. Alternatives that were rejected as too costly could be paid for by developers."

Response: See response to Comment No. 4 on page 157

Comment 4: ". . . The dam would create a scar on our beautiful hillside and defoliate a large area of land permanently."

Response: Construction of the Kohakohau Dam Project would result in the conversion of approximately 100 to 150 acres of land in the Kohala Forest Reserve from the existing condition to a reservoir with attendant facilities, representing less than 1 percent of the total Forest Reserve acreage and approximately 1.5 percent of the total Kohala Watershed Reserve acreage (page 78 in the Draft EIS). "The project will have a small effect on visual conditions in South Kohala and the Waimea area . . . . the puus (hills) behind Waimea restrict view of the project area in nearly the entire vicinity of Waimea south to a distance of three of four miles, and revegetation of the disturbed area would not be discernable from that distance" (page 80 in the Draft EIS).

Comment 5: "But my primary objection to the dam is that it would cut off the last remaining stream in Waimea. Engineers from the Mainland and Honolulu, can not appreciate what it means to have a stream flowing through a community.

"The stream ties us all together. We live on it and watch its ebb and flow. We swim in it and marvel at its waterfalls. We walk along its banks and pick the flowers that grow in its moistness. Our children can learn about the ecology of stream life -- fish, frogs, toads, algae, ginger, job's tears, ferns, lilys, moss and all the animals that drink from the stream, cattle, pigs, horses, dogs, birds (some of them endangered species) -- None of these forms of life were taken into consideration in the Environmental Impact Statement. Nor was the historic system of awais (ancient Hawaiian aquaducts) that fed the homesteads of Waimea. One of the last remaining water systems will die too with the stream. The dam would also wipe out plans for a streamside park along the Kawaihae Road. All of the trees in the park site would die without the stream and return to desert."

Response: See response to Comment No. 2 on page 152.

RECEIVED
DIV. WATER &
LAND DEVELOPMENT

SEP 13 8 23 AM '74

10 September 1974

Mr. Bob Chuck
Department of Land and Natural Resources
Division of Water and Land Development
465 South King Street
Honolulu, Hawaii 96813

Dear Mr. Chuck:

I am writing to you in regards to your future plans in the next 2 years to dam up Kohakohau Stream in Waimea. I have objections to this planned development both as a home owner and part-time resident of Kamuela and as a lover of the entire Big Island in general.

I understand that the island of Hawaii needs water. This water supposedly is to tide the farmers over any drought and to foster more development on the Kona Coast.

I am well aware of the fact that Boise Cascade's Waikaloa development and Rockefeller's development have certainly done a large bit of water drillings and successful development of wells for the tourist development with their own financing. This, I am afraid, is a different case of sacrificing the needs and desires of a few for the so-called public good and rape of the Big Island. Hotel development is fine and there should no doubt be more occuring in the next 10 years. To make, however, an irreversible decision of damming up the stream over the short-term will no doubt cause ecological chaos in the future.

Having worked for Parker Ranch for 4 years, I am well aware of several water development plans and reservoirs of State decision the Government has had. The cheapest and the fastest way is not always the best way.

To site a similar case, the H-3 Freeway through Moanalua Valley will, over the short-term of the next 4-5 years, probably solve a few traffic problems of Windward residents. However, it is obvious to me and it should be to you, that sooner or later that too will become as clogged as the Pali, Hawaii Kai and Likelike Highways are now. Funds, of course, would be better spent for mass transit; as a matter of fact, the only transportation access to that valley should be bikeways and horse-back trail rides.

Going back to the subject of the stream, I would hate to see the stream dammed up for the perpetual loss in fun and joys it has brought my children and no doubt all the other children that live along that stream.

I feel and have always felt that some of the vistas along the stream (I have three specifically in mind) are probably as beautiful as any of the other mountain views one gets from passing through Kamuela both as a resident and tourist.

