Kaumana Homesteads
Easements

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT S. COLOMA-AGARAN

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

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OFFICE OF ENVIRONMENTAL QUALITY CONTROL

SEP 25 1998

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

Mr. Gary Gill, Director
Office of Environmental Quality Control
235 South Beretania Street Suite 702
Honolulu, Hawaii 96813

SUBJECT: Finding of No Significant Impact for two perpetual, non-exclusive easements for access and utility purposes over, under and across portions of vacant State land at Kaumana, South Hilo, Hawaii, tmk: (3) 2-5-44-portion 1 and 2-5-45-portion 1.

Dear Mr. Gill:

The Department has reviewed the comments received during the 30-day public comment period which began on April 8, 1998. The agency has determined that this project will not have significant environmental effects and has issued a FONSI. Please publish this notice in the October 8, 1998 OEQC Environmental Notice.

The OEQC Publication Form and four copies of the final EA was already delivered to your office by R.M. Towill on August 17, 1998. Please call contact Charlene Unoki at (808) 974-6203 if you have any questions.

Sincerely,

MICHAEL D. WILSON
Chairperson

xc: Hawaii BM
Support Services

127

1998-10-08-HI-FEA-Kaumana Homesteads Easements

Environmental Assessment
Prepared in Accordance with Requirements of Chapter 343, Hawaii Revised Statutes

Kaumana Homesteads
Access and Utility Easements
TMK (3) 2-5-44: portion 1 and 2-5-45: portion 1

KAUMANA, SOUTH HILO
BIG ISLAND, HAWAII

SEPTEMBER 1997

PREPARED FOR:

Mr. Richard M. Towill
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Honolulu, Hawaii 96817-4941

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ENVIRONMENTAL ASSESSMENT

Kaumana Homesteads
Access and Utility Easements
TMK (3) 2-5-44: portion 1 and 2-5-45: portion 1

KAUMANA, SOUTH HILO
BIG ISLAND, HAWAII

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PREPARED BY:
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Honolulu, Hawaii 96817-4941

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PROJECT SUMMARY

Project:	Kaumana Homesteads
Applicant:	Mr. Richard M. Towill 420 Waiakamilo Road, Suite 411 Honolulu, Hawaii 96817
Agent:	R.M. Towill Corporation Contact: Colette Sakoda (Project Manager) Address: same as above Telephone : (808) 842-1133
Approving Agency:	State of Hawaii
Tax Map Keys:	TMK 2-5-44:1 (portion) TMK 2-5-45:1 (portion)
Location:	Kaumana, County of Hawaii, State of Hawaii
Owner:	Richard M. Towill Trust/Orlando H. Lyman Trust, etal.
Property Acreage:	69.2 Acres (TMK 2-5-44:1) 78.3 Acres (TMK 2-5-45:1) 147.5 Acres (total)
Surrounding Landowners:	State of Hawaii
State Land Acquisition:	±3,650 square feet (Hapuu Road widening) ±4,200 square feet (future access) ±7,850 square feet (total)
Existing Land Use:	Vacant
State Land Use Designation:	Agriculture
Development Plan Land Use Designation:	Urban Expansion Area

SECTION 1
INTRODUCTION

1.1 PROPOSED ACTION

Mr. Richard M. Towill and Orlando H. Lyman Trust, land owners, are seeking a purchase of easements in order to improve access to their properties, Tax Map Keys (TMK) 2-5-44:01 (portion) and 2-5-45:01 (portion). The properties consist of approximately 147.5 acres, of which approximately 40 acres is zoned A-1a and the balance of 107 acres is presently zoned A-20a. The properties currently have access via Hapuu Road through Kaumana Drive. The existing access road does not meet the County standards for the roadway. The purpose of the purchase of easement is to facilitate an adequate access for the proposed future development.

The landowners of the properties are planning the subdivision and development of the proposed site into small scale agricultural lots for sale. The plan for the subdivision is still preliminary, and time frame for the proposed development has not yet been determined. This supporting Environmental Assessment is prepared in accordance with Hawaii Revised Statutes, Chapter 343, for the purpose of public disclosure and to assess potential impacts of the proposed action.

1.2 DESCRIPTION OF PARCEL

The project area is located in the western portion of Hilo, in an area historically identified as Kaumana Homesteads (**Figure 1**). The site, TMK 2-5-44:1 and TMK 2-5-45:1, is vacant undeveloped land. The property encompasses 147.5 acres, south of Kaumana Drive and west of Wilder Road.

The project site lies at an elevation of approximately 1,150 feet on the east sloping to a high of approximately 1,460 feet on the west. The site is divided by a series of drainage courses, which affect the continuity of usable, moderate sloped areas. The site is mostly 10% slope or less; however, there are areas of steeper slopes. The various drainage courses have steep side slopes. Soil classification identifies slopes in the 20% to 35% range along the drainage courses.

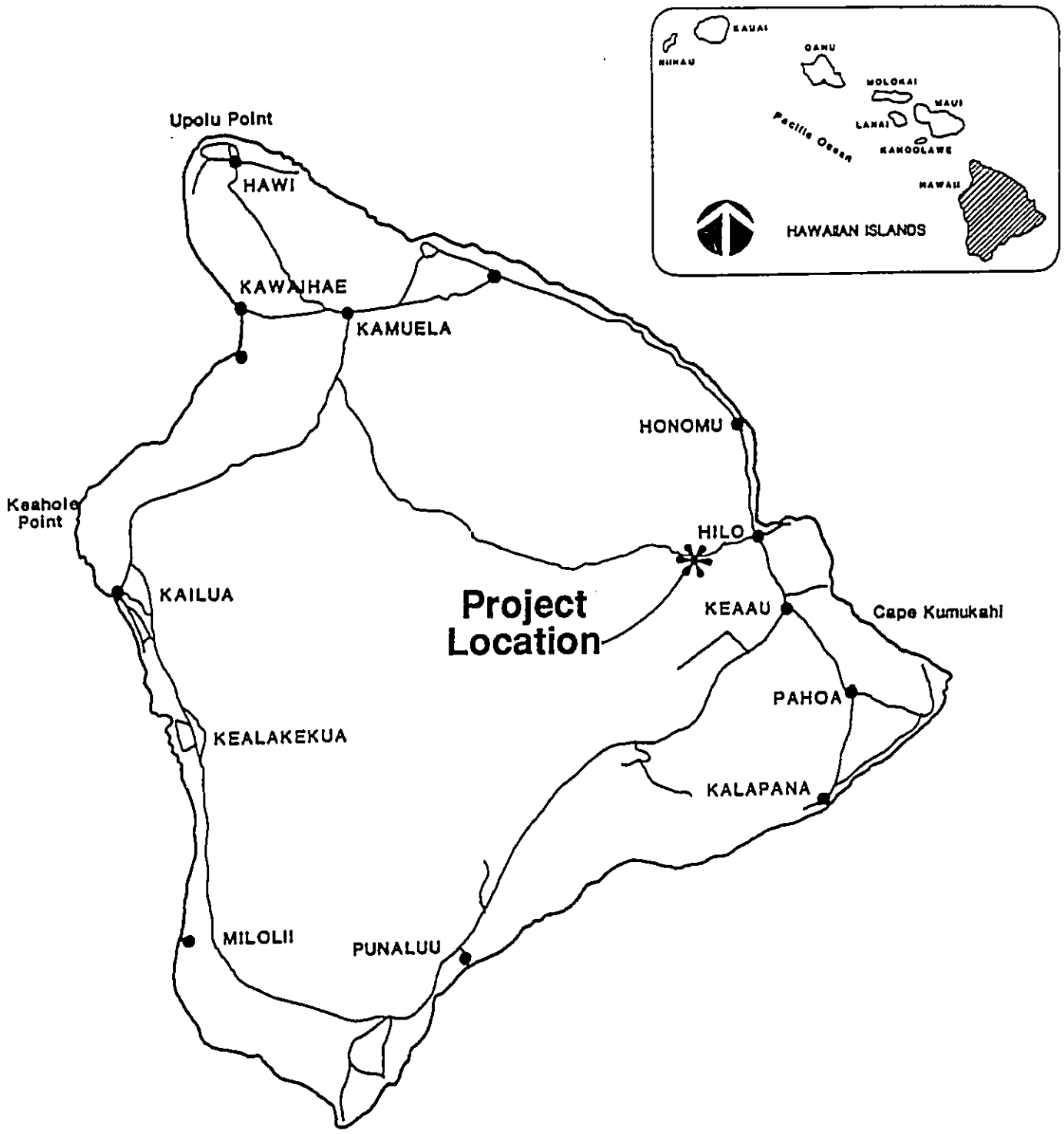

Figure 1
LOCATION MAP
Kaumana Homestead
South Hilo, Hawaii

0 15 30
MILES

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1.3 STATE LAND USE DISTRICT AND ZONING

The property is in the State Agriculture District (**Figure 2**). The County of Hawaii zoning is A-1a and A-20a (**Figure 3**). The eastern portion of TMK 2-5-45:1, approximately 40 acres, is zoned A-1a (one-acre agriculture); thus, a Zone Change is not required for this portion. TMK 2-5-44:1 and the western portion of TMK 2-5-45:1, approximately 107 acres, are presently zoned A-20a.

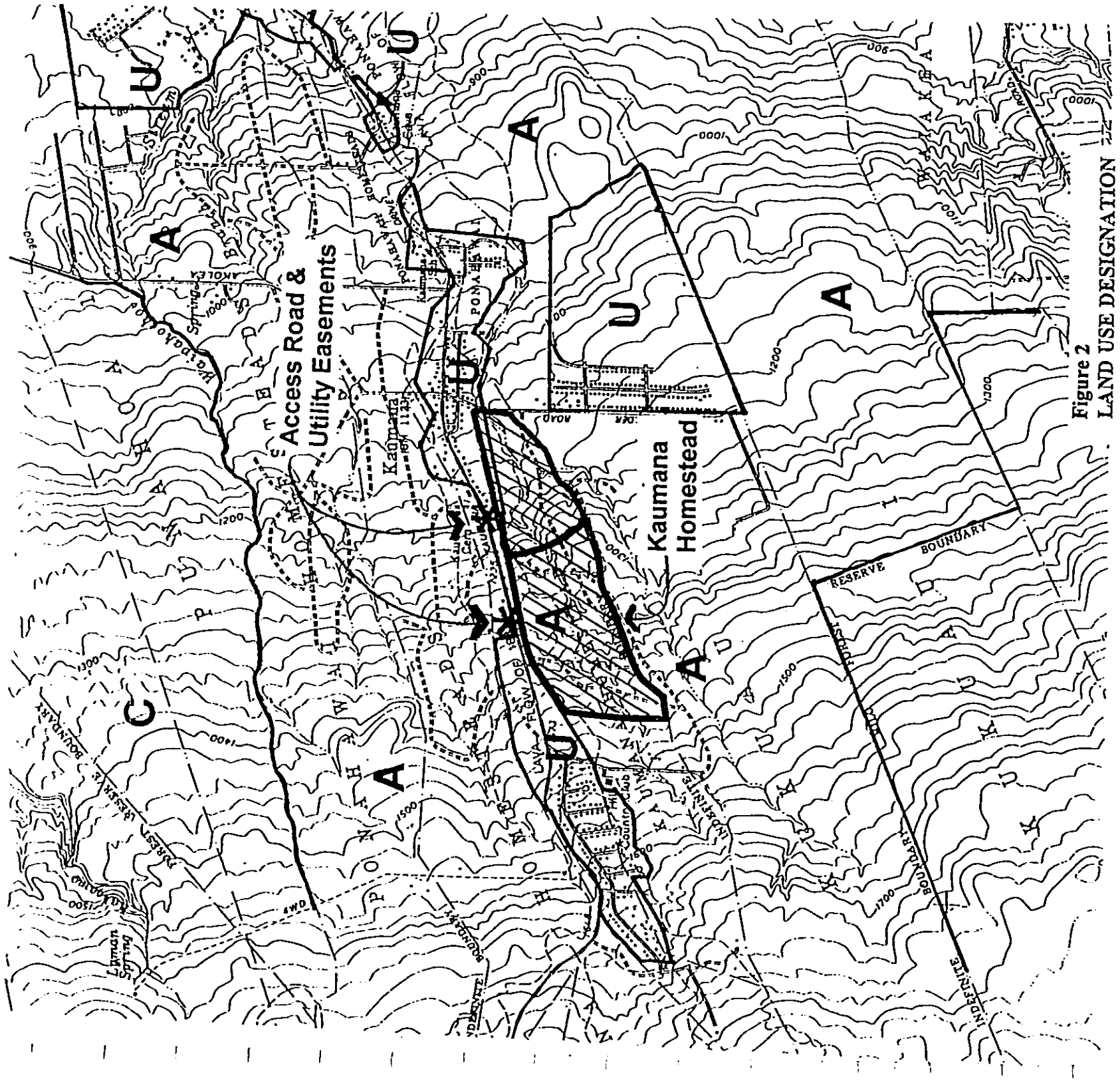

Figure 2
LAND USE DESIGNATION
Kaumana Homestead
South Hilo, Hawaii

0 2000 4000
FEET

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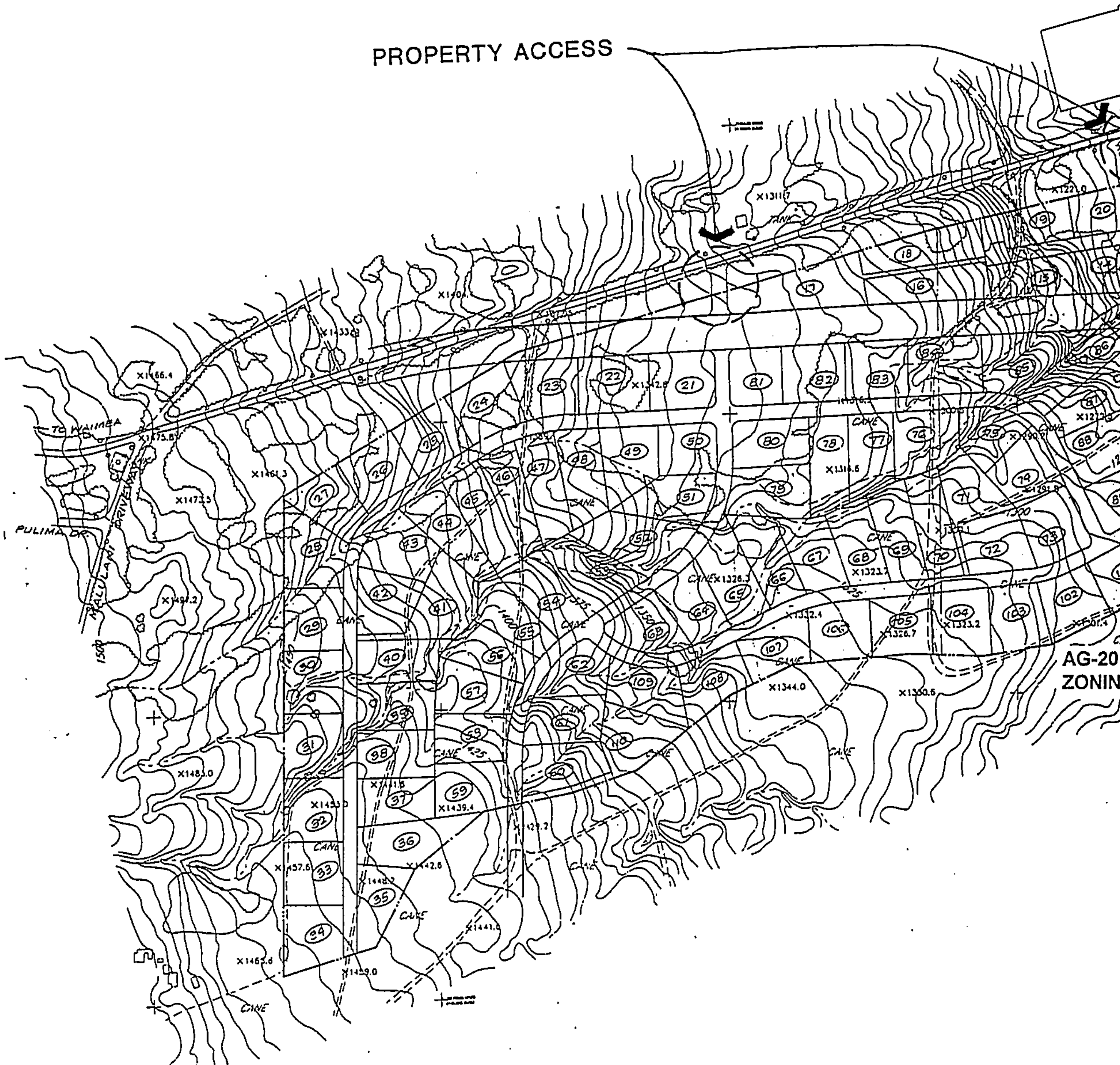
PROPERTY ACCESS
TO WAIMEA
PULIMA DR.
MALULANI DRIVEWAY
AG-20
ZONIN

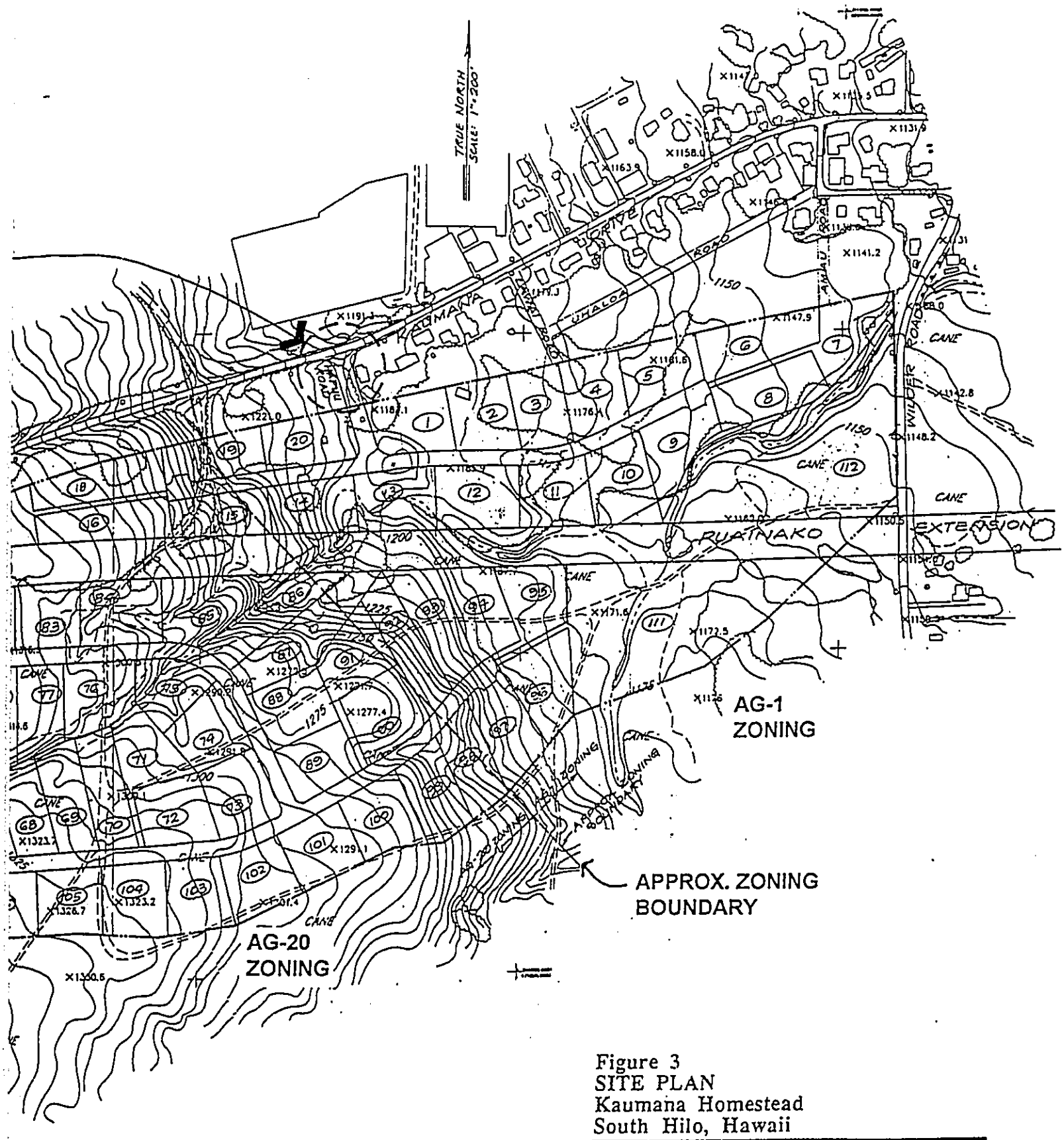

Figure 3
SITE PLAN
Kaumana Homestead
South Hilo, Hawaii

0 200 400 800
FEET

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SECTION 2
DESCRIPTION OF PROJECT

Hapuu Road is an approximately thirty (30) feet wide dead-end road and is currently used only for access to the two private properties located to the east of the road. The project will require an acquisition of easements for widening of Hapuu Road to 'fifty (50) feet' in order to meet State and County standards. A large block of the land to the west of Hapuu Road is vacant and owned by the state. Therefore, the property owner has requested state land acquisition of ±3,650 square feet along the existing Hapuu Road easement and ±4,200 square feet for a future access (see **Figure 3**). This environmental assessment is prepared to support the request for the purchase of easements for access and utility purposes. The proposed access road, intersections, and subdivision's interior roads will be designed and constructed to State and County of Hawaii standards and will be dedicated to the County of Hawaii upon completion of the construction.

