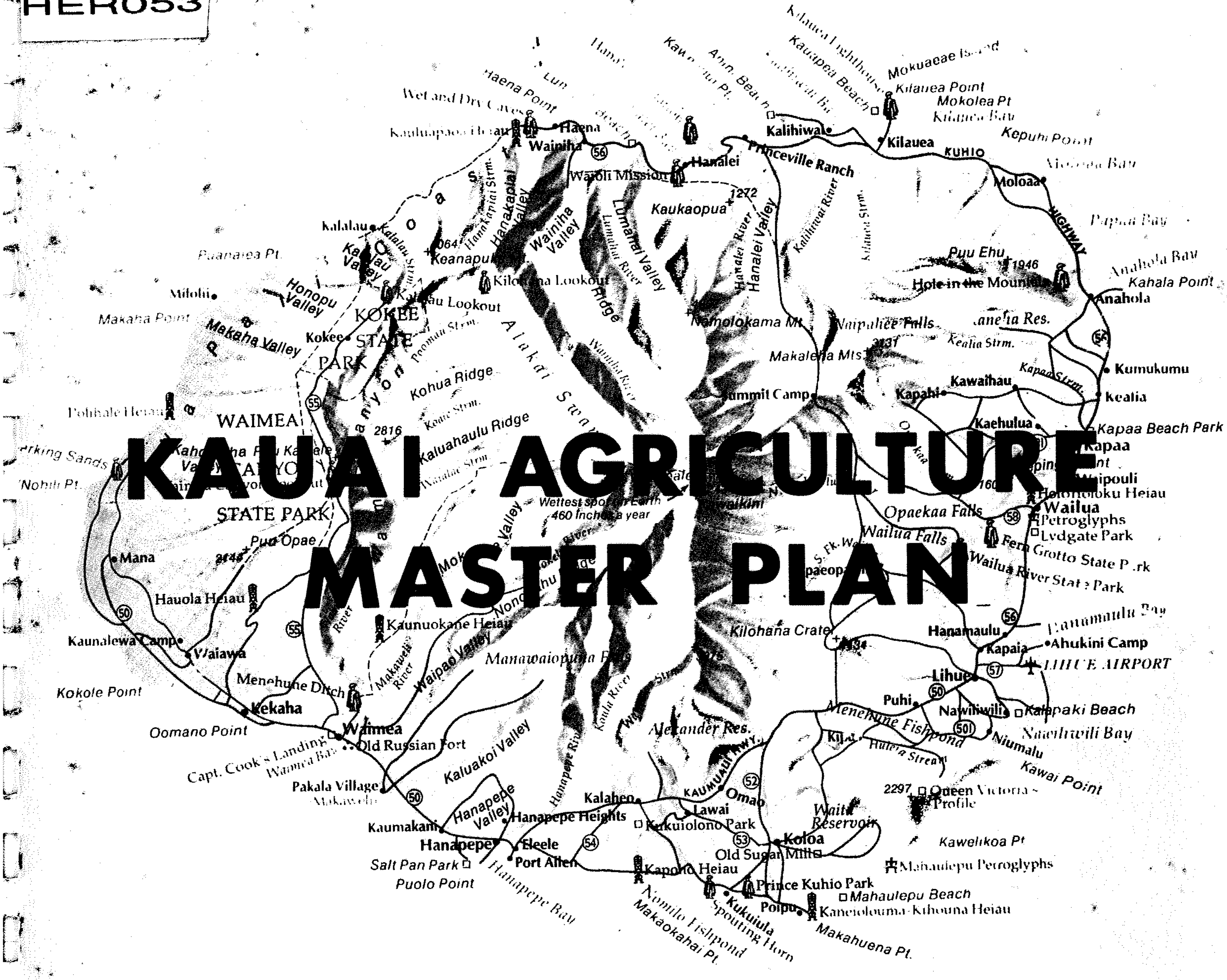
KAUAI AGRICULTURE MASTER PLAN



Prepared For:

COUNTY OF KAUAI

OFFICE OF ECONOMIC DEVELOPMENT
County of Kauai
4444 Rice St. - Room 230
Lihue, Hawaii 96766

Prepared By:

Okahara, Shigeoka & Associates Inc.
Planning and Engineering Consultants

OFFICE OF ECONOMIC DEVELOPMENT
County of Kauai
4444 Rice St. - Room 230
Lihue, Hawaii 96766

March 1983

KAUAI AGRICULTURE MASTER PLAN

(KAMP)

PREPARED BY:

OKAHARA, SHIGEOKA & ASSOCIATES, INC.

PREPARED FOR:

COUNTY OF KAUAI
ISLAND OF KAUAI

Okahara / Shigeoka & Associates
ENGINEERING AND PLANNING CONSULTANTS

March 24, 1983

Honorable Mayor Tony Kunimura
COUNTY OF KAUAI
4396 Rice Street
Lihue, Kauai, Hawaii 96766

Honorable Mayor Kunimura:

We are pleased to present the final Kauai Agricultural Master Plan (KAMP). In accordance with terms of our contract, we have evaluated the County's economic situation; the potential of existing crops and new crops in order to expand agriculture as a basic industry on Kauai; the constraints,problems and limitations of agriculture on Kauai; the agricultural resources available; and have provided a detailed implemention plan to raise the diversity and productivity of agriculture in the County.

We would like to acknowledge the excellent support and cooperation of Mr. Greg Laureta and Mr. Herman Texeira of the Office of Economic Development. We would also like to thank Mr. James Kurita for the direction and understanding throughout the study process. Further, we acknowledge the assistance given by members of the Agriculture Plan Advisory Committee (APAC), for steering the study in the right direction.

We look forward to the implementation of the recommended action plan. Thank you for this opportunity to service Kauai County in a worthwhile endeavor.

Sincerely,

Donald K. Okahara
DONALD K. OKAHARA
President

Dennis K. Shigeoka
DENNIS K. SHIGEOKA
Executive Vice President/Treasurer

ACKNOWLEDGEMENTS

Invaluable cooperation and assistance were received from members of APAC. The formulation and concepts were developed with discussions and input from three meetings. The County of Kauai are grateful to the following members without which the completion of KAMP would not be possible:

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ROY OYAMA	-	KAUAI FARM BUREAU
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JOSHUA HEW	-	COUNTY ADMINISTRATIVE ASSISTANT
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EXECUTIVE SUMMARY

Agriculture is a dynamic expanding industry which contributes greatly to Kauai's economy. Despite the economic problems of the sugar industry, Kauai has economically viable farming operations, supplemented by new and promising diversified agricultural enterprises.

OVERVIEW OF KAUAI'S ECONOMY

Over the last twenty years, the agriculture industry which is dominated by sugar, and the tourist industry changed dramatically. Agriculture industries dropped from 67% of total employment source to 15.6% and 75% of total income to 19% (1960-1980). Tourism increased from 16% to 45% for source of employment and 23% to 40% as sources of income.

Although Kauai is evolving from a primarily agricultural and rural society to an urban one brought about by its growing tourist industry, agriculture still provides the major source of "new" money and employs 18.6% of the total labor force on Kauai (1980). Its impact involves more than half of the supportive employment in manufacturing, transportation, and distribution.

Moreover, the weakening sugar industry indicates a need for new industries to assure stability and growth of economy. Recognizing the amenities of Kauai and its tourist industry potential, new industries which replace sugar must be complementary and in balance with tourism.

Tourism and the agricultural industries represent the two major sources of jobs and income for Kauai's residents. Although agriculture seems to be declining, four rationales listed below support its promotion.

1. Agriculture is a responsibility of the State as mandated by Act 100, "Hawaii State Plan," of the 1978 legislature. Kauai County has chosen to directly support and reflect the goals and objectives of the State Agriculture Plan, draft, October 1982.

2. Development of agriculture contributes to a strong and balanced economy through increasing export sales and import substitutions, and improving agriculture self-sufficiency goals.

3. Agriculture contributes to the quality of life which forms the socio-economic well-being and cultural backbone of Hawaii.

4. Kauai has excellent physical conditions and land areas suitable for agriculture development. Kauai County can lend its support and guidance to its development.

GOALS OF THE PLAN

As a working document, the Kauai Agriculture Master Plan (KAMP) defines and evaluates the various options available. KAMP provides a consistent framework for analysis of the agricultural and agriculture-related problems, benefits and specific characteristics. Past actions and its consequences are explained and identified. As a community, Kauai must be continually guided towards sound and beneficial decisions concerning agricultural development.

PURPOSE AND SCOPE

KAMP provides baseline information towards land use management systems and the recommended actions supplements land use policies found in the County General Plan and regional development plans (DP).

KAMP provides a comprehensive assessment of Kauai County's agricultural sector by thorough analysis of all physical, economic, and institutional factors. The supporting investigation includes resource assessements ranging from climatic conditions to land use. The strategy of KAMP is to evaluate the agriculture industry constraints and opportunities with existing agricultural products and crops and develop recommended action programs for implementation.

A new methodology for evaluating agriculture industry bottlenecks with the various products and crops is presented. This method evaluates each product and crop with the severity of industry constraints using numerical values. The resulting summation of numbers indicates a ranking of products and crops that have the least to the most constraints. Also, the incentives to develop the various products and crops are assigned a numerical value to show the most beneficial product or crop. By using the bottleneck index with the incentive index, a ratio much like a benefit-cost comparison can be made. This ratio is called the Incentive/Bottleneck Ratio (IBR).

KAMP will serve to strengthen the future of agriculture. This plan, as a prelude to actual implementation of recomended actions, stresses the importance of private agricultural firms and public agencies working cooperatively in developing and implementing positive, practical programs which will provide the general direction for long range agricultural growth on Kauai. It is realized that agricultural opportunities for Kauai County can best be achieved by active leadership that continually encourages, initiates, directs, and monitors a strategy.

DEVELOPMENT OF KAMP

Administration of the formulation and planning process for KAMP is by the County Economic Development office along with a twelve-member agriculture plan advisory committee (APAC) made up of representatives of the agricultural community. APAC provided the link with the agricultural community and provided credence to the approach and strategy incorporated within KAMP.

Documentary research and compiling of physical data were conducted to develop the agricultural resource baseline.

Existing planning documents such as the Kauai General Plan and Kauai Economic Development plan were reviewed and suggestions incorporated into KAMP's assessment of the agricultural profile.

Consideration of realistic agricultural goals resulted in a strategy for development of diversified agriculture.

ACCOMPLISHMENTS AND FINDINGS

One of the tasks of KAMP is to establish baseline data for agricultural resources on Kauai. Resources data included information regarding quantity and quality of land availability for agricultural uses, distribution and ownership, current utilization, land classification, zoning, general plan designation, and water resource system by planning districts. It also contains general climatic information such as solar radiation, evaporation, temperature and rainfall, on an island-wide basis. The resources assessments information takes the form of over sixty detailed maps.

Agriculture industry profile determines the extent ongoing agricultural activities interrelate with the local and export markets. The profile brings into sharper focus Kauai's share of State total consumption of agricultural products and crops. Relative importance of each agricultural product and crop is determined.

Various constraints faced by Kauai's agricultural industry including land, water, labor, capital, farm production, management, marketing, transportation, and government regulations were carefully assessed. These limitations are compared to potential incentives such as market potential, and income and employment generation that are expected to be realized from agricultural development. The results of this exercise provided an important methodology called the Incentive-Bottleneck Ratio, (IBR) upon which diversified agricultural development strategies were formulated.

KAMP further finds that Kauai has the most lands designated as prime agriculture of all the islands, adequate water resource systems, and favorable climatic conditions to develop and capture a significant share of agricultural production.

If Kauai is to proceed with the diversified agricultural development, the following steps should be undertaken:

- Conduct a detailed market potential and problem assessment for the selected types of products and crops.

- Provide ways in which Kauai products can best compete against its competitors. This may entail State and local government support in a wide range of areas including agricultural park development, land exchanges, tax and subsidy incentives and special agricultural districts.

- Provide on-going support in solving transportation problems (particulary air and surface freight facilities), marketing problems (market potential studies, promotions, quality control), as well as labor and management training programs.

Particular emphasis is made on the role of the County government which must take an expanded and aggressive stance. KAMP finds that the County of Kauai must:

- Provide positive and initiative leadership in agricultural development, particularly in diversified agriculture development.

- Actively seek outside (State and Federal) or local funding for necessary infrastructure development (for example, water).

- Expand the responsibilities and capability of coordinating planning changes, government regulations, tax and subsidy policy development, and private industry and government cooperatives.

- Develop farm management information and educational programs to assist day-to-day operation of individual farmers.

- Coordinate agricultural product development efforts with established industry programs and market development strategies of the State.

KAMP finds that the agriculture industry should:

- Take a leadership role in implementation of KAMP.

- Coordinate with County and other government agencies in their assistance efforts in:

  Formation of cooperatives and its operations

  Marketing efforts

  Training of labor

  Information dissemination

The following diagrams illustrate the plan's major items, their relationship with the County, and the recommended action plan.

PHASES — RESEARCH & ANALYSIS

KAUAI GENERAL PLAN

ECONOMIC DEVELOPMENT PLAN

SURVEY AGRICULTURE INDUSTRY OVERVIEW

AGRICULTURE PROFILE

AGRICULTURE RESOURCE ASSESMENT

AGRICULTURE CONSTRAINTS

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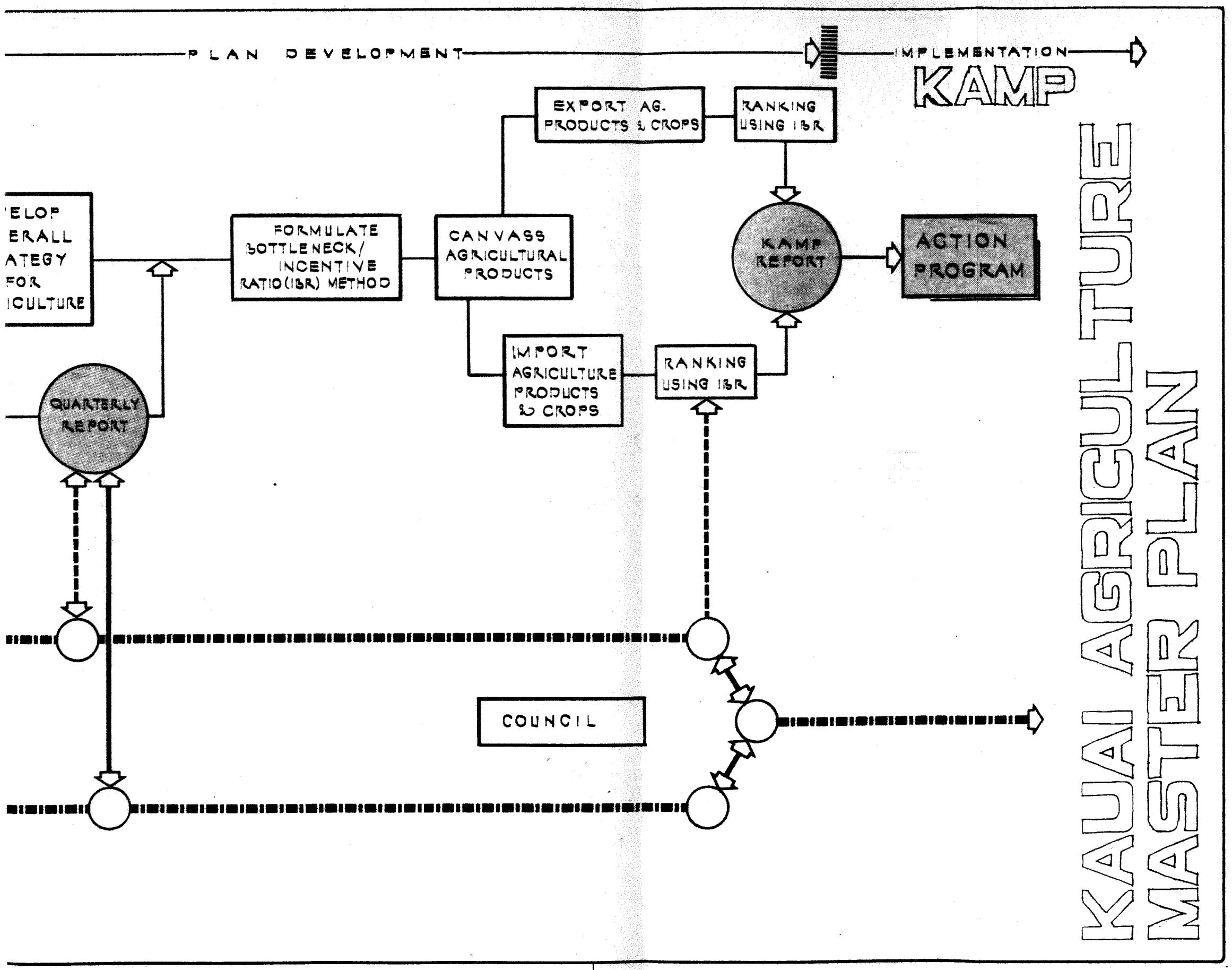
AG

COUNTY ROLE

COMMUNITY INPUT

FORMATION OF AGRICULTURE PLAN ADVISORY COMMITTEE (APAC)


PLAN DEVELOPMENT
IMPLEMENTATION
KAMP
KAUAI AGRICULTURE
MASTER PLAN
ELOP
ERALL
ATEGY
FOR
ICULTURE
FORMULATE BOTTLENECK/ INCENTIVE RATIO(IBR) METHOD
CANVASS AGRICULTURAL PRODUCTS
EXPORT AG. PRODUCTS & CROPS
RANKING USING IBR
KAMP REPORT
ACTION PROGRAM
IMPORT AGRICULTURE PRODUCTS & CROPS
RANKING USING IBR
QUARTERLY REPORT
COUNCIL

KAMP

FUTURE

- AGRICULTURAL PARK
- SPECIAL AG. DISTRICTS
- TAX & OTHER SUBSIDY
- FARMING DATA BASE

ECONOMIC & MARKETING STUDY

AGRICULTURE PRODUCT & CROP DEVELOPMENT PRIORITIES

- AGRICULTURAL PARK
- SPECIAL AG. DISTRICTS
- TAX & OTHER SUBSIDIES
- FARMING DATA BASE

ASSESS POTENTIAL PRODUCTS & CROPS

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Y FOR FUNDS

ULGATE ORDINANCES

LOP AG MANAGEMENT SYSTEM

ACTION PLAN

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- RESOURCE ASSESMENT
- IBR METHOD
- INDUSTRY BASELINE

KAMP → CHOOSE BEST AGRICULTURE STRATEGY → CONSULTANT RECOMENDATION → ANALYZE KNOWN PRODUCTS & CROPS → MARKET STUDIES → AGRICULTURE PRODUCT & CROP DEVELOPMENT PRIORITIES

ACHIEVE AGRICULTURE GOALS & OBJECTIVES

COUNTY ROLE

- FUN
- LOB
- PRO
- DEV

INTRODUCTION

INTRODUCTION

A. Purpose and Scope

The purpose of the Kauai Agricultural Master Plan (KAMP) is to provide objectives, policies, programs, and projects to guide the County of Kauai in implementing workable agricultural and agriculture-related objectives, policies, and priority directed action programs. KAMP is to be used by the private and governmental sectors of the community as well as interested out of island people who wish to perpetuate and firmly establish the agricultural and agriculture-related activities into the mainstream of Kauai's economic structure.

KAMP asseses the current status of agriculture in the County's economic situation; the potential of existing crops and new crops in order to expand agriculture as a basic industry on Kauai; the constraints, problems and limitations of agriculture in the County; and provides a detailed implementation plan to raise the diversity and productivity of agriculture in the County. General development strategy is to analyze the various agricultural products and crops with the myriad of constraints in production and distribution. This process provides an ordered determination of suitable candidate agricultural products and crops for Kauai. These candidate products and crops were ranked in order of those having the most viable and promising future. From this order, agricultural development recommendations are made meeting overall objectives for economic growth and well-being for the people of Kauai.

Utility of KAMP will be realized by using the plan modification recomendations which sets up review periods to update the resource data and provide additional evaluation and changes to the plan as required due to changing economic situations. This framework type analysis of the plan will assure that KAMP can continue to guide and assess the agricultural industry's viability for a long time to come.

B. Goals of KAMP

In developing the Kauai Agricultural Master Plan (KAMP) it is recognized that the plan reflects the statewide agricultural development goals and objectives which are mandated by Act 100, "Hawaii State Plan", of 1978. More specifically, KAMP's overall goals and objectives are consistent and conform with those set within the State Agriculture Plan, draft, October 1982. The overall objectives of the State Agriculture Plan are to "conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency, and assure the availability of agriculturally suitable lands."

The goals contained within KAMP are consistent with and reflect the overall state objectives, except in the following aspects:

- More specific to Kauai to ensure the maximum chance for implementation.

- Developed with reasonable assurance that there exist ways and means by which its goals and objectives can be realized.

- Assigns greater responsibility to Kauai County in seeking governmental guidance and support.

C. Relationship with Existing Plans and Programs

Agriculture on Kauai has been greatly influenced by many laws, ordinances, planning documents and mandates of the local as well as state legislative programs. At the forefront is Act 100 of the 1978 state legislature which is more commonly known as the "Hawaii State Plan." This law required the formulation by the State and development of goals, objectives, and policies for the specific policies, programs, and projects described in the Agriculture Plan, draft, October, 1982. KAMP is characteristically similar to the Agriculture Plan except that it is more specific to focus upon the agricultural and agriculture-related needs and

conditions on Kauai. Implementation of KAMP will support and reflect the goals and objectives for economic growth and well-being on Kauai.

As a working document, KAMP will provide the agricultural and agriculture-related resource assesment information to supplement land-use decision making processes. The resource assesment information and its continual updating will afford a baseline to measure and control the dynamic nature of land use management systems.

On Kauai, the County General Plan serves as the chief land use planning document to guide actions and activities pertaining to the land. Kauai County's General Plan, along with its regional development plans (DP), call for the establishment of agriculture preserves to maintain agricultural land uses (see North Shore Special Planning Area, Lihue DP, Waimea-Kekaha DP, and Hanapepe-Eleele Community DP) promotion and maintenance of agricultural economy, and prevention of urban encroachment into agricultural lands. The information contained within KAMP will supplement and provide policies, programs and direction concerning agriculture land use on Kauai. Specific programs within the various planning districts would be realized when the information in KAMP is utilized as policy.

D. Role of Agriculture in Kauai Economy

Kauai's economy has long been dominated by agriculture and tourism. These two industries or sectors are important in that they represent the major sources of jobs and income for the residents. Furthermore, it is these two major sectors around which other support sectors such as construction, wholesale, financial services, retail, and government services have been built. Without these sectors, it is doubtful that Kauai County could sustain its $400 million economy today.

In 1960, 66 percent of employment in Kauai was generated by agricultural and agriculture-related industries such as sugar and other food processing. On the other hand, tourism and its related activities (mainly retail and service industry) generated less than 27 percent of

employment. In terms of income earned, better than 75 percent was generated by agricultural and food processing industries and 23 percent came from tourism and its related industries. The source of employment and wage income generated by tourism, agricultural and agriculture-related industries are summarized again in Table I.

Recent Changes in Economic Structure

Table I illustrates that the agricultural sector had declined as a source of employment over the past 20 years. In 1972, agriculture and its related industries generated 32% of employment and by 1980, agriculture's share of employment fell to 15.6%. The wages earned from the agricultural sector declined even more dramatically falling from 75% in 1960, to 36% in 1972 and 19% in 1980. The total acreage for the harvested cane, however, has changed very little over the past 20 years, suggesting that the decline in employment is more due to the increase in labor productivity and the technological shift to labor intensive techniques of production.

A further change in the agricultural sector in Kauai is the total disappearance of pineapple production and processing since 1960. Although diversified agriculture has begun to grow, it has not grown rapidly enough to absorb the displaced sugar employment.

While the agricultural sector of the economy steadily declined in both sugar and pineapple industries as major employment and income sources, the visitor industry had some growth during the same period. The visitor industry and its related activities provided about 16 percent of the total employment in 1960. By 1972 it grew to 47 percent and in 1980 dropped back to 43 percent. In terms of income earned, the visitor industry 23 percent in 1960. This has grown to 46 percent in 1972 and in 1980 dropped back to 40 percent.

Table I: Employment & Wages of Workers, Kauai, 1960, 1972 & 1980[1/]

Industry	Average Employment (000)				Total Wages in Millions of Dollars		
	1960	1972	1980	1981	1960	1972	1980
Total	8.4	9.4	15.9	17.0	27.1	59.2	190.8
Agriculture, Forestry & Fishery	2.9	1.7	1.5	1.6	11.4	11.4	20.8
Non-Agriculture	5.5	7.7	14.4	15.4	15.7	47.8	17.0
Mining & Contract Construction	0.3	0.4	0.9	0.9	0.9	4.1	15.5
Manufacturing	2.5	1.4	1.1	1.3	9.0	10.7	16.6
Pineapple & Sugar Processing	1.2	1.1	0.9	0.9	8.4	9.1	14.4
Other Food & Non-Food Processing	1.3	0.3	0.2	0.4	0.6	1.6	2.2
Transportation	0.4	0.4	0.8	0.8	1.3	2.6	10.1
Communication & Utilities	0.1	0.5	0.8	0.8	0.7	5.0	16.1
Wholesale Trade	0.2	0.2	0.3	0.4	0.8	1.5	3.8
Retail Trade	0.9	1.9	3.4	3.5	2.8	8.4	25.7
Finance, Insurance, Real Estate	0.1	0.3	0.9	1.0	0.4	2.0	10.5
Services	0.8	2.5	3.4	3.9	1.6	13.4	32.9
Government	--	2.1	2.8	2.8	--	--	--

[1/] Those covered by the Hawaii Employment Security Law.

Source: Employment and Payrolls in Hawaii, 1962, 1972, 1981.

It should be noted that the visitor industry as a source of employment and income declined in 1980 relative to 1972. This is a direct result of rapid increase in other sectors in response to increase in population which jumped 32.4 percent from 1970 to 1980. For example, the government sector (County, State & Federal) provided 19 and 17 percent of total employment in 1972 and 1980, respectively.

Today, Kauai has a population of over 40,000 with 17,700 in the civilian labor force. The basic economy still is made up of two major sectors; (1) agriculture with its dominance in sugar and sugar processing; and (2) the visitor industry with its supporting industries such as retail and transportation. The past three years have been the years of economic decline for the general economy in the U.S. and Kauai County is feeling its effect. The visitor industry experienced a steady decline and there had been a significant impact on the rest of Kauai's economy. Sugar which enjoyed a brisk price increase in 1980 failed to maintain the high price and 1981 was a disappointment. Unemployment which remained at the relatively low level of 4.9 percent for the four years prior to 1981 jumped to 6.1 percent and was over 8 percent as of August 1982. Although complete data are not available for 1981, the trend in agricultural employment has been downward dropping from 11.9% in 1976 to 10.2% in 1980. Naturally, other sectors such as transportation, retail, and other service industries suffered the economic downswing.

Rationale for Support of Agriculture

There are four rationales for promoting agricultural activities in Kauai County. The overriding rationale is that agriculture is the responsibility of the State as mandated by Act 100, "Hawaii State Plan" of the 1978 legislature. KAMP directly supports and reflects the goals and objectives of the State Agriculture Plan (draft, October 1982). Kauai County must assume active leadership that is conducive to orderly agricultural development.

The second rationale is that development of agriculture contributes to a strong and balanced economy. From the State economy's point of view, having a strong agriculture based neighbor island economy strengthens the statewide economy mainly through export sales of agricultural products and import substitution thereby improving the balance of payment and improving agricultural self-sufficiency.

The third rationale is that agriculture contributes to the physical as well as socio-economic well being of the residents. The lush growth of agriculture products and crops on Kauai enhances the essence of tourism. It provides employment through direct and indirect multiplier effects and yet maintains that quality of life which forms the cultural backbone of Hawaii.

The fourth rationale is that through the identification of areas suitable for agricultural development, government can lend itself its support and guidance to primary private commercial ventures.

AGRICULTURE
INDUSTRY PROFILE

SECTION I

I. AGRICULTURE INDUSTRY PROFILE

A. Introduction

Table I.1 shows that Kauai's County's gross products, the counterpart of the gross national product, was estimated to be 242 million dollars in 1977 and 384 million dollars in 1981. During the same period agricultural income was estimated to 38.6 million dollars in 1977 and 57.6 million in 1981. The share of agricultural income in 1977 was 16.0 percent and appears steadily rising. In 1980, the share jumped to 28 percent largely due to an exceptionally good year for sugar price. Then, again due to poor sugar price, the share droped back to 15 percent range in 1981. It can therefore be said that the share of agricultural income ranges from 15 to 20 percent of the total, largely depending upon the fortune or misfortune of sugar prices.

Table I.2 indicates the total employment picture for Kauai for the period 1977 to 1981. Although the total employment has been rising at an annual rate of 2.9 percent the agricultural employment experienced steady decline at an average annual rate of 3.5 percent. The share of agricultural employment of the total employment also steadily declined, from nearly 15 percent in 1977 dropping to 8.9 percent in 1981 Agriculture as a source of employment has been losing ground at an annual average rate of 11.4 percent. The loss is alarming.

Table I.3 summarizes major agricultural products of Kauai and compares them to the State's total for 1981. In terms of sales, sugar dominates the picture with 46.6 million dollars. The next best product is cattle with 2.3 million dollars. The sale of fruits ranks a close third with 2.1 million dollars. In fact, sugar constitutes 80.9 percent of total agricultural product sales and 15.7 percent is accounted for by diversified agriculture. The cattle sale accounts for only 8 percent of the total State sales. Taro accounts for 72 percent of total State production and grain accounts 26 percent.

Table I.1: Kauai County Gross Product & Income From Agricultural Sector, 1977-1981

	77	78	79	80	81	Average Annual Growth Rate
Gross Product ($000)	241,920	264,440	295,730	338,850	383,850	12.2%
Ag Income	38,661	47,032	56,195	94,028	57,573	17.4%
% of Ag Income	16.0	17.8	19.0	27.7	15.0	4.5%

Source: Statistics of Hawaiian Agriculture 1981.