When you think of damming up the stream, I would like to ask you a couple of questions. First of all, how many streams or rivers are there on the Big Island and in the entire State of Hawaii for that matter? Secondly, do you feel that the houses built along that stream were built with the idea of looking out on the dead stream bed?

I think I am in the majority of home owners along the stream bed who feel that should this stream be dammed up, we should pay less property taxes to the Government. If your senseless raping of one of the most beautiful assets in Kamuela comes to pass, I for one will be discounting the value of my lot 10% and paying 10% less taxes to the County of Hawaii for the nearly 3 acres I own which borders the stream.

I am never one to campaign for a cause and probably will not inform too many people of my action but you can be sure several people's help will be enlisted in the fight to keep this stream.

I do suggest you send this plan back to the drawing board and over the next 10 years, build 2 more reservoirs. This, of course, will cost more money but future generations I am sure will look upon your wisdom and foresight as being instrumental in preserving the quality and beauty of ranch life.

Yes, Kamuela needs water. It needs water for the farmers and it may need some water for the tourists of Kona. However, it should not be at the expense of one of the Big Island's few streams.

Sincerely yours,

Antony P. Smart

Antony P. Smart

The Annex
Kawaihae Road
Kamuela, Hawaii 96743

Comment 1: "I am well aware of the fact that Boise Cascade's Waikaloa development and Rockefeller's development have certainly done a large bit of water drillings and successful development of wells for the tourist development with their own financing. This, I am afraid, is a different case of sacrificing the needs and desires of a few for the so-called public good and rape of the Big Island. Hotel development is fine and there should no doubt be more occurring in the next 10 years. To make, however, an irreversible decision of damming up the stream over the short-term will no doubt cause ecological chaos in the future.

"Having worked for Parker Ranch for 4 years, I am well aware of several water development plans and reservoirs of State decision the Government has had. The cheapest and the fastest way is not always the best way.

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Response: See response to Comment No. 4 on page 157

Comment 2: "Going back to the subject of the stream, I would hate to see the stream dammed up for the perpetual loss in fun and joys it has brought my children and no doubt all the other children that live along that stream.

"I feel and have always felt that some of the vistas along the stream (I have three specifically in mind) are probably as beautiful as any of the other mountain views one gets from passing through Kamuela both as a resident and tourist.

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"I am never one to campaign for a cause and probably will not inform too many people of my action but you can be sure several people's help will be enlisted in the fight to keep this stream."

Response: See response to Comment No. 2 on page 152.

Comment 3: "I do suggest you send this plan back to the drawing board and over the next 10 years, build 2 more reservoirs. This, of course, will cost more money but future generations I am sure will look upon your wisdom and foresight as being instrumental in preserving the quality and beauty of ranch life."

Response: See response to Comment Nos. 3 and 4 on pages 155 and 157. Construction of more incremental facilities such as reservoirs in the Waimea area would result,in the long-term, in greater environmental and economic impacts in comparison with the Kohakohau Dam Project. More land would be required to provide the same storage capacity, and construction costs would be significantly higher.

5 September 1974

RECEIVED
DIV. OF WATER &
LAND DEVELOPMENT

SEP 11 [illegible] '74

Dear Mr Chuck:

Contrary to popular belief, the cheapest way is not always the best way.

The proposed dam for the Kohakohau Stream in Waimea is an example of the above statement. I find it hard to believe that the State of Hawaii is willing to dam the only stream actually running through Waimea - one of few streams on the island of Hawaii itself.

I understand that Waikoloa has 3 pure water wells pumping 1½ mil. gallons per day - also I know that the Parker Ranch has built at least 1 reservoir for its purposes — both illustrating other ways of obtaining the water vital to Waimea.

I feel these other alternatives should be used. They also, like the stream, are there to be used – if we dam the stream THERE WILL BE NO MORE STREAM! We are not to the point, water-wise, where we are gasping our last. Let's save our natural beauty for as long as we can.