The proposed 147.5 acre Kaumana Homestead will consist of one acre or larger lots. The maximum number of units provided in the Kaumana Homestead will be one unit per acre. The density allowed in the homestead will be limited to a single-family dwelling per lot. Therefore, the development of this project at full occupancy could accommodate a maximum of 112 families. However, the first phase of the future development only involves forty (40) acres of the land at the northeastern portion of the property. The individual lots within the property will be sold after necessary improvements are in place. Further, development of each lot will depend on market conditions.

The initial phase of future development will be within the existing zoned A-1a portion. The one acre lots will be served by County standard roadways. Provision has been made in the plan for the proposed Puainako Street Extension. The land is divided by existing natural drainage courses, which will be partially improved. Drainage easements will be created on individual lots to keep habitable structures out of flood hazard zones. The second phase will take place within the area zoned A-20a. The landowners will be required to file a Change of Zone application for rezoning approximately 107 acres from A-20a to A-1a. However, a plan for the second phase is only at the preliminary stage, and its scope and time frame for the development has yet to be determined.

The attached market report (**Appendix D**) analyzes the potential for agricultural uses on one (1) acre lots. The proposed project will provide residential lots with a potential for subsistence and nonsubsistence agriculture depending on the prospective landowners' interests. It is unlikely that commercial agriculture will be feasible at this or at a larger scale. The lots are not intended to be affordable housing, but designed to sell for $80,000 to $100,000.

Water Supply System:

Water will be provided to the project site from the County of Hawaii, Department of Water Supply (DWS) system. Presently the Olaa Flume Intake is the main source of water, supplying the Saddle Road Reservoir.

The following improvements will need to be made to the existing water system to provide water for the area: Booster pump stations will be installed at the lower Piihonua, Kahoama, and Lyman Reservoirs with capacities of 450 gallons per minute (gpm), 400 gpm, and 400 gpm, respectively. These booster pump stations will pump water from the main source at the Piihonua Reservoir to the Kahoama, Lyman and Saddle Road Reservoirs. Funding for these improvements has been agreed upon by the applicant and the DWS.

Sewerage and Drainage:

According to the State Department of Health (DOH), Environmental Management Division, Wastewater Branch, the project site is allowed to utilize individual wastewater systems such as cesspool and septic tank providing each lot is one acre or larger (telecom w/ DOH Wastewater Branch staff, May 1998). Septic tanks are preferred due to the limited land area available to accommodate the proposed development. A variance will need to be obtained from the State DOH if the number of lots at a full-development exceeds fifty (50).

Improvements will be made to the drainage courses that traverse the project area. A retention basin will also be constructed as a part of the future development so that no adverse effect will be felt downstream of the project site. The retention basin will be sized to accommodate the increased runoff volume.

SECTION 3
ENVIRONMENTAL SETTING

3.1 PHYSICAL ENVIRONMENT

3.1.1 Climate

Hilo is located in the windward side of the island of Hawaii. The prevailing wind throughout the year is the northeasterly tradewind. Trades are generally more persistent in summer than in winter and are stronger in the evening. The average wind speed is approximately 7.5 miles per hour.

Average temperature in Hilo ranges from 65 and 85 degrees. Cloudy skies often prevail throughout the year. The area receives only about 40 percent of the possible amount of sunshine. Average annual rainfall in Hilo is 141 inches. A climatic condition known as "orographic" rain, which forms within the moist tradewind air as it moves from the sea and move upward along the steep and high mountain, is the primary cause of regional precipitation (Atlas of Hawaii, 1983).

3.1.2 Topography, Geology, Soils

The island of Hawaii, the largest and youngest of the Hawaiian Archipelago, was formed during the last 800,000 years. The island consists of five volcanos, two of which, Mauna Loa and Kilauea, are still active. Mauna Loa is 75 miles long, 64 miles wide, with a peak 13,680 feet above sea level. It is formed almost entirely by cooling of lava flows.

The project site lies at an elevation of approximately 1,150 feet on the east to a high of approximately 1,460 feet on the west. The site is divided by a series of drainage courses, which affect the continuity of usable, moderate sloped areas. The site is mostly 10% slope or less; however, there are areas of steeper slopes. The various drainage courses have steep side slopes. Soil classification identifies slopes in the 20% to 35% range along the drainage courses.

The project sites and the vicinity were previously mapped by the U.S. Department of Agriculture Soil Conservation Service as a part of an overall soil survey of the island of Hawaii. According to the Soil Survey, the site immediately adjacent and parallel to Kaumana Road is covered by pahoehoe lava with no soil overlaying it. The remaining majority of the site contains Kaiwiki silty loam. This consists of well-drained silty clay loams which have been formed in a series of layers of volcanic ash. Permeability is rapid, runoff is slow and erosion hazard is slight. Kaiwiki soils

are used for sugarcane. Small areas are used for pasture and truck crops.

3.1.3 Volcanic Hazard

According to U.S. Geological Survey, 1974, Kaumana is located within the area susceptible to burial by lava flows originated from eruptions within the northeast rift zone of Mauna Loa. According to Hazard Zones for Lava Flows, the U.S. Department of Interior, Geologic Survey, the project sites are all within Zone 2. Zone 2 is described as "areas adjacent to and downslope of active rift zones." The most recent eruption of Mauna Loa in 1984 advanced to within 4 miles of Hilo before the 3-week-long eruption ended (Christina Heliker, 1990). Although lava flows are the most common volcanic hazards in Hawaii, most lava flows from Mauna Loa, since 1880, have stopped before reaching the urban areas of Hilo (U.S. Army Corps, 1981).

3.1.4 Earthquake

During the past few decades, the island of Hawaii experienced several earthquakes with Richter magnitude ratings of 6 or more. The risk of major damage from earthquake is considerably high throughout the island.

Under the Uniform Building Code, the island of Hawaii has been designated as Seismic Zone 3 which indicates a relatively significant potential for strong ground motion generated by seismic events. The Uniform Building Code also establishes minimum seismic design criteria for any structures constructed in such a zone for resistance to deformation and damage resulting from such strong ground motion. Thus any structures that will be built for the development will be designed with consideration of the hazards of seismic activities.

3.1.5 Flora and Fauna

In December 1995, a flora and fauna survey was undertaken by Grant Gerrish, Ph.D., Biologist. Based on the field survey, no plants listed or proposed for listing as Threatened or Endangered were found. The 1881 lava flow dominates the northern portion of the site, and is unsuitable for agriculture. The majority of the site is covered by deep, cultivatable soil, which was previously cleared and used for sugarcane. The land is now abandoned and overgrown with a savanna-type vegetation of tall grass and widely scattered native and non-native trees.

Few birds or mammals were observed. One individual 'Io (Hawaiian Hawk) was observed flying overhead. Other native forest birds, including several Endangered species, are unlikely to occur at this low elevation.

No distinct streams or wetlands occur within the portion of the project area covered by the 1881 lava flow. The rest of the project area is sloping and dissected by a drainage system of intermittent streams and gullies. A few small areas have wetland indicators, but their vegetation does not appear to possess any special biological value.

The proposed project would involve clearing of the site for agricultural use and associated residential units. Because most, if not all, of the natural vegetation of the area has been cleared and subjected to long term sugar cane production, the proposed project is not anticipated to cause adverse environmental impacts.

The complete flora and fauna report is contained in **Appendix C**.

3.1.6 Scenic and Visual Resources

The property is located on the lower eastern slope of Mauna Loa. The prominent feature of the landscape is the 14,000-foot peak of Mauna Kea. The magnificent views toward the mountain are seen from various locations within the project site.

With the proposed one-acre agricultural lot, low intensity of development and land uses such as subsistence agriculture will not significantly affect the area's visual resources.

3.1.7 Cultural and Archaeological Resources

Based on the historical and archaeological overview of the Hilo region (McEldowney 1979) the South Hilo District of Hawaii Island can typically be divided into the following five zones: coastal settlement; upland agricultural; lower forest; rainforest; and sub-alpine or montane. The project area, based on elevation, is situated at the interface between the upland agricultural and lower forest. Within these two zones the most intensively utilized portions were the soil-mantled areas like the project area. However, the same area was later utilized for historic commercial sugar cane cultivation. The bulk of the project area was subject to intensive commercial sugarcane cultivation, probably from the late 1800s until mid 1980s. The remainder of the project area is the

presently heavily vegetated 1881 Mauna Loa flow.

No historic sites of any kind were observed during a field reconnaissance in January 1996 within the project area. Historic and archaeological research indicated that the potential for sites was extremely low with cane-cultivation related stone clearing mounds the most likely site type. According to the State Historic Preservation Division (SHPD), the proposed purchase of easements will have "no effect" on significant historic sites. Based on documentary background and the reconnaissance survey, no further archaeological research is necessary.

It is proposed that, if any unidentified cultural remains might be uncovered during the course of the project, work in the immediate area will cease and the appropriate government agencies will be contacted for further instructions.

An archaeological assessment is contained in **Appendix B**.

3.2 SOCIOECONOMIC ENVIRONMENT

3.2.1 Population

The City of Hilo is presently the only major metropolitan area in Hawaii County. Hilo is the county center of government, transportation, and business. Hilo also provides various secondary economic activities. Consequently, Hilo is a major population center of the island.

Approximately one-third of the county's population is concentrated in the Hilo area. According to the State of Hawaii Data Book 1993-94, the population of Hilo was 37,808 in 1990. Although the population in North/South Kohala has grown significantly in last two decades, the population in the South Hilo district continues to have a steady growth.

The proposed project is not anticipated to have a significant development impact on the population due to the low intensity of the development associated with the roadway widening.

3.2.2 Land Ownership, Surrounding Land Uses, and Land Use Designation

The property is currently vacant and owned by Richard M. Towill Trust and Orlando H. Lyman Trust, etal. Immediately adjacent properties are mostly vacant with single-family residential uses occurring adjacent to Kaumana Drive north of the site and east of Wilder Road. Surrounding

urban uses include Kaumana Town to the north and northeast; Hilo Country Club Estate Subdivision to the east; Kaumana Estate Subdivision and Hilo Country Club Golf Course to the west; and Kaumana Drive to the north. Hilo County Golf Course, approximately one-half mile west of the site, is no longer in use and covered by overgrown vegetation.

Hapuu Road is the only access to the property. The roadway is approximately thirty (30) feet wide road and currently used only for an access to the two private properties located to the east of the road. A large block of the land to the west of Hapuu Road is vacant and owned by the state. Therefore, the applicant has requested state land acquisition of ±3,650 square feet along the existing Hapuu Road easement and ±4,200 sf for a future access.

The property is zoned A-1a and A-20a by the County of Hawaii. The County General Plan Land Use classification identifies this area as an Urban Expansion Area. The State Land Use is Agriculture. The area immediately north, northeast, northwest of the property is designated as Urban.

3.3 PUBLIC FACILITIES AND SERVICES

3.3.1 Water

Water will be provided to the project site from the County of Hawaii, Department of Water Supply (DWS) system (**Figure 4**). Presently the Olaa Flume Intake is the main source of water, supplying the Saddle Road Reservoir. This reservoir then feeds the Kaumana and the Lyman Reservoirs and Kaumana Town.

Improvements will need to be made to the existing water system to provide water for the area: Booster pump stations will be installed at the lower Piihonua, Kahoama, and Lyman Reservoirs with capacities of 450 gallons per minute (gpm), 400 gpm, and 400 gpm, respectively. These booster pump stations will pump water from the main source at the Lower Piihonua Reservoir to the Kahoama, Lyman and Saddle Road Reservoirs. Funding for these improvements have been agreed upon by the applicant and the DWS.

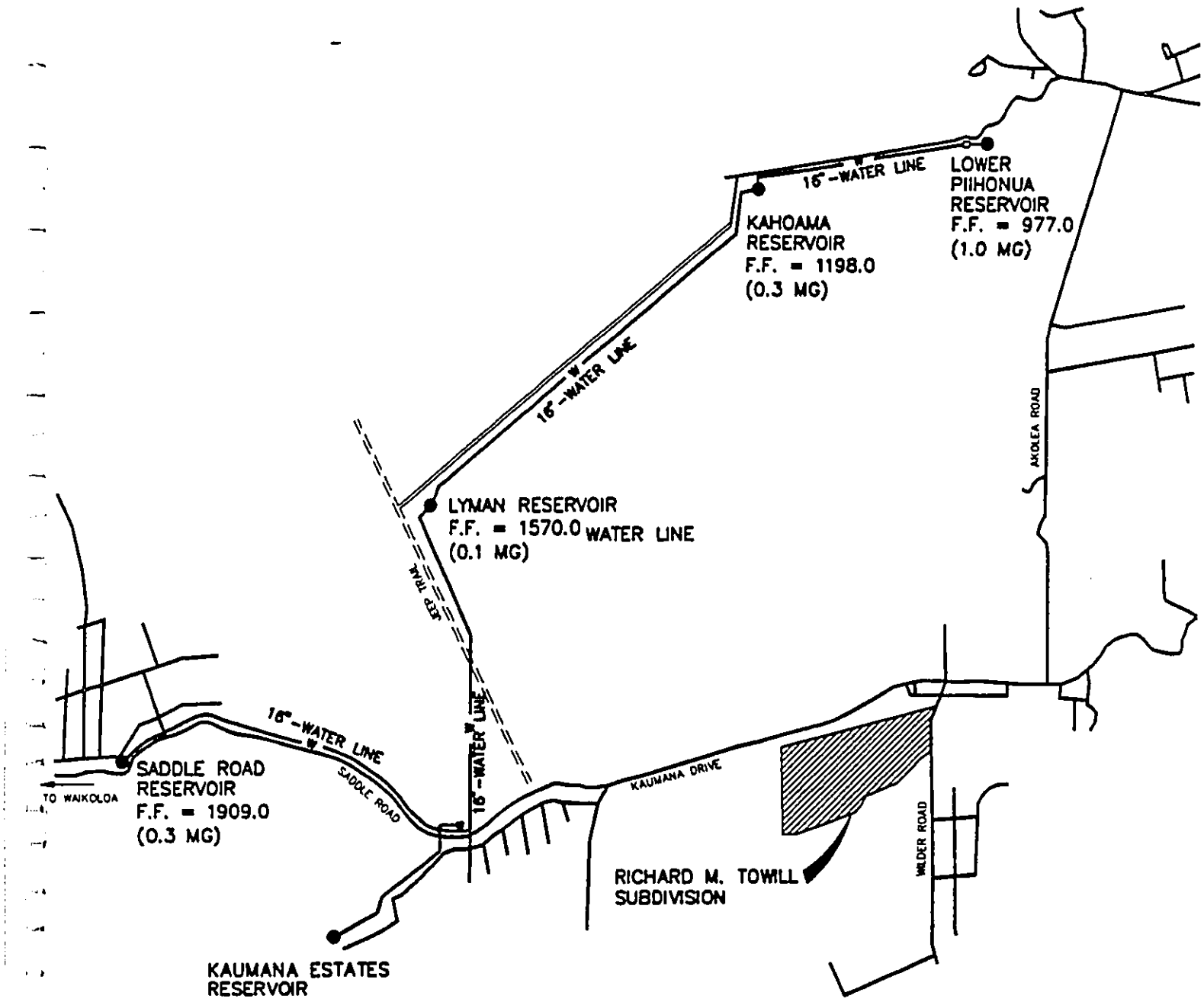

Figure 4
WATER SYSTEM MAP
Kaumana Homestead
South Hilo, Hawaii

NOT TO SCALE

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3.3.2 Wastewater

According to the State Department of Health (DOH), Environmental Management Division, Wastewater Branch, the project site is allowed to utilize individual wastewater systems such as cesspool and septic tank providing each lot is one acre or larger (telecom w/ DOH Wastewater Branch staff, May 1998). Septic tanks are preferred due to the limited land area available to accommodate the proposed development. A variance will need to be obtained from the State DOH because the number of lots in a full-development will exceed fifty (50). All sewer improvements will be made to meet County of Hawaii standards.

3.3.3 Flood/Drainage

According to the Flood Insurance Rate Map (FIRM), the project is located within Zone C and also Zone A along the drainage courses through the property. Zone C is considered "an area of minimal flooding." Zone A is defined as "areas of 100-year flood; base flood elevations and flood hazard factors not determined."