Table I.2: Agricultural and Total Employment Kauai 1977-1981

	77	78	79	80	81	AAGR
Total Civilian Employment	17,350	17,100	17,450	19,050	19,400	2.9%
Ag Employment	1990	1920	1960	1810	1725	-3.5%
% of Ag Emp.	14.7	11.2	10.7	9.5	8.9	-11.4

Source: Statistics of Hawaiian Agriculture 1981.

Table I.3: Major Agricultural Products of Kauai, its Relative Ranking, and Share of State Total in Value of Sales, 1981 (1000 of dollars)

	Value of Sales	% of State Total	Relative Share	Ranking
Sugar	46,600	22.0	80.9	1
Cattle	2,295	8.0	4.1	2
Fruits	2,095	14.0	3.6	3
Forage & grain	1,302	26.0	2.3	4
Taro	934	72.0	1.6	5
Hogs	746	9.0	1.3	6
Flower & nursery	740	3.0	1.3	7
Vegetable & melons	595	3.0	1.0	8
Others	2,266	-	3.9	-
TOTAL	57,573		100.0	

Source: Statistics of Hawaiian Agriculture 1981

Sugar is the main crop of Kauai, and about 90 percent of agricultural workers are employed in the sugar industry. Approximately 46,000 acres of sugar are planted in sugar and about 190 thousand tons are harvested each year. The value of sales during the past five years has varied from a low of $32.2 million in 1977 to a high of $83.6 million in 1980 when prices were unusually high due to a worldwide shortage. In 1981, although production was up 7,500 tons over 1980, value of sales declined to $46.6 million due to increased worldwide production which led to a drastic drop in sugar prices. (Table I.4)

Kauai's five plantations -- Lihue, Kekaha, Olokele, Gay & Robinson, and McBryde -- all have improved its yields by better cultural practices, drip irrigation, better variety, and conversion to plant field from ratoon field, etc. It is expected that Kauai's sugar production will continue to be highly productive in terms of yield per acre. The major woe to the sugar industry, however, is a highly volatile sugar price. It was already pointed out that in 1981, in spite of increase in production, the total value of sales fell. Increasing foreign competition in sugar and sugar substitutes are largely blamed for the low sugar price. The future of the sugar industry is an increasing uncertainty. The large portion of the island economy depends on sugar production and processing and the fact that the large amount of agricultural lands are being occupied by sugar production. Serious efforts must be made to assess the feasibility of gradually replacing the sugar industry with more viable crops.

Diversified Agriculture

From 1977 to 1981 diversified agriculture on Kauai has grown from a value of sales in of $6,461,000 to $10,973,000 in 1981 with an average annual growth rate of 15.1 percent. Diversified agriculture increase from 16.7 percent of Kauai's agricultural income in 1977 to 19.1 percent in 1981 with an average annual growth rate of 8.9 percent. Table I.4 shows these relationships.

Table I.4: Sugar on Kauai: Acreage, Volume of Production, Value of Sales

	77	78	79	80	81	AAGR
Acreage 1000 acres	45.9	46.1	45.8	46.0	45.8	-.05%
Volume of Production 1000 tons	187.7	191.5	199.2	187.3	194.9	1.0
Value of Sales $1000	32,200	39,600	47,700	83,600	46,600	18.6%
Share of Total Ag	83.4%	84.2%	84.9%	88.9%	80.9%	-0.6%

Source: Statistics of Hawaiian Agriculture 1981.

Table I.5 and I.6 show categories of diversified agriculture on Kauai ranked by sales value in 1981 with a comparison of State rankings for these products the same year. The State produces several other categories of diversified agricultural products which are not discussed here for various reasons: 1) Kauai is not involved in their production (e.g., pineapples, coffee), 2) there is no separate data available for Kauai (milk, eggs, chickens, macadamia nuts), or 3) the value of sales for these products is too small a percentage of the total agricultural income (livestock such as sheep and turkeys, honey and bee products).

There are a number of reasons for emphasizing diversified agricultural development in Kauai. One of the most important considerations is that the sugar industry may eventually no longer be the stable base upon which the agricultural industry can be built. Potential substitutes for sugar are needed. Another rationale is that Hawaii provides an ample market in which locally produced diversified agricultural products can be supplied. In other words, there is ample room for import substitution to take place. In some instances, export out of the State of Hawaii is also a possibility. To what extent the import substitution and export market development would occur depends on the comparative advantages of each diversified agricultural product.

A detailed production cost, transportation, and marketing and channels distribution study should be undertaken for each candidate product to determine the extent of comparative advantage enjoyed by Hawaii products. Undertaking the proposed task is neither easy nor cheap; it is <u>imperative</u> that this task be given highest priority. In the present study, only preliminary candidate products will be chosen as target products to be developed by Kauai. This will be done after a careful examination of <u>all the factors</u> involved in such development.

Table I. 5: Diversified Ag on Kauai: Value of Sales

	77	78	79	80	81	AARG
Values of Sales $1000	6461	7432	8495	10,428	10,973	15.1%
% of Total Ag	16.7%	15.8%	15.1%	11.1%	19.1%	8.9%

Source: Statistics of Hawaiian Agriculture 1981.

Table I.6 : Relative Importance of Diversified Ag in Kauai, 1981

Div. Ag	Value of Sales ($000)	Relative Share %	Kauai Rank	State Rank
Cattle	2,295	20.9	1	3
Fruits	2,095	19.1	2	6
Forage & grain	1,302	1.9	3	10
Taro	934	8.5	4	12
Hogs	746	6.8	5	8
Flowers & nurs.	740	6.7	6	2
Vegetables & mel.	595	5.4	7	5
Other	2,266	20.7	-	-
TOTAL	10,973	100.0		

Source: Statistics of Hawaiian Agriculture 1981.

B. County Objectives for Agriculture

The overall County objectives are to protect and conserve agriculturally suitable land; make such lands available at reasonable costs to the users; promote diversified agriculture, increase its share of total agriculture to 50 percent by 1990; promote both export crops and import substitutable products; and generate maximum government/private cooperation in all phases of agricultural development. These general objectives can be reiterated as follows:

1. Provide maximum government support in development of agricultural industry.

   Specific Objectives:

   - Encourage the development of agricultural cooperatives and associations and promote effective marketing strategies for agricultural commodities.

   - Determine the extent and validity of agricultural industry analyses that are completed for most of the major commodities which Kauai produces, and use the analyses as guides for public resource allocations.

   - Establish a market information system which includes market supply and demand forecasting -- new avenues by which products can reach the market rapidly.

   - Improve support capability assisting pest and disease control.

2. Protect and conserve agricultural lands. Make agricultural lands available for the best use at affordable cost.

   Specific Objectives:

   - Develop and update an inventory of existing agricultural land use and related physical and environmental parameters, with an emphasis on public lands. (This is being done under KAMP.)

   - Insure that public lands leased for agriculture are fully utilized in the best interest of a diversified agricultural sector.

   - Consider development of agricultural parks as a means of providing accessible lands for agricultural diversification.

   - Through both County and State legislative action, protect and promote productive agricultural use of the most suitable agricultural lands.

3. Develop water resources.

   Specific Objectives:

   - Maintain and improve existing public and private water collection and delivery systems for agriculture.

   - Develop new water sources and expand existing county water systems to facilitate growth of the diversified agriculture sector.

- Support development at the state level of comprehensive ground and surface water management regulations that better define and integrate respective state and county responsibilities and provide for efficient development and mangement of agricultural water supply.

4. Assist the expansion of the capital base for agricultural development.

5. Develop an adequate supply of trained labor for agricultural needs.

6. Provide adequate transportation services and facilities at economically feasible rates for agricultural needs.

7. Improve coordination and communication between the agricultural industries, transportation carriers, and affected government agencies.

C. Major Agricultural Products

The following is a brief description of major diversified agricultural products found on Kauai.

Cattle

Cattle ranks first in value of sales for Kauai's diversified agricultural products. From 1977 to 1981 beef sales increased 25 percent from $1.8 million to $2.3 million (Table I.8) although actual numbers of cattle sold declined 17 percent for the same period. The increased sales value is due to the price increase of 55 percent during the period. In 1971 Hawaii produced 46 percent of the beef consumed in the State. By 1981 Hawaii's market share had declined to 30 percent while the average annual growth rate of beef consumption within the State was 2.5 percent over the 10 year period. Mainland and foreign sources have filled in the slack with

Table I.7: Prices of Selective Ag Commodities, Kauai 1977-1981

	77	78	79	80	81	
Sugar cane $/ton	17.2	20.7	24.0	44.6	23.6	
Cattle $/100/wt	34.8	39.6	48.3	54.1	55.1	
Papaya ¢/lb	13.2	15.4	27.8	20.8	21.2	
Macad. Nuts	40.8	53.8	62.9	86.0	82.5	
Taro	12.2	12.5	14.8	19.0	21.0	
Hogs	71.5	74.0	77.5	78.0	79.5	
Green Pepper	34.7	43.8	41.4	42.3	56.4	
Milk	15.9	15.8	16.5	17.8	19.7	

Source: Statistics of Hawaiian Agriculture 1981

an increase in market share over the decade from 54 percent in 1971 to 70 percent in 1981. Kauai provides less than 10 percent of the State's beef production or less than 3 percent of Hawaii's total consumption.

A closer look at the cattle production reveals that statewide production of feed lot slaughter has been erratic and declining over the past five years. Pounds sold dropped from 36 million pounds in 1977 to 29 million in 1981. Kauai followed the state pattern even more dramatically and the amount sold in 1981 (1.0 million lbs.) is about one half of 1977 quantity (2.2 million lbs.). Although beef prices have been growing steadily, neither the State nor Kauai could take advantage of the situation.

The non-feedlot cattle (about 45 percent of total statewide) remained fairly stable over the past five years. Over that period, the State produced 23 million pounds each year and Kauai 3.1 million pounds.

Fruits

Fruits other than pineapple provide Kauai's second largest diversified crop. (Table I.9) Acreage in fruit has doubled over the past five years from 400 to 800 acres. Value of sales has similarly doubled from $1 million to $2 million.

Papaya, guava, and bananas constitute the bulk of fruit production. Kauai showed a modest growth in the percentage of State papaya crop produced; from 9.8 percent in 1977 to 11.3 percent in 1981. Papaya acreage (harvested) has increased 58 percent during this period, from 155 acres to 245 acres. Guava became a million dollar crop for the first time in 1980, with Kauai producing approximately 30 percent of the State's guava crop. In 1981, C. Brewer & Co., Ltd., produced 2 million pounds of guava at Kilauea with projections for 1982 of four million pounds. While papaya and guava are raised in large part for export and processing purposes, bananas are raised primarily for local consumption. Hawaii raises 43 percent of the State's consumption and bananas, and Kauai contributes only 7 percent of the State's production.

Table I.8 Cattle on Kauai: Volume of Marketings and Value of Sales, 1977-1981 (Dressed Weight)

	77	78	79	80	81	AARG
Volume of Mktgs 1000 pounds	2925	3170	2575	3165	2342	3.1%
Value of Sales $1000	1848	2252	2137	3118	2295	9.0%
Share of Total Div. Ag.	28.6	30.3	25.2	29.9	20.9	-5.8%

Source: Statistics of Hawaiian Agriculture 1981.

Table I.8a

State/Kauai Comparison

Cattle and Calves January 1982 Inventory

Year	All Cattle & Calves	COWS & HEIFERS			HEIFERS 500 LBS. +				Steers 500 lbs & over	Bulls 500 lbs & over	Steers Heifers & Bulls under 500
		Total	Beef Cows	Milk Cows	Total	Beef Cows	Milk Cows	Other (Replacements)			
					STATE						
1982	228	93	80	13	46	21	8	17	27	8	54
					KAUAI						
1982	17	7.2	6.8	.4	2.6	1.2	.2	1.2	1.7	.5	4.8
% of State	7.4	7.7	8.5	3.07	5.6	5.7	2.5	7.0	6.2	6.2	8.8

Table I.8.b

Cattle and Calves: Number Sold, Pounds, Price and Value Production

State/Kauai Comparison 1981

Year	Number Sold (1,000 head)	Pounds Sold (live weight)	Farm Price (live weight)	Value of Sales
		STATE		
1981	56	52,275	54.40	28,438
		KAUAI		
1981	4.6	4.266	53.8	2.293
Percent of State	8.2	8.1		8.0

Table I.8.c

Cattle: Number of Feedlot Slaughter Cattle Sold, Pound, Price and Value

State/Kauai 1981

Year	Number Sold (1,000 head)	Pounds Sold (live wt.) (1,000 lbs.)	Farm Price (live wt.) (hundred wt.)	Value of Sales (1,000 dollars)
		STATE		
1981	29.2	29,449	60.10	17,711
		KAUAI		
1981	1.0	1,075	59.10	635
Percent of State	(3.4)	(3.6)		(3.5)

Table I.8.d

Cattle: Number of Range and Other Slaughter Cattle Sold

Pounds, Price and Value. State/Kauai 1981

Year	Number Sold (1,000 head)	Pounds Sold Live Weight (1,000 lbs)	Farm Price Live Weight (hundred wt)	Value of Sales (1,000 $)
		STATE		
1981	26.8	22,826	47.00	10,727
		KAUAI		
1981	3.6	3,191	52.00	1,660
Percent of State	(13.4)	(13.9)		(15.4)

A particularly interesting development has occurred in papaya marketing efforts. Record production for 1981 of 7 million pounds has totally been marketed without a bit of difficulty. The Moloaa Farmers Cooperative, joined by additional new farmers in Koolau and Kilauea, all contributed in the production efforts. In view of recent increase in acreage to 600 planted acres, the production should reach the 10-12 million pound level. In conjunction, Best Fruit Inc. has already invested $50,000 in expanding its handling capacity such as packing line and hot water treatment.

There also has been a breakthrough in marketing areas in guava. Meadow Gold, (a major marketer of guava in Hawaii) and C. Brewer and Co. have successfully expanded the guava market to southern California, and now plans to further expand to several other states such as Idaho, Utah and Colorado. Meanwhile, Kilauea Agronomics and Hawaiian Fruit Preserving Co. are working on the expansion of a processing plant, especially the freezer capacity capabilities.

Forage and Grains

Forage and grain crops, Kauai's third ranked diversified crops, have increased 173 percent in the 1977 to 1981 period, from $447,000 to $1,302,000 (see Table I.10). Forage and grain crops consist of seed corn and feed crops, including grains, grass and legume crops, and pineapple green chop. Seed corn is produced mainly for outshipment while feed crops are used mainly by farmers within the State. Kauai's share of Hawaii's production of feed crops has increased from 16 percent in 1977 to 26 percent in 1981.

Taro

Taro ranks fourth among Kauai's diversified crops with a sales value of $934,000 in 1981 (Table I.11). Kauai is Hawaii's major producer of taro. The level of production has been decreasing statewide and this trend is reflected in the Kauai production. Since 1977, the Kauai acreage remained fairly stable at 200 - 210 acres. Production reached 4.9 million

Table I.9: Fruits Other than Pineapple on Kauai:

Acreage, Volume of Marketings, Value of Sales

	77	78	79	80	81	AARG
Acreage	400	500	600	700	800	19%
Volume of Mktgs 1000 pounds	7110	6130	6910	8080	10,860	12.6%
Value of Sales $1000	1046	872	1617	1536	2095	25.0%
Share of Total Div. Ag.	16.1	11.7	19.0	14.7	19.1	10.6

Source: Statistics of Hawaiian Agriculture 1981.

Table I.10: Forage & Grain on Kauai: Values of Sales

Kauai, 1977-1981

	77	78	79	80	81	AARG
Values of Sales $1000	477	655	935	1085	1302	29%
% of Total Div. Ag	7.3	8.8	11.0	10.4	11.9	10.5

Source: Statistics of Hawaiian Agriculture 1981.

Table I.11: Taro on Kauai Acreage, Volume of Marketings and Value of Sales

	77	78	79	80	81	AARG
Acreage	200	210	205	210	210	1.3%
Volume of Mktgs 1000 pounds	4820	4920	4330	4550	4450	-1.8%
Value of Sales $1000	588	615	641	865	934	12.9%
% of Total Div. Ag	9.1	8.3	7.5	8.3	8.5	1.3

Source: Statistics of Hawaiian Agriculture 1981.

pounds in 1978 but it decreased to 4.4 million in 1981. The average annual production over the five year registered -1.8 percent (decline).

The price of taro, however, steadily increased from 12.7 cents/lb. in 1977 to 21.4 cents/lb. in 1981. This increase, which reflects relatively stronger demand than supply, more than offsets the decrease in production. The result has been that value of sales increased at an average annual rate of 13 percent.

The market potential of taro remains strong, especially in the fresh market during the summer months. The inshipment of fresh taro increased from a mere 45,000 pounds in 1977 to an incredible 905,000 pounds in 1981. It appears that if a suitable market development program is instituted, the future of taro market can further increase substantially. Recent release of Federal lands (U.S. Wildlife Reserve) and its conversion to an agricultural park in Hanalei Valley should boost Kauai's ability to further increase taro production.

Hog

Hog production is Kauai's fifth largest agricultural commodity with a value of sales of $746,000 in 1981. Production increased 86 percent from 1977 to 1981 while during this period value of sales rose 96 percent due to modest increases in price (Table I.12). However from 1971 to 1981, Hawaii's total pork production rose only slightly, from 8.4 million to 8.7 million pounds. Kauai's share of State production has therefore risen from 4.5 percent in 1977 to 8 percent in 1981. Total pork consumption in Hawaii has shown an average annual growth rate of 2.5 percent since 1971, and mainland and foreign produced supplies have risen during this period from 69 percent of consumption in 1971 to 75 percent in 1981.

Table I.12: Hogs on Kauai: Volume of Marketings and Value of Sales

	77	78	79	80	81	AARG
Volume of Mktgs. 1000 pounds	400	492	378	648	704	20%
Value of Sales	380	486	391	674	746	22.9%
% of Total Div. Ag	5.9	6.5	4.6	6.5	6.8	6.7

Source: Statistics of Hawaiian Agriculture 1981.

Number of hog operations in 1981 increased to 115 from 110 in the two previous years. However, these five additional operations are small scale with less than 10 hogs per operation. It is encouraging that Kauai's market share in the hog market nearly doubled, as noted above. In view of the ever expanding market, a comprehensive assessment of the production and marketing aspects of the operation is warranted.

Flowers and Nursery Products

Flowers and nursery products are sixth on the list of Kauai's diversified crops with a value of sales of $740,000 in 1981. Table I.13, the sales value of flowers and nursery products increased almost 335 percent since 1977 due to an average annual growth rate of 85 percent. Kauai's crop consists mainly of nursery products such as unspecified cut and lei flowers and potted plants, with a small contribution from anthurium cut flowers. Although the industry expanded nearly five-fold over the 5 years, the Kauai flowers and nursery products represents 2.5 percent of the State's total in terms of wholesale value. There were 25 nursery farms throughout the County with 38,000 square feet of greenhouses in 1981. These 25 farms encompassed a total of 27 acres of which 19 acres are in the open area.

The State of Hawaii exported $15 million worth of flowers and nursery products in 1981. This represents 110 percent increase in marketing value over 1977 figures. Market demand for anthuriums somewhat declined in 1981 from its previous peak. However, potted orchid plants, ornamentals, and trees have registered impressive growth in export market over the past ten years. A careful assessment of Kauai's potential for flowers and nursery production is warranted.

Table I.13: Flowers & Nursery Products on Kauai:

Value of Sales, 1977-1981

	77	78	79	80	81	AARG
Acreage	-	19	26	22	27	5.0
Values of Sales $1000	170	279	153	615	740	85.3%
% of Total Div. Ag	2.6	3.8	1.8	5.9	6.7	58.7

Source: Statistics of Hawaiian Agriculture 1981.

Vegetables and Melons

Kauai's seventh largest group of diversified crops is vegetables and melons, with a sales value of $595,000 in 1981. Since 1974, Hawaii has produced about 40 percent of the fresh vegetables consumed in the State, but Kauai's share of the State's production had been only 2 to 3 percent (Table I.14). Although separate data is not available for most of Kauai's vegetable crops, a few vegetables can be looked at in detail. Data is available only for cucumbers, eggplant, green peppers, tomatoes, and watermelon. Kauai's share of the total market in 1981 ranged from 0.8 percent for tomatoes to 30 percent for eggplant (Table I.15).

It is interesting to note that some vegetables such as green pepper and eggplant enjoy much higher productivity (yield/acre) in Kauai than in any other islands. However they represent only 35 and 30 percent, respectively, of state total supply, and 16 and 31 percent, respectively of state total consumption. On the other hand, products such as cucumber and tomatoes, which have lowest yield/per acre, continue to be produced, using over 45 acres of land. This observation, though tentative, leads to the conclusion that information of comparative production advantages that Kauai farmers have over their counterparts in other islands should be better disseminated.

Table I.14: Vegetables & Melons on Kauai: Acreage, Volume of Marketings and Value of Sales

	77	78	79	80	81	AARG
Acreage	100	100	100	100	100	0
Volume of Mktgs. 1000 pounds	1900	2330	2090	1460	1590	-2.2%
Value of Sales $1000	553	659	722	537	595	3.5%
% of Total Div. Ag.	8.6	8.9	8.5	5.1	5.4	-13.8

Source: Statistics of Hawaiian Agriculture 1981.

Table I.15: Market Supply of Selected Vegetables, 1981

(1000 lbs.)

	Kauai	State	Inship	Total	State% consump.	Kauai % of consumption
Cucumbers	400	5000	1544	6544	76%	6%
Eggplant	490	1580	81	1661	95%	30%
Green peppers	265	760	1683	2443	31%	11%
Tomatoes	130	8300	6744	15,044	55%	0.8%
Watermelon	80	1610	5393	7003	23%	1%

Source: Statistics of Hawaiian Agriculture 1981

D. Agencies Affecting Agriculture Industry

It is evident that the agricultural sector of Kauai's economy consists of many diverse activities with considerable differences in their respective size, productivity and earning power. Agricultural commodity industries vary widely in their respective levels of development, industry organization and amount of government involvement.

Because of a commonality of problems related to land, water, capital, labor, and transportation, one would assume that government support would naturally tend to focus on these broad resource factors. However, this has not been the case. Instead, the bulk of existing government programs in support of agriculture has tended to focus more specifically on problems such as cultural practices, pest control, handling and processing, and marketing.

Functionally, the State Department of Agriculture has the assigned leadership in the traditional program support areas, however, with new program development ventures by the State administration, its role as a coordinating agency has become more pronounced. The Department has become active in agricultural planning and resource assessement. To fully develop this function, it has interacted with Federal and County agencies which have direct influence upon agricultural development. Therefore, with this expanding role the Department has ultimately affected agricultural development in Kauai County.

The Governor's Agriculture Coordinating Committee (GACC) composed of government representatives and industry leaders, has played an important role in guiding government support programs to eliminate industry "priority bottlenecks". All government agencies, Federal and State with any major influence upon agricultural development, are members of the GACC which is also represented by agricultural industries. For example, the chief executive of the State Department of Land and Natural Resources (DLNR), Department of Agriculture (DOA), Department of Transportation (DOT), and Department of Planning and Economic Development (DPED) are members of the GACC. Key officials of the Federal agricultural agencies are also members.

The GACC has also provided an appropriate discussion forum for agricultural research programs of the University of Hawaii. This has, for example, resulted in major redirection of research and development for the taro industry, which for all intents and purposes is dominated by Kauai farmers.

Thus, functionally the GACC with tremendous influence on all government agricultural development programs in the State has affected agricultural programs on Kauai. It has in fact, acted as a clearinghouse for all statewide agricultural development programs.

In the area of agricultural finance, government agencies such as the Farmers Home Administration (FmHA) and State Department of Agriculture have influenced Kauai's agricultural development in the past, and are expected to continue to do so in the future. Quasi-public bodies such as the Federal Land Bank, Production Capital Association, and Commodities Credit Association are active in Kauai. Additionally, invaluable financial assistance and guidance have been provided by the major private banking institutions such as Bank of Hawaii and First Hawaiian Bank.

During the past few years, resource assesment and evaluation have become an important activity which has influenced agriculture in Kauai. The ALISH described in the agriculture resource assessment section was a result of competitive action by the US Department of Agriculture, Soil Conservation Service and the State Department of Agriculture. The procedure has influenced land use planning decisions. The DLNR through its Soil and Water Conservation Districts and administration of conservation land use districts has also influenced agriculture land use decisions.

Government regulations of the Federal, State and County also have direct influence on the agricultural industry of Kauai. For example, virtually all agricultural activties on Kauai are affected by stringent Federal and State pesticide restrictions which have reduced the numbers and types of effective insecticide and herbicide registered and available for sale.

Agricultural research and education on Kauai has and will continue to be influenced by Federal and State agencies and institutions. Cooperative programs of the U.S. Department of Agriculture and University of Hawaii have assisted farmers in Kauai. Educational programs of the university system will continue to influence the availability of skilled agricultural technicians.

Transportation and marketing of agricultural products from Kauai are influenced by functional support and regulatory programs of Federal and State agencies. The Federal government through its regulatory operations inspect all agricultural products moving to the mainland and international markets. The State DOA also inspects products moving into the State and regulates certain agricultural products moving between counties. Marketing development is a function which is influenced by government support programs of Kauai's County of Economic Devlopment, the State DOA, and DPED.

E. Agriculture Plan Advisory Committee (APAC) and Agency Coordination

The County of Kauai formulated the KAMP study under the auspices of the overall Economic Development Plan (Phase 1, December 1980). Subsequently, the County of Kauai decided to pursue master planning of four major industries, of which agriculture was the first.

The KAMP study structured the establishment of an advisory committee to oversee the study's development and results. A list of about 20 names was developed by the Office of Economic Development and presented to the mayor for appointment to serve as this advisory committee. Therein, the formation of APAC was created with 12 people from government, public and semi-public interests.

APAC is coordinated through the Economic Development Department of the County with assistance from the consultant group. Free exchange of information is received during the meetings called by the consultant to develop concepts and assure credibility towards the KAMP study's recomendations.

AGRICULTURE
RESOURCE ASSESSMENT

SECTION II

II. AGRICULTURE RESOURCE ASSESSEMENT

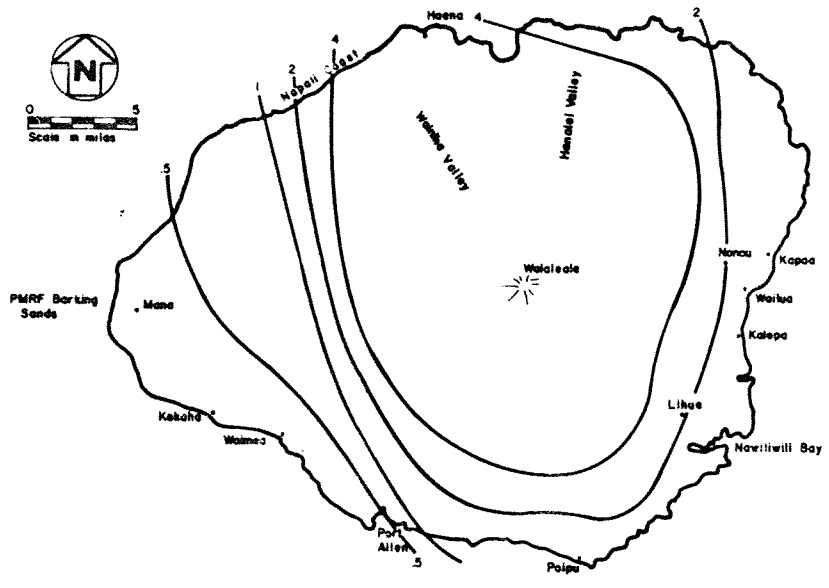
A. Climate

Precipitation

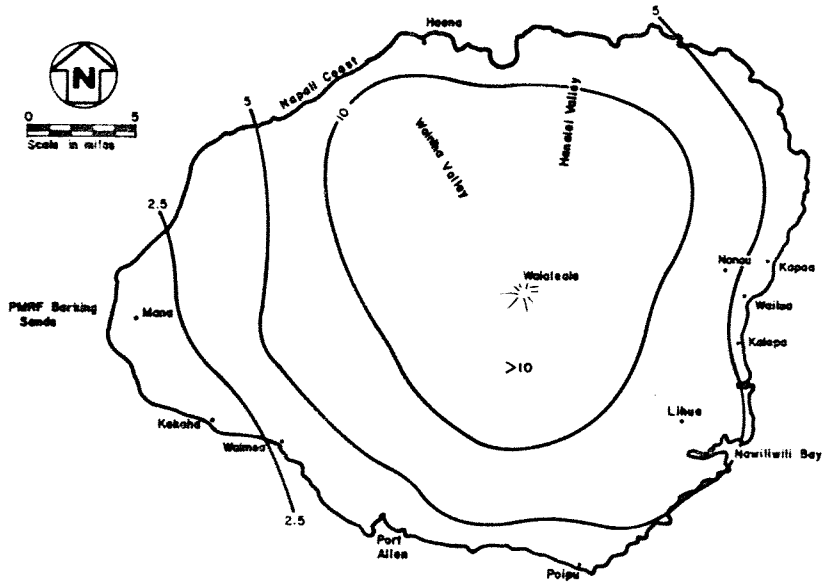
Spatial patterns of agricultural potential on Kauai are directly related to local variations in those climatic controls essential for plant growth. Because of the prevailing north-east tradewind circulation, Kauai like the other Hawaiian Islands, experiences a distinctive windward/leeward contrast in seasonal and annual precipitation. The mountainous terrain induces copious orographic precipitation on windward slopes and at the same time creates dry "rainshadow" regions leeward. Map 1 illustrates annual and seasonal median rainfall for the island of Kauai. The dramatic variation in rainfall over short distances reinforces the importance of local topographic control.

With median annual rainfall of less than 30 inches in much of west Kauai, commercial agriculture is completly dependent upon irrigation. In the windward (eastern and northern) sections of the island, median annual rainfall over much of the coastal plain ranges from 50 to 70 inches. However, even in these comparatively high rainfall areas, low summer rainfall renders irrigation essential for current diversified agricultural endeavors.