Remember – killing Kohakohau stream is irreversable – the plant and animal life contained within it will never come back. I have had enough of willful destruction of nature.

Haven't you?

Sincerely,

Diana Damon Swart

Comment 1: "I understand that Waikoloa has 3 pure water wells pumping 1½ mil. gallons per day--also I know that the Parker Ranch has built at least 1 reservoir for its purposes--both illustrating other ways of obtaining the water vital to Waimea.

"I feel these other alternatives should be used. They also, like the stream, are there to be used --"

Response: See response to Comment No. 3 on page 155.

Comment 2: "--if we dam the stream THERE WILL BE NO MORE STREAM! We are not to the point, water-wise, where we are gasping our last. Let's save our natural beauty for as long as we can.

"Remember -- killing Kohakohau Stream is irreversible -- the plant and animal life contained within it will never come back. I have had enough of willful destruction of nature."

Response: See response to Comment No. 2 on page 152.

Board of Land and Natural Resources
King St., Honolulu, Hawaii

WEST HAWAII CHAPTER
RR1 - 125 CAPTAIN COOK 96704
August 21, 1974

Gentlemen:

Re: Questions that need answers concerning
the KOHAKOHAU DAM Environmental Impact Statement

Your Draft EIS Statement neglects to discuss the following items. Kindly do so in a written reply to our organization so that full disclosure will occurr.

1) If you decide to vote in favor, would you not be in violation of the Hanapepe Decision (Kauai - Robinson & McBride)? If you feel that you would not be in violation, please explain why, in terms of the downstream vegetation that be adversely affected by the water cut-off; and the rights of the makai property owners who may someday wish to farm the areas and whose ancestors may have been using the area back in 1848, as referred to in the above decision.

Your board, as trustees of the public interest, must also answer if a "yes" on this would or would not be violating your trust, because the above decision is that the waters of Hawaii's streams belong to the public - how could you then justify an action that entails diverting much of that water into PRIVATE SPECULATION?

Mauna Loa Corporation - a Japan outfit - along with Olohana have disclose the letter of intent to the Land Use Commission that they are arranging to [un]derwrite a bond so as to assure water from the dam to their West Hawaii [(spe]culative) land developments. (Nobuo Kitsuda letter of Nov. 13, to L.U.C)

Could you confirm if the above is correct?

If so, is it intended that the encouragement of speculative land schemes - [su]ch as projected by the above firms - is part of the DLNR's goals and purposes [in] regard to this Dam project?

If not, how do you justify this dam?

[Wh]at available studies can you point to in order to show a need for the dam?

[Ca]ndidly relate this project to other proposed projects in the area.

[Do]es an overall relationship of this kind indicate large-scale development the[n]

this dam will contribute toward large-scale development - what environmental assessments have been done to determine air pollution limits and ground water supply? If no studies are available to accurately predict these fac[tors] should we not wait until such studies are done?

[Ple]ase discuss the above questions fully in your answers,

Most appreciatively,

Alan Tyler, Chairman, Friends of the Earth
West Hawaii Chapter

[c]c: OEQC

Comment 1: "If you decide to vote in favor, would you not be in violation of the Hanapepe Decision (Kauia - Robinson & McBride)? If you feel that you would not be in violation, please explain why, in terms of the downstream vegetation that (would) be adversely affected by the water cut-off; and the rights of the makai property owners who may someday wish to farm the areas and whose ancestors may have been using the area back in 1848, as referred to in the above decision.

"Your board, as trustees of the public interest, must also answer if a 'yes' on this would or would not be violating your trust, because the above decision is that the waters of Hawaii's streams belong to the public - how could you then justify an action that entials diverting much of that water into PRIVATE SPECULATION?"