No significant adverse impacts are anticipated to result from the development of the proposed project. The proposed future development will include improvements to the drainage courses that traverse the project area, and a retention basin will be constructed so that no adverse effect will be felt downstream of the project site. The retention basin will be sized to accommodate the increased runoff volume.

3.3.4 Recreational Facilities

The town of Kaumana is a predominantly residential community. The Kaumana Public Park and Playground is situated between Akolea Road and Wilder Road in a close proximity to the proposed property. This 1.5 acre playground is used for community recreation and maintained by the county.

Another significant recreational site in this area include Kaumana Caves County Park. Kaumana Caves County Park, approximately one-half mile east of the site, contains lava tubes created by 1881 eruption of Mauna Loa.

3.3.5 Power/Electricity

The Hawaii Electric Light Company (HELCO) provides electric power to the Hilo area primarily through HELCO's power generation system. HELCO has six power plants which produce electric power by steam units, diesel units, a gas turbine, and hydroelectric units. These electric power plants are situated at Keahole, North Kohala; Waimea, South Kohala; Waiau Puueo, Waiakea Peninsula, and Kanoelehua, South Hilo. HELCO also purchases power from Hilo Coast Power Company, a privately-owned biomass generator, and from a geothermal generator owned by Puna Geothermal Ventures.

3.3.6 School and Medical Services

School

The public school system in Hilo is under the jurisdiction of the state Department of Education. The public schools include two high schools, three intermediate and eight elementary schools. The current population of South Hilo public school is 10,287 students. The nearest to the project site is Kaumana Elementary School which currently has an enrollment of 314 students. Hilo High School has enrollment of 1,739 students. The enrollment of Waiakea High School is 2,258 students. St. Joseph High and Elementary complex, the major private school complex, is also located in downtown Hilo.

The University of Hawaii at Hilo (UHH) is the only public institution of higher education in the County of Hawaii. UHH has an enrollment approximately 4,000 students. The main campus encompasses approximately 137 acres. The university incorporates a two-year community college, a four year university, and a continuing educational program.

Medical Services

The only state-owned Hospital in the general project area is Hilo Medical Center (HMC), established in 1897. The HMC provides complete health care services, including medical, surgical, ambulatory care, home care, psychiatry, and an extended care facility.

3.3.7 Fire and Police Protection

Fire Protection

The South Hilo District is served by the following four major stations; Waiakea Station, Central Station, Kauailani Station, and Kaumana Station. The Kaumana Station, is located on Kaumana

Drive near the intersection with Ainako Avenue, approximately 2.5 miles north of the project site.

Police Protection

The Police Department is located on Kapiolani Street near the intersection with Kukuau Street. The police station in Hilo provides service to the South Hilo District. In addition to the main station in downtown Hilo, there are three other community police stations serving the general area located at Clem Akina Park on Wainaku Avenue, Mooheau Bus Terminal on Kamehameha Highway, and Richardson beach Park off Kalanianaole Avenue.

3.3.8 Traffic

A traffic assessment was prepared (see **Appendix E**) to identify the potential impact of the project at a full-development, including future peak hour conditions at nearby intersections with the project completed and in full use.

Increases in traffic volumes in the area will occur with or without the project. A total increase in traffic volumes of 30% over existing volumes would be appropriate for a ten-year period, based on recent increases in traffic volumes in the area. With the expected growth in traffic volumes, the increased traffic due to the proposed project would be approximately five percent of the future traffic increase on Kaumana Road near Ainako Avenue. The extension of Puainako Street from the Waiakea area of Hilo to Kaumana has also been identified as a desirable roadway improvement; the proposed project will reserve a right-of-way for this improvement.

The proposed project will have a greater relative impact to traffic volumes at the intersections which provide access into the project area. The assessment has evaluated these intersections and has found that the addition of project traffic would have minimal impact on operating conditions at this intersection.

3.3.9 Noise

The overall characteristics of the project site is low density residential and agricultural community. The present noise quality of the project site is within the level of rural agricultural-residential community. No adverse noise impacts are anticipated to result from the proposed one-acre agricultural subdivision. The proposed development will not exceed the present noise quality of rural residential and agricultural lifestyle.

3.3.10 Air/Water Quality

Air quality at the project site has a very low level of urban generated pollutants due to the relatively low residential density and the distance from emission sources. The major factor affecting air quality in the area is vehicular traffic. A small amount of air pollution may be generated from farm equipment including small tractors or composters. Use of all such equipment will be in accordance with applicable State and County of Hawaii regulations governing use.

Use of chemicals including pesticides or herbicides will also be governed in accordance with applicable State, Federal, or County of Hawaii regulations.

SECTION 4
RELATIONSHIP TO STATE AND COUNTY LAND USE PLANS AND POLICIES

4.1 THE HAWAII STATE PLAN

The Hawaii State Plan, Chapter 226, Hawaii Revised Statutes, serves as a written guide for the future long range development of the State. The Plan identifies statewide goals, objectives, policies, and priorities.

The proposed project would be in conformance with the State Plan's objectives and policies for agriculture. According to Section 226-7 Objectives and policies for the economy - Agriculture, the following policies would apply to the proposed activity:

(5) Enhancing agricultural growth by providing public incentives and encouraging private initiatives;

(7) Increase the attractiveness and opportunities for an agricultural education and livelihood; and

(8) Expand Hawaii's agricultural base by promoting growth and development of flowers, tropical fruits and plants, livestock, feed grains, forestry, food crops, aquaculture, and other potential enterprises.

4.2 STATE LAND USE LAW

The project site lies within the state land use category "agriculture" (see **Figure 2**). Use proposed under the development would be consist with objectives and policies of the State Land Use Law, Chapter 205, Hawaii Revised Statutes.

The State Agricultural District permits lots as small as one acre. The project's lot size meet the Agricultural District minimum lot size. In addition, pastoral and homestead use, including subsistence farming, would be consistent with rules governing uses in the State Agricultural District. According to the classification based on Agricultural Land of Importance to the State of Hawaii (ALISH), the property does not include any Prime Agricultural land.

4.3 STATE FUNCTIONAL PLAN

The Hawaii State Functional Plans (Chapter 226, Hawaii Revised Statutes) provide a management program that allows use of State Resources to improve current conditions and attend to various social issues and trends. The proposed project is consistent with the State Functional Plan for Agriculture through the following Implementing Action:

AGRICULTURE

Objective D: Achievement of Optimal Contribution by Agriculture to the State's economy.

Policy D(1): Encourage the conduct of basic and applied research on agricultural systems, technologies, practices, organisms, crops, and products, and encourage the transfer of research information to agricultural users.

Implementing Action D(1)(d): Support research and development of non-traditional Agricultural uses and cultural practices, including natural and organic methods.

4.4 COUNTY ZONING

The County of Hawaii zoning is A-1a and A-20a. The eastern portion of TMK 2-5-45:1, approximately 40 acres, is zoned A-1a (one-acre agriculture); thus, Zone Change is not required for this portion. TMK 2-5-44:1 and western portion of TMK 2-5-45:1, approximately 107 acres, is presently zoned A-20a (see **Figure 3**).

4.5 COUNTY OF HAWAII GENERAL PLAN

The vicinity of the project area has been subdivided and developed into suburban residential. According to the "Land Use Pattern Allocation Guide Map", the project site is designated as being within the "Urban Expansion Area". The "Urban Expansion" land use category is described in the County General Plan as follows:

Urban Expansion Area: Allows for a mix of high density, medium density, low density, industrial and/or open designations in areas where new settlements may be desirable, but where the specific settlement pattern and mix of uses have not yet been determined.

Within areas designated for development as resorts, portions of the resort area may be included in the urban expansion area.

The "agriculture" element of the General Plan cites various goals and policies. The following supports 'small scale' agricultural use, which is related to the proposed project.

"Rural-style residential-agricultural developments, such as small-scale rural communities or extensions of existing rural communities, shall be encouraged in appropriate locations."

In addition, an agricultural policy states:

"Designate, protect and maintain important agriculture lands from urban encroachment."

The proposed project is consistent with the South Hilo agricultural "Course of Action" as outlined in the County General Plan. These "Course of Actions" are listed below:

"The County shall provide for agricultural areas within proximity to the city for products consumed locally."

"The County shall encourage buffer zones or compatible uses between agricultural and urban/residential areas."

4.6 COUNTY OF HAWAII AGRICULTURAL DEVELOPMENT PLAN - 1992

The County Agricultural Development Plan has a stated vision:

"The County of Hawaii will continue to be the center of diversified agriculture in the State of Hawaii"

Goals and strategies within the Agricultural Development Plan support local private, diversified agriculture. As an agricultural subdivision, the proposed project would be consistent with the goals and policies stated above.

4.7 HILO COMMUNITY DEVELOPMENT PLAN - 1975

The Hilo Community Development Plan recognizes that future agricultural uses are dependent upon a variety of factors, which include:

- areas of high agricultural suitability
- location of the state agriculture district
- providing opportunity for both small scale and large scale agricultural operations
- use of agricultural zones for 'large lot development', e.g. one acre, single-family residential

The County Development Plan promotes the rural lifestyle and need for agricultural diversity. Due to the location of the proposed property and the adequate nature of the soils and terrain, rural, small scale ("large-lot") residential-farms can be developed on the subject site providing a variety of commodity alternatives to the farmer.

SECTION 5
ALTERNATIVES TO THE PROPOSED ACTION

5.1 NO ACTION

The purchase of easements is required for access and utility purposes. The proposed future development would promote the potential for diversified agricultural use and provide drainage improvements which will reduce flood potential. In order to amortize the costs of development, comprised of roads, water system, electric system, the smaller lot size is required to provide lots that can be sold at market prices.

The proposed widening of Hapuu Road would still be necessary under the "no action" alternative because the existing roadway does not meet the County standards and requirements. The "no action" alternative would continue the current undeveloped condition of the land. In addition to the hardship which would be imposed on the landowner by no action, the following lost opportunities would also result:

- failing to provide lots for agricultural use and related living dwellings at reasonable prices; and

- loss of short term construction jobs

5.2 ALTERNATIVE SITE

The owner does not own an alternative location that has the same potential for agricultural subdivision.

SECTION 6
RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

No short-term exploitation of resources resulting from development of the project site for Kaumana agricultural subdivision will have long-term adverse consequences. The existing vegetation, which primarily consists of overgrown savanna-type vegetation of tall grass and widely scattered trees, will be removed in order to use the land for agricultural use and related dwellings.

Once construction activities for support infrastructure are completed there will be no effect on air and noise quality, wildlife, or residents of the area.

Long-term gains resulting from development of the proposed project include provision of more house and farm lots at reasonable prices. This will enhance the use of the land which is now vacant and fallow.

SECTION 7
IRREVERSIBLE/IRRETRIEVABLE COMMITMENT OF RESOURCES BY THE PROPOSED ACTION

Development of the proposed project will involve the irretrievable loss of certain environmental and financial resources. However, the costs associated with the use of these resources should be evaluated in light of recurring benefits through agricultural use, which is a renewable resource.

It is anticipated that the construction of the proposed project will commit the necessary construction materials and human resources (in the form of planning, designing, engineering, construction and labor). Reuse for much of these materials and resources is not practicable. Labor expended for project development is non-retrievable.

SECTION 8
DETERMINATION

This Environmental Assessment, prepared in accordance with Chapter 343, Hawaii Revised Statutes as amended, has concluded that the potential for impacts associated with the proposed action will be minimal.

The potential effects of the proposed project are evaluated based on the significance criteria in section 11-200-12 (Hawaii Administrative Rules, revised in 1996). The following is a summary of the potential effects of the action.

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource:

Development of the project will involve the irrevocable loss of certain environmental resources. However, the costs associated with the use of these resources should be evaluated in light of recurring benefits through agricultural use, which is a renewable resource.

The county of Hawaii will benefit in terms of additional consumer spending on construction materials, home furnishings, agricultural tools, and appliances and associated tax revenues.

(2) Curtails the range of beneficial uses of the environment:

The project will not curtail the range of beneficial uses of the environment. The subject site is a currently undeveloped vacant land. The surrounding areas are sparsely developed for single family residential use.

(3) Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in chapter 344, HRS:

The project would be in conformance to the Chapter 344, HRS, State Environmental Policy, to enhance the quality of life. The project would individuals

incentives to conserve agricultural lands of Hawaii. It is the long term goal of the project to foster a Hawaiian lifestyle with subsistence homesteads traditional to Hawaiians of the recent past. The neighborhood that would result from this project would reflect rural agricultural lifestyle.

(4) Substantially affects the economic or social welfare of the community or State:

With the proposed one-acre agricultural lot, low intensity of development and land uses such as subsistence agriculture will not significantly affect economic or social welfare of the community or the state.

(5) Substantially affects public health:

The proposed low density development is not anticipated to have substantial effects on public health. The landowner will improve existing facilities and provide infrastructure necessary to support the proposed development. The development of basic support infrastructure such as drainage, sewer, and water systems, will be done in accordance with county standards and integrated with existing systems.

(6) Involves substantial secondary impacts, such as population changes or effects on public facilities:

The proposed low density of the development is not anticipated to result in substantial secondary impacts. Hilo is the only major metropolitan area in Hawaii County and a major population center of the island. The present level of public facilities and services provides adequate services to handle the current demand. The proposed project is not expected to place enough of a demand to result in the need to increase the level of current facilities and services.

(7) Involves a substantial degradation of environmental quality:

The proposed project is not anticipated to involve a substantial degradation of environmental quality. The 1881 lava flow dominates the northern portion of the

site. The majority of the site is covered by deep cultivated soil, which was previously used for intensive commercial sugarcane cultivation. The land is now abandoned and overgrown with a savanna-type vegetation of tall grass and widely scattered native and non-native trees.

(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions:

The proposed low density of development is not anticipated to result in cumulative effects; therefore, it would not involve a commitment to larger actions.

(9) Substantially affects a rare, threatened, or endangered species, or its habitat:

The proposed project is not anticipated to have substantial effects on a rare, threatened, or endangered species, or its habitat. Much of the property has historically been modified for agricultural use. The flora and fauna survey conducted in December, 1995, did not find any species listed or proposed for listing as Threatened or Endangered.

(10) Detrimentally affects air or water quality or ambient noise levels:

No significant impacts on the area's long-term air or water quality or ambient noise levels are anticipated to result from the project. Use of farm equipment and chemicals for subsistence agriculture will be in accordance with applicable State, Federal, or County of Hawaii regulations.

(11) Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters:

The project is not anticipated to affect environmentally sensitive areas. However, the Hilo area has been subject to several natural hazards including flood, volcanic activity, and earthquakes. The potential threats of these natural hazards for the

each project site are discussed in Section 3.1.3 and 4, and 3.3.3 of this Environmental Assessment.

(12) Substantially affects scenic vistas and viewplanes identified in county or states plans or studies:

With the proposed one-acre agricultural lot, low intensity of development and land uses such as subsistence agriculture will not significantly affect the area's visual resources.

The prominent feature of the landscape is the 14,000-foot peak of Mauna Kea. The magnificent views toward the mountain are seen from various locations within the project site.

(13) Requires substantial energy consumption:

The proposed low density of the development is not anticipated to result in substantial energy consumption.

In accordance with the provision set forth in Chapter 343, Hawaii Revised Statutes, this Environmental Assessment has determined that the project will not have significant adverse impacts to water quality, air quality, existing utilities, noise, archaeological sites, or wildlife habitat. Therefore, it is recommended that an Environmental Impact Statement (EIS) not be required and a Finding of No Significant Impact (FONSI) be issued for this project.

SECTION 9
NECESSARY PERMITS AND APPROVALS

9.1 STATE

No state permits are required for the proposed action.

9.2 County of Hawaii

County of Hawaii, Planning Department, Change of Zone

9.3 Federal

No federal permits are required for the proposed action.

SECTION 10
CONSULTED AGENCIES AND PARTICIPANTS IN THE PREPARATION OF THE ENVIRONMENTAL ASSESSMENT

10.1 FEDERAL AGENCIES

U.S. Army Corps of Engineers

10.2 STATE AGENCIES

Department of Land and Natural Resources

- Historic Preservation Division
- Forestry and Wildlife Division
- Land Management Division

Department of Health

Office of Hawaiian Affairs

10.3 COUNTY OF HAWAII

Department of Parks and Recreation

Department of Water Supply

Fire Department

Planning Department

Police Department

Public Works Department

REFERENCES

Archaeological and Historical Literature Search and Research Design: Lava Flow Control Study, Hilo, Hawaii , Department of Anthropology, B.P. Bishop Museum, Holly McEldowney, 1979.

Archaeological Inventory Survey Pu'ainako Street Extension Project, Terry L. Hunt, and Matthew J. McDermott, May 1994.

Atlas of Hawaii, Second Edition. Department of Geography, University of Hawaii, 1983.

McEldowney, Holly, 1979. *Archaeological and Historical Literature Search and Research Design: Lava Flow Control Study, HIlo, Hawaii* , Department of Anthropology, B.P. Bishop Museum

The State of Hawaii Data Book 1993-1994; A Statistical Abstract. Department of Business, Economic Development and Tourism, State of Hawaii, 1994.

Soil Survey of the Island of Hawaii, State of Hawaii, U.S. Department of Agriculture, Soil Conservation Services, December 1973.

Supplemental Environmental Impact Statement for Hilo Wastewater Treatment and Conveyance Facilities, Hilo District, South Hilo, Hawaii, M & E Pacific, Inc., February 1989.

APPENDICES

APPENDICES

A. Comments and Responses to the Draft Environmental Assessment

B. Archaeological Assessment

C. Flora and Fauna Report

D. Market Research and Analysis

E. Traffic Assessment Report

Appendix A

Comments and Responses to the Draft Environmental Assessment

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4185
FACSIMILE (808) 586-4186

GARY GILL
DIRECTOR

April 13, 1998

COPY

Charlene Unoki
Department of Land & Natural Resources
PO Box 936
Hilo, HI 96721

Dear Ms. Unoki:

RE: Draft Environmental Assessment (EA) for Kaumana Homesteads Easements

Please note that unbound copies of the EA are not permitted. Bind or staple all copies of the final EA. Also note that the term "negative declaration" has been replaced with Finding of No Significant Impact (FONSI). In addition we have the following comments to offer:

1. Contacts: List state and county agencies contacted during the pre-consultation phase and enclose copies of any correspondence. Notify the nearest neighbors or neighboring landowners of the proposed project, allowing them sufficient time to review the draft EA and submit comments. Document all contacts in the final EA and include copies of any correspondence.

2. Library copy of draft EA: A new administrative rule, signed into law 8-31-96, requires the applicant of any environmental assessment to place a copy in the public library closest to the project site. Please arrange to have this done as soon as possible, requesting library staff to place the document on reserve.