In assessing "average" or "median" rainfall patterns, it must be emphasized, particularly in the "Hawaiian situation", that year to year and season to season rainfall variability is high. Hence, periodic drought or excessive rain present significant risks for non-irrigated agriculture even in those areas where high "average rainfall" appears adequate for crop growth. Today, more than 75 percent of all agricultural crop lands on Kauai is under some form of irrigation.



MEDIAN JUNE RAINFALL



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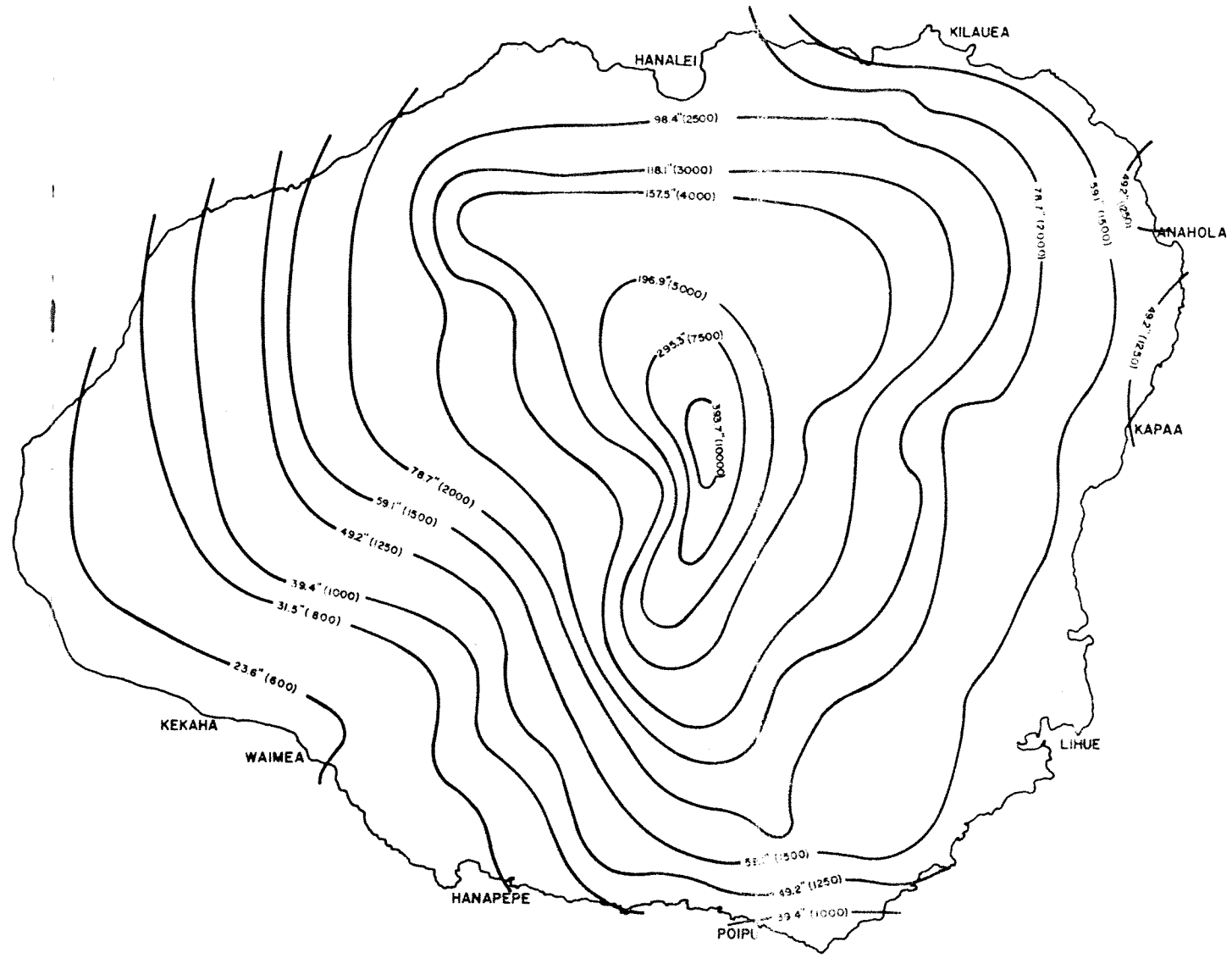


MEDIAN ANNUAL RAINFALL

ISOHYETS IN INCHES AND (MILLIMETERS)
DATA BASED TO 1975

MEDIAN RAINFALL

ISLAND OF KAUAI
KAUAI AGRICULTURE MASTER PLAN

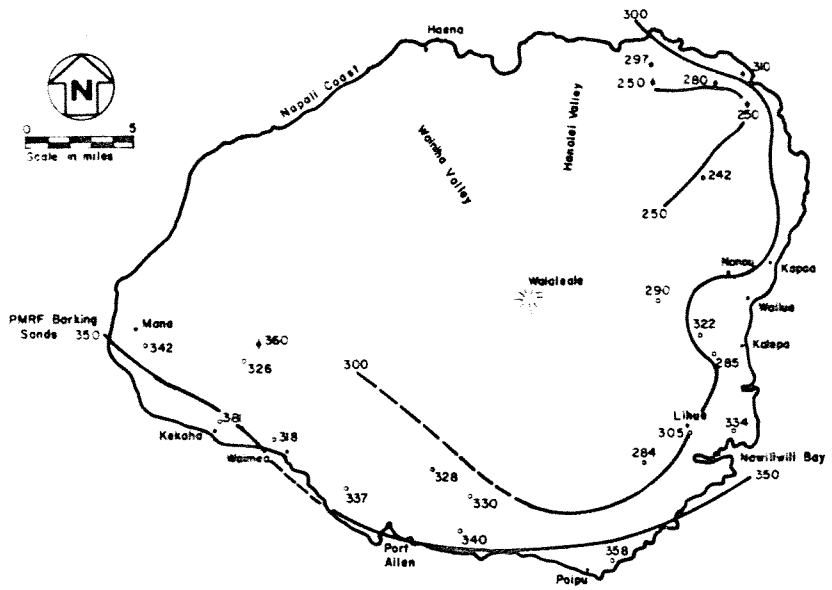
MAP 1

Solar Energy and Temperature

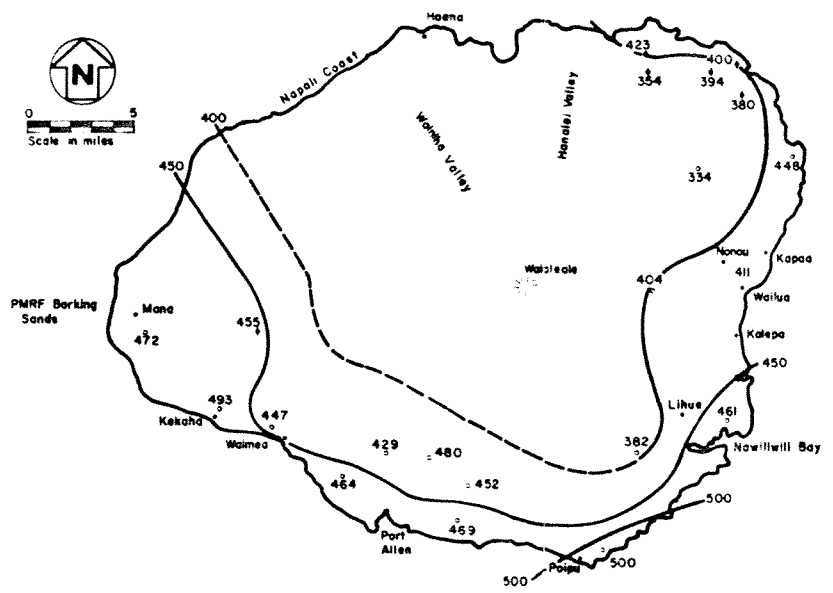
Solar radiation is the driving energy behind both atmospheric processes and plant growth (photosynthesis). Because of dramatic windward/leeward differences in extent and duration of cloud cover over Kauai, there is considerable spatial variation in annual and seasonal receipt of solar radiation at the ground surface. Both winter and summer solar radiation values are substantially higher (20-30 percent) in leeward locations (Map 2). Kekaha, for example, has more than six months of solar radiation with mean daily solar radiation exceeding 500 calories/cm^2/day compared to the Kilauea/Hanalei areas where such values are attained less than two months of the year.

In continental environments, air temperatures are closely correlated with available solar radiation. In the Hawaiian Islands, however, the steady advection of marine air across the islands moderate to a large degree the windward/leeward temperature differences that might otherwise develop as a consequence of local variation in solar radiation. Average annual temperatures in west Kauai (74-75°F) are only a few degrees warmer than those found in the east. Because of lower cloud cover, leeward areas frequently experience comparatively lower nighttime temperatures. This is an advantage agriculturally, because low nighttime temperature increases net photosynthesis by reducing nighttime plant respiration rates.

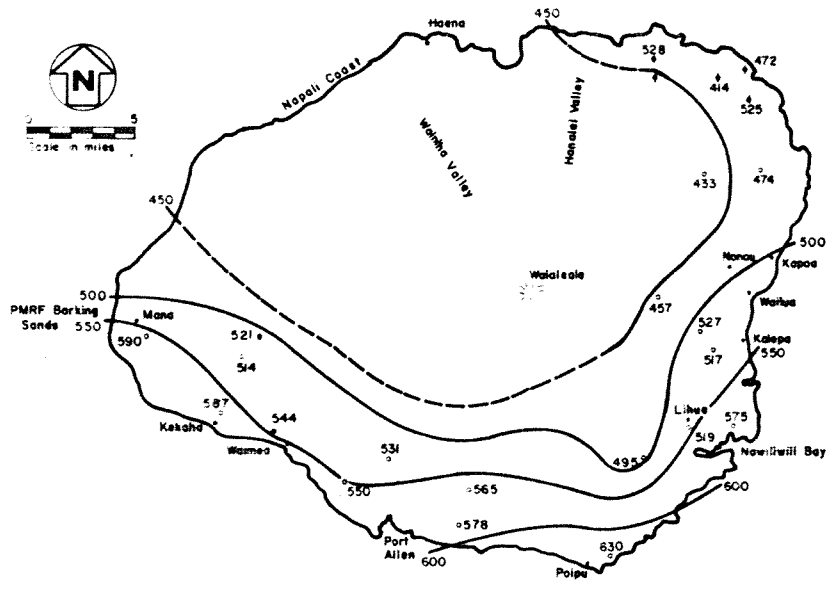
Within the Hawaiian Islands, as a consequence of decreasing air density, temperatures decline approximately 3°F per 1000 feet increase in elevation. The combined effects of temperature and precipitation change with elevation (at both windward and leeward locations) and produce considerable climatic diversity on the island of Kauai. As compared with Maui (Kula area) and the Big Island (Waimea area), however, the potential for developing significant "upland-temperate" agriculture on Kauai is restricted by the generally rugged, dissected topography, excessive cloud cover and precipitation, and the need to protect unique natural mountain ecosystems.



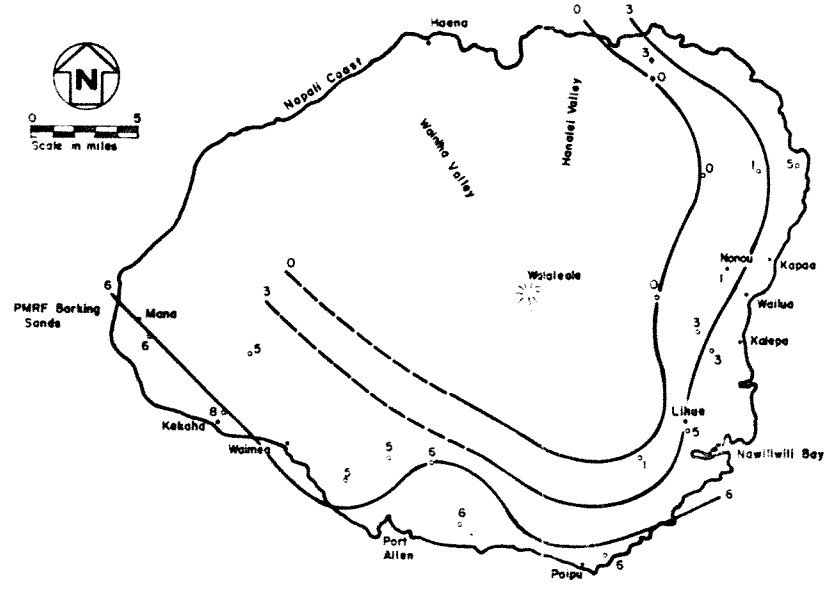
MEAN JANUARY SOLAR RADIATION $\left(\frac{cal}{cm^2/day}\right)$



MEAN ANNUAL SOLAR RADIATION $\left(\frac{cal}{cm^2/day}\right)$



MEAN JULY SOLAR RADIATION $\left(\frac{cal}{cm^2/day}\right)$



NUMBER OF MONTHS PER YEAR WITH MEAN MONTHLY SOLAR RADIATION GREATER THAN 500 $cal/cm^2/day$

LEGEND

- o Solar Radiation Station - ACTIVE
- ♦ Solar Radiation Station - INACTIVE

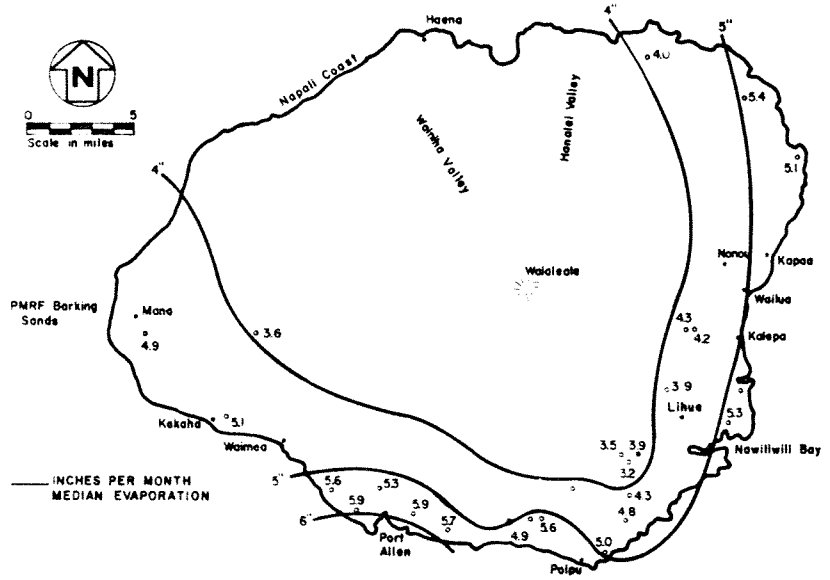
SOLAR RADIATION
ISLAND OF KAUAI
KAUAI AGRICULTURE MASTER PLAN

MAP 2

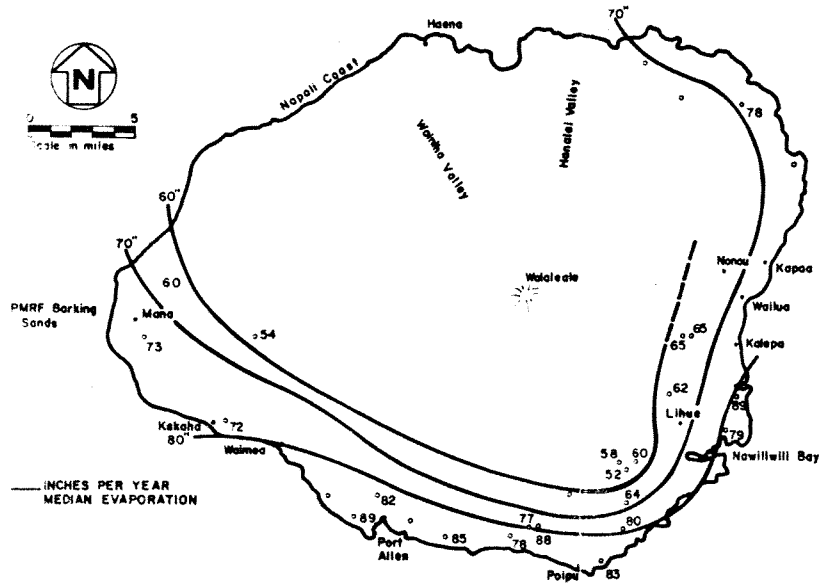
Evaporation and Water Balance

In order to achieve maximum growth agricultural crops require sufficient water to meet the evaporation potential of a specific site. Map 3 illustrates median annual and seasonal pan evaporation values for the agricultural areas of Kauai. Median annual evaporation averages 70-80 inches in the coastal zone. The windward/leeward contrast in evaporations are not as dramatic as those exhibited for annual rainfall. Evaporation rates are primarily a function of available heat energy and because temperatures are not dramatically different between east and west Kauai evaporation rates are also similar. To some extent the lower solar radiation (the driving force of evaporation) in windward areas is off-set by higher wind speeds which increase evaporation rates.

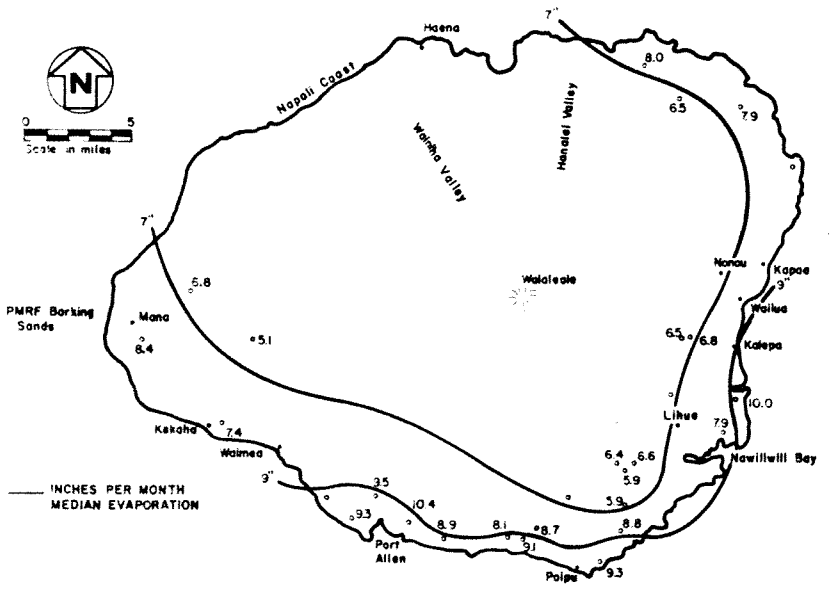
From an agricultural standpoint, a more meaningful interpretation of evaporation rates is obtained by integrating annual evaporation values (water loss) with precipitation (water gain). Map 3 shows the spatial pattern in median annual "net evaporation," that is annual evaporation less annual rainfall. These values may be interpreted as the approximate "water need" of a crop that must be met by irrigation in order to achieve maximum crop growth. By way of illustration, the median annual rainfall at Kekaha is approximately 20 inches while the evaporation demand created by the energy regime at that location is approximately 80 inches. The net evaporation is thus 60 inches, which represents the irrigated water required to supplement the average rainfall of this leeward location. In windward areas, net evaporation is appreciably less because higher rainfall more nearly fulfills evaporation demand. However, because of generally low summer rainfall (in relation to evaporation), and the risks of high rainfall variability, windward irrigation is still an essential requirement for most commercial crops. However, the per acre irrigation requirement is substantially lower (1/3 - 1/2) than for leeward locations (Map 3).



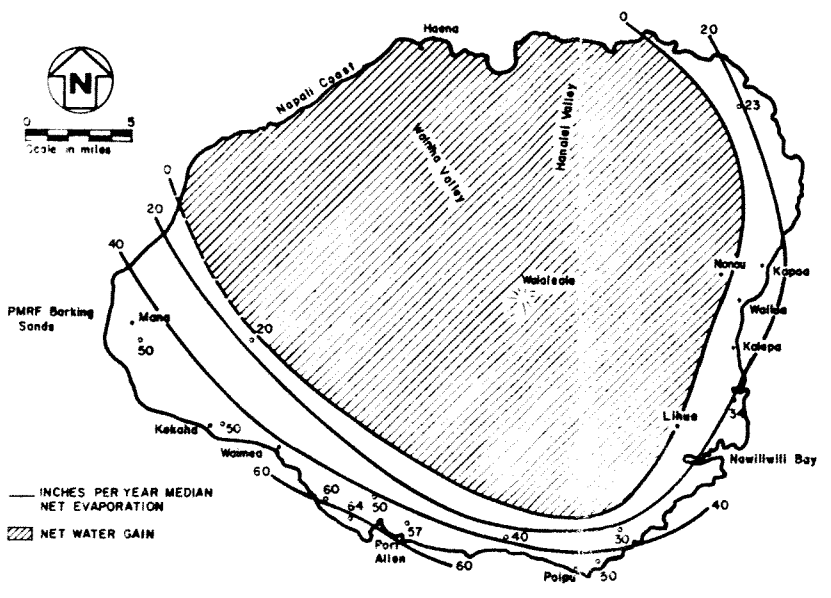
MEDIAN JANUARY EVAPORATION



MEDIAN ANNUAL EVAPORATION



MEDIAN JULY EVAPORATION



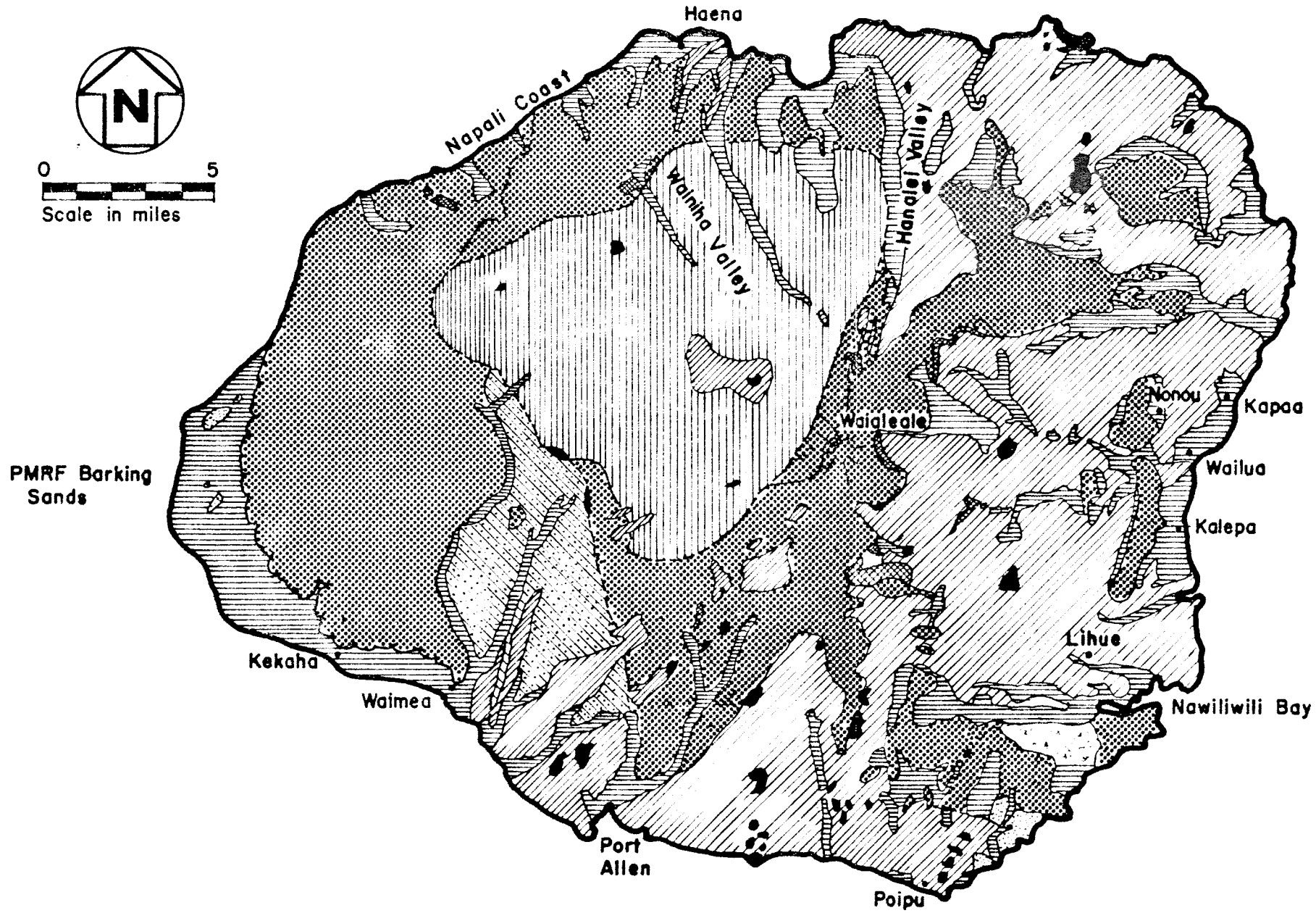
MEDIAN ANNUAL NET EVAPORATION (INCHES)

LEGEND

o ACTIVE GAGE

MEDIAN EVAPORATION
ISLAND OF KAUAI
KAUAI AGRICULTURE MASTER PLAN

MAP 3



LEGEND

QUATERNARY

Recent

Alluvium beach and dune sand, lagoonal clays and marls.

Lithified calcareous dune sand.

Pleistocene

Koloa volcanic series

Breccia and conglomerate of Palikea formations.

Lavas of Koloa volcanic series.

TERTIARY

Pliocene

Waimea Canyon volcanic series

Lavas of Makaweli formation.

Lavas of Olokele formation.

Lavas of Haupu formation.

Lavas of Napali formation.

Vents of Koloa and Waimea Canyon volcanic series.