Response: This Environmental Impact Statement discusses (page 15) the prevailing water rights agreements for the Kohakohau Stream waters. To what extent the Hanapepe Valley water rights case, and its far-reaching implications on surface water rights, bears on the Kohakohau Stream situation cannot be presumed at this time, since the Hanapepe case is still being adjudicated.

Comment 2: "Mauna Loa Corporation - a Japan outfit - along with Olohana have disclosed in the letter of intent to the Land Use Commission that they are arranging to underwrite a bond so as to assure water from the dam to their West Hawaii (speculative) land developments. (Nobuo Kitsuda letter of Nov. 13, to L.U.C.)

"Could you confirm if the above is correct?

"If so, is it intended that the encouragement of speculative land schemes such as projected by the above firms - is part of the DLNR's goals and purposes in regard to this Dam project?"

Response: The above correspondence mentions the possibility of private investments in water facilities in connection with land developments in the coastal Kawaihae area, but the discussion is of an exploratory, and not confirmative, nature. The State Department of Land and Natural Resources is not aware of any commitments by that private concern for financial contributions.

Comment 3: " . . . how do you justify this dam?

"What available studies can you point to in order to show a need for the dam?"

Response: See response to Comment No. 4 on page 157.

Comment 4: "Kindly relate this project to other proposed projects in the area."

Response: Pages 1 to 17 in the Draft EIS and, particularly, Figure 8, outline the relationship of the Kohakohau Dam Project to other water supply facilities in the Waimea area.

Comment 5: "If this dam will contribute toward large-scale development - what environmental assessments have been done to determine air pollution limits and ground water supply? If no studies are available to accurately predict these facts, should we not wait until such studies are done?"

Response: See response to Comment No. 4 on page 157.

Dr. Richard Marland, D. ector
Office of Environmental Quality Control
550 Halekalani Street
Honolulu, Hawaii

RR1 - 25
Captain Cook, Hawaii 96704
August 22, 1974

Subject: KOHAKOHAU DAM PROJECT EIS - A LESSON IN OVERLOAD

Dear Sir:

The following elements need to be dealt with, or expanded upon:

... WHO IS THE DAM REALLY FOR? Will the dam provide water primarily for local residents, for tourists, or for future in-migrants? ... Primarily for in-migrants who will settle in the vast subdivisions at Olohana, Waikoloa, etc

....LIFE STYLE DISRUPTION: Will the Community and the human values it represents, suffer? ... The resulting increase in development caused by the dam's water supply, will lead to increases in crime rates, divorce rates, congestion, air pollution and scenic despair

SAFETY:

...Even so-called "UNBREAKABLE DAMS" SHOULD SHOW THE PATH OF POSSIBLE INUNDAT (Downstream sliding of rock-fill dams is a notorious problem..see page V-10 of the Kohakohau Dam Engineering Feasibility report,197

...THE SPECULATION INDUCEMENT: Disclosure should be made that two of the land developers (Olohana and Mauna Loa) made arrangements to underwrite the floating of a state bond so as to insure water from the dam for their speculative developments.

... Projections: Projections need to take into account the present "two-digi inflation, with its accompanying curtailments in travel; also the cutbacks in government fundings and jobs; and finally, the expected in-migrant population's economic base

OVERLOAD.... Most importantly, the Kohakohau Dam is a prime way to guarantee overload for the West Hawaii Coast, because it will spur costly and questionable growth within a delicate sparse air and/water zone.

Alternative: Heavy consideration should be given to ascertaining the carrying capacity of Kohala and West Hawaii, PRIOR TO proceeding with th

STUDIES NEEDED:.... At least two studies should be done at this point: One on hydrology, so as to determine HOW MUCH, WHERE, AND WHAT TH RATE OF RECHARGE IS of West Hawaii's existing ground water.

Another needs doing on AIR. Meterological stations need to be set up to monitor directions and speeds of winds; temperatures; C_O; Sulphur oxides; and mercury, etc.