3. Impacts and mitigation measures: The document describes current environmental conditions in Section 3, but does not analyze impacts nor describe related mitigation measures of the project at full development. The following questions relate to full development of the site:

   ▸ *Population*: 111 lots are planned. What is the maximum number of homes allowed and what population increase is projected at full occupancy?

   ▸ *Water quality and wastewater*: What is the maximum number of cesspools that would be required and what impacts would there be to the area's water resources? Contact the Environmental Planning Office of the Department of Health regarding alternate methods of wastewater disposal and document your contact in the final EA.

   ▸ *Social impacts*: Describe the impacts that can be expected on schools, recreational facilities (would a park dedication be required?), and the character of the community. Cultural impacts, if any, should be described following the enclosed Cultural Impacts guideline.

   ▸ *Archeological resources*: The archeological assessment in Appendix A covers a 100+ acre area, but the project site encompasses a little over 250 acres. Consult with the State Historic Preservation Department of the Department of Land and Natural Resources to determine whether additional studies are required for the remaining 150 acres.

4. Timeframe: What are the anticipated start and end dates of this project?

If you have any questions call Nancy Heinrich at 586-4185.

Sincerely,

Gary Gill
Director

Enc.

c: Richard Towill c/o Colette Sakoda, RMTC

420 Wa'alamāo Road
Suite 411
Honolulu Hawaii 96817-4941
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@h-one.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
Engineering
Environmental Services
Photogrammetry
Surveying
Construction Management

September 15, 1998

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

Dear Mr. Gill:

Subject: Your Letter of April 13, 1998 Regarding the Draft Environmental Assessment for Kaumana Homesteads Easements, Kaumana, Hawaii, TMK 2-5-44:01 (portion) & 2-5-45:01 (portion)

Thank you for reviewing the Draft Environmental Assessment (EA) for the proposed Kaumana Homesteads.

We have received your comment letter through the Department of Land and Natural Resources (DLNR), and provided the following comments to your concerns:

1. Contacts: The Department of Land and Natural Resources has circulated the Draft EA to applicable agencies. The list of the agencies contacted by the DLNR will be included in the Final EA. Also, the Draft EA was sent to the Department of Hawaiian Home Lands (DHHL), the nearest and largest land owner to the project site.

2. Library copy of draft EA: A copy of the draft EA was sent to Hilo Public Library in December 13, 1997, by DLNR. No questions or comments were received from the library.

3. Impacts and mitigation measures:
Population: The proposed 147.5 acre Kaumana Homestead will consist of one-acre or larger lots. The maximum number of units provided in the Kaumana Homestead will not exceed one unit per acre. The type of the dwelling unit allowed in the homestead will be single-family dwelling only. Therefore, the development of this project at full occupancy could accommodate a maximum of 112 families. However, the first phase of the development involves forty (40) acres of the land. In addition, the proposed project will

only provide basic infrastructure necessary. The individual lots within the property will be sold after necessary improvements are in place. All in all, development of each lot will depend on the market conditions.

Water Quality and Wastewater: According to the State Department of Health, Environmental Management Division, Wastewater Branch, the project site is allowed to utilize individual wastewater systems such as cesspools and septic tanks providing each lot is one acre or larger (telecom w/ SDOH Wastewater Branch staff, May 1998). Septic tanks are preferred due to the limited land area available to accommodate the proposed development. However, if the number of lots exceeds fifty, a variance is required from SDOH.

Social Impacts: The proposed project is not anticipated to have significant cultural impacts due to the low intensity of the development with small scale agricultural-residential lots.

Archaeological resources: The total project area is approximately 150 acres. The SHPD found the purchase of easements will have "no effect" on significant historic sites.

4. Time Frame: The development of the first phase which includes approximately 40 acres of the land located at the eastern tip of the property will occur as the proposed easements are granted. The construction of the first phase is estimated at 210 days. The development time frame or scope for the remaining land has not yet been determined.

If you have further questions or comments, please contact me or Tomo Murata at (808) 842-1133.

Sincerely,

Colette Sakoda
Project Manager, RMTC

cc. Ms. Charlene Unoki, DLNR, Hawaii District Land Agent
cc: Mr. Richard M. Towill, RMTC

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF LAND MANAGEMENT
P.O. BOX 936
HILO, HAWAII 96721-0936

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

Dec 26 2 38 PM

December 13, 1997

Suspense Date: 1/2/98

MEMORANDUM

TO: County of Hawaii
Public Works Department

FROM: Charlene E. Unoki
Hawaii District Office

SUBJECT: Request for 2 easements for access and utility purposes on vacant State land at Kaumana, Hawaii, tmk: (3) 2-5-44-portion 1, 2-5-45-portion 1

Please review the attached:

( ) DRAFT EIS
( ) EIS PREPARATION NOTICE
(x) ENVIRONMENTAL ASSESSMENT
( ) LUC REVIEW
(x) Correspondence
( ) Other

and submit your comments within the time requested above. If you have any questions, please call my office at 974-6203.

If no response is received by the suspense date, we will assume there are no comments.

( ) We have no comments or objections

(✓) Comments attached or written below

Signed: DPW-ENG

Date: 12/29/97

Attachment(s) - Confirm proper sight distances at all intersections.
- Road improvements and channelizations will be required along Kaumana Drive.

12.29.97: YC FILE

420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4941
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtow@lol-one.com

R. M. TOWILL CORPORATION
SINCE 1930

Planning
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Photogrammetry
Surveying
Construction Management

September 15, 1998

County of Hawaii
County of Hawaii, Department of Public Works
Engineering Division
25 Aupuni Street, Room 202
Hilo, HI 96720-4252

Dear Sir:

SUBJECT: Your Comments on December 24, 1998 Regarding Request for 2 easements for access and utility purposes on vacant State land at Kaumana, Hawaii
TMK 2-5-44:01 (portion) & 2-5-45:01 (portion)

Thank you for reviewing the Draft Environmental Assessment (EA) for the proposed Kaumana Homesteads. We have received your correspondence through DLNR. Your comments, regarding site distances at all intersections and road improvements, will be taken under advisement.

If you have any questions, please contact me or Tomo Murata at (808) 842-1133.

Sincerely,

Colette Sakoda
Project Manager, RMTC

cc: Ms. Charlene Unoki, DLNR, Hawaii District Land Agent

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF LAND MANAGEMENT
P.O. BOX 936
HILO, HAWAII 96721-0936

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FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

Jan 6 1 39 PM '98

December 13, 1997

Suspense Date: 1/2/98

MEMORANDUM

TO: County of Hawaii
Planning Department

FROM: Charlene E. Unoki
Hawaii District Office

SUBJECT: Request for 2 easements for access and utility purposes on vacant State land at Kaumana, Hawaii, tmk: (3) 2-5-44-portion 1, 2-5-45-portion 1

Please review the attached:

( ) DRAFT EIS ( ) LUC REVIEW
( ) EIS PREPARATION NOTICE (x) Correspondence
(x) ENVIRONMENTAL ASSESSMENT ( ) Other

and submit your comments within the time requested above. If you have any questions, please call my office at 974-6203.

If no response is received by the suspense date, we will assume there are no comments.

(X) We have no comments or objections

( ) Comments attached or written below

Signed:

Date: 1/6/98

Attachment(s)

12164

420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4941
Telephone 808 842 1133
Fax 808 842 1937
eMail rmtowill@hi.one.com

R. M. TOWILL CORPORATION
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Planning
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Environmental Services
Photogrammetry
Surveying
Construction Management

September 15, 1998

County of Hawaii
Planning Department
25 Aupuni Street, Room 109
Hilo, HI 96720-4252

Dear Sir:

SUBJECT: Your Comments on January 6, 1998 Regarding Request for 2 easements for access and utility purposes on vacant State land at Kaumana, Hawaii
TMK 2-5-44:01 (portion) & 2-5-45:01 (portion)

Thank you for reviewing the Draft Environmental Assessment (EA) for the proposed Kaumana Homesteads. We have received your correspondence through DLNR. We acknowledge that the County of Hawaii Planning Department has no objections for the proposed purchase of easements.

If you have any questions, please contact me or Tomo Murata at (808) 842-1133.

Sincerely,

Colette Sakoda
Project Manager, RMTC

cc. Ms. Charlene Unoki, DLNR, Hawaii District Land Agent

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

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

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

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HISTORIC PRESERVATION DIVISION
LAND DIVISION
STATE PARKS
WATER AND LAND DEVELOPMENT

Mar 12 2 13 PM '98

March 4, 1998

MEMORANDUM

LOG NO: 21105
DOC NO: 9802ms07

TO: Charlene E. Unoki, Hawaii District Land Agent
Land Division

FROM: Don Hibbard, Administrator
State Historic Preservation Division

SUBJECT: State Land Disposition - Purchase of easements
Kaumana, South Hilo, Hawaii Island
TMK: 2-5-44: 1 (portion)
TMK: 2-5-45: 1 (portion)

HISTORIC PRESERVATION CONCERNS:

We have no record of any significant historic sites in the project areas. We believe the purchase of easements will have "no effect" on significant historic sites. If you should have any further questions, please contact Historic Preservation Division staff archaeologists Patrick C. McCoy or Marc Smith at 587-0006 (Honolulu).

MS:amk

420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4941
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eMail rmtowill@hi-one.com

R. M. TOWILL CORPORATION
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September 15, 1998

Mr. Don Hibbard, Administrator
State Historic Preservation Division
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

Dear Mr. Hibbard:

SUBJECT: Your Letter of March 4, 1998 Regarding State Land Disposition - Purchase of easements, Kaumana, South Hilo, Hawaii Island
TMK 2-5-44:01 (portion) & 2-5-45:01 (portion)

Thank you for reviewing the Draft Environmental Assessment (EA) for the proposed Kaumana Homesteads. We have received your comment letter through DLNR. We acknowledge that the SHPD has found the proposed purchase of easements will have "no effects" on significant historic sites.

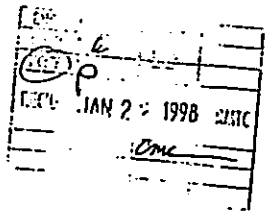
If you have any questions, please contact me or Tomo Murata at (808) 842-1133.

Sincerely,

Colette Sakoda
Project Manager, RMTC

cc. Ms. Charlene Unoki, DLNR, Hawaii District Land Agent

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPIOLANI BOULEVARD, SUITE 500
HONOLULU, HAWAII 96813-5249
PHONE (808) 594-1888
FAX (808) 594-1865



January 15, 1998

Ms. Colette Sakoda
R.M. Towill Corporation
420 Waiakamilo Rd., Suite 411
Honolulu, HI 96817-4941

Subject: Draft Environmental Assessment (DEA) for TMK 3-2-5-44 & 45, Lots 8 (portion) and 10, Kaumana Homesteads, Kaumana, South Hilo, Island of Hawaii.

Dear Ms. Sakoda:

Thank you for the opportunity to review the DEA for TMK 3-2-5-44 & 45, Lots 8 (portion) and 10, Kaumana Homesteads, Kaumana, South Hilo, Island of Hawaii. The subject area, owned by the R.M. Towill and the Lyman Trust, comprises about 147 acres, with 107 acres zoned A-20a and 40 acres zoned A-1a. The preparation of this DEA is triggered by the applicants' request for a change of zone for the 107 acre section from A-20a to A-1a. According to the applicant, the proposed change of zone is needed to facilitate the partitioning and development of the property into small scale (one-acre) agricultural lots for sale.

The Office of Hawaiian Affairs has the following comments on the proposed request. Based on information contained in the DEA, the proposed rezoning and further development will not significantly impact flora and fauna resources nor recreational resources. According to the DEA, the subject land is presently idle but was previously under sugarcane cultivation.

However, the Kaumana area was known to be a well developed area of Hawaiian occupation. Therefore, it is quite possible that subsurface archaeological resources remain. The archaeological report in the DEA consists only of a review of past research and a one day survey of the site. Thus, the information needed for decision making is inadequate. We strongly suggest that provisions for subsurface testing be completed.

In addition, we find the applicant's suggestion that one acre parcels will serve the demand for agricultural lots unsubstantiated. Instead, the consultant's report suggest that the only demand that could be filled would be that of a hobbiest. Even subsistence agriculture is not applicable since a true subsistence farmers is not likely to be able to afford the anticipated cost of the one-acre parcels.

Please contact Colin Kippen (594-1938), LNR Officer, or Luis Manrique (594-1758), should you have any questions on this matter.

Sincerely yours,

Randall Ogata
Administrator

Colin Kippen
Officer,
Land and Natural
Resources Division

cc Board of Trustees

420 Waiakamilo Road
Suite 411
Honolulu, Hawaii 96817-4941
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eMail rmtowill@i-one.com

R. M. TOWILL CORPORATION
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Planning
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Construction Management

September 15, 1998

Mr. Randall Ogata
Administrator
Office of Hawaiian Affairs
State of Hawaii
711 Kapiolani Boulevard, Suite 500
Honolulu, Hawaii 96813-5249

Dear Mr. Ogata:

Subject: Your Letter of January 15, 1998 Regarding the Draft Environmental Assessment for Kaumana Homesteads Easements, Kaumana, Hawaii, TMK 2-5-44:01 (portion) & 2-5-45:01 (portion)

Thank you for reviewing the Draft Environmental Assessment (EA) for the proposed Kaumana Homesteads. Your recommendation, regarding potential subsurface testing for archaeological resources, will be taken under advisement. Please note that the State Historic Preservation Division indicates that the purchase of easements will have "no effect" on historic sites (refer to March 4, 1998 memorandum attached in the Final EA).

The proposed project will provide a residential lot with a potential of subsistence and nonsubsistence agriculture depending on the prospective landowners' interests.

Your comments and recommendation will be addressed in the Final EA. If you have any questions, please contact me or Tomo Murata at (808) 842-1133.

Sincerely,

Colette Sakoda
Project Manager, RMTC

cc: Ms. Charlene Unoki, DLNR, Hawaii District Land Agent

Appendix B

Archaeological Assessment

AN ARCHAEOLOGICAL ASSESSMENT
OF A 100+ ACRE PARCEL IN
KAUMANA, SOUTH HILO, HAWAII ISLAND

DRAFT

By

Douglas Borthwick, B.A.
and
Hallett H. Hammatt, Ph.D.

Prepared for

R.M. Towill

Cultural Surveys Hawaii
January 1996

I. INTRODUCTION

Cultural Surveys Hawaii conducted an archaeological assessment on a 100+ acre parcel (TMK 2-5-44:1 & 2-5-45:1) in Kaūmana, South Hilo District, Hawaii Islands (Figures 1-4) at the request of R.M. Towill Corp. The assessment included a review of historical and archaeological literature concerning the project area and a one-day archaeological field reconnaissance.

The review of pertinent literature focused mainly on these documents: Hilo Bay, A Chronological History (Kelly, Nakamura, Barrère 1981); Archaeological and Historical Literature Search and Research Design, Lava Flow Control Study, Hilo, Hawaii (McEldowney 1979); and Archaeological Inventory Survey Pu'ainako Street Extension Project (Hunt and McDermott 1993). The three documents offer both general and specific historical and archaeological information regarding the project area.

The field reconnaissance was conducted 1/3/96 by two Cultural Surveys Hawaii archaeologists, Dough Borthwick and Ian Masterson. Essentially the field reconnaissance was undertaken to verify two documented land altering episodes which would directly affect the possibility of archaeological sites within the subject parcel. The two episodes or activities were the Lava flow of 1881 and commercial sugar cane cultivation.

The reconnaissance consisted of two roughly north-south transects and two roughly east-west transects through the project area. Photographs were taken to document present conditions. Additionally, we were able to talk with a farmer of the immediately adjacent parcel who provided us with further information on commercial sugar cane cultivation in the project area.

Project Area Description

The project area (100+ acres) is situated in the land division called Kaūmana in the South Hilo District of Hawaii Island. Kaūmana Drive (Saddle Road) parallels the northern boundary of the subject parcel which is at an elevational range of 1225 ft. to 1450 ft. amsl, approximately 1 mile upslope (*i.e.* west) of Kaūmana Cave.

The soil types in the project area include Kaiwiki silty clay loam, and a portion of the 1881 Maunaloa (pahoehoe lava) flow. The soil area, approximately 80% of the project area) is dominated by California grass and other secondary growth (*i.e.* guava, ferns and various weeds) in former commercial sugar cane fields. Vegetation on the 1881 flows is dense consisting of a variety of trees (guava, *'ohia*, eucalyptus) and an understory mainly of *uluhe* fern and grass. Average annual rainfall is 150 inches a year.