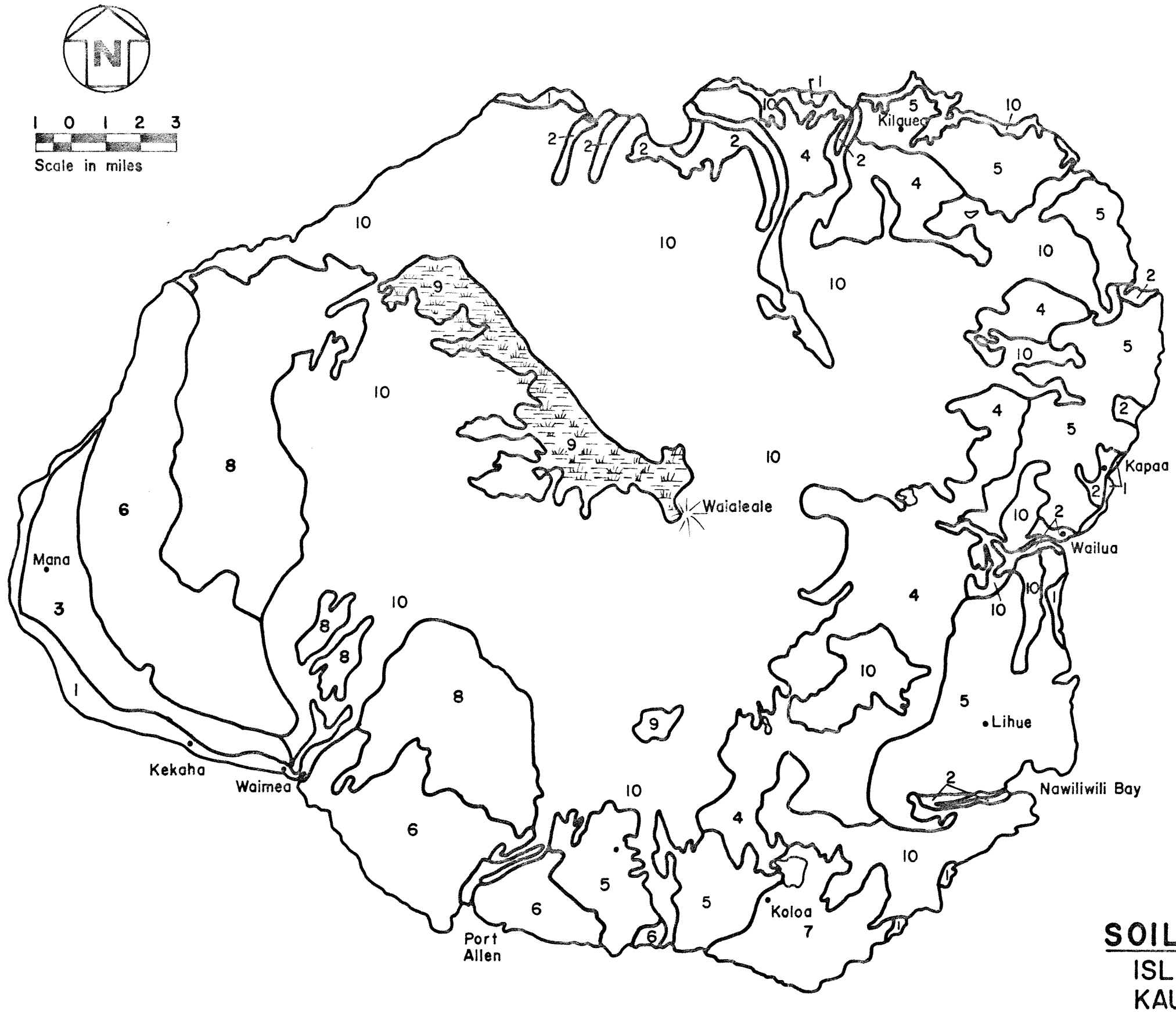
——— Buried fault scrap

GEOLOGIC FORMATIONS

ISLAND OF KAUAI

KAUAI AGRICULTURE MASTER PLAN

MAP 5



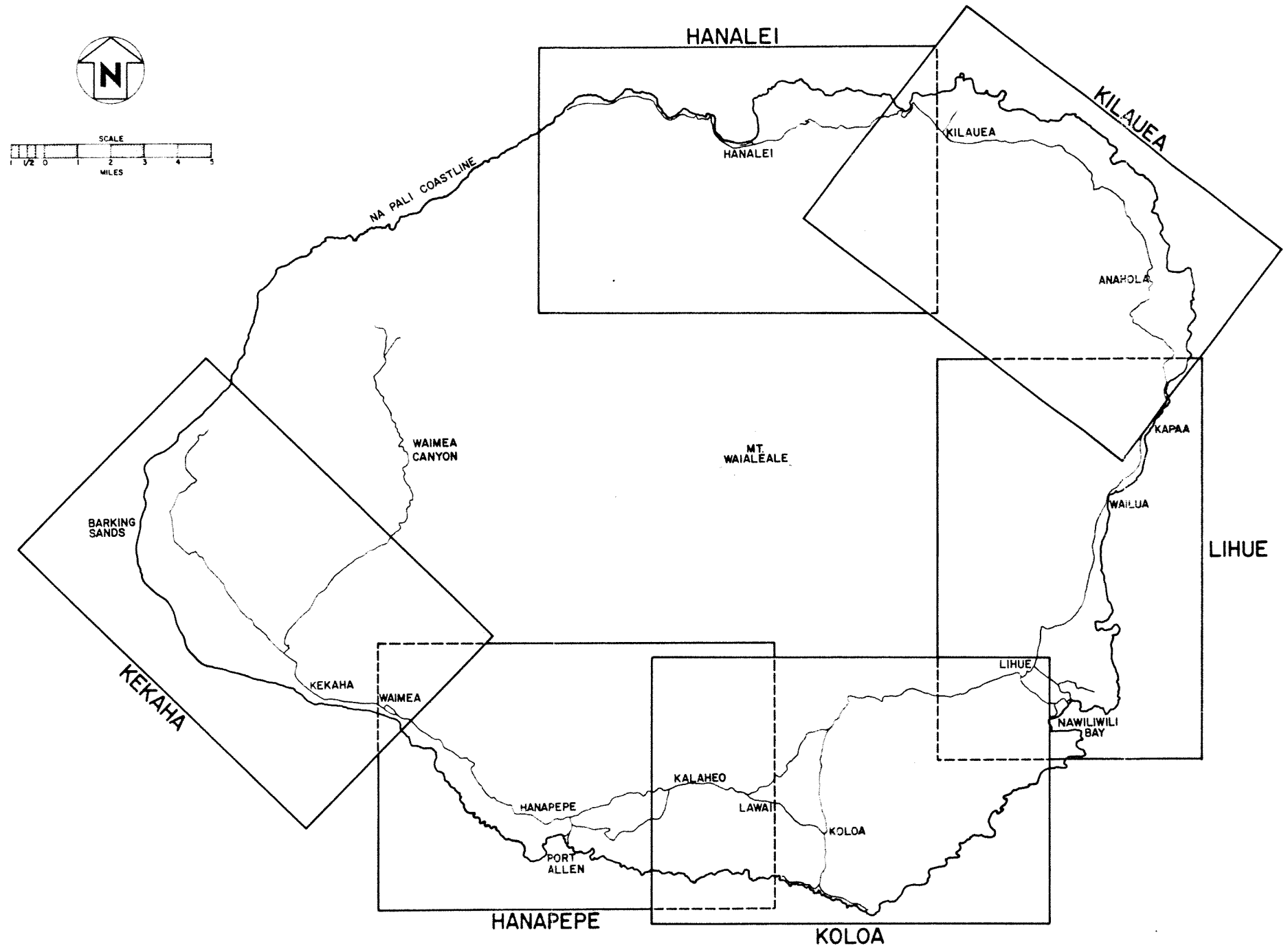
SOIL ASSOCIATIONS

1	JAUCAS- MOKULEIA ASSOCIATION
2	HANALEI-KOLOKOLO- PAKALA ASSOCIATION
3	KEKAHA-NOHILI ASSOCIATION
4	KAPAA- POOKU- HALII- MAKAPILI ASSOCIATION
5	LIHUE-PUHI ASSOCIATION
6	MAKAWELI- WAIAWA- NIU ASSOCIATION
7	WAIKOMO- KALIHI- KOLOA ASSOCIATION
8	ROUGH BROKEN LAND- MAHANA-KOKEE ASSOCIATION
9	WAIALEALE- ALAKAI ASSOCIATION
10	ROUGH MOUNTAINOUS LAND-ROUGH BROKEN LAND-ROCK OUTCROP ASSOCIATION

SOIL TYPES

ISLAND OF KAUAI
KAUAI AGRICULTURE MASTER PLAN

MAP 6

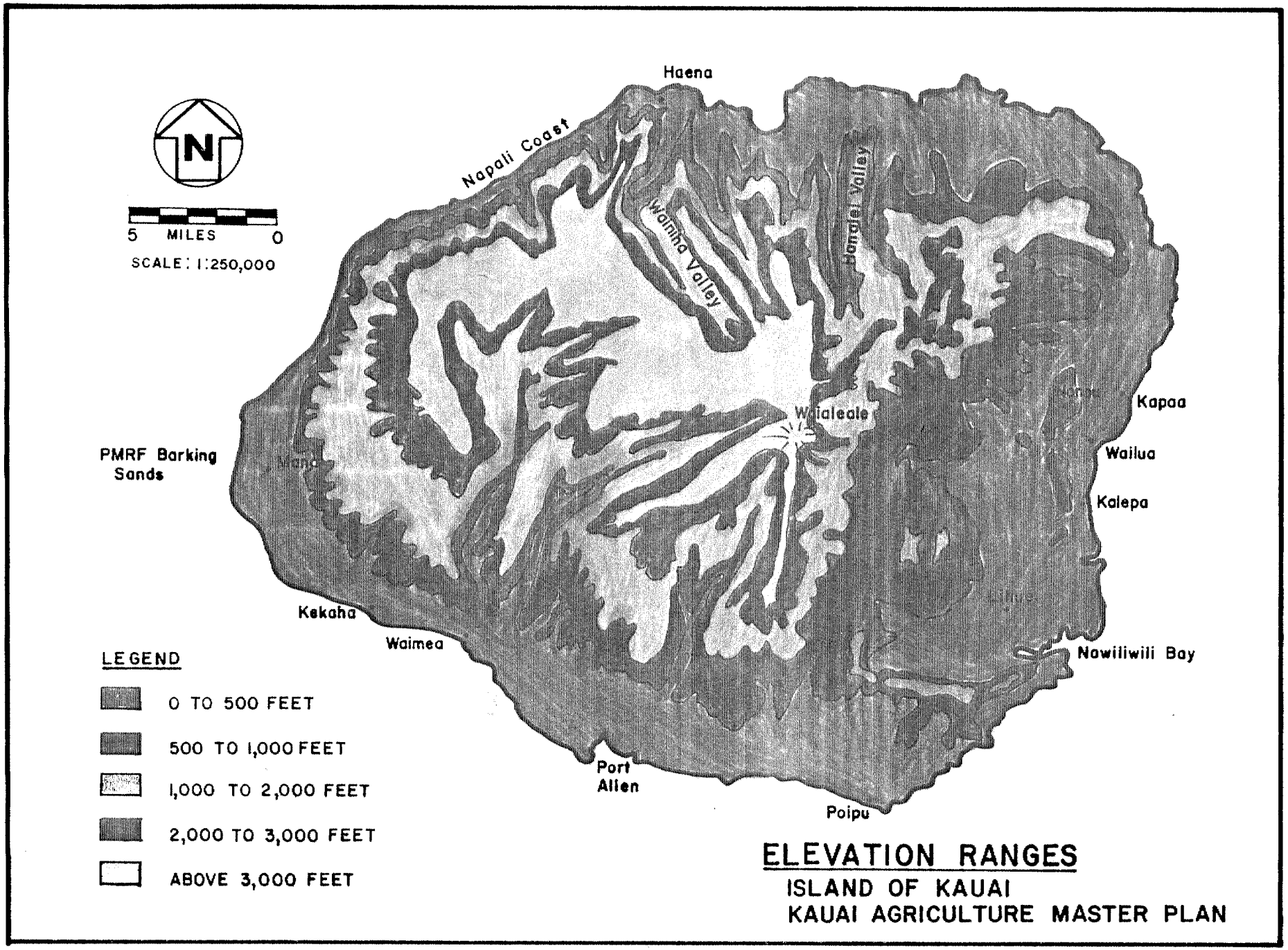


PLANNING DISTRICTS

ISLAND OF KAUAI

KAUAI AGRICULTURAL MASTER PLAN


LEGEND
OVERALL PRODUCTIVITY RATING
A
B
C
D
E
U
HIGHEST PRODUCTIVITY
LOWEST PRODUCTIVITY
URBAN
MAP 7-a
LAND STUDY BUREAU
DETAILED LAND
CLASSIFICATION
KEKAHA
PLANNING DISTRICT
KAUAI AGRICULTURE MASTER PLAN
OKAHARA, SHIGEOKA & ASSOCIATES INC.
SCALE IN THOUSAND FEET
1 0 2 4
DEC. 1982


N
5 MILES 0
SCALE: 1:250,000
Haena
Napali Coast
Waimna Valley
Hanalei Valley
Waialeale
Kapaa
Wailua
Kalepa
PMRF Barking Sands
Kekaha
Waimea
Nowiliwili Bay
Port Allen
Poipu
LEGEND
0 TO 500 FEET
500 TO 1,000 FEET
1,000 TO 2,000 FEET
2,000 TO 3,000 FEET
ABOVE 3,000 FEET
ELEVATION RANGES
ISLAND OF KAUAI
KAUAI AGRICULTURE MASTER PLAN

MAP 4

Throughout the mountainous interior of Kauai, the abundant orographic rainfall exceeds evaporation which decreases in the cooler and cloudier mountain environments. The net water gain in this mountain region is reflected in the development of perennial streams and ground water recharge.

B. Land Quality

Introduction

Because of Kauai's comparatively old geologic age approximately 4-6 million years the interior uplands are heavily eroded and dissected. More than half of the island areas are steep sloping cliffs and valley lands unsuitable for agricultural development (Map 4). In contrast, the high quality agricultural lands of the surrounding coastal plains are derived primarily from detrital sediments (Mana Plain) or post erosional lavas (Koloa volcanics), overlying the older gently sloping erosional surfaces of the island (Map 5).

The distribution of soil types on Kauai (Map 6) is a reflection of both the composition and age of underlying rock coupled with the distinctive climatic regimes of windward and leeward areas. The most productive agricultural soils are the Mollisol (Makewell-Waiawa-Nui associations) and Entisols (Jaucas-Mokuleia: Kekaha-Nohili) of south western Kauai. The predominant agricultural soils over the rest of the island (from Kalaheo to Kilauea) are deeply weathered oxisols derived from the post erosional Koloa volcanics. Those soil characteristics directly related to agricultural potential (drainage, slope, fertility,) have been incorporated into the major land classification schemes developed for assessing agricultural land quality.

Resource assessments were prepared from base maps at a scale of 1 : 24,000 and have been mapped for each of Kauai's six planning districts (see Planning District reference map).

Land Study Bureau: Detailed Land Classification

During the 1960s the University of Hawaii's Land Study Bureau (LSB) developed a statewide land classification system based on indices of climate, soil and the yield potentials for specific use for sugar or pineapple production or general agricultural use. The lands were divided into five overall productivity rating classes (A, B, C, D, E), ranking from highest to lowest in agricultural suitability.

The Land Study Bureau classification maps of planning districts for Kauai are presented in Maps 7a-f. Virtually all of the 10,068 acres of highest quality ("A" designation) agricultural land on Kauai are located in the southwest of the island between Mana and Koloa. The 30,371 acres of "B" classification land is more widely distributed throughout lowland areas from Mana to Hanalei. A further 59,160 acres of "C" and "D" class lands occupy the transitional (moderately disected) zones between coastal plains and the rugged mountainous pali lands of the island's interior. The "C" and "D" lands are most frequently utilized for cattle grazing.

The remaining 250,044 acres of the island (representing approximately 71% of Kauai's total area) are "E" designated lands, considered generally unsuitable for agriculture. These "E" class lands are largely watershed areas in the conservation district supporting natural forest ecosystems.

LAND STUDY BUREAU
DETAILED LAND
CLASSIFICATION

HANAPEPE
PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET
1 0 2 4

DEC. 1982

LEGEND

OVERALL PRODUCTIVITY RATING

A	HIGHEST PRODUCTIVITY
B	
C	
D	
E	LOWEST PRODUCTIVITY
U	URBAN

MAP 7-b

LEGEND

OVERALL PRODUCTIVITY RATING

A	HIGHEST PRODUCTIVITY
B	
C	
D	
E	LOWEST PRODUCTIVITY
U	URBAN

MAP 7-c

LAND STUDY BUREAU
DETAILED LAND
CLASSIFICATION

KOLOA
PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

LAND STUDY BUREAU
DETAILED LAND
CLASSIFICATION

LIHUE
PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET
1 0 2 4

DEC. 1982

LEGEND

OVERALL PRODUCTIVITY RATING

A	HIGHEST PRODUCTIVITY
B	
C	
D	
E	LOWEST PRODUCTIVITY
U	URBAN

MAP 7-d

LEGEND

OVERALL PRODUCTIVITY RATING

A	HIGHEST PRODUCTIVITY
B	
C	
D	
E	LOWEST PRODUCTIVITY
U	URBAN

LAND STUDY BUREAU DETAILED LAND CLASSIFICATION

KILAUEA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET 1 0 2 4

DEC. 1982

MAP 7-8

Agricultural Lands of Importance to the State of Hawaii (ALISH)

In 1977 the State Department of Agriculture adopted the ALISH land classification system for delineating valuable agricultural lands. ALISH is the State's system which classifies agricultural land into three categories:

1. Prime Agricultural Land
2. Unique Agricultural Land
3. Other Agricultural Land

The classification is based on intrinsic soil and environmental qualities of a site, and unlike the LSB system, does not rate the land in terms of its specific suitability for sugar and pineapple production. The State Agricultural Plan (1980) has recommended ammending the State Land Use Law to consider agriculture land use decisions utilizing the ALISH system rather than the currently adopted LSB system.

Maps 8a-f present the ALISH land classification for the Island of Kauai by planning districts.

- Prime Agricultural Land on Kauai totals 54,916 acres and is fairly evenly distributed in eastern and western parts of the island. From Anahola to Mana) these prime lands are largely committed to sugar cane production.

- Unique Agricultural Land on Kauai totals 388 acres and is restricted to specialized river valley sites for wetland taro and other suitable crops. These locations include the Hanalei Valley, Wainiha River Valley, and portions of the Hanapepe and Waimea River Valleys.

LEGEND

OVERALL PRODUCTIVITY RATING

A	HIGHEST PRODUCTIVITY
B	
C	
D	
E	LOWEST PRODUCTIVITY
U	URBAN

MAP 7-f

LAND STUDY BUREAU
DETAILED LAND
CLASSIFICATION

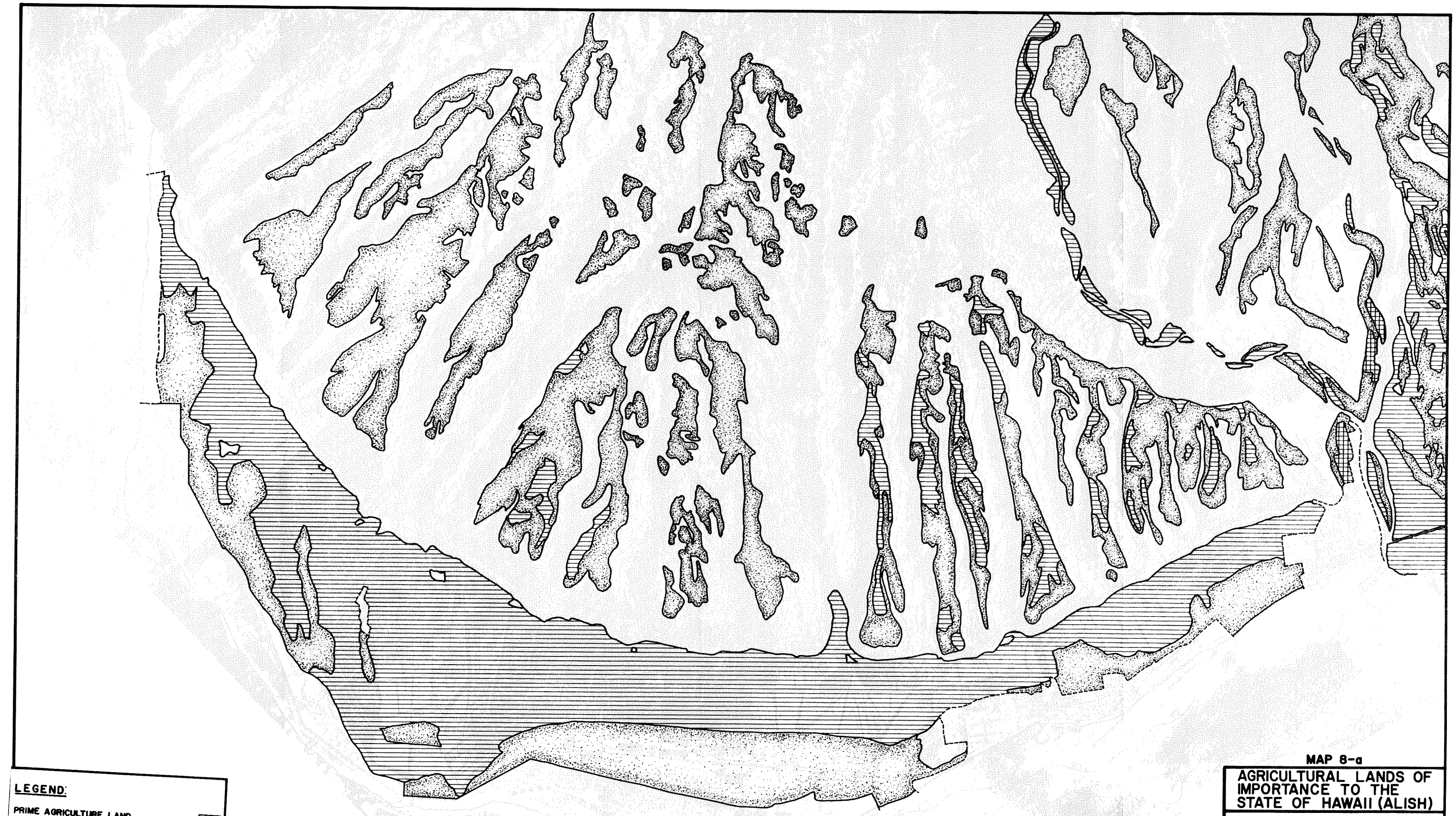
HANALEI
PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET
1 0 2 4

DEC. 1982


LEGEND:
PRIME AGRICULTURE LAND
UNIQUE AGRICULTURE LAND
OTHER IMPORTANT AGRICULTURAL LAND
EXISTING URBAN DEVELOPMENT
U.S. GOVERNMENT
MAP 8-a
AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)
KEKAHA
PLANNING DISTRICT
KAUAI AGRICULTURE MASTER PLAN
OKAHARA, SHIGEOKA & ASSOCIATES INC.
SCALE IN THOUSAND FEET
1 0 2 4
DEC. 1982

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)

HANAPEPE PLANNING DISTRICT

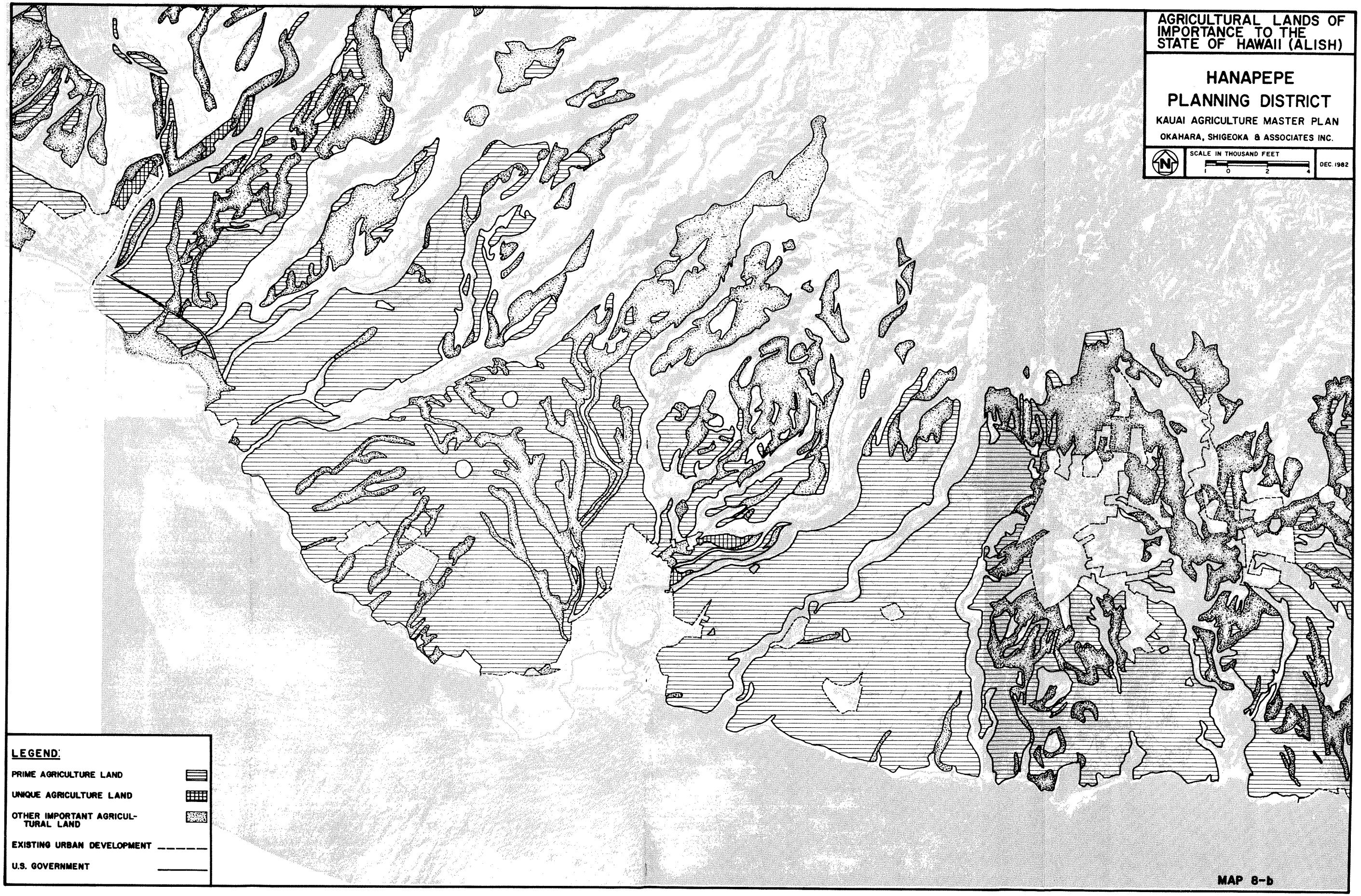
KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982



LEGEND:

- PRIME AGRICULTURE LAND
- UNIQUE AGRICULTURE LAND
- OTHER IMPORTANT AGRICULTURAL LAND
- EXISTING URBAN DEVELOPMENT
- U.S. GOVERNMENT

MAP 8-b

LEGEND:

- PRIME AGRICULTURE LAND
- UNIQUE AGRICULTURE LAND
- OTHER IMPORTANT AGRICULTURAL LAND
- EXISTING URBAN DEVELOPMENT
- U.S. GOVERNMENT

MAP 8-c

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)

KOLOA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)

LIHUE PLANNING DISTRICT

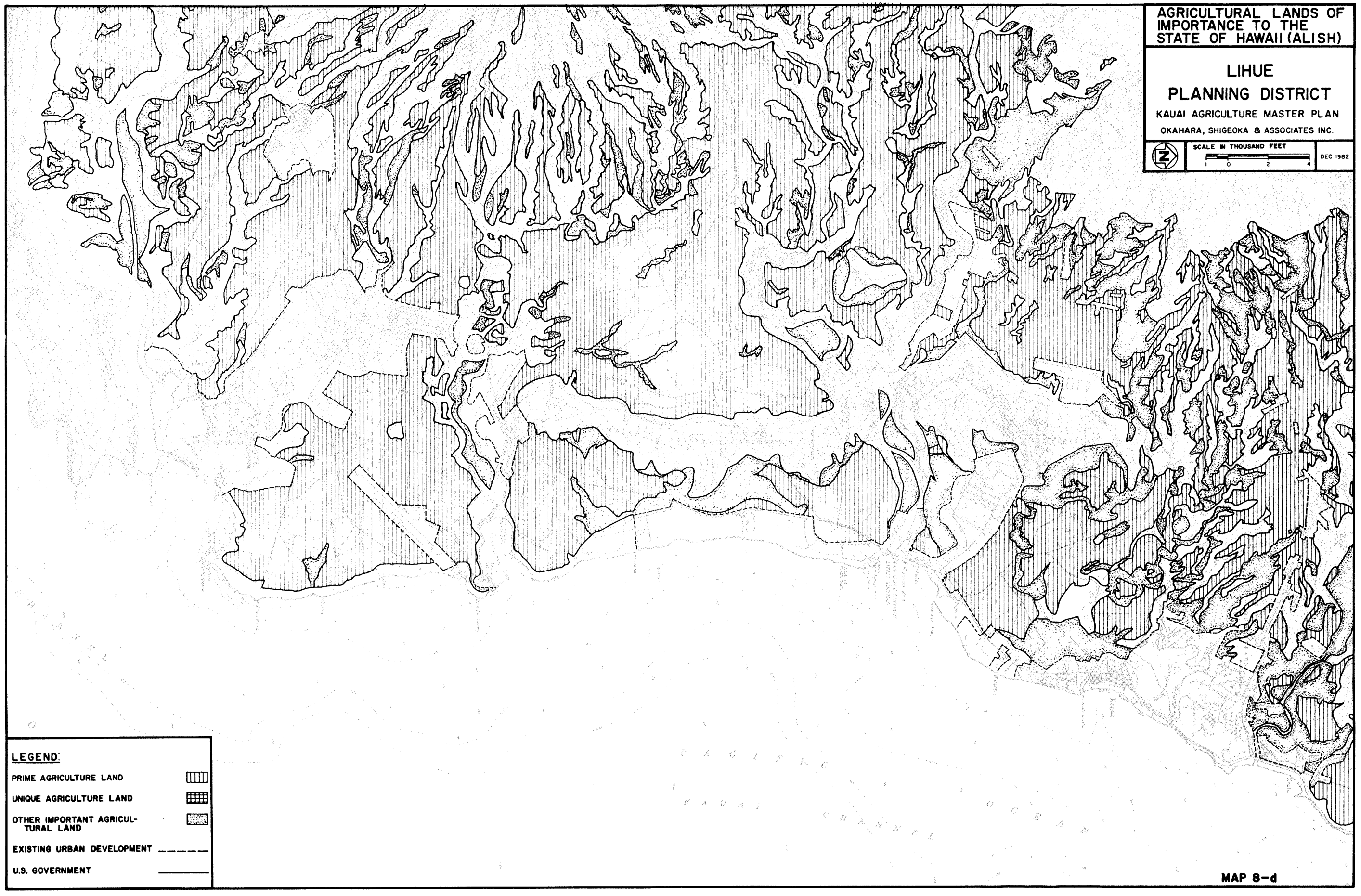
KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC 1982



LEGEND:

- PRIME AGRICULTURE LAND
- UNIQUE AGRICULTURE LAND
- OTHER IMPORTANT AGRICULTURAL LAND
- EXISTING URBAN DEVELOPMENT
- U.S. GOVERNMENT

MAP 8-d

LEGEND:

PRIME AGRICULTURE LAND

UNIQUE AGRICULTURE LAND

OTHER IMPORTANT AGRICULTURAL LAND

EXISTING URBAN DEVELOPMENT

U.S. GOVERNMENT

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)

KILAUEA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

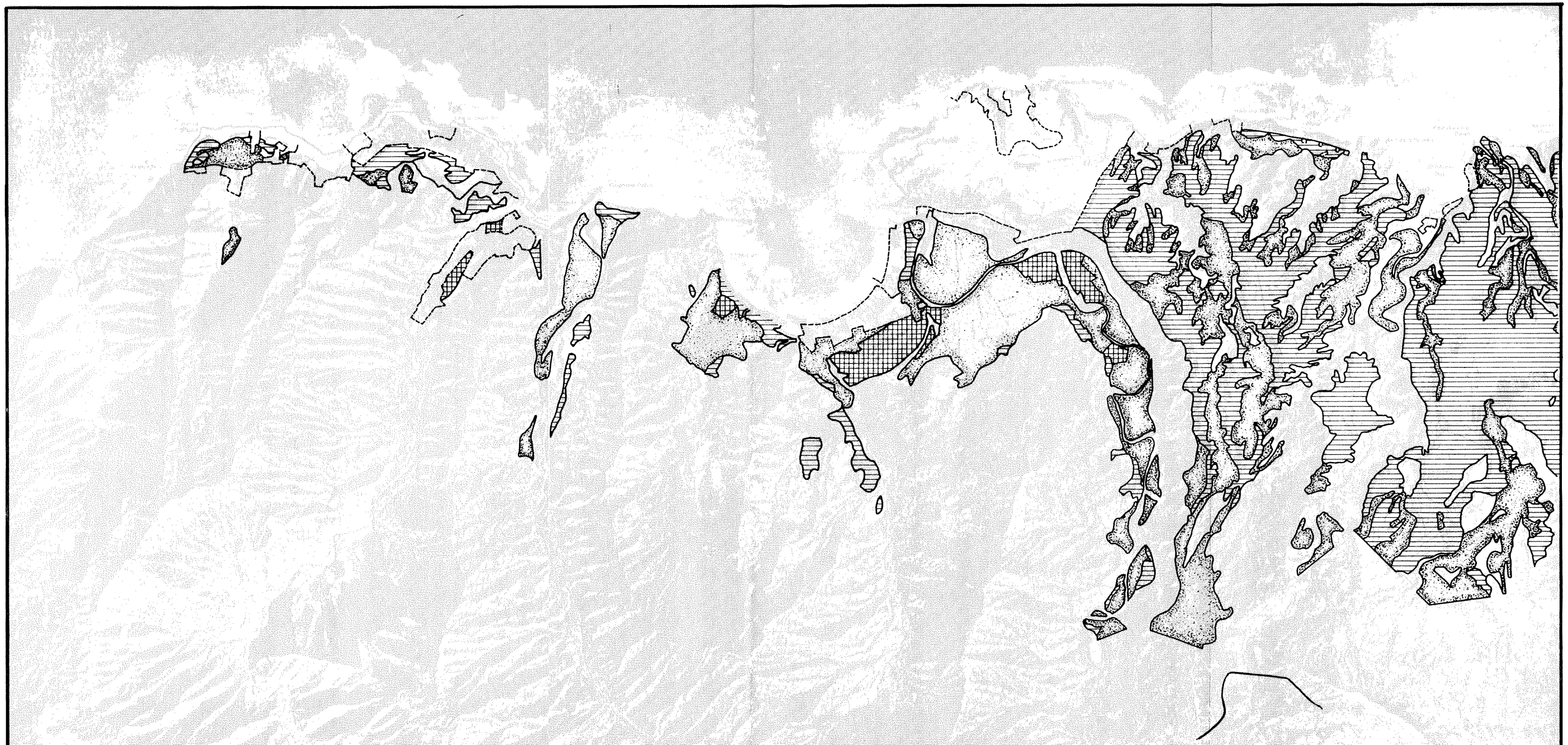
OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

MAP 8-a



LEGEND:

- PRIME AGRICULTURE LAND
- UNIQUE AGRICULTURE LAND
- OTHER IMPORTANT AGRICULTURAL LAND
- EXISTING URBAN DEVELOPMENT
- U.S. GOVERNMENT

MAP 8-f

AGRICULTURAL LANDS OF IMPORTANCE TO THE STATE OF HAWAII (ALISH)

HANALEI PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC 1982

- Other important agricultural lands on Kauai total 36,673 acres fairly evenly distributed between eastern and western parts of the island. Sugar is cultivated on some of these lands (above Mana) while cattle ranching represents the most important diversifed agricultural use of these lands.