LONG RANGE GOALS: ... Once the data is available on our air and water conditi policies can be adopted as to future development based upon the realities of our potential carrying capacity.

Your consideration of and reactions to this will be very much appreciated, alan tyler

alan tyler / Friends of the Earth

Comment 1: "Who is the dam really for? Will the dam provide water primarily for local residents, for tourists, or for future in-migrants? . . . Primarily for in-migrants who will settle in the vast subdivisions at Olohana, Waikoloa, etc."

Response: The Kohakohau Dam Project will result in no growth which is incompatible with the County of Hawaii General Plan. The level of expected growth and development in South Kohala and Hamakua will not be altered by the project (page 77 in the Draft EIS). See response to Comment No. 4 on page 157.

Comment 2: "Will the Community and the human values it represents, suffer? . . . The resulting increase in development caused by the dam's water supply, will lead to increases in crime rates, divorce rates, congestion, air pollution and scenic despair."

Response: Issues of the quality of life in relation to objectives for the County of Hawaii are addressed in the General Plan. See response to Comment No. 4 on page 157.

Comment 3: "Even so-called 'UNBREAKABLE DAMS' SHOULD SHOW THE PATH OF POSSIBLE INUNDATION. (Downstream sliding of rock-fill dams is a notorious problem...see page V-10 of the Kohakohau Dam Engineering Feasibility report, 1970."

Response: Page V-10 in the 1970 Feasibility Report, in discussing rock-fill dam stability, states that sliding of dams is not a "notorious problem" but rather represents the controlling design consideration in most cases:

> Because of their large mass, rock-fill dams are generally stable against overturning. However, sliding of the dam along the foundation or along other weak planes is usually critical, particularly sliding of the downstream section of the dam. The downstream wedge of the dam was analyzed to determine the sliding factor (ratio of loads parallel and perpendicular to assumed plane of failure) and the factor of safety against sliding. The sliding factor represents the minimum angle of internal friction required to maintain stability. The factor of safety against sliding represents the ratio of the maximum shear resistance along the plane of sliding to the applied load along the plane.
>
> For the loading conditions outlined above, the sliding factor for both the main dam and saddle dam was determined to be 0.4. It is generally known

that sliding factors of loose rock on rock or loose rock on loose rock range from 0.6 to 1.0. The respective factors of safety for the main dam and the saddle dam against sliding were 2.0 and 1.8.

See response to Comment No. 1 on page 147.

Comment 4: "Disclosure should be made that two of the land developers (Olohana and Mauna Loa) made arrangements to underwrite the floating of a state bond so as to insure water from the dam for their speculative developments."

Response: See response to Comment No. 2 on page 294.

Comment 5: "Projections need to take into account the present 'two-digit' inflation, with its accompanying curtailments in travel; also the cutbacks in government fundings and jobs; and finally, the expected in-migrant population's economic base."

Response: Population characteristics and projections are under consideration by the County of Hawaii Planning Department. See response to Comment No. 4 on page 157.

Comment 6: "Most importantly, the Kohakohau Dam is a prime way to guarantee overload for the West Hawaii Coast, because is will spur costly and questionable growth within a delicate air and sparse water zone. Heavy consideration should be given to ascertaining the carrying capacity of Kohala and West Hawaii, PRIOR TO proceeding with the (project) . . . . At least two studies should be done at this point: One on hydrology, so as to determine HOW MUCH, WHERE, AND WHAT THE RATE OF RECHARGE IS of West Hawaii's existing ground water.

"Another needs doing on AIR. Meterological stations need to be set up to monitor directions and speeds of winds; temperatures; Co; Sulphur oxides; and mercury, etc. ...Once the data is available on our air and water conditions,policies can be adopted as to future development based upon the realities of our potential carrying capacity."

Response: Objectives, goals, and criteria for the planned future of the County of Hawaii are considered and promulgated by the appropriate planning processes and agencies. See response to Comment No. 4 on page 157.