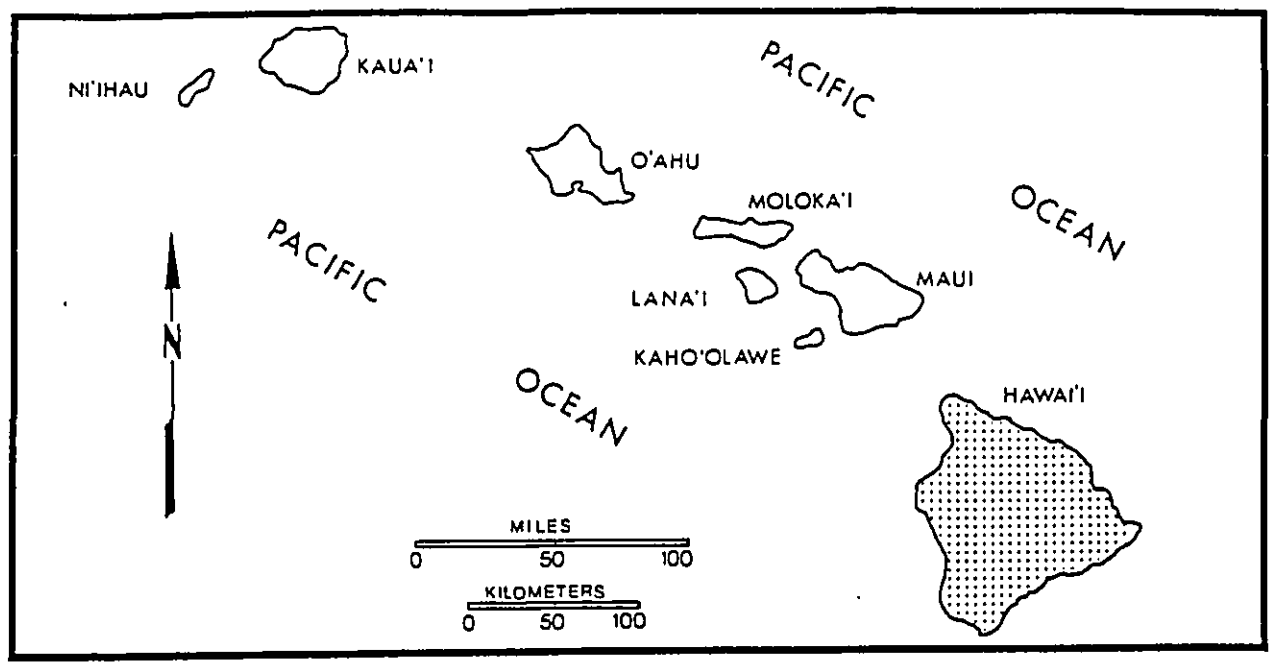


FIGURE 1
State of Hawai'i

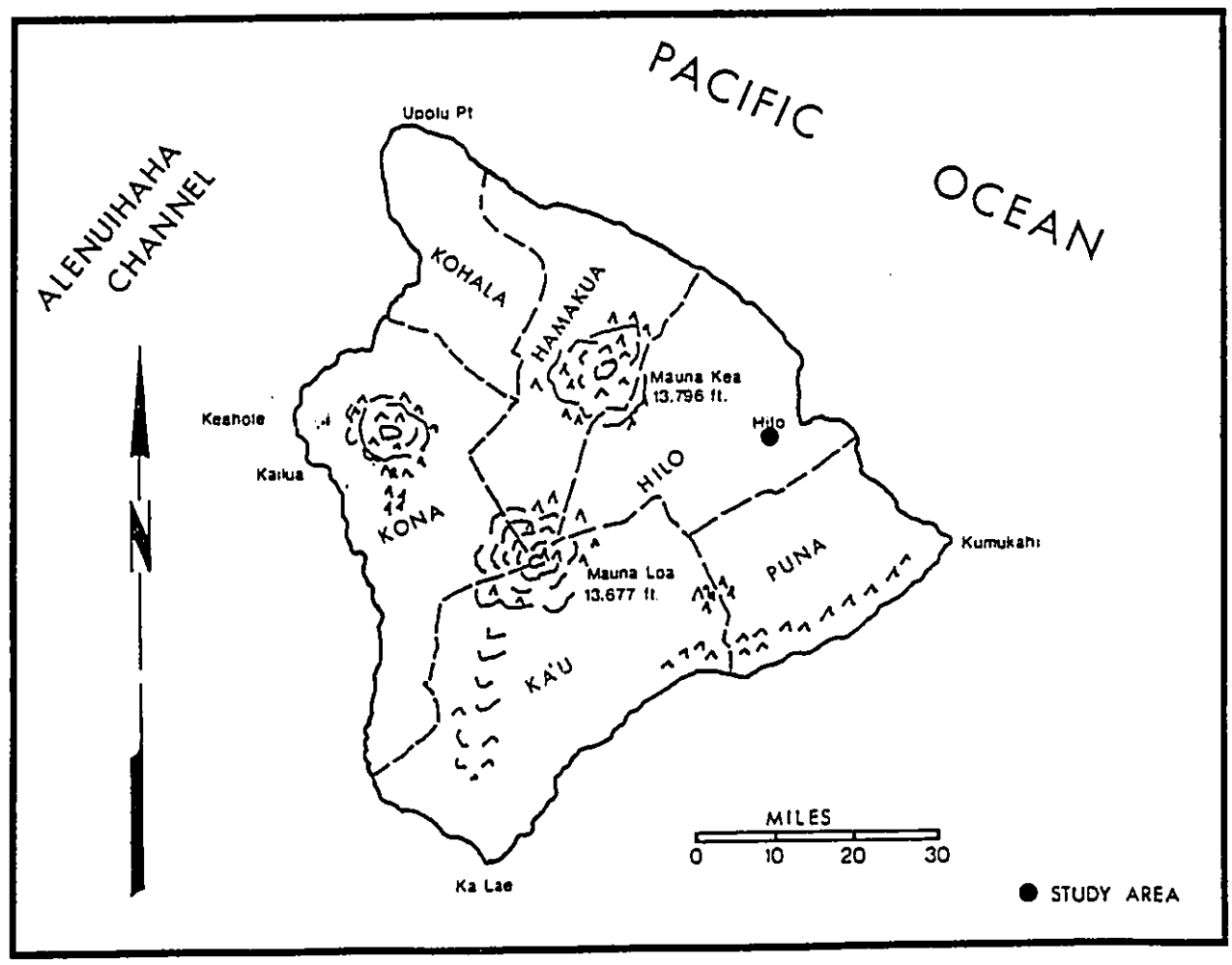


FIGURE 2
General Location Map, Hawai'i Island

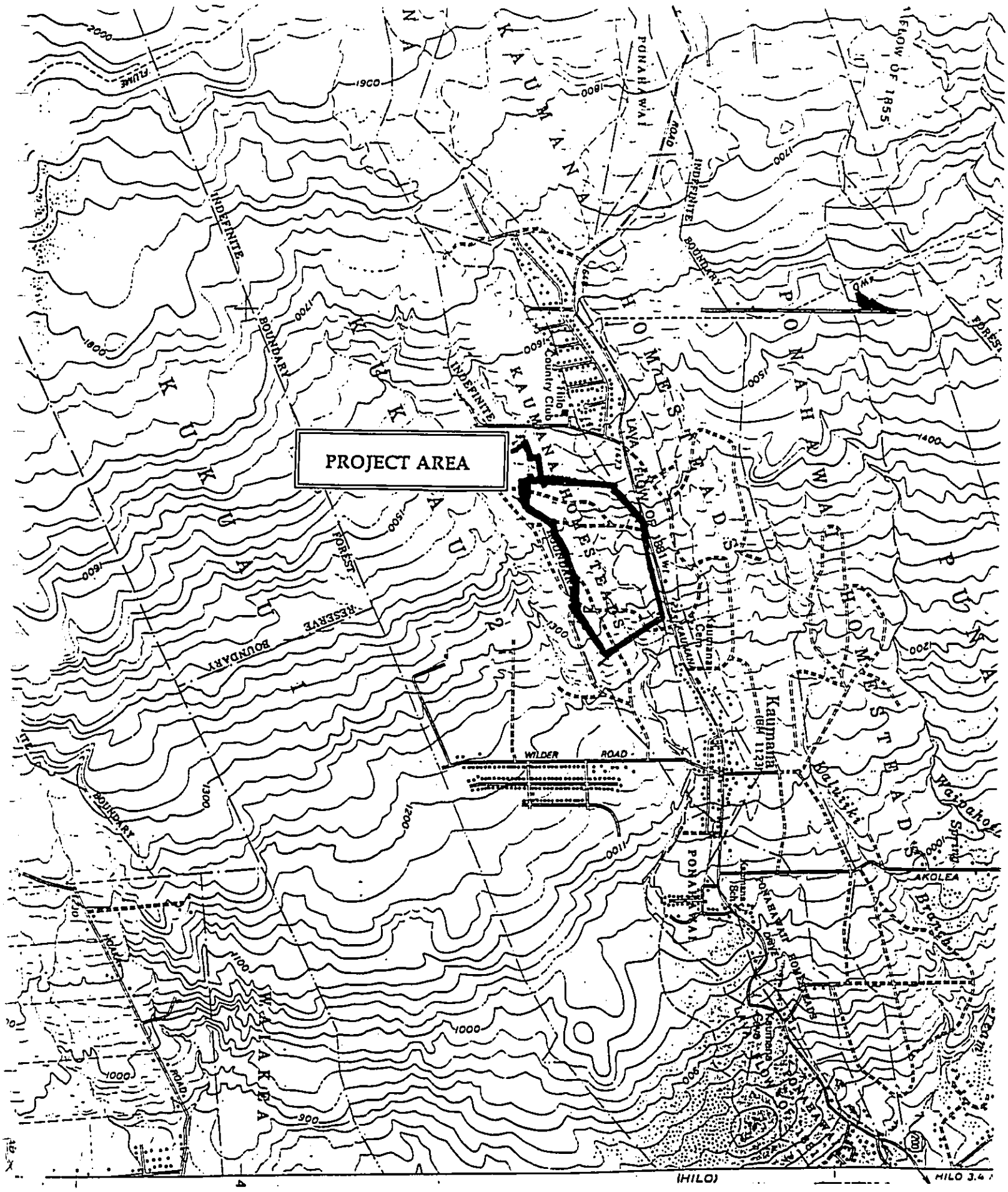


Figure 3 Portion of USGS 7.5 Minutes Series Map of Piihonua Quad (Scale 1:24000)


TO WAIMEA
PULIMA DR.
MALULANI DRIVEWAY
CANE
1500
1275

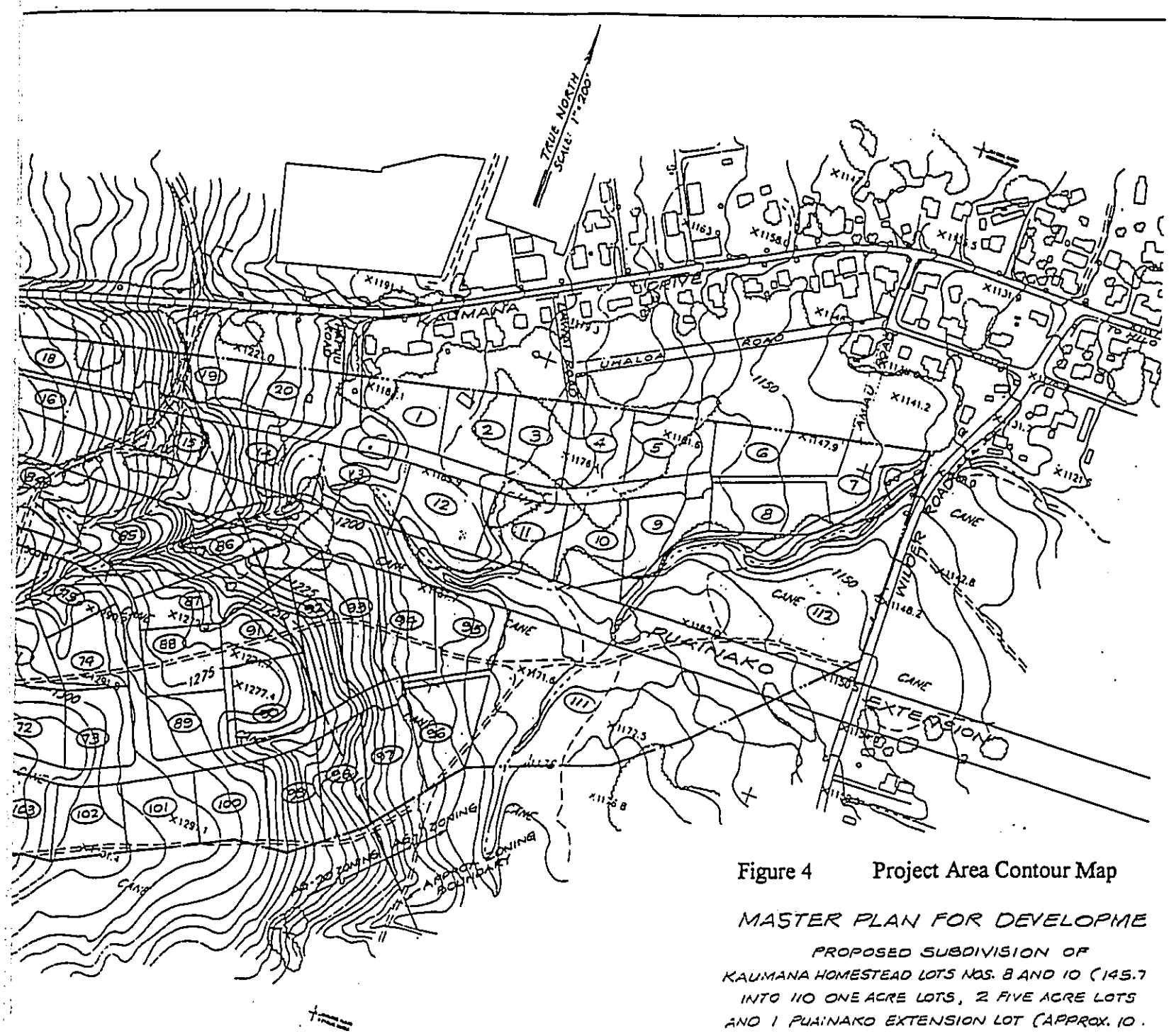


Figure 4 Project Area Contour Map

MASTER PLAN FOR DEVELOPME

PROPOSED SUBDIVISION OF KAUMANA HOMESTEAD LOTS NOS. 8 AND 10 (145.7 INTO 110 ONE ACRE LOTS, 2 FIVE ACRE LOTS AND 1 PUAINAKO EXTENSION LOT (APPROX. 10.

AT KAUMANA, SOUTH HILO, HAWAII

TMK: 3RD DIV 2-5-44:1 AND 2-5-45:1

II. HISTORIC BACKGROUND

The project area is situated within the land unit of Kaūmana (Pukui *et al.* 1974:94) in the South Hilo District of Hawaii Island. Based on the archaeological and historical overview of the Hilo region (McEldowney 1979) five land use zones have been identified. The zones included (1) coastal settlement; (2) upland agricultural; (3) lower forest; (4) rainforest; and (5) sub-alpine or montane. The project area based on elevation, is situated at the interface between the upland agricultural (variable to 1500 ft. amsl), and Lower Forest (1500 ft. to 2500 ft. amsl) Zones.

The upland agricultural zone was presumably characterized by plantings of dryland taro, sweet potatoes, bananas, breadfruit, *kukui*, and various other economically important crops. Habitation was scattered and probably associated with garden plots (McEldowney 1979:18). Within this zone the most intensively utilized portions were the soil-mantled areas like the bulk of project area, however these are the same soil areas where historic (*ca* late 1800s to 1980s) commercial sugar cane cultivation was undertaken.

The lower forest zone was characterized by minimal cultivation and associated with scattered habitation with the main land use focused on procurement of forest projects such as timber, medicinal plants and fiber plants (*e.g. olonā* , *'ie'ie*)(McEldowney 1979:25-28). Similar to the upland agricultural zone portions of the soil-mantled terrain of the lower forest zone were subsequently utilized for commercial sugar cane cultivation.

During the mid-1800s the land unit Kaūmana appears to have been "unassigned lands" (Indices 1929:24) that were subsequently (1890) part of a compromise between the Bishop Estate and Hawaiian Government. Kaūmana (and other lands) were "surrendered" to the Government by the Estate in exchange for clear title (*i.e.* patent) to certain other lands. Land use during this mid- to late-1800s specific to the project area is uncertain, however, commercial sugar cane cultivation is clearly indicated by the early 1900s.

The project area was part of Hilo Sugar Companies' (formed in 1884) fields, then later Maunakea Sugar Co. Inc. Maunakea Sugar Co. Inc. was the result of the mid 1960s merger of Hilo and Onomea Sugar Companies (Kelly *et al.* 1981: 130-136). Sugar cane was last harvested during the mid 1980s.

The bulk of the project area has been subjected to intensive commercial sugar cane cultivation, probably from the late 1800s until the mid 1980s. The remainder of the project area is the presently heavily vegetated 1881 Maunaloa Flow. The 1881 flow has been well documented both geologically (Buchanan-Banks and Lockwood 1981) and historically (Kelly *et al*, 1981:72-84).

PREVIOUS ARCHAEOLOGY

There have been several general studies of the Hilo area which have synthesized archaeological and historical research, consisting of works by McEldowney (1979) Kelley et al. (1981) and Moniz (1992). The only previous archaeological research specific to the project area was related to the proposed Pu'ainako Street Extension Project (Hunt and McDermott 1993). An approximately *2,000 foot long section of Alternative Alignment* 1 passes through the northern portion of the project area (see Figure 4). No historical sites of any kind were observed within the inventory level surveyed portion of the project area (*Ibid.*). The closest site recorded, 50-10-35-18921, is approximately 3,800 feet *makai* (i.e. east) of the present project area (Figure 5).

Site 18921, like other sites recorded during the Pu'ainako Street Extension Project, represents historic sugar cane related constructions. "Our field survey records in detail 11 sites (complexes of features in spatial association), comprising 88 individual features within or closely adjacent to the alternative alignments of the project area. Historical research (discussed above), including early and later historic documentary sources, Land Commission Awards, analysis of maps, and interviews corroborates the field evidence of the historic origin for all of the structures recorded" (Hunt and McDermott 1993: 90).

Summary of Background and Previous Research

The project area is situated at the interface of two prehistoric land use zones, Upland Agricultural and lower forest, in which dispersed agricultural pursuits, forest products procurement, and associated temporary habitation were the main focus of land use (McEldowney 1979, Hunt and McDermott 1993). During the late 1800's portions of these two zones with substantial soil cover were converted into commercial sugar cane fields. The bulk of the project area was under cultivation by Hilo Sugar Company and later the Maunakea Sugar Company. The fields in the project area were last harvested approximately 10 years ago (*i.e.* mid 1980's).

Along the northern edge of the project area is a finger of the 1881 Mauna Loa flow. The flow was pahoehoe lava that has subsequently been reforested due to the heavy rainfall in the Hilo area.

Based on sugar cane cultivation, 1881 lava flow, and an inventory level survey (Hunt and McDermott 1993) of a portion of the project area only historic era cane related structures were anticipated.