Recently the U.S. Soil Conservation Service has developed a new nationwide land classfication system: The Agricultural Land Evaluation and Site Assessment System (LESA). An inventory of the state's agricultural lands utilizing this new system is currently being developed by the Soil Conservation service.

C. Land Ownership, Control and Use

Ownership

Land ownership on Kauai is highly concentrated in the hands of a few public and private owners. The State of Hawaii (with 134,516 acres) and 19 private land owners (170,135 acres) combined, hold title to 86.4% of the total land area of the island (353,900 acres). Maps 9a-f depict land ownership patterns by planning districts. The land owners for all parcels larger than 5 acres are listed in Appendix 1.

Quality agricultural lands under state ownership (plus Hawaiian Homes Lands) include substantial tracts in the Kekaha, Hanapepe, and Hanamaulu to Anahola areas. Most of this prime agricultural land is on lease to sugar cane plantations.

LEGEND:

SYMBOL	OWNERS
	STATE OF HAWAII
	DHHL
	FEDERAL
1.	B.P. BISHOP ESTATE
2.	GAY & ROBINSON
3.	C. BREWER & CO. LTD.
4.	ALEXANDER & BALDWIN, INC.
5.	AMFAC, INC.
6.	ERIC & AUGUST KNUDSEN TRUST
7 to 10	VARIOUS LANDOWNERS SEE APPENDIX
	SMALL PRIVATE LAND-OWNERS (LESS THAN 5 ACRES)

MAP 9-a

OWNERSHIP

KEKAHA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC 1982

OWNERSHIP

HANAPEPE PLANNING DISTRICT

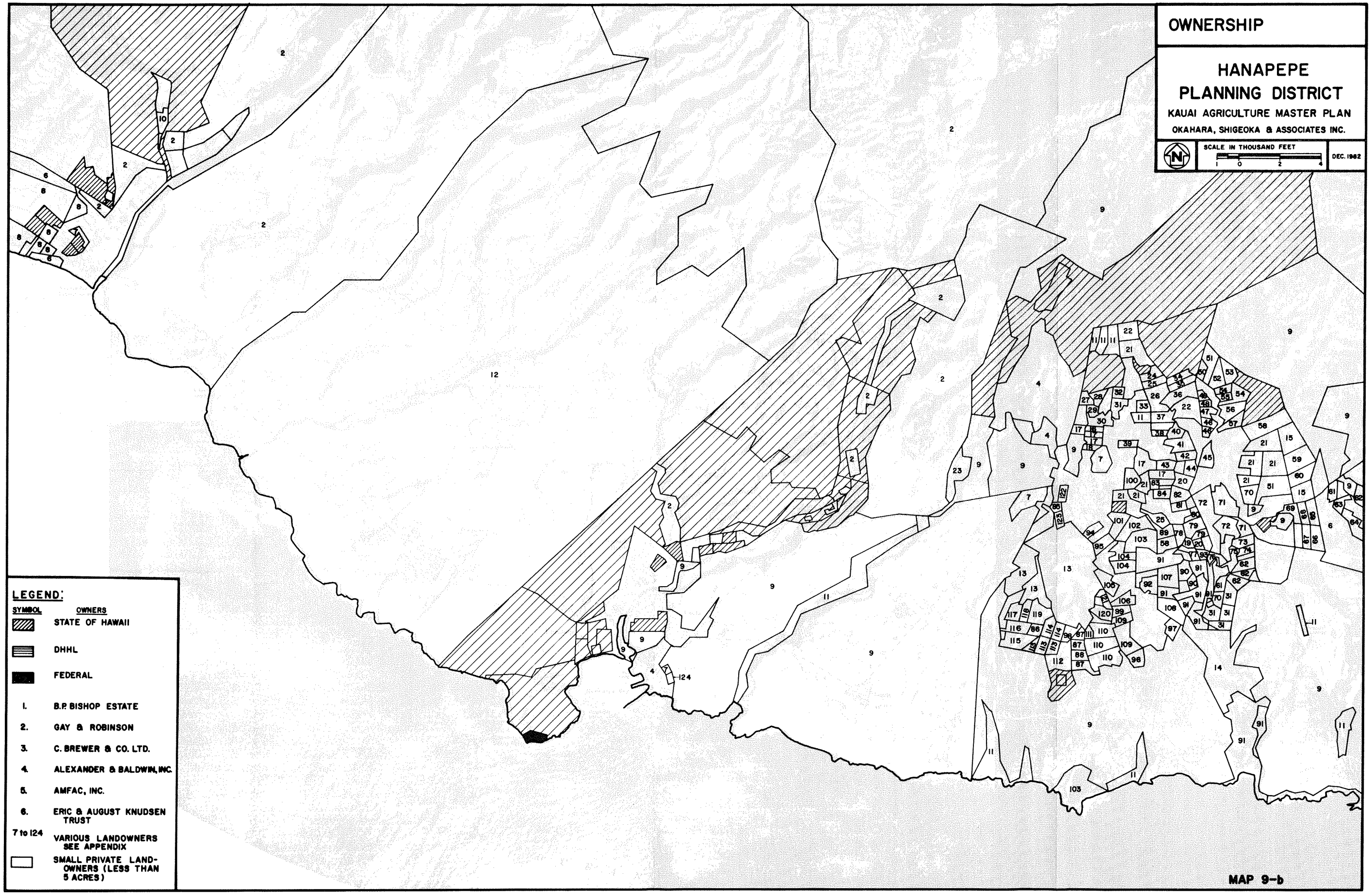
KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982



LEGEND:

SYMBOL	OWNERS
	STATE OF HAWAII
	DHHL
	FEDERAL
1.	B.P. BISHOP ESTATE
2.	GAY & ROBINSON
3.	C. BREWER & CO. LTD.
4.	ALEXANDER & BALDWIN, INC.
5.	AMFAC, INC.
6.	ERIC & AUGUST KNUDSEN TRUST
7 to 124	VARIOUS LANDOWNERS SEE APPENDIX
	SMALL PRIVATE LAND-OWNERS (LESS THAN 5 ACRES)

MAP 9-b

LEGEND:

SYMBOL	OWNERS
	STATE OF HAWAII
	DHHL
	FEDERAL
1.	B.P. BISHOP ESTATE
2.	GAY & ROBINSON
3.	C. BREWER & CO. LTD.
4.	ALEXANDER & BALDWIN, INC.
5.	AMFAC, INC.
6.	ERIC & AUGUST KNUDSEN TRUST
7 to 29	VARIOUS LANDOWNERS SEE APPENDIX
	SMALL PRIVATE LAND-OWNERS (LESS THAN 5 ACRES)

MAP 9-c

OWNERSHIP

KOLOA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

OWNERSHIP

LIHUE PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

LEGEND:

SYMBOL	OWNERS
	STATE OF HAWAII
	DHHL
	FEDERAL
1.	B.P. BISHOP ESTATE
2.	GAY & ROBINSON
3.	C. BREWER & CO. LTD.
4.	ALEXANDER & BALDWIN, INC.
5.	AMFAC, INC.
6.	ERIC & AUGUST KNUDSEN TRUST
7 to 194	VARIOUS LANDOWNERS SEE APPENDIX
	SMALL PRIVATE LAND-OWNERS (LESS THAN 5 ACRES)

PACIFIC OCEAN

KAUAI CHANNEL

MAP 9-d

OWNERSHIP

KILAUEA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

MAP 9-e

LEGEND:

SYMBOL	OWNERS
	STATE OF HAWAII
	DHHL
	FEDERAL
1.	B.P. BISHOP ESTATE
2.	GAY & ROBINSON
3.	C. BREWER & CO. LTD.
4.	ALEXANDER & BALDWIN, INC.
5.	AMFAC, INC.
6.	ERIC & AUGUST KNUDSEN TRUST
7 to 71	VARIOUS LANDOWNERS SEE APPENDIX
	SMALL PRIVATE LAND-OWNERS (LESS THAN 5 ACRES)

LEGEND:

SYMBOL	OWNERS
	STATE OF HAWAII
	DHHL
	FEDERAL
1.	B.P. BISHOP ESTATE
2.	GAY & ROBINSON
3.	C. BREWER & CO. LTD.
4.	ALEXANDER & BALDWIN, INC.
5.	AMFAC, INC.
6.	ERIC & AUGUST KNUDSEN TRUST
7 to 59	VARIOUS LANDOWNERS SEE APPENDIX
	SMALL PRIVATE LAND-OWNERS (LESS THAN 5 ACRES)

MAP 9-f

OWNERSHIP

HANALEI PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

Zoning

State of Hawaii land use district zoning is shown on Maps 10a-f which also include designation of Kauai County Open, Agricultural and Special Treatment areas. Comprehensive Kauai general plan districts are presented in Maps 11a-f. Virtually all of the lands potentially suitable for agriculture are currently included within existing agricultural (or open) districts.

Between 1977-1980 actions on State land use boundary ammendment petitions resulted in the transfer of 213 acres of prime (ALISH) agricultural land out of the agricultural district with transfer pending for further 746 acres of prime land. Land acquisition for the Lihue Airport expansion accounts for a major portion of this land transfer.

Current Agricultural Use

Current agriculture land use on Kauai (by Planning Districts) is presented in Maps 12a-f. In 1981, there were 47,500 acres in crop production with sugar acreage accounting for 46,500 acres of this total. This leaves little more than 1000 acres in diversified agriculture (concentrated in river valley areas) excluding cattle grazing which utilizes approximately 55,000 acres of predominantly mauka land bordering the coastal plain.

Water Supply

Current agricultural and domestic water supply and distribution systems are illustrated on Maps 13a-f.

LEGEND:

STATE LAND USE DISTRICTS

- URBAN
- RURAL
- AGRICULTURE
- CONSERVATION

COUNTY ZONES

- AGRICULTURE
- OPEN (O)
- SPECIAL TREATMENT DISTRICT

MAP 10-a

ZONING
STATE LAND USE

KEKAHA
PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

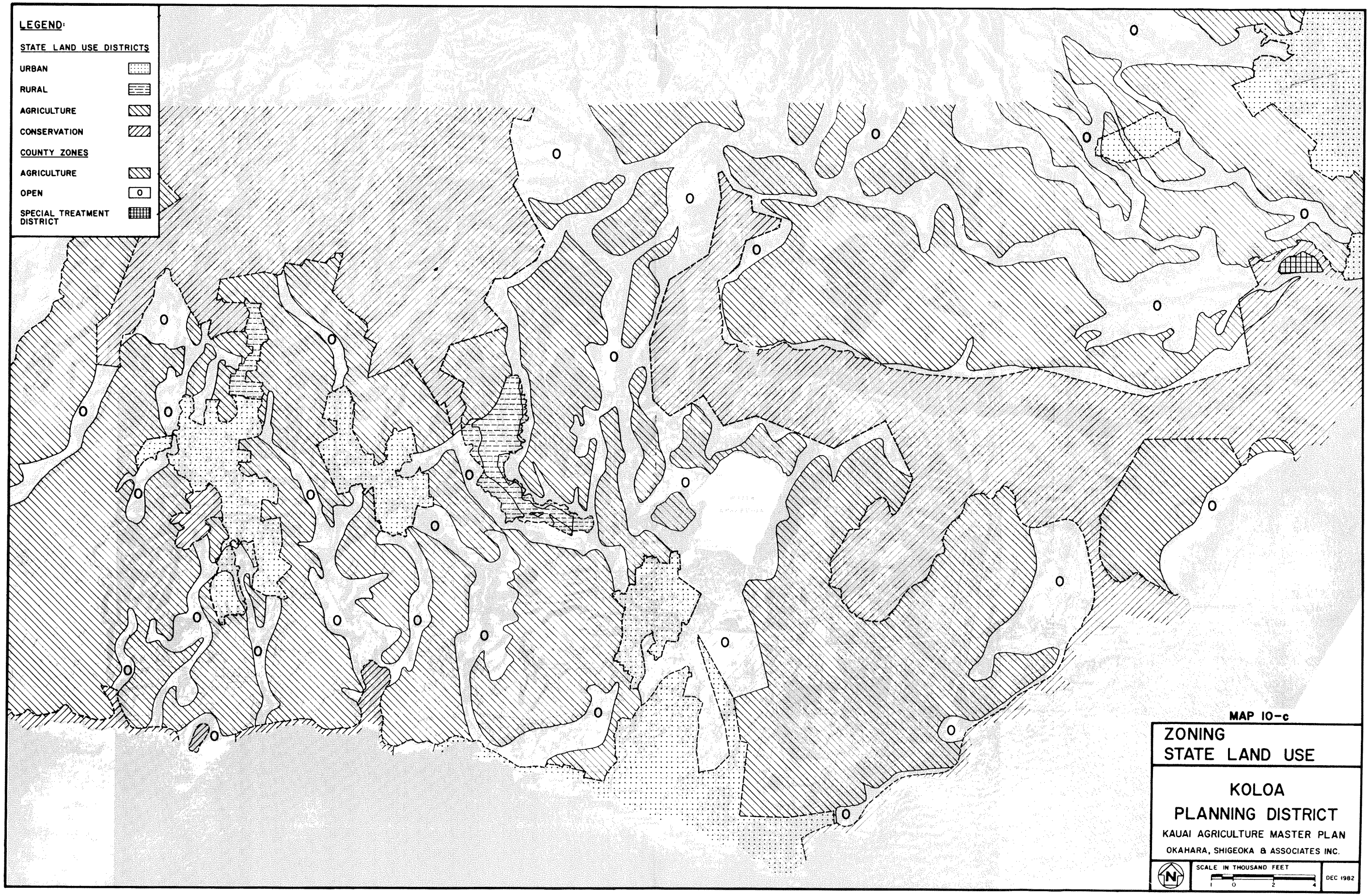
ZONING
STATE LAND USE

HANAPEPE
PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN
OKAHARA, SHIGEOKA & ASSOCIATES INC.

DEC. 1982

MAP 10-b


LEGEND:
STATE LAND USE DISTRICTS
URBAN
RURAL
AGRICULTURE
CONSERVATION
COUNTY ZONES
AGRICULTURE
OPEN
O
SPECIAL TREATMENT DISTRICT
MAP 10-c
ZONING
STATE LAND USE
KOLOA
PLANNING DISTRICT
KAUAI AGRICULTURE MASTER PLAN
OKAHARA, SHIGEOKA & ASSOCIATES INC.
N
SCALE IN THOUSAND FEET
1 0 2 4
DEC 1982

ZONING
STATE LAND USE

LIHUE
PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

N

SCALE: 1" = 2,000'

1 0 2 4

DEC. 1982

LEGEND:

STATE LAND USE DISTRICTS

- URBAN
- RURAL
- AGRICULTURE
- CONSERVATION

COUNTY ZONES

- AGRICULTURE
- OPEN (O)
- SPECIAL TREATMENT DISTRICT

MAP 10-d

LEGEND:

STATE LAND USE DISTRICTS

- URBAN
- RURAL
- AGRICULTURE
- CONSERVATION

COUNTY ZONES

- AGRICULTURE
- OPEN (O)
- SPECIAL TREATMENT DISTRICT

ZONING
STATE LAND USE

KILAUEA
PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

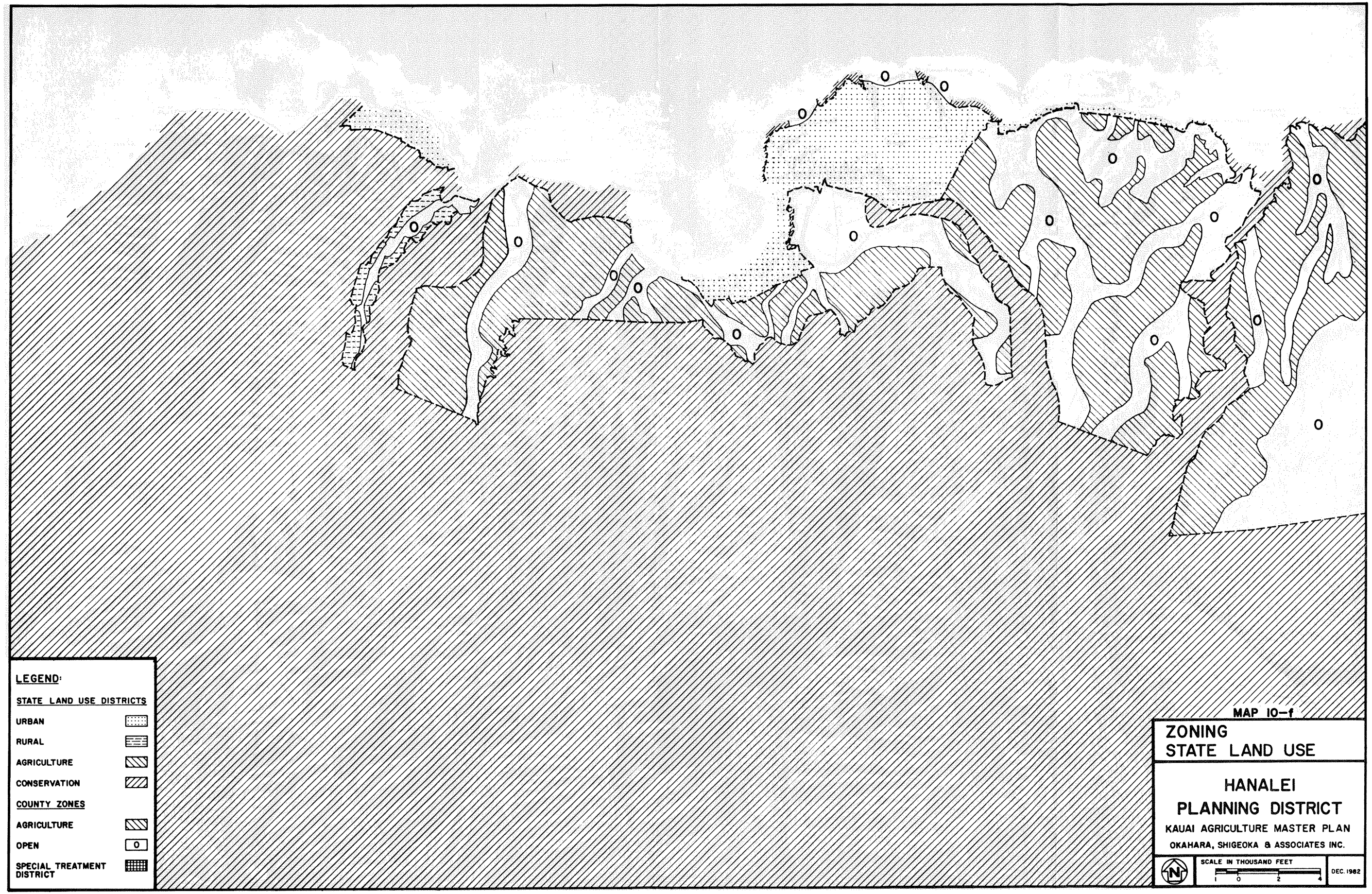
OKAHARA, SHIGEOKA & ASSOCIATES INC.

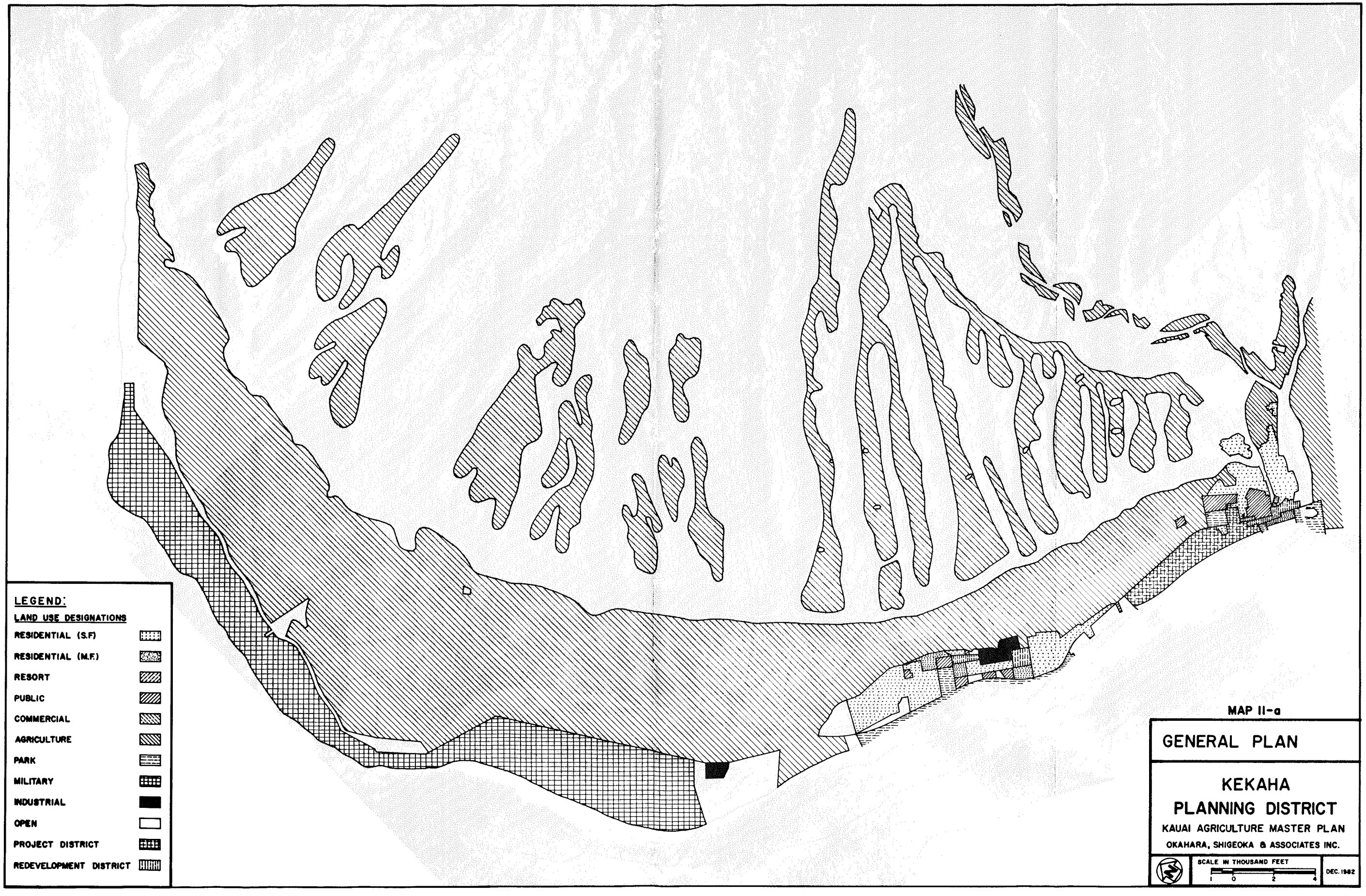
SCALE: 1" = 2,000'

1 0 2 4

DEC. 1982

MAP 10-8


LEGEND:
STATE LAND USE DISTRICTS
URBAN
RURAL
AGRICULTURE
CONSERVATION
COUNTY ZONES
AGRICULTURE
OPEN
O
SPECIAL TREATMENT DISTRICT
MAP 10-f
ZONING
STATE LAND USE
HANALEI
PLANNING DISTRICT
KAUAI AGRICULTURE MASTER PLAN
OKAHARA, SHIGEOKA & ASSOCIATES INC.
N
SCALE IN THOUSAND FEET
1 0 2 4
DEC. 1982


LEGEND:
LAND USE DESIGNATIONS
RESIDENTIAL (S.F)
RESIDENTIAL (M.F.)
RESORT
PUBLIC
COMMERCIAL
AGRICULTURE
PARK
MILITARY
INDUSTRIAL
OPEN
PROJECT DISTRICT
REDEVELOPMENT DISTRICT
MAP II-a
GENERAL PLAN
KEKAHA
PLANNING DISTRICT
KAUAI AGRICULTURE MASTER PLAN
OKAHARA, SHIGEOKA & ASSOCIATES INC.
SCALE IN THOUSAND FEET
1 0 2 4
DEC. 1982

LEGEND:

LAND USE DESIGNATIONS

- RESIDENTIAL (S.F)
- RESIDENTIAL (M.F.)
- RESORT
- PUBLIC
- COMMERCIAL
- AGRICULTURE
- PARK
- MILITARY
- INDUSTRIAL
- OPEN
- PROJECT DISTRICT
- REDEVELOPMENT DISTRICT

MAP II-b

GENERAL PLAN

HANAPEPE PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

LEGEND:

LAND USE DESIGNATIONS

- RESIDENTIAL (S.F)
- RESIDENTIAL (M.F.)
- RESORT
- PUBLIC
- COMMERCIAL
- AGRICULTURE
- PARK
- MILITARY
- INDUSTRIAL
- OPEN
- PROJECT DISTRICT
- REDEVELOPMENT DISTRICT

MAP II-c

GENERAL PLAN

KOLOA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

GENERAL PLAN

LIHUE
PLANNING DISTRICT

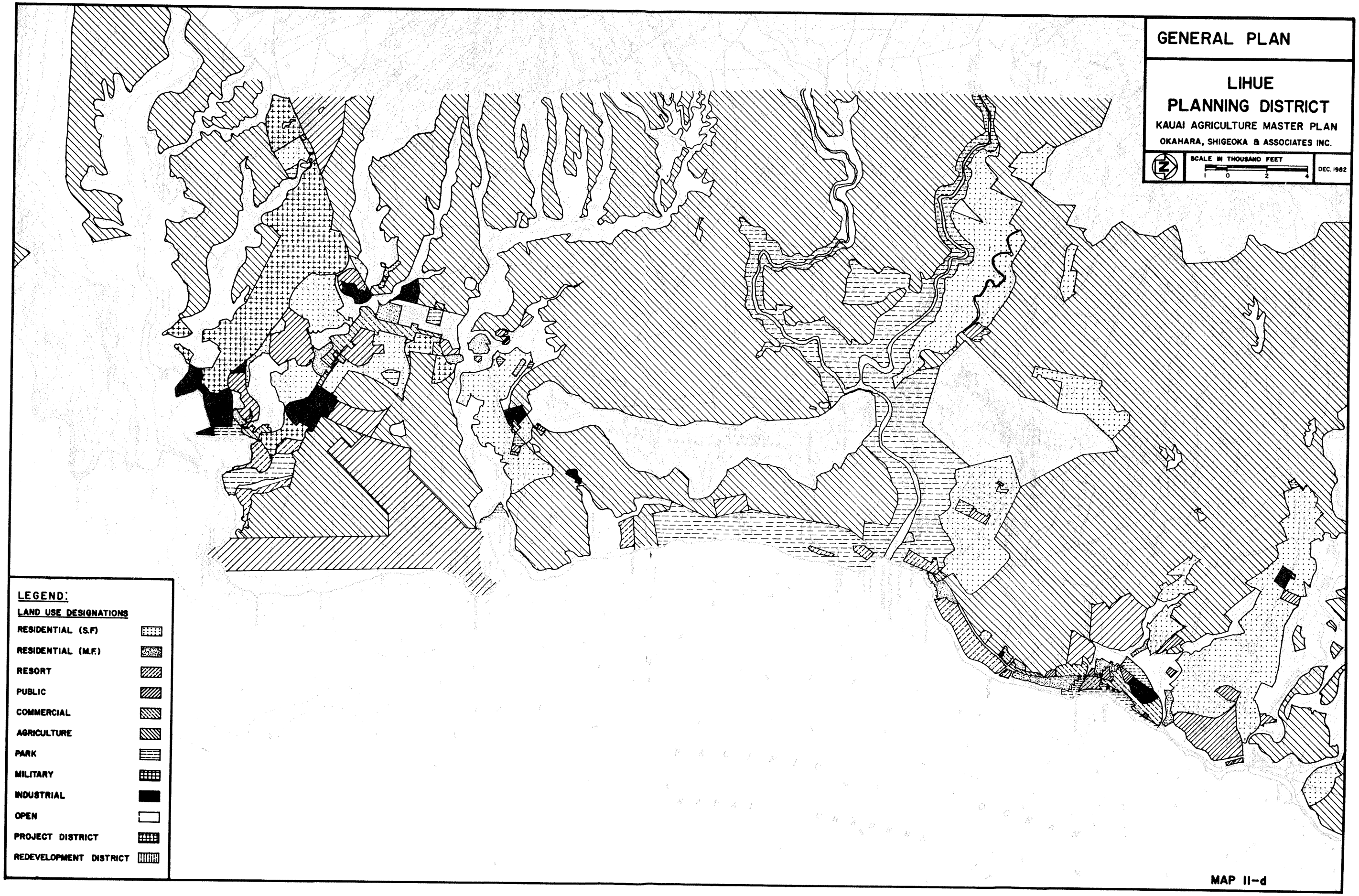
KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982