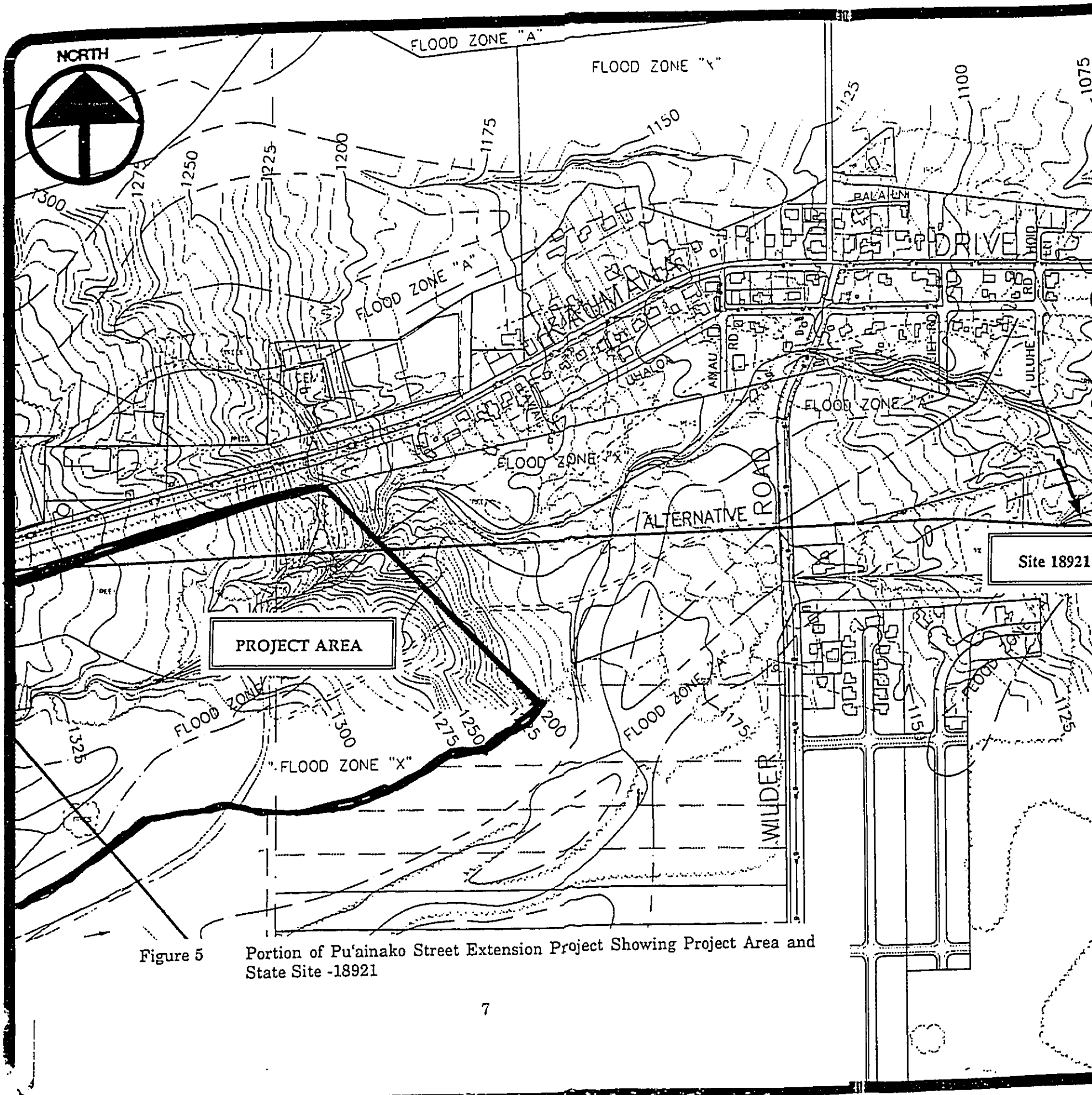
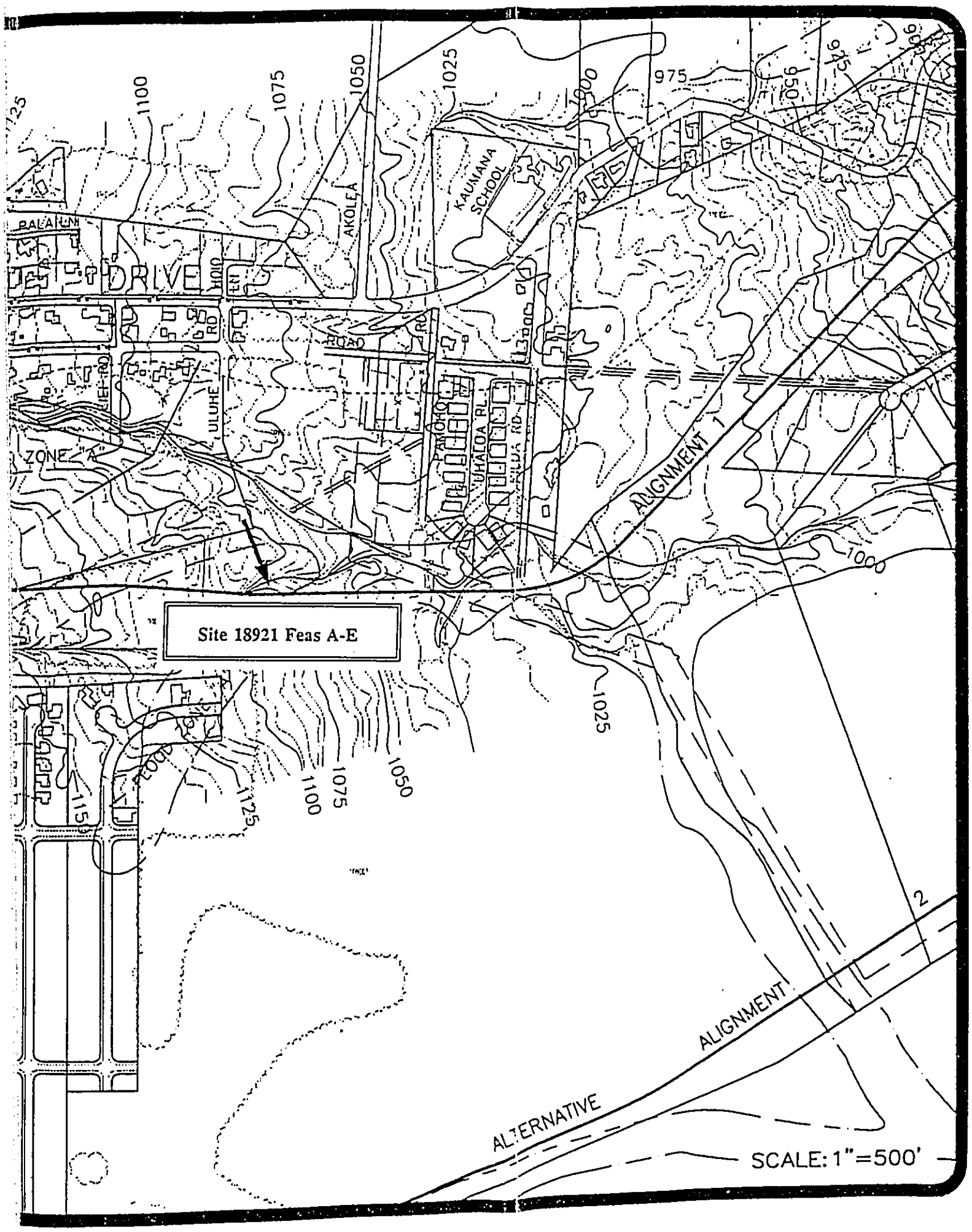


Figure 5 Portion of Pu'ainako Street Extension Project Showing Project Area and State Site -18921


1100
1075
1050
1025
1000
975
950
925
900
AKOLEA
KAUNANA SCHOOL
DRIVE
ROAD
ULUHE
ZONE A
ALIGNMENT 1
Site 18921 Feas A-E
1025
1000
1050
1075
1100
1125
ALTERNATIVE
ALIGNMENT
2
SCALE: 1"=500'

SURVEY RESULTS

The one-day field reconnaissance survey confirmed anticipated finds. There was a very clear distinction both in terms of vegetation and sub-strata between the 1881 lava flow and former cane fields. The 1881 flow had a very dense mix of vegetation including many trees. The former cane fields were open by comparison, being dominated by California grass. Bulldozed cane roads are visible though overgrown.

No historic sites of any kind were observed during the reconnaissance survey, not even rock clearing mounds like those recorded elsewhere on Hilo sugar lands (Borthwick *et al.* 1993; Hunt and McDermott 1993). During the survey we met and talked with a ginger root farmer of an adjacent parcel who had recently cleared land abutting the project area (See photo Figure 4). The farmer related to us the time of the last sugar harvest (*ca.* mid 1980s) when the entire project area was clear, except for the 1881 flow area and one stand of large eucalyptus trees. inspection of the stand of eucalyptus trees indicated no sites, not even a large rock pile. Inspection of portions of the 1881 flow indicated no sites as well. Additionally, the majority of the inventory level surveys conducted for the Pu'ainako Street Extension within the present project area was through the forested 1881 flow area.

Conclusions

No historic sites of any kind were observed within the project area. Historic and archaeological research indicated the potential for sites was extremely low with historic cane cultivation related stone structures (clearing mound) the most likely site type. Based on documentary background and the reconnaissance survey Cultural Surveys Hawaii recommends that no further archaeological research is necessary for the subject parcel.

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PHOTO APPENDIX

Figure 6 Grass in fallow Cane Fields

Figure 7 Cleared Field Adjacent to Project Area, Project Area on the Right Side

Figure 8 Fallow Cane Fields with 1881 Lava Flow Vegetation Cover in Background

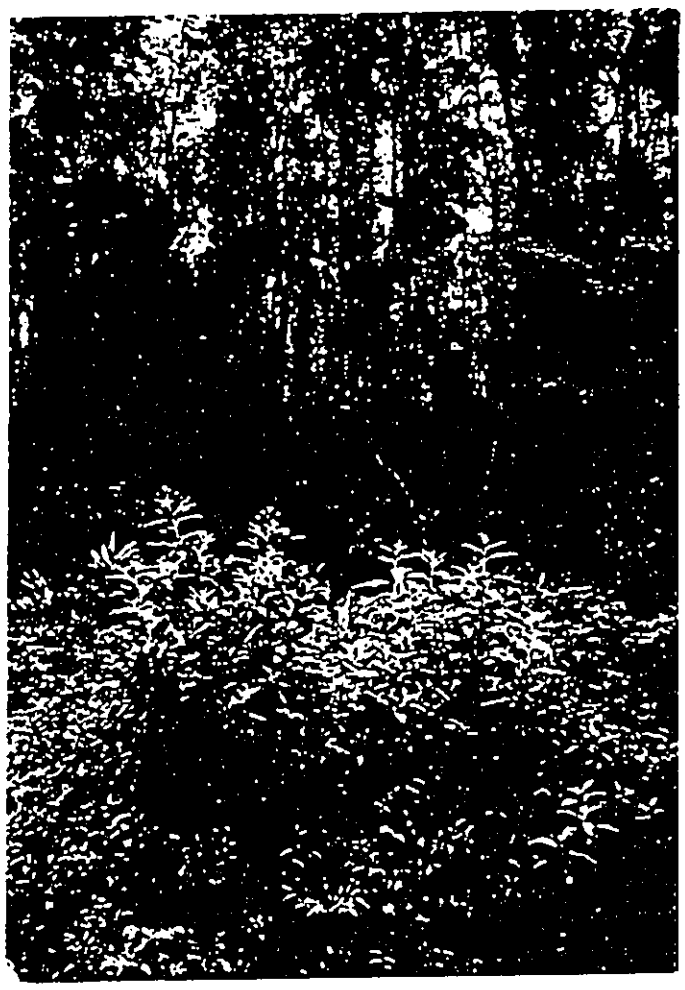

Figure 9 Vegetation on 1881 Lava Flow

Appendix C

Flora and Fauna Report

DRAFT

FLORA AND FAUNA REPORT FOR KAUMANA HOMESTEADS, SOUTH HILO DISTRICT HAWAII COUNTY

TMK 2-5-44:1 and TMK 2-5-45:1

December 28, 1995

PREPARED FOR:

R. M. Towill Corp.
420 Waikamilo Rd. # 411
Honolulu, Hawaii 96817-4941

PREPARED BY:

Grant Gerrish, Ph.D.

Y.K. Hahn and Associates

Okahara and Associates
Hilo, Hawaii 96820

DRAFT

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FLORA AND FAUNA STUDY OF KAUMANA HOMESTEADS, HILO, HAWAII

EXECUTIVE SUMMARY

This study of the flora and fauna of TMK 2-5-44:1 and TMK 2-5-45:1 within the Kaumana Homesteads, South Hilo District, was conducted to provide documentation for a rezoning request. The objectives of this study are to describe and evaluate the biological resources of the area proposed for rezoning and to determine if ecologically sensitive or valuable plants, animals or communities occur within the project area. The study included a literature search to determine which, if any, plant or animal species listed or proposed for listing as Endangered or Threatened by the U. S. Fish and Wildlife Service might occur within the project area. A field survey of the site was carried out on two days in December, 1995. All parts of the site were visited by biologist Grant Gerrish, Ph.D.

Ninety-seven species of vascular plants were recorded in the project area during the field survey. Of these, 17 are endemic (found only in Hawaii), 8 are indigenous (native to Hawaii and other places), and 72 species are alien (brought to Hawaii by humans). No plants listed as Threatened or Endangered, or proposed for listing, were found, nor is it considered likely that any such plants occur in or near the project area since no such plants are known to occur at the elevation of the project area in windward Hawaii.

The project area is distinctly divided into two vegetation types. The northern approximately one-third is on the 1881 lava flow. The pahoehoe lava is covered by a thin layer of soil, unsuited for agriculture. The natural vegetation here is an 'Ohi'a Forest that has not been cleared for human use. The significant presence of aggressive alien plants compromises the value of this native plant community. However, most native forests near Hilo are at least partially invaded by alien plants. This forest appears to be serving as a seed source for reinvasion of abandoned fields by native plants.

The rest of the project area has deep, cultivatable soil. Here, the natural vegetation was along ago cleared and the land used for sugar cane production. These abandoned fields are now overgrown with a savanna-type vegetation of tall grass and widely scattered trees. Within this Savanna, the native 'ohi'a is becoming widely reestablished and mats of the native fern, uluhe, are estimated to cover somewhat less than half of the area. In some areas, a simple native community dominated by these two species is well-established.

Few birds or mammals were observed during the field survey. One individual 'Io (Hawaiian Hawk) was observed flying overhead. The 'Io or Hawaiian Hawk is listed as an Endangered Species. The 'Io is well-adapted to native forests and landscapes disturbed by human activities. Large 'ohi'a and koa trees, as well as some alien trees, within the project area could provide suitable nesting sites. Other native forest birds, including several Endangered species, are unlikely to occur in the project area because they do not occur at this low elevation.

No distinct streams or wetlands occur within the portion of the project area on the 1881 lava flow. The rest of the project area is sloping and strongly dissected by a drainage system of intermittent streams and gullies. A few, small areas have wetland indicators, but their vegetation does not appear to possess any special biological value.

1.0 INTRODUCTION

This study of the flora and fauna of TMK 2-5-44:1 and TMK 2-5-45:1 within the Kaumana Homesteads, South Hilo District, was conducted to provide documentation for a rezoning request. The objectives of this study are to describe and evaluate the biological resources of the area proposed for rezoning and to determine if ecologically sensitive or valuable plants, animals or communities occur within the project area. Special attention was given to the search for rare or listed endangered species, and for ecosystems that might be unique to the project area.

2.0 METHODS AND SITE DESCRIPTION

The study began with a literature search to determine which, if any, plant or animal species listed or proposed for listing as Endangered or Threatened by the U. S. Fish and Wildlife Service might occur within the project area. Such listed plants are legally protected by Federal and State law. The lists of Threatened and Endangered species were reviewed (Federal Register 1990a, 1990b; and updated lists provided by USFWS, Pacific Islands Office, Honolulu). The ranges of listed and proposed plants were determined from the Manual of Flowering Plants of Hawai'i (Wagner et al. 1990). Literature was also used to determine the known distributions of endangered mammals (Tomich 1986) and birds (Stone and Scott 1988, HAS 1989, Berger 1990).

A field survey of the site was carried out on two days in December, 1995. All parts of the site were visited by biologist Grant Gerrish, Ph.D. Vegetation descriptions were recorded throughout the project area and a list of all plant species encountered was prepared. Nomenclature used for flowering plants generally follows Wagner et al. (1990); plants not listed in that source are named according to St. John (1973). Fern nomenclature follows Neal (1965), for the most part, or secondarily, Mueller-Dombois et al. (1980).

Observations of vertebrate animal species were recorded. No formal sampling for animals was conducted. Invertebrate species were not recorded. Bird taxonomy and nomenclature conforms to HAS (1989) and mammals are named according to Tomich (1986).

Factors controlling the vegetation pattern were analyzed. The Soil Survey (Sato et al. 1973) and the U.S. Geological Survey topographic maps (Piihonua and Hilo Quadrangles) were consulted for information relating to substrate age and type and to land-use history. An Environmental Impact Statement for a proposed extension of Puainako St. through the project area was also consulted for background information (Public Works County of Hawaii 1992).

3.0 RESULTS

3.1 FLORA

3.11 PLANT SPECIES OF THE PROJECT AREA

Ninety-seven species of vascular plants were recorded in the project area during the field survey. Of these, 17 are endemic (found only in Hawaii), 8 are indigenous (native to Hawaii and other places), and 72 species are alien (brought to Hawaii by humans).

The scientific and common names for each plant species are listed in Table 1. Other information given is the place of origin (endemic, indigenous or alien); the life form (tree, shrub, herb, grass or grasslike, and fern); and the wetland indicator status (U.S. Fish and Wildlife Service 1988). An estimate of the abundance of each species in each of two plant communities ('Ohi'a Forest and Savanna, see below) is also given. The abundance scale used is Dominant (most important species within a vegetation layer), Abundant (occurs frequently and with relatively high cover), Frequent (frequently encountered), Infrequent (low numbers and infrequently encountered), and Localized (very low in numbers or restricted to one or two sites). Since the plant species are not evenly distributed within the project area, these abundance estimates are an approximate average only.

3.12 DESCRIPTION OF VEGETATION COMMUNITIES

3.121 ENVIRONMENT AND LAND USE HISTORY

Originally, the natural vegetation of all of the project area was Lowland Wet Forest (Gagne and Cuddihy 1990). The younger lava flows support a subtype called the 'Ohi'a/Uluhe (Metrosideros/Dicranopteris) Fern Forest. This community is dominated by a deep mat of uluhe, more or less scattered 'ohi'a trees, and relatively few other plant species. On older flows or deeper soils derived from ash, the vegetation had further developed into the 'Ohi'a (Metrosideros) Lowland Wet Forest or the Koa/'Ohi'a (Acacia/Metrosideros) Lowland Forest communities (Gagne and Cuddihy 1990). These communities have a closed tree canopy, less uluhe ground cover, and a somewhat richer assortment of associated species.

Today, the project area is distinctly divided into two vegetation types related to the underlying soils and their history of human use. The northern part of the project area, paralleling Kaumana Drive, is on the 1881 lava flow. The pahoehoe lava of this Mauna Loa flow is covered by a thin layer of soil, unsuited for agriculture. The natural vegetation here is an 'Ohi'a Forest that has not been cleared for human use. In strong contrast, the rest of the project area has deep, cultivatable soil derived from Mauna Kea ash. Here, the natural vegetation was along ago cleared and the land farmed and used for sugar cane production. These fields are now abandoned and grown over with a savanna-type vegetation of tall grass and widely scattered trees. The division between these two vegetation types conforms to the tree-line and the edge of the 1881 lava flow as shown on the site plan.

The part of the 1881 lava flow within the project area is shown of the soils map as Lava Lands, marked with the symbol rLW (Sato et al 1973). The soil is a very thin, discontinuous layer of organic matter. The surface may be 50% or more pahoehoe lava outcrop.

Approximately two-thirds of the project area is on relatively deep soils of Mauna Kea ash that have been cleared and cultivated. These soils are identified as Kaiwiki silty clay loam by the soil map symbols KaC, KaD and KaE (Sato et al 1973). The Kaiwiki soils are classified in the Hydrandept group and are generally well-drained. The land surface in these abandoned fields is dissected by well-defined gullies and intermittent streams.

In this report, community names written with capital letters, i.e. 'Ohi'a Forest and Savanna refer to the two plant communities specifically as described below in section 3.122 and 3.123, respectively.