LEGEND:

LAND USE DESIGNATIONS

- RESIDENTIAL (S.F)
- RESIDENTIAL (M.F.)
- RESORT
- PUBLIC
- COMMERCIAL
- AGRICULTURE
- PARK
- MILITARY
- INDUSTRIAL
- OPEN
- PROJECT DISTRICT
- REDEVELOPMENT DISTRICT

MAP II-d

GENERAL PLAN

KILAUEA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

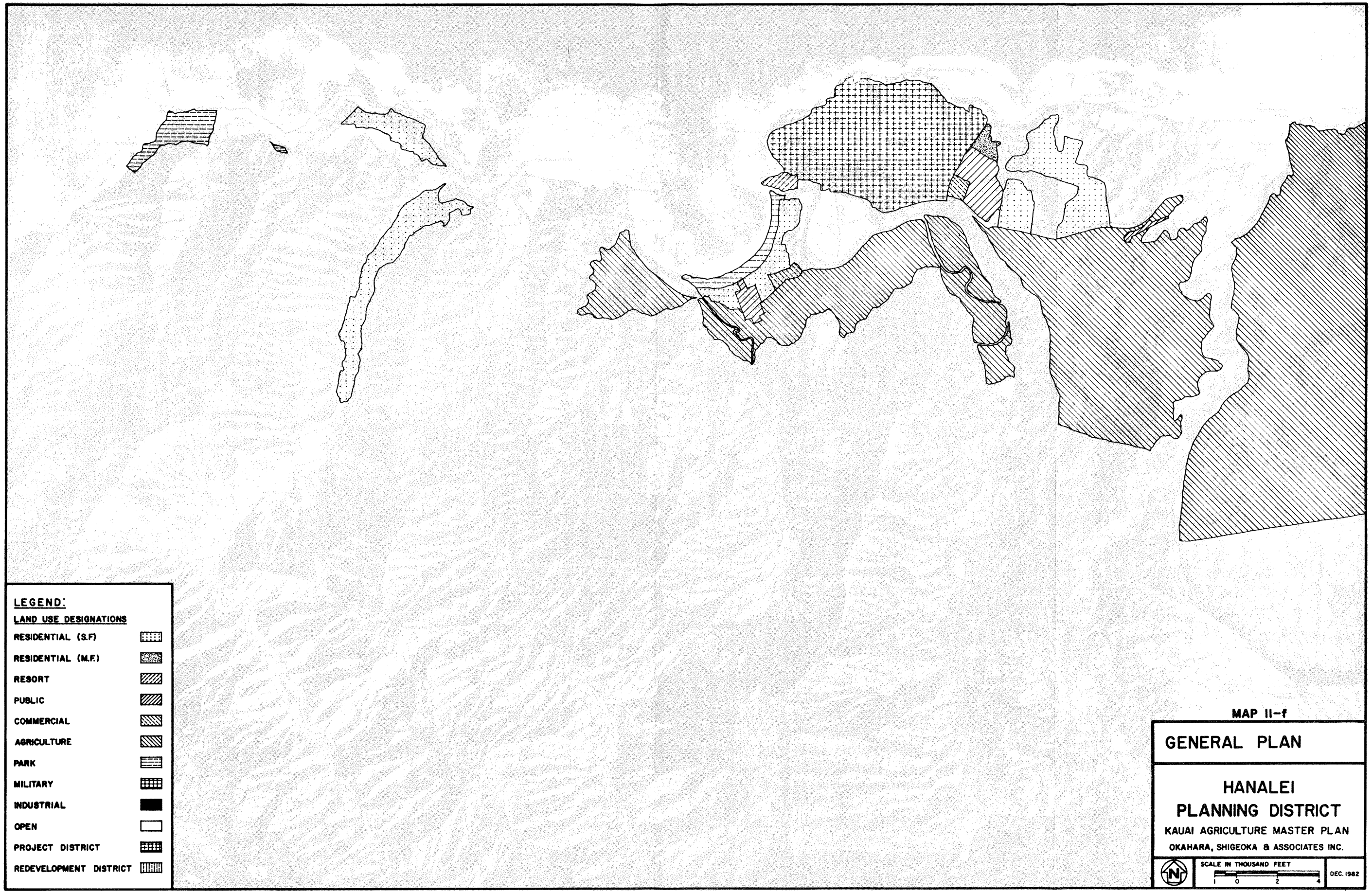
DEC. 1982

MAP II-8

LEGEND:

LAND USE DESIGNATIONS

- RESIDENTIAL (S.F)
- RESIDENTIAL (M.F.)
- RESORT
- PUBLIC
- COMMERCIAL
- AGRICULTURE
- PARK
- MILITARY
- INDUSTRIAL
- OPEN
- PROJECT DISTRICT
- REDEVELOPMENT DISTRICT



MAP II-f

GENERAL PLAN

HANALEI PLANNING DISTRICT

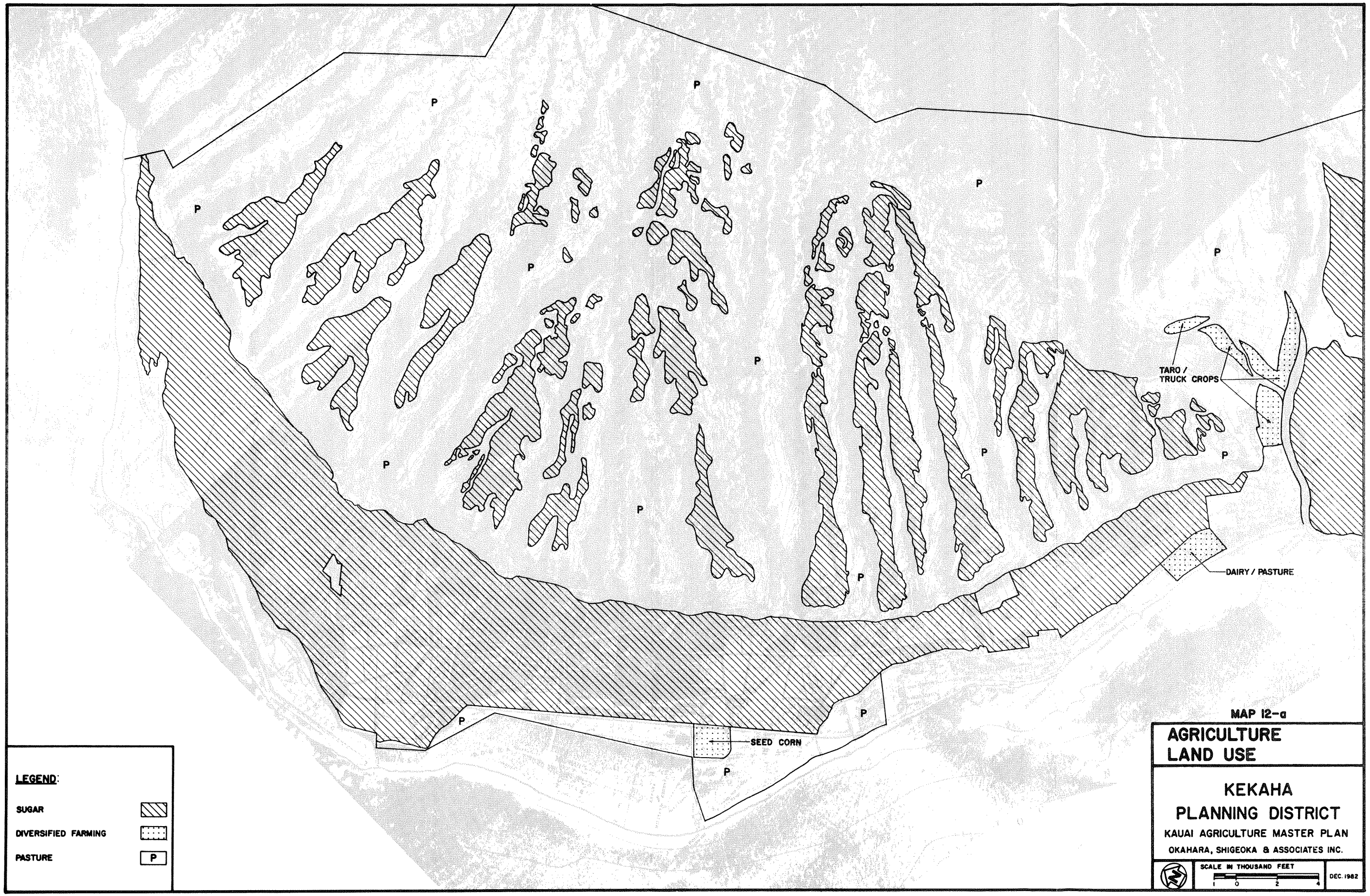
KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982


P
TARO / TRUCK CROPS
DAIRY / PASTURE
SEED CORN
LEGEND:
SUGAR
DIVERSIFIED FARMING
PASTURE
P
MAP 12-a
AGRICULTURE LAND USE
KEKAHA PLANNING DISTRICT
KAUAI AGRICULTURE MASTER PLAN
OKAHARA, SHIGEOKA & ASSOCIATES INC.
SCALE IN THOUSAND FEET
1 0 2 4
DEC. 1982

AGRICULTURE LAND USE

HANAPEPE PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

TARO/
TRUCK CROPS

P

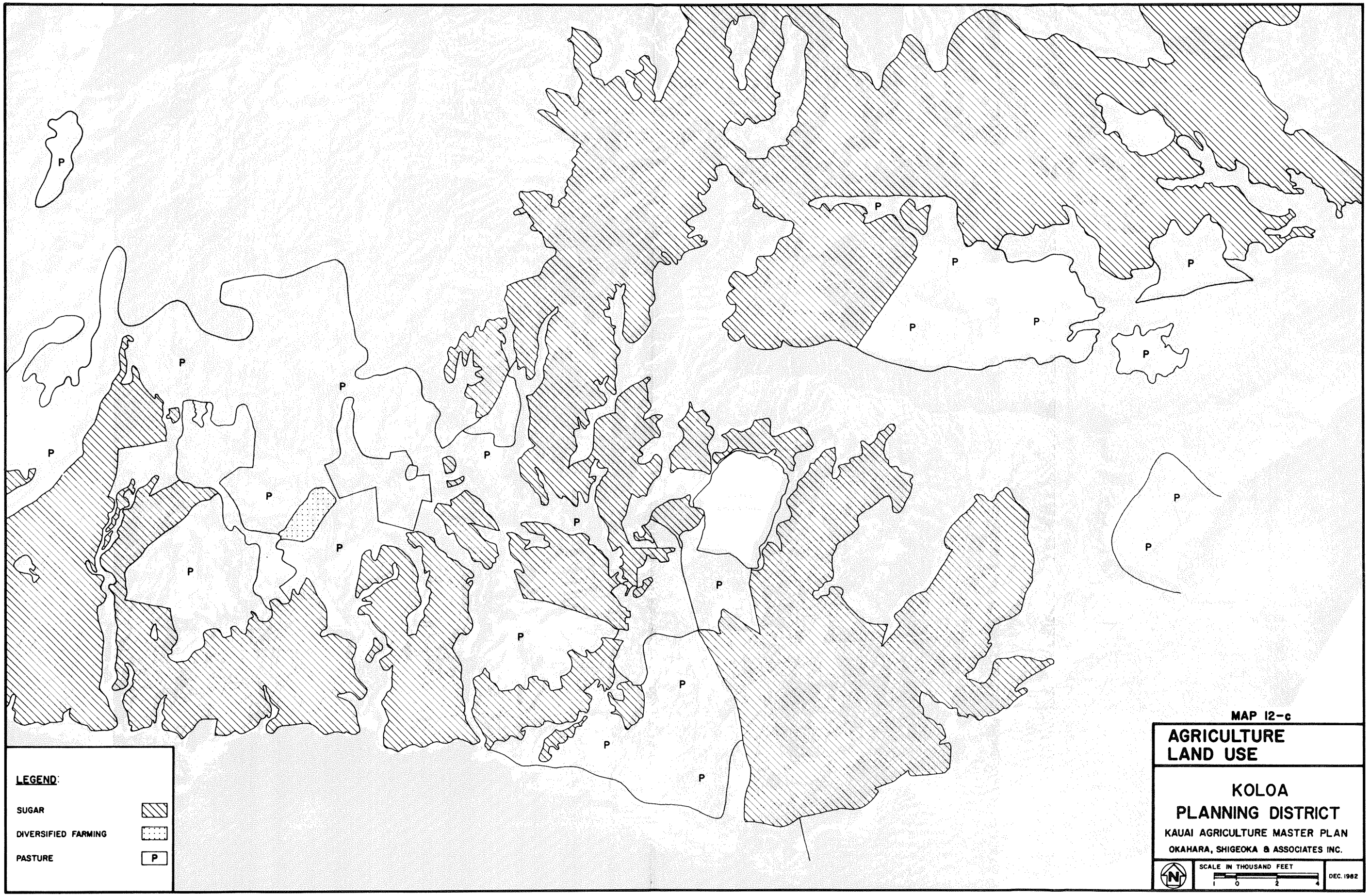
LEGEND:

SUGAR

DIVERSIFIED FARMING

PASTURE P

MAP 12-b



MAP 12-c

AGRICULTURE LAND USE

KOLOA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

N

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

AGRICULTURE LAND USE

LIHUE PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

LEGEND:

- SUGAR
- DIVERSIFIED FARMING
- PASTURE (P)

MAP 12-d

AGRICULTURE LAND USE

KILAUEA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

MAP 12-e

ORCHARD

ORCHARD

TRUCK CROP

ORCHARD

PRAWNS

TRUCK CROP

ORCHARD

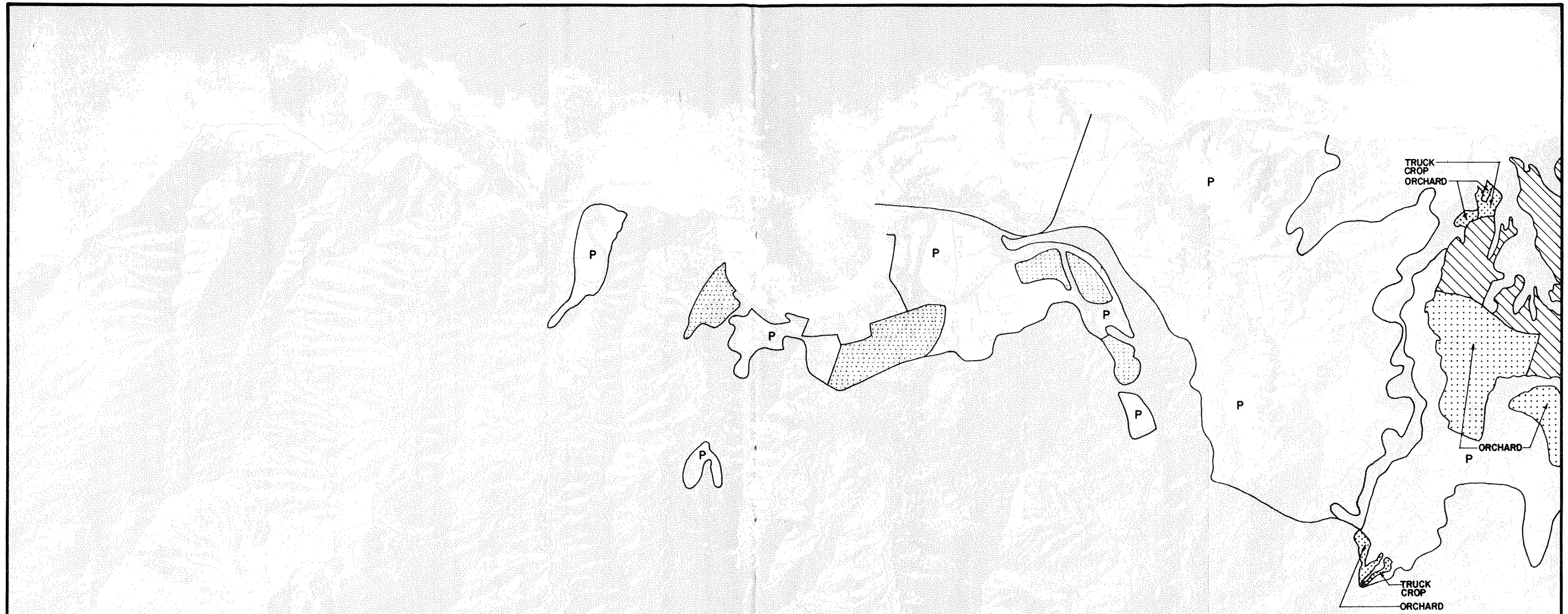
SILAGE CORN

ORCHARD

TRUCK CROP

ORCHARD

P



LEGEND:

- SUGAR
- DIVERSIFIED FARMING
- PASTURE — P

MAP 12-f

AGRICULTURE LAND USE

HANALEI PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC 1982

LEGEND:

DOMESTIC WATER

IRRIGATION & AGRICULTURE WATER

STREAMS WITH DIVERSION

RESERVOIRS

LAKES & RIVERS

MAP 13-a

DOMESTIC AND IRRIGATION WATER

KEKAHA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

LEGEND:

DOMESTIC WATER

IRRIGATION & AGRICULTURE WATER

STREAMS WITH DIVERSION

RESERVOIRS

LAKES & RIVERS

MAP 13-b

DOMESTIC AND IRRIGATION WATER

HANAPEPE PLANNING DISTRICT

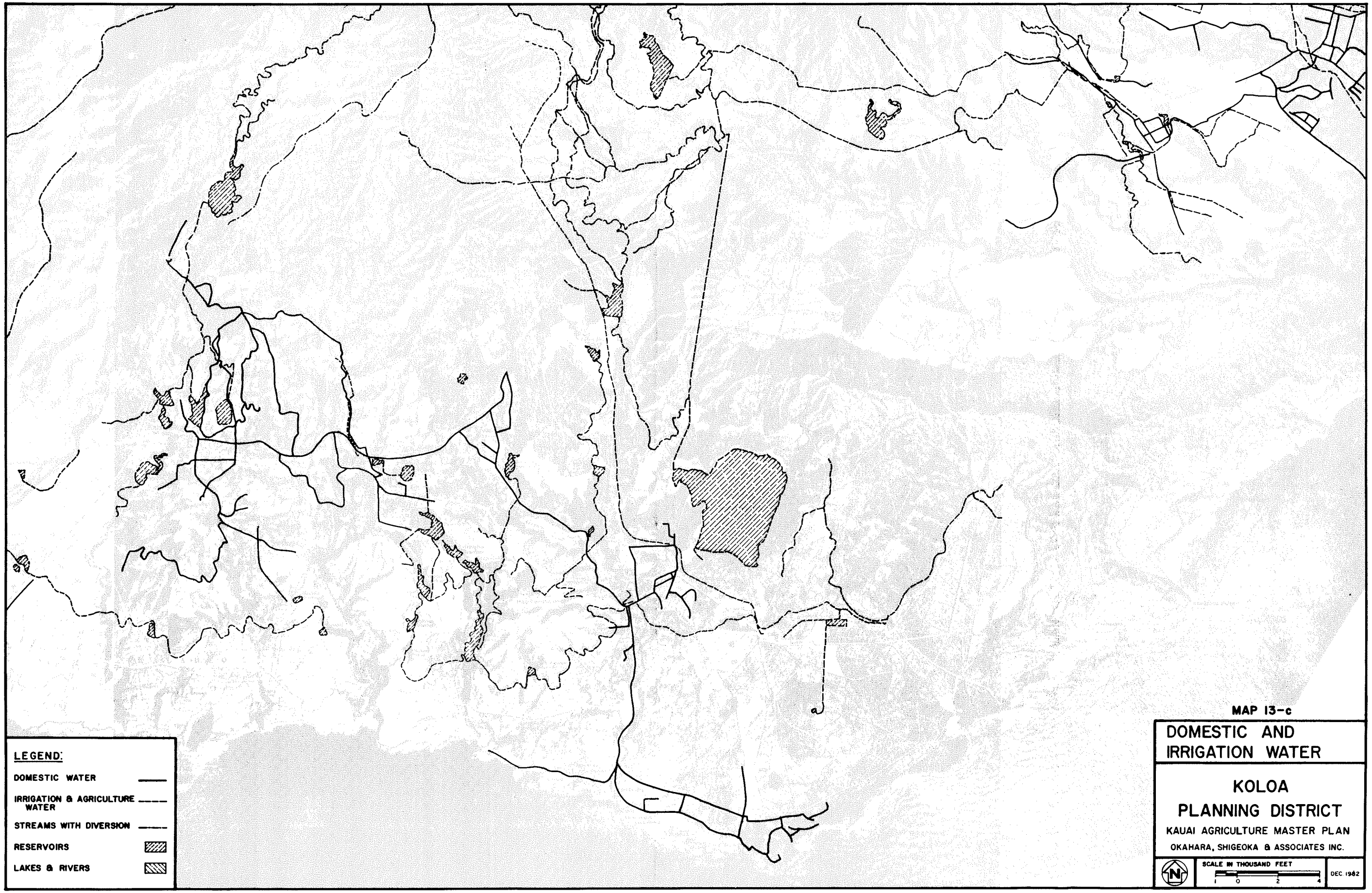
KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982



MAP 13-c

DOMESTIC AND IRRIGATION WATER

KOLOA PLANNING DISTRICT

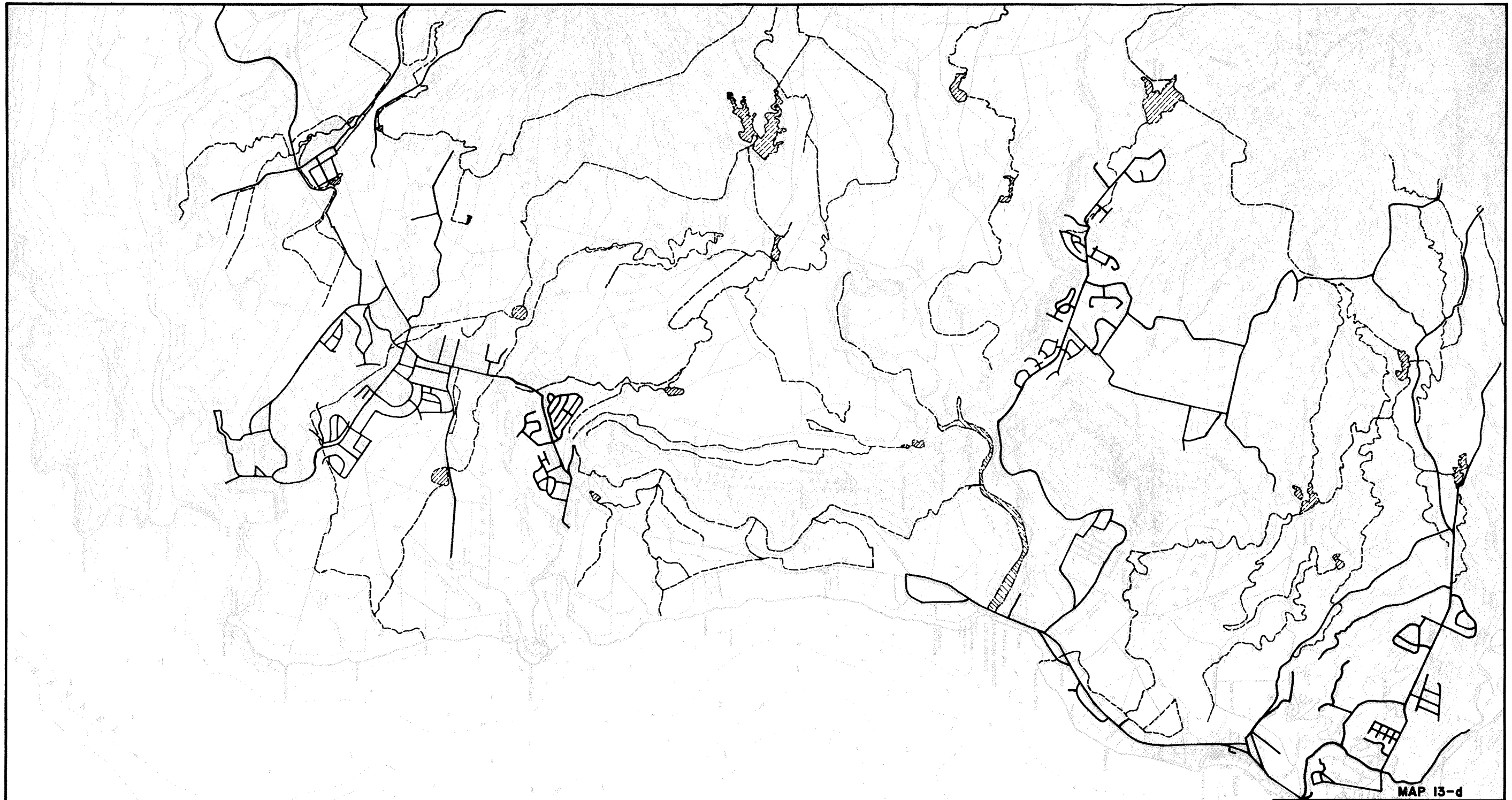
KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC 1982


LEGEND:
DOMESTIC WATER
IRRIGATION & AGRICULTURE WATER
STREAMS WITH DIVERSION
RESERVOIRS
LAKES & RIVERS
MAP 13-d
DOMESTIC AND IRRIGATION WATER
LIHUE PLANNING DISTRICT
KAUAI AGRICULTURE MASTER PLAN
OKAHARA, SHIGEOKA & ASSOCIATES INC.
SCALE IN THOUSAND FEET
1 0 2 4
DEC. 1982

LEGEND:

DOMESTIC WATER ——

IRRIGATION & AGRICULTURE WATER _____

STREAMS WITH DIVERSION ——

RESERVOIRS

LAKES & RIVERS

DOMESTIC AND IRRIGATION WATER

KILAUEA PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

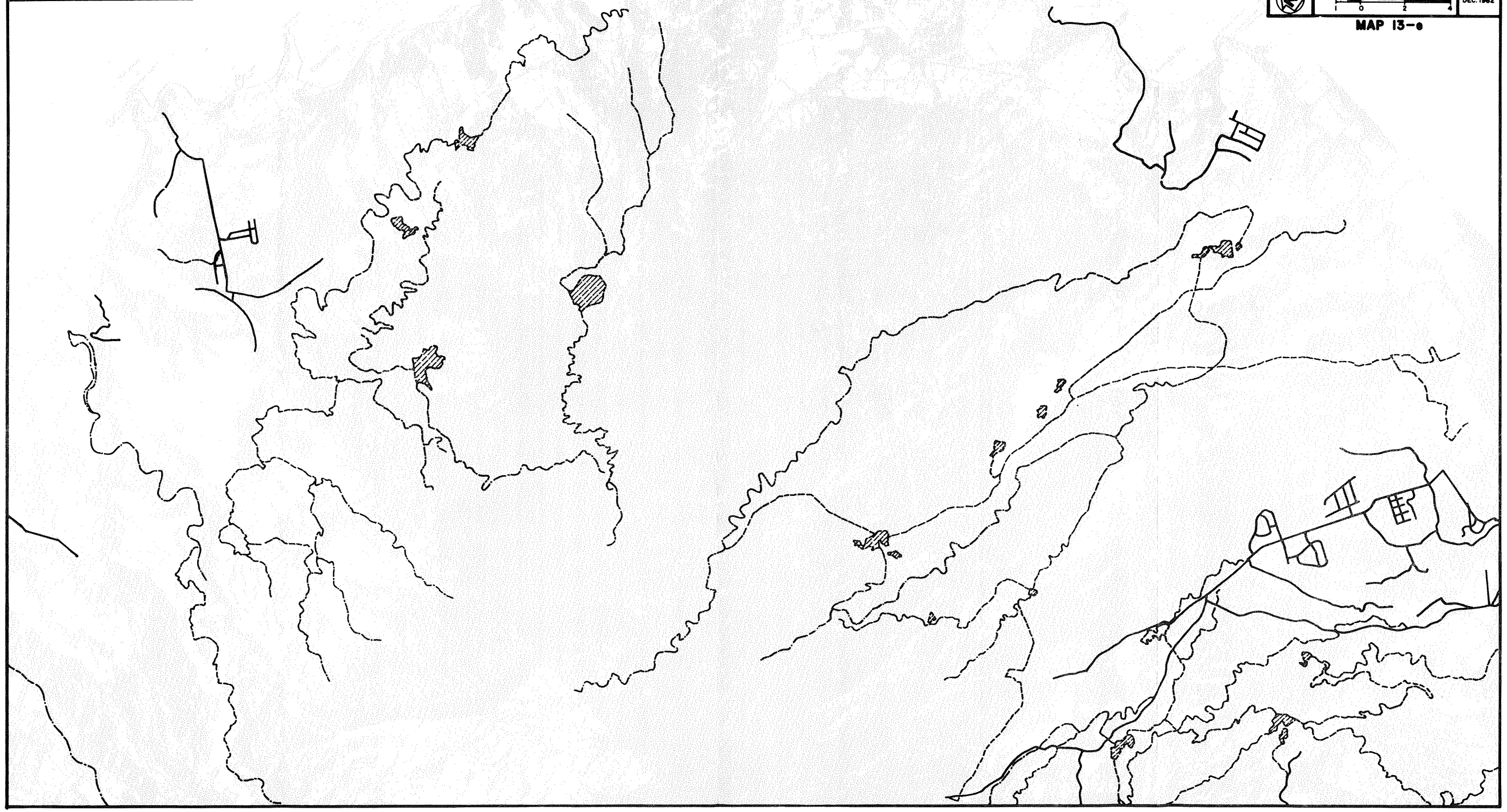
OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

MAP 13-e



LEGEND:

- DOMESTIC WATER
- IRRIGATION & AGRICULTURE WATER
- STREAMS WITH DIVERSION
- RESERVOIRS
- LAKES & RIVERS

MAP 13-f

DOMESTIC AND IRRIGATION WATER

HANALEI PLANNING DISTRICT

KAUAI AGRICULTURE MASTER PLAN

OKAHARA, SHIGEOKA & ASSOCIATES INC.