3.122 'OHI'A FOREST

The vegetation of the 1881 lava flow within the project area is a predominantly native 'Ohi'a Forest. The maximum tree height and spacing vary, as does the species composition. The canopy is generally closed, but may have gaps in places. Some of these gaps are caused by death of 'ohi'a trees in the canopy. Several large canopy gaps occur in the extreme northwest corner of the project area. The 'ohi'a are widely scattered and the ground cover is a dense mat of uluhe with a few other native plants. The cause of these openings is not known.

The canopy is generally between 40 and 50 ft. (12 and 15 m) high and made up of three varieties of Metrosideros polymorpha ('ohi'a): varieties incana, glaberrima and macrophylla. The largest trees are of variety macrophylla. Other native trees include kopiko (Psychotria hawaiiense) and pilo (Coprosma rhynchocarpa.) Hapu'u, or tree fern (Cibotium spp.) are fairly common. Some uluhe does grow in sunnier spots, but the ground-cover is generally dominated by the alien swordferns (Nephrolepis hirsutula and N. cordifolia), and kahili ginger (Hedychium gardnerianum). The epiphytic flora is well-developed, including ie'ie (Freycinetia arborea), 'ekaha (Elaphoglossum spp.), wawai-'iole (Lycopodium phyllanthum), palai-lau-li'i (Sphaerocionium lanceolatum), and Adenophorus sp., and mosses and liverworts.

Alien trees are also common in this community and may locally dominate the understory. Strawberry guava, or waiawi (Psidium cattleianum), and melastoma (Melastoma candidum) form dense understory thickets in many places. Common guava (Psidium guajava), African tulip tree (Spathodea campanulata), and Alexander palm (Archontophoenix alexandrae) occasionally occur.

3.123 SAVANNA

The majority of the study site was previously cleared for agriculture. These abandoned fields are now vegetated by dense stands of grass, uluhe and brush from 3 to 6 ft. (1 to 2 m) high, with trees widely scattered throughout. All of this vegetation can be described as Savanna even though the species composition is highly variable from place to place. This Savanna is an intermediate stage in the recolonization of the abandoned fields. It is expected that, in time, a closed secondary forest would develop on the site. 'Ohi'a trees or saplings were recorded in all parts of the Savanna. 'Ohi'a, hapu'u and uluhe are commonly seen in gullies where they may have survived land clearing. In other places, it is clear that 'ohi'a saplings are becoming reestablished, in the midst of alien grasses, and uluhe mats are displacing the grasses of the Savanna.

Four vegetation layers can be generally described in the savanna:

The tall tree layer, above 25 ft. (8m), consists of widely scattered trees or scattered clumps of trees. Estimated mean spacing between trees or clumps is 260 ft. (80 m). The tallest growing, and most abundant, tall tree is albizzia (Paraserianthes falcatria). Native koa (Acacia koa) is fairly abundant, especially in the western half of the project area.

The short tree layer is from 10 to 25 ft. (3 to 8 m). 'Ohi'a (M. polymorpha var incana and var glaberrima) is the most common tree, along with many young albizzia trees. Mean tree spacing in this layer is roughly estimated at 130 ft. (40 m).

The shrub layer is mostly woody or semi-woody plants from 3 to 10 ft. (1-3 m) high. This layer is highly variable from place to place. In some areas, 'ohi'a saplings are abundant with a mean spacing of about 16 ft. (5 m). Melastoma may form small thickets and, especially near the western end, volunteer sugar cane (Saccharum officinarum) still forms dense stands.

The ground layer is usually a dense mat of herbaceous plants up to 6 ft. (2 m) high. The species composition is highly variable from place to place. Most of this variation appears to reflect species competition rather than site differences. Of the various dominant plant species of this layer, uluhe is the most widespread, being dominant or present in about half of the savanna. The largest uluhe patches occur in the eastern part of the project area. Other areas are dominated by alien grasses in various combinations. Most abundant of these grasses are little bluestem (Schizachyrium condensatum), Wainaku grass (Panicum repens), California grass (Brachiaria mutica), and molassesgrass (Melinis minutiflora).

3.2 FAUNA

3.21 BIRDS

Few birds were observed during the field survey. One individual 'Io (Hawaiian Hawk: Buteo solitarius) was observed flying overhead. 'Io have been sighted elsewhere in the Kaumana area (Kjargaard 1992).

The only other native bird seen or heard was one individual Kolea (Pacific Golden Plover: Pluvialis fulva) flying above the project area. Kolea usually feed and nest in areas with very short vegetation, such as mowed grass. The project area does not contain such suitable Kolea habitat. Kolea are common elsewhere in the Hilo area.

Introduced birds observed during the field survey were the Japanese White-eye (Zosterops japonicus), Nutmeg Mannikin (Lonchura punctulata), Common Myna (Acridotheres tristis), and the Northern Cardinal (Cardinalis cardinalis). It is probable that several other species of common introduced birds utilize the project area.

Native forest birds, including several Endangered species, are unlikely to occur in the project area. These birds usually do not occur below 1625 ft. (500 m) elevation in this part of the island (Stone and Scott 1988).

3.22 MAMMALS

The Small Indian Mongoose, an introduced mammal was observed in the project area. Although they were not seen during the field survey, it is probable that mice, rats, feral dogs and feral cats also utilize the site.

3.3 STREAMS AND WETLANDS

3.31 STREAMS

No distinct streams or wetlands occur within the portion of the project area on the 1881 lava flow. The very shallow soil and pahoehoe lava of this flow are highly permeable, permitting little surface runoff.

The topography of the rest of the project area is sloping and strongly dissected by intermittent streams and gullies. The overall slope from west to east is about 7%, a drop of approximately 250 ft. (75 m) over a distance of 3600 ft. (1100 m). According to the Soil Survey (Sato et al 1973), microtopography varies between zero and 35% slope. The steepest slopes are the sides of the gullies and drainageways. The Kaiwiki series soils are well-drained with rapid permeability.

A well-developed drainage system extends throughout most of this part of the project area. Part of it is shown on the site plan and on the USGS Topographic Map, Piihonua Quadrangle, as an unnamed intermittent stream with several tributaries. The major branches of this system had a low flow of water during the field survey. These watercourses have distinct channels with high water marks and, usually, streambeds of bare lava about 3 ft. (1 m) wide. The banks are usually steep and 10 to 15 ft. (3-4 m) high. A number of short gullies with no streambed or high water mark feed this drainage system. Sometimes the head of the gully is a broad swale with no steep sides.

3.32 WETLANDS

Wetlands may have special value as habitat. Wetlands are classified as "Waters of the United States" if they meet a three criteria test; i.e. they must be dominated by hydrophytic vegetation (plants adapted to wetlands), have a hydric soil (a soil characteristic of flooded conditions), and wetland hydrology (water must be present at or near the surface of the soil during a part of each year). Waters of the United States are regulated by the Army Corps of Engineers under the authority of the Clean Water Act.

The information and analysis presented here is not a wetlands delineation as defined in the "Wetlands Delineation Manual" (Corps of Engineers 1987), nor does this report include any determination that Waters of the United States are present within the project area.

The vegetation information in this section is presented in a format consistent with the definitions of the Wetlands Delineation Manual and the "National List of Plant Species that Occur in Wetlands" (U.S. Fish and Wildlife Service 1988). The wetland indicator status of each plant species recorded in the project area is given in Table 1. The vegetation is considered hydrophytic if 50% or more of the dominant species are listed as "Obligate" (OBL), "Facultative Wetland" (FW), or "Facultative" species. A hydrophytic vegetation is only one of the three conditions necessary to determine that a site is part of the Waters of the United States and subject to regulation.

Within the study area as a whole, only one plant species is an Obligate wetland species. This plant, kamole (Ludwigia octovalis) occurs very sparingly in certain locations along streams and is never a dominant species.

Three species are listed as Facultative Wetland species. This designation means that 67% to 99% of the occurrences of these species would be in wetlands, the remainder of the time in drained sites. One of the three, California grass, is widespread in the project area and is often a dominant species. A second, honohono (Commelina diffusa) is also widespread and abundant. Both of these species are widespread in the high rainfall areas of windward Hawaii and frequently occur on drained, as well as poorly drained, sites. As such, they are poor wetland indicators. Most of their occurrences within the project area are on drained soils. The third Facultative Wetland species, umbrella sedge (Cyperus halpan) is more restricted in its distribution and is somewhat valuable as an indicator species.

Twenty-Seven Facultative species were found in the project area. Facultative species are defined as those that occur in wetland sites from 33 to 67% of the time. These include many widespread species, some of which are dominant species within the project area, such as the three varieties of 'ohi'a, hapu'u and Wainaku grass. These species have very little value in indicating the presence of wetlands.

The remaining 67 plant species found in the project area do not have listed status as wetland indicators.

The vegetation at many places within the project area and throughout the Hilo area is dominated by a combination of Facultative Wetland and Facultative species. This can often be related to the very high rainfall of the area more so than to the soil drainage condition. A preliminary determination of the presence or absence of wetlands was made in the field based on easily observable soil and topographic characteristics.

As mentioned above, the 1881 lava flow has high permeability and does not appear to retain water in the shallow soil overlying the lava. Wetland habitat does not appear to be present in this part of the project area.

Most of the deep soil part of the project area is gently to moderately sloping providing good runoff. Moreover, upon examination, the upper 12 inches of soil has *strong blocky structure, indicative of non-wetland conditions.*

The vegetation on the steep banks of the streams usually resembles the surrounding community. In most places there is no special plant community above the high water mark nor any other wetland indicators.

A few areas in gullies or near streams do have some wetland indicators. A slight variation in the vegetation may occur in the bottom of swales, or in a few narrow floodplains within the gullies. In these locations, the plant cover may be nearly 100% California grass or Wainaku grass. A few individuals of kamole may occur along with umbrella sedge. Water saturated soil with weak structure was sometimes found within 12 inches (30 cm) of the surface. Some of the swales have very shallow soil over bedrock, indicating erosion has taken place. It appears that the bedrock may be impermeable and result in saturated soil near the surface.

Two sites were found where the old cane haul roads partially block drainageways. In one place this results in a standing pool of open water. In the other, a mat of Wainaku grass grows in the standing water.

In summary, nearly all of the project area lacks soil and hydrological indicators of wetland conditions. Some areas near streams or in swales have weak or ambiguous wetland indicators. A few very small areas where drainage is clearly impeded have strong wetland indicators.

4.0 DISCUSSION

4.1 CRITERIA FOR DETERMINING BIOLOGICAL RESOURCE VALUE

All vegetation has general resource value regardless of the species present, whether dominated by native or alien plants, or the rarity or abundance of the species present. These general values include control of soil erosion, retention of water in the soil, atmospheric cooling, noise reduction and aesthetic value associated with greenery and open space. The vegetation of the project area provides these resource values to the Hilo community.

Biological resource value refers to values that individual species have because of their important role in supporting the ecosystem, uniqueness or rarity. A community with a unique combination of plant species or that is habitat for valuable animal species also has biological value. For the purposes of the present assessment, alien plants and animals are considered to have general value but no biological resource value.

Biological values identified in this report are

1) vegetation dominated by native plants, especially if the plant community is a combination of species found only in that area;

2) plant communities that support native animal species.;

3) rare or Endangered or Threatened native plants and animals.

4.2 BIOLOGICAL RESOURCE VALUES OF THE VEGETATION

The northern portion of the project area, on the 1881 lava flow running parallel with Kaumana Drive, is 'Ohi'a Forest. Although waiawi, swordfern, kahili ginger,and other alien species are present, this community appears to be a functioning, mid-succession 'ohi'a forest where a few other native tree species are becoming established. The community is simple with 29 vascular plant species recorded, including ferns and epiphytes.

The significant presence of aggressive alien plants compromises the value of this native plant community. However, most native forests near Hilo are at least partially invaded by alien plants. This forest on the 1881 lava flow appears to be serving as a seed and spore source for reinvasion of abandoned fields by native plants (see below).

The primary natural vegetation of all of the project area with deep soil was destroyed in the past by agriculture. This area is now covered by secondary (regrowth) vegetation identified in this report as the Savanna community. The majority of the plant species here are alien.

Within the Savanna, the native 'ohi'a is becoming widely reestablished and mats of the native fern, uluhe, are estimated to cover somewhat less than half of the area. In some areas, a simple native community dominated by these two species is well-established. The future direction of vegetation development on these abandoned fields is unknown. It is probable that native plant species, especially 'ohi'a and uluhe, will develop an equilibrium with alien species, including the fast-growing albizzia tree and the brushy melastoma. The high rainfall and soil conditions of this area indicate that a forest will eventually develop on this site if undisturbed. In Hawaii, secondary communities which include dominant alien plant species, such as waiawi, are generally considered to be of low biological resource value.

4.3 NATIVE ANIMAL HABITAT

Few native, vertebrate animals are likely to occur within the project area. However, two animals that may be utilizing the vegetation are listed as Endangered: the 'Io or Hawaiian Hawk (Buteo solitarius) and the Hawaiian Hoary Bat (Lasiurus cinereus semotus) (Federal Register 1990a). Both of these species are relatively non-selective in the type of habitat required for nesting and foraging. Both utilize alien as well as native vegetation, and are well-adapted to human altered landscapes. All the plant species and community types within the project area are widely available within the region. No known vegetation resources important to these or any other native vertebrate species are localized in or near the proposed alignments.

The invertebrate fauna of the project area and entire Hilo region is poorly known. For the most part, the value of the vegetation of the project area as habitat for native invertebrates is unknown. The one site where good data exist is Kaumana Cave, which was formed in the 1881 lava flow. The cave may extend under part of the project area. Sixteen native invertebrate species are reported from the cave in the vicinity of the project area. These include cave-adapted insects, spiders and crustaceans (Stone 1992). The invertebrate community within the cave is dependent on roots from overhead vegetation. The native invertebrate species do not occur within segments of the cave that do not have 'ohi'a-dominated vegetation overhead (Stone 1992).

4.4 ENDANGERED PLANTS

No plants listed as Threatened or Endangered, or proposed for listing, by the U.S. Fish and Wildlife Service (Federal Register 1990a, 1990b) were found, nor is it considered likely that any such plants occur in or near the project area. No other plants known to be considered rare by other parties or agencies were found.

It is unlikely that any undetected Threatened or Endangered plants occur in the project area. The known locations of all such species on the Island of Hawaii were checked. None have ever been found on windward Hawaii at the elevation of the project area. Furthermore, the past removal of the primary native vegetation by agriculture, made a large part of the site unsuitable as rare plant habitat.

4.5 ENDANGERED ANIMALS

The 'Io or Hawaiian Hawk is listed as an Endangered Species (Federal Register 1990a). One 'Io was observed above the project area during the field survey. These birds of prey are widespread on the island of Hawaii and well known in the Hilo area (HAS 1989, Berger 1990). The 'Io is well-adapted to hunting in either native forests or landscapes disturbed by human activities such as agriculture. It nests in large trees of either native or alien species (Griffin 1985). The large 'ohi'a trees of the 'Ohi'a Forest on the 1881 lava flow, as well as the large albizzia, koa and other trees of the savanna, could provide suitable nesting sites (Kjargaard 1992).

The 'A'o, (Newell's Shearwater: Puffinus auricularis newelli), which is a listed Threatened Species (Federal Register 1990a) was reported in the upper Hilo area before 1980 (Conant 1980), but no recent sightings are known. The 'A'o was not observed during the field survey. The project area is unlikely to be desirable nesting habitat because the proximity of homes ensures that domestic or feral cats roam the project area. The ground-nesting 'A'o is highly vulnerable to predation by rats and cats (HAS 1989).

The only land mammal native to Hawaii is the Hawaiian Hoary Bat (Lasiurus cinereus semotus), which is a listed Endangered Species (Federal Register 1990a). No dawn or evening observations were made during the field survey; this study detected no bats within the project area. The Hawaiian Hoary Bat has been sighted in a nearby subdivision (W. Brilhante, personal communication) and is well-known in the general Hilo area. It is possible that the Hawaiian Hoary Bat roosts or forages within the project area. The distribution and habits of this bat are poorly known. It is known to be widely distributed on the island of Hawaii and is known to be a solitary rooster that utilizes alien as well as native tree species (Tomich 1986).

4.6 STREAMS AND WETLAND HABITAT

An intermittent stream system drains part of the project area. The stream generally has a very low flow rate. This stream does not reach to the ocean, but disappears into the ground about one mile below the project area. The stream may enter Kaumana Cave at this point (F. Stone personal communication).

The stream system, described above, area passes through mixed plant communities within the project area. A short distance to the north of the stream is native 'Ohi'a Forest on the 1881 lava flow. The stream system itself is through abandoned sugarcane lands. Here, the Savanna vegetation ranges from alien grasslands, of California grass and Wainaku grass to re-invading native vegetation of 'ohi'a and uluhe. Native koa occur sparingly in parts of the area. The vegetation of the stream banks usually does not differ from the surroundings, with the alien grasses, or uluhe, spilling over the banks. The vegetation above the high water mark does not represent a unique or even identifiable element within the surrounding community mosaic. No native vertebrate wildlife has been observed making special use of the vegetation along the streams, nor is there reason to believe that this vegetation is important habitat for fauna.

The few areas with strong wetland indicators are very small. The vegetation of these poorly drained sites is made up of the same species that are widespread in and around the project area, with the exception of a few individual plants of kamole, a common alien herb. These areas do not appear to possess any special biological resource value.

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Table 1. Vascular plants found within the Kaumana Homesteads Project area. ORGN = Origin (E = endemic, I = indigenous, P = Polynesian introduction, A = other alien); LF = Life Form (T = tree, TF = tree fern, S = shrub, H = herb, G = grass or grass-like, F = fern, L = liana or vine); WET = Wetland Indicator Status from National List (FWS 1988) (OBL = Obligate, FW = Facultative Wetland, F = Facultative, FU = Facultative Upland, NI = Not Indicator); 1 = abundance in Ohia/Uluhe forest, 2 = abundance in Savanna (D = dominant, A = Abundant, F = Frequent, I = Infrequent).