SCALE IN THOUSAND FEET

1 0 2 4

DEC. 1982

AGRICULTURE
INDUSTRY CONSTRAINTS

SECTION III

III. AGRICULTURAL INDUSTRY CONSTRAINTS

A. Introduction

The general nature of constraints imposed on Kauai agricultural industry are the same constraints faced by the State's agricultural industry. However, there are differences in degree of problems faced by each county. For example, in Hawaii County the land availability problem is not as severe as that faced by Oahu, Kauai, or Maui. Also, each agricultural industry experiences different types of constraints and this further increases the degree of complexities in analyzing island-specific industry constraints.

It is useful for analytical purposes to separate the industry constraints into two broad categories: Production and distribution constraints, bottlenecks and problems are synonymous.

The production problem entails the general areas of:

- Land: Suitable land, availability and price
- Water: Quantity, quality and price
- Capital: Quantity and cost
- Labor: Quantity, quality and wage level
- Production Technology: Cultural practices, pest control, waste management, disease control, farm management, etc.

The distribution problem entails the areas of:

- Transportation: Land, air and surface

- Distribution channel: Number of steps included for the farm product to reach consumer since leaving farm gate.

- Marketing: Market information; supply and demand conditions; price information; product promotion and market penetration, research on basic consumer attitudes and change of appeal.

It is readily apparent that these problem areas are largely interrelated and in some instances it is not practical to treat them as separate problems. It is also true that this highly interdependent nature of the problem affords a simultaneous solution when critical bottlenecks are removed. For example, effective marketing and/or purchasing cooperatives may solve many of the transportation and marketing of production problems simultaneously.

Major problems in each area outlined above are briefly summarized. Then, each problem will be weighted according to the degree of difficulty which exists on Kauai.

B. Production Constraints

Land

Island of Kauai with an area of 353,900 acres constitutes 8.6% of the land area of the State of Hawaii. Because of its comparatively old geologic age Kauai's terrain is characterized by the fact that, while 66.6% of the land possesses slopes exceeding 10%, at the same time the island has a disproportionately large share of the State's best agricultural land on the surrounding coastal plains.

Two different land classification systems are currently in use in Hawaii for the general and comparative rating of agricultural suitability: The Land Study Bureau (LSB) Land Types system, and the more recently developed "Agricultural Lands of Importance to the State of Hawaii" (ALISH) system. In addition to physical andenvironmental attributes the LSB system classifies land with respect to its yield

potential for selected major Hawaiian crops (e.g., sugar and pineapple), while the ALISH system is based solely on physical and environmental characteristics including updated soil analysis and interpretations not available in the LSB system.

As of 1981 there were 47,500 acres in crop production on Kauai. The difference between this figure and the available Prime and Unique land resource (55,304) acres is 7,804 acres. This nearly 8,000 acres represents high quality agricultural land unused or underutilized at present. This figure includes land taken out of production with the closing of Kilauea sugar and or placed into less intensive agricultural use.

With respect to current land zoning on Kauai according to the State's land use districts there are 144,023 acres in the agricultural district or 40.7% of the island's land area. A further 56% of the land area of Kauai is included within the Conservation District predominately State-owned land.

Land ownership on Kauai, reflecting tenure systems developed during the plantation era and Monarchy period, is highly concentrated. The State of Hawaii holds title to 134,516 acres (38% of the island) while 19 private land owners together control a further 170,135 acres (48.4%).

Current land use on Kauai is overwhelmingly dominated by sugar cane production which in 1981 encompasses 46,500 acres (1981) of the estimated 47,500 total acres in intensive crop production. Before the closing of Kilauea Sugar Company in 1971, sugar cane acreage averaged about 59,000 acres.

Beef production represents the major component in diversified agricultural production on Kauai with a sales value of 2.3 million dollars in 1981. Acreage in improved grassland or wooded pasture is estimated at 55,000+ acres. Other diversified crops (papaya, orchard and vegetable crops) combined utilize 1,800 - 2,000 additional acres. Combining both intensive and extensive agricultural uses approximately 102,800 acres (29% of the island area) are directly utilized in agricultural production.

From the standpoint of further agricultural diversification on Kauai, availability of land appears to represent a serious constraint. The high land values on Kauai combined with concentrated ownership limit the availability of fee simple land for new farmers. Long term leases from major private land owners are also frequently difficult to obtain.

Water

Average rainfall over the island of Kauai is approximately 100 inches annually or 2.5 billion gallons per day for the island as a whole. However, much of this rainfall is concentrated in the interior mountains where precipitation may exceed 300-400 inches annually, while the surrounding cultivated coastal zone receives appreciably less rain (20-60 inches).

Today, approximately 76% of the island's 47,500 acres in crop production are under some furrow, spinkler or drip form of irrigation In 1980, Kauai agriculture consumed 339 million gallons of water per day, representing 70% of total county water consumption; This is 33% of the island's estimated total daily sustainable water yield of 1.04 billion gallons per day of both surface and ground water. Irrigated sugar lands account for nearly all of this agricultural water consumption.

Although at present less than half of the island's total sustainable water yield is developed, the most economically exploitable surface and ground water sources are heavily utilized. (See Maps 13a-f) In particular, the upland gravity fed water systems exploiting perched, diked and surface water sources from the interior mountains are unlikely to be expanded dramatically for economic and environmental reasons. Currently unresolved legal issues relating to public/private water rights are also a factor that may constrain or delay future water development schemes, particularly where water diversion between different watershed areas is involved.

Development of ground water resources at low elevations for diversified agriculture is frequently constrained by both the capital and operating (pumping) costs of developing localized sources for comparatively small and dispersed agricultural operations.

Labor

Agricultural industry in Kauai, excluding sugar, has been experiencing general statewide problem of lack of both skilled and nonskilled labor at reasonable costs. Of 17 agricultural industries surveyed by Industry Analysis, 11 industries or 65 percent of the total industry indicated that they are faced with labor availability problems.

Kauai's employment statistics indicate that the non-agricultural employment has risen from 11,100 in 1976 to 14,700 in 1980; a 32 percent increase whereas the agricultural employment dropped from 1,660 to 1,550 for the same period of time. In fact, self-employed farm operators with their family members working 15 hrs or more per week declined in number from 400 in 1974 to 260 in 1980. Decline in self-employment is partly due to the change from traditionally small independent farm operation to more organized agri-business firms. Wages offered by business firms is higher than the level offered by family workers. And yet many large scale farmers or organized agri-firms are experiencing difficulty attracting young people with adequate training to agriculture as a career.

Table III.1

Agriculture Wage Rate by Type of Work, April, 1981

Type of Work Performed	Dollar/hr.
Field Workers	5.17
Live Stockworker	5.08
Machine Operators	6.83
Supervisors	8.85

Source: Hawaii Agricultural Statistics, p. 94.

Lack of skilled manpower stems from a general failure to attract young people to choose agriculture as business opportunity. According to a recent survey done by the University of Hawaii School of Tropical Agriculture and Human Resources, less than 1% of high school graduates wish to seek further training in agriculture. This lack of interest in agriculture is mainly due to the lack of information and/or knowledge the operation and management of agricultural businesses. It is imperative that all the concerned institutions, DOE, DOA, GTAHR, and others put forth an effective educational program to foster the quality and quantity of future farmers.

Labor shortage problems may also be somewhat mitigated if and when the average farm size gets bigger and the efficient mechanization takes hold in farm operation. Wages for mechanized farm labor are always higher than that of manual farm hand, reflecting higher productivity of the former. Hence, mechanism may provide better opportunity of attracting young people into farming activity.

Capital

Farmers in Kauai have five major sources of agricultural credits:

- Commercial Banks
- Farmers Home Administration (FmHA)

- Farm Credit Bank (comprised of Federal Land Bank, Hawaii Production Credit Association and Bank for Cooperatives)
- State Agricultural Loan Program (SALP)
- Dealers

Of these sources, the most significant amounts of credit, over 70 percent, are handled by Farm Credit Banks for those established farmers. The SALP is also very active in providing financial services to those qualified farmers who are somewhat more risky and unable to obtain financial assistance from other sources. Both commercial banks and FHA are active in providing financing needs of the farmers.

Availability of Information: Information regarding the source of capital, qualification requirements, limitation on sum, and terms and conditions of loan, are not readily available to farmers. Information dissemination programs should be strengthened; in general, educational efforts should be designed to assist farmers.

Capital Base: Capital requirement for production of specific agricultural commodity is not known as of yet. Neither have the industrywide capital requirements been estimated. Thus, the capital fund allocation to provide agricultural loans has been inadequate to meet the needs of farmers and of late the cost of funding is too high.

There is no doubt that government must provide effective incentive programs which will attract more private capital into agricultural investment. There presently are a number of incentive programs existing in various stages of development such as the State's orchard development program, agricultural park concepts, and product promotion. Effectiveness of such programs in attracting capital into the agriculture industry should be carefully evaluated.

Capital base also can be expanded by greater participation of State Loan Funds. The Department of Agriculture and private industries should double their efforts in attracting Federal Land Banks, Production Credit Associations, and other large mainland financial institutions to expand their operation in Hawaii.

Farm Management and Cultural Practices

Fundamental problems of farm management facing the agriculture industry are typical for most non-corporate or small farm operations. On farm effeciency and marketing management continue to be the major constraint to the industry. Farmers generally are not efficient in financial management and marketing as the current economy requires. The economy because of its complexity and sophistication requires the farmer to be knowlegeable about his financial arrangements and markets in order to survive. Today's farmer can no longer depend on elementary business and marketing systems to remain viable. Kauai's farmer needs more adequate training in financial management and on farm management information systems which would enable him to ultimately manage his operation. Planned expansion of Kauai's agriculture sector will no doubt be hampered by inefficient operations and the lack of skilled farm managers.

Farmers need to constantly implement improved cultural practices. Crop production must be enhanced by a working knowledge of plant and animal nutrient requirements and optimum fertilization practices. A farmer must be cognizant of the effects of fertilizer inputs versus economic production. There is a basic need to institute more education programs in this area.

There is a lack of improved crop cultivars variety which are disease resistant and produce well. Likewise, in the livestock industry there is a general lack of improved cattle breeds that perform well in tropic environments. Dairy cattle in Hawaii exhibit a lower conception rate than herds on the mainland. There is a need for directed research in this area.

Basic crop cultural needs and management needing improvement are:

- Nutrient requirements to produce optimum marketable yields of all crops need to be determined.
- Optimum densities for all crops need to be determined.
- Optimum irrigation practices (overhead, subsurface, and drip) need to be determined.
- Optimum fertilization practices (side dress, through drip systems) need to be determined. Interaction between fertilization and irrigation practices needs to be determined.
- Feasible integrated weed, insect and disease control measures need to be developed using irrigation systems where possible.
- The technology to produce uniform crop seasons need to be determined and transmitted to Kauai's growers.
- Mechanization for more crop cultural practices such as seedling production, transplanting and harvesting where applicable for certain crops should be determined.
- The programs of tissue analysis and soil analysis are still needed to develop optimum fertilization practices.

The livestock industry of Kauai has some key areas of concern which require immediate attention and improvment:

- A feasible State land lease policy must be developed in order to maintain reasonable livestock improvements against payments.

- Herd selection and testing program to improve inherent performance need to be established with adequate supporting research in order to determine the genetics and interrelationships of complex traits.

- Feasible cost efficient methods of developing and delivering the water in livestock producing areas need to be continually pursued.

- The productivity of Kauai's pasture lands need to be improved with data secured by intensive research on the composition of Kauai's soils and their relationship to plant growth and quality for each forest species in different climatic zones.

- Effective methods to control weed infestation and disease need to be determined.

- Kauai's livestock producers need to be introduced to a more efficient livestock handling practices and rearing facilities.

C. Distribution Constraints

Marketing

Kauai's diversified agriculture farmers are typically characterized, as in other countries, as small farm operators dispersed throughout the island. Perhaps the most critical problem area for these farmers is marketing of their product in a well-organized manner, producing right amounts, delivering them to the market in a timely manner and, above all, being able to receive a stable price that will encourage continuous production/operation. Obviously, this is easier said than accomplished, for various and complex reasons.

First, there are 200 or so independent farmers on Kauai engaged in producing a diversified range of agricultural commodities from snap beans to watercress; cattle, poultry, hogs; dairy products; seed corn; papaya and other fruits and melons. None of these Kauai products, (with the exception of taro) constitute any significant portion of total State's consumption, save taro, of the State. Moreover, many of these locally consumed fresh vegetables and fruit are easily over-supplied, thereby depressing market prices to a level ruinous to farmers.

Second, there are very few organized groups of farmers such as Farmers' Cooperative Exchange (FCE) (only Maui and Hawaii have FCE's), or commodity based cooperatives. Without the organizational strength, individual farmers cannot survive effectively in this highly competitive industry. Individual farmers, are constantly in need of information regarding market demand and supply conditions.

Products must also be uniformly graded and standardized. These requirements must be initiated, organized and continuously revised by cooperatives.

There is also the need to keep in constant touch with wholesalers, cooperatives,and produce directors such as big chain stores. All these needed information cannot be obtained by individual farmers and therefore reliance must be placed on the cooperatives.

In organizing cooperatives, any number of difficulties could be encountered. First, like any other organized business entity, need managerial talents for organizational skills, operational efficiency, and adequate resource staff and support. There has been very little opportunity to attract these kinds of talent to the Kauai agriculture industry, except for a few better organized agri-business firms.

- Establishment of tax incentives, reduction of unnecessary regulations and the consolidation/-coordination of necessary regulations.

Particularly important to the marketing area is the availability of transportation means to bring products to market places fast, reliably and inexpensively.

Transportation

Transportation is the life line of Hawaii. This is more so than any other State, simply because of its geographical location as a multi-island state. Significant portions of cargo movements in and out of Hawaii are composed of agricultural goods such as large quantities of fertilizer, farm machineries. Hawaii's export products such as sugar, pineapple, and other tropical fruits also constitute the bulk of cargo. Included in the cargo are inter-island as well as interstate shipments.

Some fundamental problems of transportation in the agricultural industry in Hawaii stemming from basic "imbalance" in the transportation system are:

- Hawaii imports four times the volume of goods through Honolulu Harbor than it exports.

- Cargo shipped from Honolulu to the neighbor islands is two times greater than that shipped from the neighbor islands to Honolulu.

- Half of the Hawaii exports using Honolulu harbor is fruit and juices and one-third of shipment from neighbor islands to Oahu is fresh fruit.

- Most air cargo traffic is from Honolulu to neighbor island rather than in the opposite direction Hilo is an exception.

The above conditions imply that:

- There are excess capacity problems in both air and waterborne cargo transportation out of Honolulu to mainland and foreign destinations.

- There is excess capacity from the neighbor islands to Honolulu both in air and waterborne cargo.

- There is excess capacity from the neighbor islands to overseas destinations for containerized cargo.

These features, in turn, produce a series of transportation problems to farmers in Kauai as well as other neighbor islands. The problems can be expressed as follows:

- Although air cargo carriers and surface carriers give special rates to Hawaiian agricultural cargo (air carriers rates are due to excess capacity and Young Brothers and Matson rates are due to 50% harbor tariff along with preferential treatments) the high air freight rates prevent farmers to ship their produce by air.

- Inadequate surface transportation services also stems directly from the excess capacity that the carriers are faced with. The carriers operate in an environment where short distance hauling, frequent docking time and low volume of cargo produce high proportions of non-revenue time. This consequently leads to inadequate scheduling, and sometimes unreliable services. No doubt, both transportation providers and the agricultural industry must do their part to resolve at least short-run problems. It appears that the agricultural industry in its part must make the utmost effort

to consider the special nature of cargo that agricultural commodities represent.

The lack of adequate storage and/or supporting facilities, particularly at or near air terminals poses another bottleneck. For example, a lack of covered holding areas, refrigerated storage space, ramps and cargo terminal facilities for Lihue Airport and all other neighbor islands are recognized by the State Department of Transportation. Construction of such needed facilities to be leased to private operators should be stressed.

The need for major cargo hauling facilities at Nawiliwili harbor, such as container terminal areas and berthing space requirements should be quickly assessed and this CIP item should be stressed to State DOT as a high priority item.

AGRICULTURAL PRODUCTS DEVELOPMENTAL PRIORITIES - A STRATEGY

SECTION IV

IV. AGRICULTURAL PRODUCTS DEVELOPMENT PRIORITIES - A STRATEGY

A. Introduction

The basic strategy of the Kauai Agricultural Master Plan is to select a number of products in which a concerted effort can be applied and a sound industry can be established. In developing such a strategy it is of the utmost importance that Kauai County assume an assertive role and be willing to spearhead all the required actions together. A great degree of joint effort by the administration and the County Council is needed, with a cooperative spirit between private and government sectors, and particularly the all-out support from higher levels of government (State and Federal) are required. We believe that this can best be achieved when the county government is entrusted with more responsibilities than is the case at present.

B. Formulation of Bottleneck & Incentive Index

The critical step in expanding the diversified agriculture industry lies in the selection of suitable products. This task however, poses a considerable challenge. For one thing, development potential for each type of product is limited by two factors: size of market and supply capability. Since there are a large number of agricultural products, that are currently produced in Kauai as well as new potential products that may be developed, any attempt to analyze each and every of these products in detail will be an enormous task. Nevertheless, the task cannot be ignored. In an effort to handle this important task, we have developed a model which will enable us to screen many candidate products which have the most viable and promising future. This model or approach is described briefly in the following section.

There are fifteen problem areas identified by the Industry Analysis conducted by the University of Hawaii's College of Tropical Agriculture and Human Resources (CTAHR). Of these, 12 are related to production activities such as land, water, farm management, pest control, two are related to distribution, transportation and marketing; and one deals with government regulations.

There are also a dozen well defined product or product groups that are produced and marketed by Kauai farmers. Needless to say, each of these products faces different degrees of difficulties in the problem areas identified above. The Industry Analysis refers to analysis of each product on the statewide basis and assigns priority weight on each problem area. Thus, for example, for the dairy industry, feed costs and its related problems are most severe and rated priority 1 whereas breeding and genetics problem areas are not as critical and are priority 14. The taro industry would have water and land problems as its priority 1 and 2, respectively, where as the cost of production and farm management ranks 13. As pointed out, these analyses are done on a statewide basis and as such are subject to a slight variation from island to island.

In order to apply the information and data available to the development of Kauai Agricultural Master Plan, two modifications to the Industry Analysis are necessary.

- Development of Kauai specific "Bottleneck Index" by which each product or group of products is reevaluated to reflect local conditions.

- Development of an "Incentive Index" (I-I) from which the benefits and contribution of each product or group of products is expected to make.

Using these two indices, each product is ranked in order of the Incentive/Bottleneck Ratio (IBR). This ratio has similar interpretations to the cost/benefit approach used for project selection. In this instance, however, the "Bottleneck Index" reflects the anticipated problems, and the costs of removing the bottleneck are not specified. The following is a brief explanation on how these two indices are developed.

1. Bottleneck Index

Table IV.1 is a "bottleneck" matrix in which problem (Bottleneck) is listed across (column) and products are listed down (row). Each problem listed is assigned a weight, for example, land (17). These weights are average weight assignments given by a panel of five expert. These are consistent with the results of Statewide Industry Analysis. Each product then is evaluated on the scale of 1-3 (1 = relatively no problem; 3 = considerable problem), for each problem area. For example, for bananas the land problem received 1 and 2 for availability and price, respectively, 1.5 for the marketing problem and 2.0 for the capital problem. Multiplying the degree of difficulties (1-3) faced in each problem area by problem weights and adding it across the problems, we established a bottleneck index for bananas. This procedure is followed for all products. Thus, a score of 100 would be the lowest a product can receive, signifying that the product has no bottleneck problems in any of the areas. On the other hand, a score of 300 is the maximum and this means the product has severe difficulties in all the problem areas. It must be pointed out here that the approach is designed to discriminate one product from another in some quantitative manner, and as such the bottleneck index should not be interpreted to have any meaning in an absolute sense. It should be noted that an entirely different index can be developed should the experts opinion are other than expressed in this study.

Table IV.1 Major Bottleneck Areas in Agriculture Industry in Kauai Other than Sugar[1]

Constraints / Product	Land		Water	Labor	Capital	Transportation	Farm Mgmt	Marketing	Gov't Reg	Total
	Avail	Price								
weight	8	8	9	7	10	16	12	24	6	100
Banana	1.0	2.0	1.5	2.0	2.0	1.5	1.5	1.5	1.0	155.5
Beef	3.0	3.0	1.0	1.0	3.0	1.5	1.5	1.5	1.0	178.0
Dairy	1.0	1.0	1.0	1.0	3.0	2.0	1.5	1.5	1.0	154.0
Feed & Forage	3.0	3.0	2.0	1.0	1.5	1.0	1.0	1.0	1.0	146.0
Leafy Vegt.	1.0	2.0	1.0	1.5	2.0	2.0	1.0	1.0	1.0	137.5
Macadamia Nut	1.0	1.0	1.0	1.0	2.0	1.0	1.0	2.0	1.0	134.0
Flower & Plants	2.0	2.0	2.0	1.0	3.0	2.0	1.0	2.0	1.0	185.0
Juice (Guava, P. Fruit)	1.0	1.0	1.0	1.0	1.5	2.0	1.0	3.0	1.0	169.0
Papaya	2.0	2.0	3.0	2.0	2.0	1.0	1.0	1.0	1.5	154.0
Seed Corn	2.0	2.0	2.0	1.0	2.0	1.0	1.0	1.0	1.0	135.0
Swine	1.0	2.0	1.5	1.5	3.0	1.5	1.5	1.5	2.5	171.0
Taro	2.0	2.0	1.5	1.5	1.5	1.5	2.0	1.5	1.5	164.0

[1]The weight distribution among the bottleneck areas and the degree of problems (1-3) were determined by a group of experts (Agronomist, Agriculture Economist, Environmental Geographer).

2. Incentive Index

The Incentive Index (I-I) is designed to reflect the "desirability" of a product measured by its contribution to the economy through income and employment. The current as well as the future market potential (can be used a proxy) for the magnitude of products' contribution to the enconomy. There is also a criterion by which the levels of government regulation and/or support are measured. Understandably, construction of an index of this nature is complex and particularly quantitative assessments are at best subjective. However, the index does serve as a discriminator and enables us to rank the product in order of priority.

Three incentive areas being considered are weighted according to the relative importance of each incentive. Thus, the market potential is assigned 50%, employment and income contribution 25%, and the level of government support-regulation 25%. Contribution of each product then is evaluated on the scale of 1-3 (1 = light contribution; 3 = heavy contribution). This score is then multiplied by each of the three incentive weights and totaled to arrive at the Incentive Index. Table IV.2 provides Incentive Indices for 12 selected products. The Incentive Indices ranges from a high of 300 points (perfect score) for papaya to a low of 125 for dairy products.

C. Selection of the Candidate Product

The candidate products are selected within each of the following two categories:

1. Export Market (out of state)

2. Intra-state market

Table IV.2 Major Incentives Associated with Selected Agriculture Products, Kauai

	Market Potential (5 years)	Employment Income	Gov't Support/[1] Regulation	Total
Weight	50	25	25	100
Banana	3	2	2	250
Beef	3	3	1	250
Dairy	1	1	2	125
Feed & Forage	3	2	1	225
Leafy Vegetable	2	3	2	225
Macadamia Nut	1.5	2	2	175
Flower/plants	2	3	1	200
Juice	3	2	1	225
Papaya	3	3	3	300
Seed Corn	2	3	2	225
Swine	3	1	2	225
Taro	3	2	2	250

[1]Here score of 1 = Lack of government support and/or burdensome government regulation
3 = good government support and minimum problem in regulation

Within each market products are selected for the short-term and long-term development objectives. Those products that fall into the short-term objectives usually are the products that are already established, and resource requirements, particularly land, are not the bottleneck for immediate development. On the other hand, the products with long-term objectives usually require large scale land and also prolonged product promotion. The products with long term objectives in its development obviously would also have a greater chance of eventually replacing the sugar industry on Kauai.

D. Export Product Potential

There are seven product groups that are produced in Kauai and exported. In Table IV.3, sugar represented $74 million of $79 million exported in 1981. The $5 million remaining were contributed by six products. We have examined these six groups of export products in detail, subjecting them to our bottleneck-incentive analysis. Bottleneck index and incentive index for each of these products are developed in Table IV.1 and IV.2. Table IV.4 summarizes the results of these analyses. For each product, current production and market values (as of 1981) are indicated. We then indicate a market potential that can be developed within the next 5 years along with required additional land acreage. We have not developed other resource requirements such as water, capital, labor, and marketing development category etc. simply because these would require much greater effort and time, and thus are beyond the scope of the present study. We also ranked each export candidate in terms of Incentive/ Bottleneck Ratio (IBR). This ratio is derived by dividing the incentive index by the bottleneck index and, as pointed out earlier, has a similar meaning as cost-benefit ratio.

Table IV. 3 Agricultural Products for Export and Local Market, Kauai, 1981

Market	Thousands of Dollars	Percentage of State Supply	Percentage of State Consumption
Export Market (1981)			
Commodities:			
Sugar	$74,000	35.6	-
Papaya	1,567	12.8	-
Nursery Products other than Anthurium	730	3.0	-
Anthurium	10	0.1	-
Macadamia Nut (Maui/Oahu)	99	0.4	-
Guava (Maui/Molokai/Oahu)	329	45.9	-
Seed Corn	2,900 (State Total)		
Local Market Commodities: (1980)			
Beef	2,295	8.1	0.02
Dairy (Maui/Hawaii)	6,684	3.4	3.40
Poultry (Hawaii/ Maui/Molokai)	73	30.0	0.07
Eggs (Hawaii/Maui/Molokai)	2,322	15.3	0.14
Swine	746	8.9	0.02
Vegetables & Melons	595	2.7	0.01
Orchard Crops (Banana)	234	15.0	0.15
Taro	934	71.6	-

Source: Hawaiian Agricultural Statistics, 1981

Table IV.4 Candidate Product for Export Market

Product	Current Mkt Value 1981 ($1000)	Potential Mkt Value in 5 years	Additional Land Reqts (Acres)	Incentive/ Bottleneck	Rank
Papaya	1,567	4,000	600-650	1.94	1
Flower/Potted Plants	730	2,000	60-80++	1.08	6
Winter Veg. & melons	595	1,000	40-60	1.63	3
Guava/Passion Fruit & Citrus	329	1,000	500-700	1.33	4
Macadamia Nut	99*	-	-	1.31	5
Seed Corn	600+	2,400	600-700	1.67	2

* Represents total production of Kauai, Mauai & Oahu

\+ State total is $2.9 million in 1981. The Kauai figure is our estimate

++ Requires approximately 120,000 sq. feet area of Greenhouse & 180,000 of artificial shade areas

This ranking does not necessarily represent the recommendation of priority in the export product development. It merely quantifies the overall ranking among the exportable products. Development of each product to it's full market potential obviously requires a different set of resources and development strategies. For instance, guava/passion fruit and other citrus products would probably take the form of concentrated "juice" and thus the transportation problems may not be as critical as that faced by export of fresh papaya. However, these products will still require extensive marketing promotion. There is ample land in Kilauea that may very well be suited for guava, passion fruits and other citrus fruits. Other bottleneck areas are not considered as critical and thus it received a relatively low bottleneck index.

Winter vegetables, although ranked 5th in IBR has a good potential of expanding it's market by concentrating only during winter months for export and using higher elevation lands. Kauai enjoys a definite comparative advantage over mainland growers during this period. It requires relatively small acreage and capital although these products, like most of the other perishables, do require efficient channels of distribution.

Seed corn which is ranked number 1 in our IBR deserves careful scrutiny. Our preliminary assessment is that it has just about the highest value/acre and potentially up to 2.5 to 3 crops/year turnover rate. There is already a well established market for it and there is ample indication that the product will expand rapidly. Capital requirement is not that great and presently the industry wage offered is as good, if not better, than sugar. It is only a matter of who will be the first to take advantage of the opportunity. We believe that the only serious constraint faced by seed corn is the quantity and quality of land availability.

Flowers and potted plants also have excellent market potential. We believe that tripling of current production level should be the goal of the industry within the next five years. There has been a good steady increase in the market, particularly for potted plants, in recent years. These recent market developments are primarily stemming from a shift to a highly concentrated urban mode of living, condominium and other multiplex

residents, from more traditional single owner occupied living arrangements. The important bottleneck, however, is the capital intensive nature of the production which requires heavy front end investments. When this bottleneck is eased these commodities could contribute heavily to Kauai's overall diversified agricultural activities.

One of the longer term product developments is macadamia nuts. Currently, Kauai has virtually no production of this crop. Presently, there is about28-30 acres that have been planted. Macadamia nut is the product with the least bottleneck, except the land requirements. The fact that the production cycle requires a relatively longer gestation period (6-7 years), the amount of acreage required is large, and that the turnover of the initial investment is long all lead to the conclusion that the product is a good candidate to be kept under constant reevaluation for potential development. An immediate development cannot be justified at this time.

E. Import Substitution Potential

The candidate products for potential import substitution were also evaluated in a similar manner as export products. Each product was subject to our bottleneck and incentive index analysis and they are summarized in Table IV.5 Again, for each product, current as well as potential market values that can be developed within the next five years are considered. Also, additional land requirements are indicated, along with now familiar IBR and relative marketing. For short-term consideration we evaluate banana which has the highest IBR ranking, taro which has the second highest ranking, and pork with the lowest IBR ranking. For longer term development, beef and feed crops are analyzed.

Table IV.5 Candidate Product for Import Substitution

Product	Current Mkt value $1000 (1981)	Potential Mkt value in 5 yrs $(000)	Additional Land Requirement	Incentive/ Bottleneck	Rank
Banana	234	750	250	1.62	1
Beef	2,295	5,000	none	1.41	4
Feed Grains	1,302	20,000	62,000	1.54	2
Taro	(wet) 934	(dry) 1,500	100-150	1.52	3
Pork	746	1,500	none	1.32	5

[1]Computed on the basis of 14 tons per/acre and today's average price of $23/ton

[2]Taro production here includes dry land taro

1. Short Term

Bananas on the east side of the island remains a viable agricultural crop. Excellent bananas can be grown with favorable yields. Despite damaged fields, Kauai can still recover to regain its market share and increase its share of the market gap created by the cessation of banana imports from South America. Producers in Kauai have a distinct market advantage over other neighbor island producers because of their lower cost of transportation. Oahu producers are not expected to increase their acreage in production.

Kauai County like the rest of the State still produces less than half of the beef consumed by visitors and local residents. With improved market efficiencies, and farm management technologies, Kauai could increase its market share and reduce the amount of imported beef. Expanded beef production as a long term prospect is particularily encouraging if feed crop industry can rapidly be expanded in Kauai. The feed/forage potentials are discussed under the long term product development section.

The State of Hawaii still imports roughly 77% of the pork consumed by visitors and local residents. Kauai producers have demonstrated that they can compete favorably with mainland producers to maintain a commanding share of the fresh pork trade in Kauai. As intrastate transportation efficiencies occur, Kauai farmers could increase their share of the "soft" pork trade in Honolulu. This share could be enhanced in the long term should a feed and forage operation become a reality.

2. Long Term

Feed/forage and corn production on Kauai can also reduce the State's dependence on imported feed for its livestock. This potential remains as a multimillion dollar possibility that could replace sugar cane on highly productive agricultural lands. If the sugar industry continues to reduce its planted acreage to gain economic efficiencies, feed/forage and corn could be produced. As transportation costs from the mainland continue their upward pressures, local dairies and feedlots may force or add impetus to the industry's development.

Dryland taro with adequate market development can be produced on Kauai, especially on the east side. Kauai producers could maintain an economic advantage over other neighbor island producers because of lower transportation costs.

Some import substitutions could also occur with the establishment of citrus orchards in the upper elevations of West Kauai, if irrigation water was available. Planning has been intiated for long term development of west Kauai water resources in the Kokee watershed.

IMPLEMENTATION MECHANISM AND RECOMMENDED ACTIONS

SECTION V

V. IMPLEMENTATION MECHANISM AND RECOMENDED ACTIONS

A. Institutional Adjustments

KAMP recognizes that both private organizations and government agencies must do their part in order to accelerate agricultural development on Kauai. Particularly of importance is that County government must take active role in coordination, product promotion, and agriculture industry development. In anticipation of such expanded role by County government, the following institutional adjustments are recommended.

Role of County Government

The lead agency as designated by the Mayor will be the Department of Economic Development. This agency will have the agricultural coordinator as staff resident to provide the direct liason with APAC, the County administration and the agri-business community.

County involvement in all sectors of agriculture planning is very important for coordination as well as implementation role playing. The State Agriculture Plan presently precludes direct County involvement and responsibility, although indirectly the County has a role in agriculture activies. Examples of the County's role are:

- Public land leasing: When public lands (State) are leased for cattle grazing the County has a minor role. But, in economic development programs such as agriculture parks, aquaculture and forest products development, the County must coordinate and/or provide the necessary leadership.

- Soil and water conservation: All counties are made up of Soil and Water Conservation Districts (SWCD). Technical assistance to the SWCD is provided by the U.S.D.A. Soil Conservation Service. The County refers subdivision plans and specs to the SWCD for their

review of soil and water aspects. The SWCD solicits comments/recommendations from SCS. The County should expand its utilization of the SWCD's

- The Agricultural Functional Plan: The action implementation process indicates that the Board of Agriculture on which the counties are represented has no power in determining what the priorities or budget will be for the Governor's Agriculture Coordinating Committee (GACC) where there is no County representation from Kauai. The GACC prepared the important section in the Functional Plan that deals with program and priorities (implementing actions). The County should request representation on the GACC since all action programs developed by the Department of Agriculture go to the GACC for review and approval. Ultimately, all statewide agricultural programs affects Kauai's agricultural sector.

Agricultural Plan Advisory Committee (APAC)

Upon adoption of the Kauai Agricultural Master Plan (KAMP), it is necessary to effectuate an advisory group to monitor the implementation process of the recommended high priority programs and provide the necessary adjustments during the process. The APAC would be characterized by the following aspects:

- Provides consistency to the implementation process, the advisory group should be appointed by the Mayor.

- All major agricultural industries should be (cattle industry, pineapple, papaya, guava, banana, sugar, seed and forage, dairy, taro, flowers and nursery,

vegetable, and swine) represented in the advisory group. A smaller industry group representation could be realized by combining similar industries. This could be recommended to the Mayor by the existing APAC.

- County Department heads from Planning and Economic Development should be permanent members of APAC. It has been demonstrated by the Governor's Agricultural Coordinating Committee that State Department heads serving on the committee makes the group more effective.

- Programmatically, APAC should provide the Department of Economic Development with clear direction on where to budget the County's agricultural development funds, in order to implement KAMP.

- APAC should be represented on the GACC to provide a positive coordinating link to the State agricultural development program.

Agriculture Coordinator

In a general sense, the coordinator is in essence the principal staff person in Kauai County, responsible for the coordination of all functional activities that facilitate the growth and sustenance of the agricultural sector. Functionally, the coordinator provides primary advice, support and counsel to the administration.

As a primary staff person in the Department of Economic Development, responsibilities could include such duties as:

- Serve as the Staff Executive Director to the APAC, as such, conduct and supervise all staff and support work relating to the activities of APAC.

- Coordinate and supervise all staff work relating to the market development of agricultural commodities.

- Serve as the primary County Liason for agricultural activities conducted by Federal and State agencies.

- Serve as Kauai County's representative on the Governor's Agriculture Coordinating Committee (GACC).

- Provides and coordinates the agricultural information and referral assistance to other related County agencies interested farmers and investors.

- Maintains an active role towards the maintenance of KAMP and its implementing actions.

- Actively assists new projects and programs initiated by APAC and coordinates its activities with other County State and Federal agencies.

As a staff member of the administration, the coordinator is ultimately responsible to the Mayor and receives primary supervision and direction from the Director of the Department of Economic Development. Therefore, because of the coordinator's complex and important role relating to economic development activities of the County, adequate staffing and funding must be provided to that office.

B. Recomended Actions

There are eight specific areas in which varying degree of implementation actions are recommended in order to achieve goals and objectives of the KAMP. Each of these areas are identified as follows:

1. Agricultural Development

Candidate agricultural products and crops described in Section IV exhibit high potential for development and will no doubt stimulate economic growth of Kauai's agricultural sector. Many agricultural development strategies are available to the County:

- Initite and encourage two types of agriculture parks.
  - Government: State, County and Federal sponsored or developed. Co-development also possible.

    Example: Present State agriculture park program is ongoing. Maui county initiated an agriculture park at Kula for vegetable and flower crop production. Hanalei Agriculture park uses Federal lands and improvement funds backed with support from the State DOA.

  - Private: County government can provide incentives or provide direct assistance to private land owners developing an agriculture park. Some incentives and assistance may include:
    - Special agriculture park zoning for lot size, road, water, and drainage standards.
    - Provide needed infrastructural improvements. (water, roads and drainage)

- Promulgate special agricultural park district with special taxation and rules.

- Provide direct and indirect financial sources for developers.

- County assistance to resolve transportation, labor, water, capital, and farm production constraints.

- Utilize resource assessment information in KAMP to determine best planning district to initiate agricultural development.

- Allow the County under the advice of APAC members to develop an agricultural development program using recommended actions outlined in KAMP.

- Emphasize import substitution market for agricultural products and crops development to allow Kauai to be self sufficient and supply portions of the State's market.

2. Land

- Seek the release of public land (with infrastructure improvements) for agricultural park development so that the County of Kauai can initiate an Agricultural Park Program or provide cooperation with the State's agricultural park program.

- Seek to locate agricultural park developments at sites environmentally compatible with viable crop types such as those recommended for emphasis in KAMP. It is essential for the success of diversified agriculture parks that high quality, rather than marginal lands, be committed for development. A thorough survey of publically owned lands in leeward Kauai should be initiated to identify parcels that might be developed into agricultural parks for the production of such crops as vegetables, seed and feed grains, etc.

- Perform detailed economic analysis to determine how both diversified agriculture and sugar can best be accommodated in west Kauai.

- Examine the possibility of acquiring private lands on lease or by exchange with State land, or transfer of development rights in order to make more land available for diversified agriculture.

- Promulgate and utilize tax and subdivision regulations to encourage intensive use of quality agricultural lands. A suggested mechanism for regulatory policies is to use the LESA system (Section II-B).

- Develop agricultural use contingency plans to be implemented in the event prime agricultural lands are withdrawn from sugar production.

3. Water

- Seek State funds to rehabilitate the Kilauea water system and resolve related management/use issues.

- Determine specifically which County domestic water systems can be most effectively improved or enlarged to promote growth of the diversified agriculture sector.

- Formulate and promote a prioritized list of specific water development projects for State CIP funding to assist diversified agriculture.

- Formulate and adopt an equitable method for the continuing provision of preferential water rates for agriculture.

4. Capital

- Develop mechanism by which available capital can be channeled to Kauai agricultural development activities.

- Assess the extent of capital requirements for the selected agricultural commodities and development. Obtain technical assistance from DOA, industry, and other sources.

- Determine fund requirements in providing set-up level of support for agricultural development, e.g., assisting marketing, promotion, transportation, market information, etc. Develop strategy to best mobilize needed funds for this effort.

- Develop an effective lobbying organization to win the financial support direct from legislative action in assisting infrastructure requirements in Kauai.

5. Labor

- Assist state and private efforts in evaluating, improving, and expanding agricultural training programs.

- Develop and promote career opportunity in agricultural educational programs with the assistance of DOE, DOA, and CTAHR.

6. Transportation

- Review loading and shipping fee charges as they relate to agricultural commodities.

- Explore the possibility of allowing Matson to carry periodic loads of interisland cargo when Young Brothers cannot meet load capacity or when service is interrupted by long holiday weekends.

- The State and Kauai County should develop an integrated capital development program which will ultimately facilitate the movement of agricultural goods to and from mainland distribution centers. The program should provide for adequate transportation facilities at piers and in terminals to move farm products to the market place efficiently and economically.

- There is need to re-examine roles of finished agricultural products versus raw agricultural materials that are being imported from the mainland.

7. Marketing

- Develop a computerized information system pertaining to the up-to-date production technology, cost of production, optimal size lot, market supply and price movements, and capital requirements for all existing agriculture products that old and new farmers can take advantage of.

- Establish a spearhead group representing industry and explore the potential benefits of formation of cooperatives. The County must play a lead role in obtaining assistance from State DPED, DOA, GACC, and CTAHR.

- Improve the marketing capabilities of selected local commodities. This will require an indepth understanding of marketing and distribution channel, including transportation system. We believe this is the highest priority action item. A permanent marketing specialist assigned to the co-op and possibly supported, at least partially, by County/State funds is needed.

- Establish a close link with DOA, HARS to which one major responsibility lies in providing market supply information along with supply forecasting of various commodities.

- Promotional to stimulate consumer awareness of Kauai's agricultural products must be supplemented by an efficient, supportive distribution system.

- Agricultural product consolidation centers with support facilities to maintain quality control should be considered for Kauai County.

8. Research and Education

- Although research and educational programs are essentially a function of the State, Kauai County should consider improving its participation and commitment to provide leadership in this area. As new problems arise, agricultural producers and processors should actively press for final solutions.

- Increasing costs, price-cost squeeze, larger operations and technological change will place greater emphasis on sound business management throughout the agriculture industry for years to come.. Educational programs placing greater emphasis on tasks for practical business decision-making in agriculture should be encouraged.

9. Disease and Pest Control

- Assess how the existing higher level government efforts in controlling pest and disease can best be taken advantage of by Kauai farmers.

- Develop early warning system for monitoring the status of disease and pest problem. Industry representatives and County agents should play lead role in getting assistance from State and Federal DOA.

C. Implementation Management System & Plan Modification

We confine our recommendations to the necessary updates of the elements contained within KAMP and other subsequent projects and programs that may be developed as implementation of KAMP proceeds. The following management system and plan modifications are recommended:

1. Implementation Management System

- Upon acceptance of KAMP as the agriculture planning document, the County is to develop a prioritized specific action program as the first step towards achieving the goals and objectives contained within the document.

- Formulation and structure of these action programs should be undertaken by the Agriculture Coordinator with input and direction from APAC. The final approval of the program is expected to be made by the Mayor and the County Council.

- The Agriculture Coordinator should prepare annual reports designed to monitor the progress of ongoing action programs and projects. This should be reviewed by APAC and submitted to the Mayor shortly thereafter.

2. Plan Modification

- Short term projects and programs should be reviewed annually and appropriate adjustments should be made when necessary.

- Long-term development strategy should be reviewed at least once every four years to insure that ongoing action programs are consistent with shifting market environments.

- Physical Resource Data Base should be reassessed using the following guidelines:

Land Tenure	5 years
Land Use Pattern	5 years
Zoning	4 years
Water Resources	5 years
Labor Market	Annual
Capital Market	Quarterly
Transportation & Infrastructure	Annual

- All other information including production technology and marketing development should be reassessed as often as feasible.

APPENDIX

SECTION VI

VI. APPENDIX

The following lists refer to land owners with reference No. 7 on up for the various Kauai Planning Districts (refer to Maps 9a-f). All map parcels are over five (5) acres in size.

MAP 9a: KEKAHA PLANNING DISTRICT

Map Parcel No.	Owner
7	County of Kauai
8	Kiklaola Land Co.
9	Kekaha Sugar Co.
10	Kilchi Odo

MAP 9b: HANAPEPE PLANNING DISTRICT

Map Parcel No.	Owner
7	County of Kauai
8	Kiklaola Land Co.
9	McBryde Sugar Co.
10	Kilchi Odo
11	Manuel Medeiros
12	Olokele Sugar Co.
13	McBryde Trust Estates
14	Pacific Tropical Botanical Garden
15	Pacific Standard Life Co.
16	Manuel Parraga
17	Frank Fernandez

HANAPEPE (Continued)

Map Parcel No.	Owner
18	Manuel Fernandez
19	Alfred Reis
20	Fusao Tanabe
21	Manuel Andrade
22	Benny Silva
23	Alice Robinson
24	Charlene Vidinha
25	Richard Vidinha
26	Lillian Tao
27	Masao Kimura
28	John Camara
29	Sheko Tanigawa
30	Mary Camara
31	Manuel Camara
32	Louis Fontad
33	Emily Sonza
34	Rafael Matias
35	Elsie Matias
36	Jesus Feliciano
37	Sadaichi Matsumoto
38	Alfonso Martin
39	Fangene Byrne
40	Frank Silva
41	Antone Martin
42	Paul Harmone
43	Shiro Nishimura
44	William Keao
45	William Cramer
46	Walter Abrew

HANAPEPE (Continued)

Map Parcel No.	Owner
47	David Abrew
48	Manuel Perez
49	Antone Perez
50	Maynard Givens
51	Tom Kawakami
52	Norito Kawakami
53	Nicholas Dettman
54	John Taylor
55	Cathy Stickney
56	Frank Lloyd
57	Shoki Yamauchi
58	Joseph Decosta
59	Elmer Muraoka
60	Joy Okada
61	Edene Vidinha
62	Antone Vidinha
63	Wayne Green
64	Mamora Kaneshiro
65	Dennis Vasconcellos
66	August Carvalho
67	Esther Kinney
68	Frank Silva
69	John Ayres
70	Lawrence Vidinha
71	Walter Zane
72	Baker Taniguchi
73	James Marques
74	Jiso Kawate

HANAPEPE (Continued)

Map Parcel No.	Owner
75	Yuriko Miyakado
76	Antone Bukeski
77	Toshio Kaneko
78	McGedye Sugon
79	Ichiro Ichiguru
80	Mann Corp.
81	John Santos
82	Paul Yardley
83	Charles Chism
84	Tadashi Tamakazu
85	Joseph Brun
86	Ushi Higa
87	Frank Rapoza
88	Lawrence Rego
89	Theresa Santos
90	Michiyuki Fujimoto
91	John Allerton
92	John Dang
93	Robert E. Wilson
94	Eke'a Paloma
95	Clara Dale
96	Kai Hirand
97	Yutaka Hamamoto
98	Virginia Rapoza
99	Minoru Fujimoto
100	Stanley Takishi
102	Alf. Holmer
103	Hisako Palama

HANAPEPE (Continued)

Map Parcel No.	Owner
104	Raymond Hoe Realty
105	Shigeta Yamaguchi
106	Tsuneo Taguma
107	Francis Takahashi
108	Megumi Nagata
109	Alfred Toulon
110	A.C. Nominee
111	Hans Hansen
112	Benjamin Vin
113	Stanley S. Momohara
114	Charles Uejo
115	Gosuke Higa
116	Kazuo Takanishi
117	Akio Arakaki
118	Yutaka Arakaki
119	Masao Tawata
120	Philip Coke
121	Puget Sound College of the Bible
122	Roman Catholic Church
123	Ruth Masunaga
124	Citizens Utilities Co.

MAP 9c: KOLOA PLANNING DISTRICT

Map Parcel No.	Owner
7	County of Kaual
8	Grove Farm Co. Inc.
9	McBryde Sugar Co.
10	Martha Hiramoto
11	Manuel Medeiros
12	Antone Vidinha
13	Mamoro Kaneshi
14	Hiroshi Iwamoto
15	John Medeiros
16	Herbert Miyahara
17	Martin Manaday
18	Christopher White
19	Kiyono Hadama
20	Poipu Ranch Co. Inc.
21	Roman Catholic Church
22	Eric Moir
23	Island Holiday Ltd.
24	Poipu Stores Inc.
25	Pan Pacific Lands
26	Leadership Homes of Hawaii
27	Royal Hawaiian Management Co.
28	John Thomas Waterhouse
29	John Sheehan

MAP 9d LIHUE PLANNING DISTRICT

Map Parcel No.	Owner
7	County of Kaual
8	Lihue Plantation Co. Ltd.
9	Grove Farm Co. Inc.
10	William Hyde Rice Ltd.
11	John Sheehan
12	Kanoa Estates Inc.
13	Interisland Resorts Co. Ltd.
14	Road Development Inc.
15	University of Hawaii
16	Ethel Wilcox Trust
17	Wilcox Hospital
18	Lihue Shopping Center
19	Puhi Enterprises Inc.
20	Jo Developers Inc.
21	Protestant Church
22	Madeline Nakamura
23	George Fernandez
24	Niu Pia Farms Ltd.
25	Blackfield Hawaiian Corp.
26	Island Holidays Ltd.
27	Kauai Sands Inc.
28	Shiro Nishimura
29	Kahili Development Co. Inc.
30	Minoru Kubota
31	Myra Chun
32	John Fernandes
33	Kamoto Shimabukuro
34	Glenn Shimabukuro
35	Masami Jo Doi

BIBLIOGRAPHY

Anderson, Robert N. et al., Kauai Socioeconomic Profile, University of Hawaii, 1975.

Armstrong, R. W. (1973), Atlas of Hawaii, University of Hawaii Press Honolulu

First Hawaiian Bank, Economic Indicator, 1982-1983, Honolulu, Hawaii.

Hawaii, State of, DPED, The Hawaii Urban Planning Information Center, Kauai County Land Inventory Report 1972, Honolulu, Hawaii, 1974.

Hawaii, State of, DPED, Data Book: A Statistical Abstract, 1981.

Hawaii, State of, Department of Agriculture, Statistics of Hawaii, 1980-81, Honolulu, Hawaii.

Hawaii, State of, DPED, State Agriculture Plan, 1981.

Hawaii, State of, DPED, Hawaii's Income and Expenditure Account, 1958-1980, Honolulu, Hawaii, 1982.

Hawaii, State of, DPED, Quarterly Statistical and Economic Report of Hawaii, Honolulu, Hawaii 1982.

Hawaii, State of, Labor and Industrial Relations, Employment and Payroll in Hawaii, Honolulu, Hawaii, 1962, 1972, 1981.

Hawaii, State of, DOA, Opportunities for Hawaiian Agriculture, Honolulu, Hawaii, 1970.

How, K.S. (1978) "Solar Radiation in Hawaii 1932-1975" State of Hawaii: DLNR Report R57.

Kauai, County of, Finance Director's Annual Report, 1980, Lihue, Kauai, 1980.

Muroda & Associates, County of Kauai Economic Development Plan: Phase 1, 1980.

Souza, Robert. "The Marketing of Hawaiian Agriculture," Hawaiian Agriculture: A County Responsibility, Proceedings of the 1982 HSAC Annual Conference.

LIHUE (Continued)

Map Parcel No.	Owner
36	Irving Jenkins
37	Nobuo Ota
38	Eugene Henriquez
39	John O'Brian
40	Kenneth Tatsumi
41	Seifuku Tamashiro
42	Robert Scanlon
43	Takato Sokei
44	Jay Otsuka
45	Thomas Akutagawa
46	Roman Catholic Bishop of Honolulu
47	Toao Nakamura
48	August Aguiar
49	James Bender
50	Edward Martins
51	Kenichi Iwai
52	Vincent Regalbuto
53	Patty Kalliher
54	Tomiko Sokei
55	Richard Parr
56	William McCumber
57	Hiroshi Miyashiro
58	Victorino Medeiros
59	Sarah Sheldon
60	Samuel Thronas
61	Tetsuo Esaki
62	Edward Goo
63	Roichi Sokei
64	Thomas, Baker Associates
65	Mary Stason-Dower
66	Kama Matayoshi

LIHUE (Continued)

Map Parcel No.	Owner
67	Hawaii Housing Authority
68	Isabella Garcia
69	Josephine Chansky
70	Frank DeSilva
71	Clementina Garcia
72	Barbara Rapozo
73	Albert Wada
74	Tsutomu Miyashiro
75	John Vilella
76	Clarence Ebinger
77	Mamoru Wakuta
78	George Hiyano
79	Steven Miyashiro
80	Kiyoto Miyashiro
81	Hideo Wakuta
82	Takashi Yamamoto
83	Kama Ikehara
84	George Takahashi
85	Francis Lum
86	John Rodriguez
87	Ben Lizama
88	Ronald Matsumura
89	Montague Downs
90	Moksha Community Ltd. Trustee
91	Ronald Fernandez
92	Wallace Isoda
93	Antome Sanchez
94	John Sanchez
95	Manuel Sanchez
96	William Sanchez
97	Gary Clemente
98	Micheal Dietz

LIHUE (Continued)

Map Parcel No.	Owner
99	Harold Brown
100	Nobu Takahashi
101	Albert Onellas
102	Satoru Tada
103	Albert Bettencourt
104	Marie Lemke
105	Beatrice Roberts
106	Alfred Viveiros
107	Fred Thronas
108	Beatrice Aguiar
109	Gilbert Lai
110	Antone Andrade
111	Charlotte Seyer
112	Mary Goomes Trust Estate
113	Kazumasa Morita
114	Antone Arruda
115	Sally McClanahan
116	Lehua Kahele
117	Shigeru Miyasato
118	Francis Frazier
119	Michiko Esaki
120	Robert Wood
121	Beverly Sainte-Marie
122	Alvin Bugbee
123	William Wilson
124	Alfred Silva
125	Alfred DeSilva
126	Henry George
127	Minnie Correa
128	Josephine Ornellas
129	Mitsuo Wakumoto
130	Hiroshi Wakumoto

LIHUE (Continued)

Map Parcel No.	Owner
131	Mauel Medeiros
132	Mamie Medeiros
133	Edward Bettencourt
134	Donald Bettencourt
135	Joseph Bettencourt
136	Teiji Miyashiro
137	George Miyashiro
138	Douglas Cheeseman
139	Jules Kanarek
140	Marvin McClure
141	Charles Miyoshi
142	Roy Miyake
143	Rose Contrades Estate
144	Masanobu Kutaka
145	Ernest Palmeira
146	Elithe Aguiar
147	Mindalen Gonzalez
148	David Hepa
149	Urbatek Systems Inc.
150	May Jenkins
151	Hisao Nakamura
152	August Heidt
153	Harry Bray
154	Beverly Ching
155	Glenn Ching
156	Wailua Basin Dev.
157	Ruth Fernandez
158	Bruce Harding
159	Edward Rice
160	Fritz Huntsinger
161	Kauai Builders Ltd.

LIHUE (Continued)

Map Parcel No.	Owner
162	Yasuo Moribe
163	George Nishida
164	Melvin Lowe
165	Andrew Ward Trustee
166	Shigeru Osaki
167	Fred Blanco
168	Lincoln Ching
169	Lai Inc.
170	Antone Vilela
171	William Fernandez
172	Wakaichi Kondo
173	Hale Kauai, Ltd.
174	Tressler, Lowe, Ready Mix Concrete Co. Ltd.
175	Henry Christiansen
176	Daniel Hironaka
177	Adam Perreira
178	Hideo Honaka
179	James Nishida
180	J. Thomas Hahn
181	Edward Taniguchi
182	Harry Baldry
183	George Stepovich
184	Brilahante & Associate
185	J & B Development
186	Harold Takanaka
187	Saiichi Fujii
188	Masao Fujii

LIHUE (Continued)

Map Parcel No.	Owner
189	Toshio Fujii
190	Walker Ware
191	Subramuniya Soga
192	Itsuo Uyeda
193	York Au
194	Tomiko Sokei
195	Mitsuji Iide
196	Jennie Naiwaiole

MAP 9e KILAUEA PLANNING DISTRICT

Map Parcel No.	Owner
7	County of Kauai
8	Lihue Plantation Co. Ltd.
9	Mary Lucas Trust Est.
10	Marion Keat
11	Waioli Mission
12	Kilauea Lake Shores Ltd.
13	Kilauea Pastures Consortium
14	Tropical Acres Co.
15	Albert Ley
16	Gary Cadnallader
17	William Staunton III
18	Plantation Estate
19	Harold Watson
20	Robert MacMillan
21	Foster Petroleum Corp.
22	Theodore Tullio
23	Kilauea Panoramas Consortium

KILAUEA (Continued)

Map Parcel No.	Owner
24	Oceanic Vistas Consortium
25	John Sramek Jr.
26	Kilauea Agronomics
27	Paradise Lake Consortium
28	James Hormel
29	Janet Scott Akana Trust
30	Emela Hood
31	James Hansen
32	Agnes Thronas
33	Charles Burton
34	Royal Hawaiian Management Corp.
35	Aylmer Robinson
36	Henry Thronas
37	Moloaa Bay Kauai Land Partners Napali Sands Maui Corp.
38	Percival Bailey
39	Cresencio Ragasa
40	Dick Yoshii
41	Rodney Yadao
42	Rudolpho Notebo
43	Odo Farms Inc.
44	Bay Akana Fisheries Inc.
45	Theodore Savellana
46	Shoken Kobashigawa
47	Edward Goo
48	Tokiyoshi Moritsugu
49	Delbert Goo
50	Reuben Ohai
51	Takeshi Yamamoto
52	Haruo Kakimoto
53	Martha Gerbode Trust Estate

KILAUEA (CONTINUED)

Map Parcel No.	Owner
54	Irving Jenkins
55	Yoshio Shiraki
56	Tetsuo Esaki
57	William Wright Estates
58	Myra Chun
59	Richard Tongg
60	Paul Daly
61	Antone Andrade
62	Kenji Yamashiro
63	Micheal Strong
64	Rey Finance Corp.
65	Thomas Chung
66	Timothy Richardson
67	Peter Makarewicz
68	Helen Ferria
69	Edward Moritsugu
70	Micheal Noonan
71	Kenneth Martin

MAP 9f HANALEI PLANNING DISTRICT

Map Parcel No.	Owner
7	County of Kauai
8	McBryde Sugar Co. Ltd.
9	Princville Corp.
10	Ethel Wilcox Trust Estate
11	Eagle County Development Corp.
12	Consolidated Oil & Gas Inc.
13	Kilauea Sugar Co. Ltd.
14	Kilauea Agronomics
15	Albert Ley

HANALEI (Continued)

Map Parcel No.	Owner
16	Gary Cadnallader
17	Lihue Plantation Co. Ltd.
18	Harold Morris
19	Harold Watson
20	Robert MacMillan
21	Foster Petroleum Corp.
22	Howard Yamaguchi
23	John Perry
24	James Cullen
25	Dale Stark
26	Harold Maull
27	Richard Texeira
28	Gregory House
29	Micheal Kido
30	Jack Bennington
31	Phillp Wright
32	David Estrella
33	Harry Weinberg
34	Interisland Builders & Developers Ltd.
35	P. Kassler
36	Princville Sealodge
37	Hanalei Horizon Inc.
38	Realty Income Trust
39	Mike McCormick Inc.
40	Hasurf Corp.
41	Hanalei Bay Village Assoc.
42	General Hawaiian Development Corp.
43	Kaual County Public Improvement Corp.
44	C. Itoh & Co. Inc.
45	Hawaiian Corp. of Vacation Villages

HANALEI (Continued)

Map Parcel No.	Owner
46	Kukui Ranch Inc.
47	Fred Allison
48	Waioli Mission
49	Goichi Kobayashi
50	Deborah Pratt
51	Bryson Nishimoto
52	Ivy Nishimoto
53	Nancy Piliani
54	Leslyn Shriver
55	Myra Maka-Dower
56	William Thompson
57	Juliet Wichman
58	Haena Hui
59	E.W. Westgate Co. Inc.