BOTANICAL NAME COMMON NAME	ORGN	LF	WET	1	2
Acacia koa Gray koa	E	T	NI		D
Adenophorus tamariscinus (Kaulf.) Hook. & Grev. wahine-noho-mauna	E	F	FU	I	
Ageratina riparia (Regel) R. King & H. Robinson Hamakua pamakani	A	S	FU		I
Ageratum conyzoides L. maile-honohono	A	H	FU		F
Andropogon virginicus L. broomsedge	A	G	FU		A
Archontophoenix alexandrae (F. v. Muell.) H. A. Wendl. & Drude Alexander palm	A	T	NI	I	
Ardisia crenata Sims Hilo holly	A	S	NI	I	
Arundinia bambusifolia (Roxb.) Lindl. bamboo orchid	A	H	FU		F
Athyrium esculentum (Retz.) Copel. warabi, paco	A	F	NI		I

BOTANICAL NAME COMMON NAME	ORGN	LF	WET	1	2
Athyrium sandwicianum Presl. ho'i'o	E	F	NI	I	
Bambusa sp. bamboo	A	T	NI		L
Begonia hirtella Link pikonia	A	H	NI		I
Blechnum occidentale L. blechnum	A	F	NI		I
Brachiaria mutica (Forsk.) Stapf California grass	A	G	FW		D
Castilleja arvensis Schlecht. & Cham. paintbrush	A	H	NI		I
Centella asiatica (L.) Urb. Asiatic pennywort	A	H	F		F
Cestrum nocturnum L. night cestrum	A	S	NI		I
Cibotium chamissoi Kaulf. hapu'u-'i'i	E	TF	F	F	I
Cibotium glaucum (Sm.) H. & A. hapu'u	E	TF	F	F	I
Coffea arabica L. Arabian coffee	A	T	NI		L
Commelina diffusa N. L. Burm. honohono	A	H	FW	F	
Coprosma rhynchocarpa Gray pilo	E	T	NI		I

BOTANICAL NAME COMMON NAME	ORGN	LF	WET	1	2
Crotolaria juncea L. sunn hemp	A	H	NI	I	
Cuphea carthagenensis (Jacq.) Macbride tarweed	A	H	F	I	
Cyclosorus dentatus (Forsk.) Ching oak fern	A	F	NI	I	
Cyperus halpan L. umbrella sedge	A	G	FW	I	
Desmodium sandwicense E. Mey. Spanish clover	A	H	FU	F	
Desmodium tortuosum (Sw.) DC Florida beggarweed	A	S	NI	I	
Dicranopteris linearis (Burm.) Underw. uluhe, false staghorn	I	F	FU	F	D
Dissotis rotundifolia (Sm.) Triana no common name	A	H	NI	L	
Elaphoglossum alatum Gaud. 'ekaha	E	F	F	I	
Elaphoglossum reticulatum (Kaulf.) Gaud. 'ekaha	E	F	NI	I	
Erechtites velerianifolia (Wolf) DC fireweed	A	H	F	I	
Eucalyptus robusta Sm. swamp mahogany	A	T	FU	L	
Eucalyptus saligna Sm. Sydney blue gum	A	T	NI	L	

BOTANICAL NAME COMMON NAME	ORGN	LF	WET	1	2
Freycinetia arborea Gaud. ie'ie	E	L	FU	I	
Hedychium gardnerianum Roscoe kahili ginger	A	H	NI	D	I
Impatiens sultani Hook f. impatiens	A	H	NI		I
Justica betonica L. white shrimp plant	A	H	NI		L
Kyllinga brevifolia Rottb. kili'o'opu	A	G	F		F
Lantana camara L. lantana	A	S	NI		I
Lycopodium cernuum L. wawae-'iole	I	F	F		F
Lycopodium phyllanthum H. & A. wawae-'iole	I	F	NI	I	
Ludwigia octovalvis (Jacq.) Raven kamole, primrose willow	A	H	OBL		L
Machaerina mariscoides (Gaud.) J. Kern 'ahaniu	I	G	FU		I
Mecodium recurvum 'ohi'a-ku	E	F	NI	I	
Melastoma candidum D. Don melastoma	A	S	NI	A	D
Melinis minutiflora Beauv. molassesgrass	A	G	NI		D

BOTANICAL NAME COMMON NAME	ORGN	LF	WET	1	2
Melochia umbellata (Houtt.) Staph. melochia	A	T	NI	I	
Metrosideros polymorpha Gaud.var. glaberrima 'ohi'a, 'ohi'a-lehua	E	T	F	D	D
Metrosideros polymorpha Gaud. var. incana 'ohi'a, 'ohi'a-lehua	E	T	F	D	A
Metrosideros polymorpha Gaud. var. macrophylla 'ohi'a, 'ohi'a-lehua	E	T	F	A	
Microsorium scolopendria (Burm.) Copel. laua'e	I	F	NI	I	
Mimosa pudica L. sensitive plant	A	S	FU	F	
Musa x paradisiaca L. banana	A	T	FU	L	
Nephrolepis cordifolia (L.) Presl no common name	A	F	FU	F	
Nephrolepis hirsutula (Forst.) Presl swordfern	A	F	F	A	F
Paederia scandens (Lour.) Merr. maile pilau	A	L	NI	I	
Panicum repens L. wainaku grass	A	G	F	D	
Paraserianthes falcataria (L.) Nielson albizia	A	T	NI	D	
Paspalum conjugatum Berg. Hilo grass	A	G	F	F	

BOTANICAL NAME COMMON NAME	ORGN	LF	WET	1	2
Paspalum scrobiculatum L. ricegrass	I	G	F		I
Paspalum urvillei Steud. vaseygrass	A	G	F		I
Pennisetum purpureum Schumach. elephant grass	A	G	FU		L
Persea americana Mill. avocado	A	T	NI		I
Phaius tankarvilleae (Banks ex L'Her.) Blume Chinese ground orchid	A	H	FU	I	
Phlebodium aureum (L.) J. Sm. laua'e-haole	A	F	NI		I
Pityrogramma chrysophylla gold fern	A	F	NI		I
Pleopeltis thunbergiana Kaulf. pakahakaha	I	F	NI		I
Pluchea symphytifolia (Mill.) Gillis sourbush	A	S	F		I
Polygala paniculata L. Milkwort	A	H	NI		F
Psidium cattleianum Sabine waiawi, yellow strawberry guava	A	T	F	A	I
Psidium guajava L. common guava	A	T	FU		I
Psychotria hawaiiense (Gray) Fosb. kopiko	E	T	NI	I	

BOTANICAL NAME COMMON NAME	ORGN	LF	WET	1	2
Pycreus polystachyos (Rottb.) P. Beauv. no common name	I	G	F		F
Pyracantha angustifolia (Franch.) C.K. Schneid firethorn	A	S	NI		L
Richardia brasiliensis Gomes no common name	A	H	NI		I
Rhus sandwicensis Gray neneleau	E	T	NI		I
Rubus rosifolius Sm. thimbleberry	A	S	F		I
Saccharum officinarum L. sugar cane	A	G	FU		D
Saciolepis indica (L.) Chase Glenwoodgrass	A	G	F		F
Sadleria cyatheoides Kaulf. 'ama'u	E	F	FU		L
Schizachyrium condensatum (Kunth) Nees little bluestem	A	G	NI		D
Setaria gracilis (Poir.) Beauv. perennial foxtail	A	G	NI		I
Setaria palmifolia (Koen.) Stapf palmgrass	A	G	FU		I
Spathodea campanulata Beauv. African tulip tree	A	T	NI	L	L
Spathoglottis plicata Blume Philippine ground orchid	A	H	F		I

BOTANICAL NAME COMMON NAME	ORGN	LF	WET	1	2
Spermacoce assurgens Ruiz & Pav. buttonweed	A	H	NI		I
Sphaerocionium lanceolatum (H. & A.) Kopel. Palai-lau-li'i	E	F	NI	I	
Sphenomeris chusana (L.) Copel. palaa, lace fern	A	F	F	F	
Stachytarpheta urticifolia (Salisb.) Sims no common name	A	S	F		I
Syzigium jambos (L.) Alston rose apple	A	T	F		L
Themeda villosa (Poir.) A. Camus Lyon's grass	A	G	NI		I
Tibouchina herbacea glorybush	A	S	F		F
Torenia asiatica L. Ola'a beauty	A	H	F		I
Tritonia crocosmiflora Nichols. montbretia	A	H	NI		I
Wedelia trilobata (L.) Hitchc. wedelia	A	H	FU		L

Appendix D

Market Research and Analysis

MARKET RESEARCH AND ANALYSIS

PROPOSED AGRICULTURAL/RESIDENTIAL DEVELOPMENT

KAUMANA, SOUTH HILO, HAWAII

PREPARED FOR:

R. M. TOWILL CORPORATION

PREPARED BY:

REAL ESTATE SERVICES, INC.

PETER T. YOUNG
CERTIFIED GENERAL REAL ESTATE APPRAISER

JANUARY 1996

REAL ESTATE SERVICES, INC.

Peter T. Young
President

- Appraisal
- Consulting
- Arbitration
- Market Analysis
- Permit Processing
- Impact Studies

January 18, 1996

Stephen Kellogg
R.M. Towill Corporation
420 Waiakamilo Road, Suite 411
Honolulu, Hawaii 96817

Re: Market Analysis
Proposed Agricultural/Residential Development
Tax Map Key: 3/2-5-044:001 & 3/2-5-045:001
Kaumana, South Hilo, County of Hawaii

Dear Mr. Kellogg:

In accordance with your request, this serves as a review of the property identified above, a review of the market conditions affecting the use of the property and an estimate of the market opportunities for the property.

This market study considers the proposed project in relation to the overall condition and trends in the market place, identifying historic and predicted changes in population, economic opportunities and competitive developments.

In this process a variety of plans and proposals (both government and private) were reviewed. Many of the findings and conclusions of these reports are summarized in this report; in addition, narrative and statistical data from these documents have been incorporated into this analysis and report.

The findings of this review are summarized in this report. Thank you for the opportunity to be involved in the project. If you have any questions, please do not hesitate to contact me.

Sincerely,
REAL ESTATE SERVICES, INC.

Peter T. Young
President

POST OFFICE BOX 2665 KAMUELA, HAWAII 96743 (808) 885-4200

PLANNING ASSUMPTIONS

The proposed project is an undeveloped parcel of land that is proposed for agricultural, residential and related development. In order for the proposed development to be accomplished certain land use entitlements must be obtained. These entitlements are granted from various State and County agencies and require time for application, processing and approval.

It is assumed that approximately four to five years will elapse in this process. Approximately 1.5 to 2 years will be required for the approvals of the County zoning, approximately 1 year for final planning and design and approximately 1 to 2 years for construction of the approved development.

The review and findings in this analysis consider the historic trends and activities in the region and the probable elapsed time from initial planning (today) to final construction and sales opportunity (approximately 4 to 5 years).

POPULATION PROJECTIONS

Most population estimated refer to the State's M-K estimates. According to the Hawaii County Department of Research and Development, the M-K estimates are the currently used estimates and are generally reflected in the estimates in the Hawaii County General Plan.

State M-K Series Population Estimates

The M-K projections were produced through the Hawaii Population and Economic Projection and Simulation Model, a system of mathematical equations designed to give a consistent set of State and County projections. At the center of the system is the State model, which forecasts expenditures, production, employment, income and population. The State model uses projections of U.S productivity and wage rates, and other variables, produced in turn by other economic models maintained by the UCLA Business Forecasting Project, the U.S Bureau of Economic Analysis, and other agencies. A County model, in turn, allocates the State forecasts of population, employment and income among the four counties.

State Model

The State model contains two major component submodels. An economic submodel produces projections of economic activity ranging from jobs in individual industries, wages and personal income to Gross State product. A demographic submodel generates the natural increase in population based on demographic factors such as birth and deaths. The interaction

between the economic and demographic models determines the expected level of net migration, which is added to the natural growth of the population resulting from births and deaths.

The County Model

The County model distributes the State forecasts of population, employment and income among the four Counties. Like the State model, the model for the Counties is based on the concept that the growth of the Counties' exports and their important import replacement activity (which together are called "basic" activity) is the primary influence on the growth of the Counties' economies and populations in general. However, in contrast to the information available for the State as a whole, there are no data bases or relationships available for the Counties that reliably measure dollar values for County exports and imports, or county specific multipliers to distribute the impact of export sales. Therefore, county employment by industry is used as a substitute basis for measuring most economic activity at the county level.

The key export industry for all counties is tourism. However, in the absence of reliable and comprehensive visitor statistics for the Counties, the magnitude of county tourism is reflected best by the number of occupied visitor accommodations and the level of employment in hotel and eating and drinking establishments. Each county is independently allocated a share of the statewide projection for occupied hotel rooms based on analysis of past, current and expected future trends in resort development and occupancy rates. Visitor accommodations projections are then translated into levels of hotel and eating and drinking establishment employment.

The projections are designed to be as objective as possible. This means that assumptions upon which the projections are based have been chosen on the basis of their likelihood, not their level of desirability. Likewise, the relationships within the forecasting model which translate assumptions into projections of the future are based, as much as possible, on objective analysis of past and current trends. The projections, therefore, do not necessarily represent preferred levels of future economic activity or population. Rather, they represent only the most likely future given the state of knowledge about the economic and demographic factors at work.

It is also very important to note that the projections do not represent either a certain or unalterable future. They are not certain because there will obviously be some error involved in forecasting 20 years or more into the future, as the result of both unanticipated future events and limitations of the forecasting techniques available. Moreover, if the projections suggest future conditions which the community determines to be

undesirable, policies can be formulated to help bring about a more desirable future; thus, the projections, regardless of their potential accuracy, are not unalterable. Notwithstanding these limitations, it must be cautioned that these projections have embodied the established trends of some very powerful economic and demographic forces, which are not subject to either easy or rapid manipulation.

Major Findings

The M-K projections indicate continued growth in both the population and economy of the State, although at a somewhat reduced rate compared with the rapid increases of the past quarter of a century. The resident population, which includes members of the armed forces and their dependents but excludes visitors, is projected to rise from 1,051,500 in mid-1985 to 1,435,500 in 2010. The de facto population, which includes visitors present but excludes residents temporarily absent, is projected to grow from 1,149,600 in 1985 to 1,674,200 in 2010.

The M-K projections anticipate that population increases on the Neighbor islands will be proportionately greater. The resident total on Oahu is projected to rise 23 percent, from 811,100 in 1985 to 999,500 in 2010. The Neighbor Island total, by contrast is projected to rise 81 percent over the 1985 to 2010 period, from 240,400 to 435,900. All three Neighbor Island counties share in this expansion. Nevertheless, Oahu would still account for 70 percent of the State resident total in 2010 under the projections, down from 77 percent in 1985.

Because of the continued growth projected for the visitor industry and its expansion to the Neighbor Islands, the de facto populations of Hawaii, Kauai, and Maui Counties are projected to approximately double in size from 1985 to 2010. Oahu de facto population is expected to increase 27 percent, to 1,094,700 in 2010.

Diminished birth rates and longer life expectancy will inevitably produce an aging of the population, with the median age rising from 30.5 years in 1985 to 35.3 years in 2010. The population under 15 years of age is projected to fall from 22.9 percent of the total to 19.6; during the same quarter of a century, persons 65 years old and over are projected to rise from 9.4 percent of the total to 13.1. The sex ratio, 104.1 males per 100 females in 1985, would decline to 101.4 by 2010 under the new projections.

The civilian job count which was 473,100 in 1985 is projected to increase to 720,600 by 2010. Two of today's major industries, sugar and pineapple, are expected to decline in employment, while manufacturing and Federal government are expected to achieve only modest gains. Employment in trade,

services, and diversified agriculture, however, are expected to show continued rapid increases.

The Hawaii County General Plan uses three sets of projections for the comprehensive review program, series A, B and C. The major variable in each of these projections was the rate of growth of the visitor industry. Plans for resort complexes and other factors were considered in the forecast of hotel rooms. It should again be emphasized that the projections are not statements of goals.

Series A is the most conservative projection. It assumes the demise of the sugar industry and modest expansion in the visitor industry. The overall 1985-2005 rate of growth for series A of 2.0% per annum is less than the 2.9% rate of growth of employment in the County evidenced in recent times.

Series B projections were developed as a medium series. Theses projections lie between series A and C. Sugar employment is maintained and the overall per annum employment growth rate anticipated in Series B is approximately 3.7%.

Series C is an optimistic outlook of the County's future. It is assumed that 17,800 hotel rooms plus additional condominium units will be built in the County by 2005. The average annual growth rate of employment in series C is 4.7%

District Distribution
(Year 2005 Projections)

District	Series A	Series B	Series C
Puna	39,790	49,910	58,340
S. Hilo	44,115	55,335	65,790
N. Hilo	1,211	1,519	1,806
Hamakua	5,363	6,721	7,896
N. Kohala	5,363	6,721	7.896
S. Kohala	19,203	24,087	28,638
N. Kona	43,250	54,250	64,500
S. Kona	10,899	13,671	16,254
Kau	3,806	4,774	5,676

Population Characterizations

Prior years statistics indicated a proportion of residential population in East Hawaii to West Hawaii as 67 percent to 33 percent, respectively. County projections for the year 2005 indicate a shift in population from East Hawaii to West Hawaii. The county projects that by the year 2005, 45.5 percent of the residential population will be living in West Hawaii.

Hawaii County Department of Research and Development provided data that estimated Hawaii population to be 138,040 people in

1995. 1990 South Hilo population was estimated at approximately 44,639, with the 1995 estimate at 47,754. (Note that these estimates are higher than the lowest Series M-K estimate for the year 2005.)

Housing Supply and Demand

A variety of housing supply and demand studies were reviewed. The following is a relatively consistent conclusion found in these reports.

Projected Housing Demand and Supply
County of Hawaii
1990 to 2010

Housing Demand:	1990	1995	2000	2005	2010
Population	124,600	142,500	160,400	180,800	206,100
Persons per housing unit	2.8	2.8	2.75	2.75	2.7
Units required (rounded)	44,500	50,900	58,300	65,700	76,300
Housing Supply:					
1985 housing stock	40,820	38,320	38,100	37,880	37,660
Demolitions/period	225	225	225	225	225
Nonresident unit inventory	2,279	---	---	---	---
Remaining units (rounded)	38,320	38,100	37,880	37,660	37,440
Excess of demand over supply	6,180	12,800	20,420	28,040	38,860
Additional vacancy factor	4%	4%	4%	4%	4%
Total resident units needed	1,780	2,040	2,330	2,630	3,050
Total resident units/year	1,600	1,360	1,600	1,580	2,240

DBED, "Population and Economic Projections for the State of Hawaii to 2010 (Series M-K)", November 1988.
Projected by Hawaii County Planning Department.
Bank of Hawaii, Construction in Hawaii 1989.
Based on 1980-1988 data.
DBED, "Housing Unit Estimates for Hawaii, 1970-1988".

Overall Economic Conditions

The region historically has experienced cyclical activity in the local economy and real estate activity. This pattern is evidenced over the past few decades, generally following the apparent patterns in the national and global economic conditions. The cycle has periods of accelerated growth (in actual construction, sales prices, volume of sales activity and overall economic activity) followed by periods of slower growth

and, at times, stagnation; followed by increased activity leading to another peak to another downward trend, etc..

For some, the Big Island real estate cycle is described as 'boom or bust' and/or 'feast or famine'. There appears to be periods of extremes, with transition occurring between these extremes. The overall cycle (peak-to-peak) appears to occur in approximate seven- to ten-year increments.

The current nature of the local and State economies appear stabilized and the future is optimistic. Of primary importance is the local real estate market which has had recent signs of stagnation, but the long-term outlook shows signs of dramatic growth. Based on the review of the market place, it appears the local real estate market has plateaued with probable increase and an upswing in sales volume, indicating increased sales activity, increased market values and reduced length of time property is on the market before sold.

Recent bank economic department reports (Bank of Hawaii and First Hawaiian Bank) indicate that the downward trend in the State's economy has apparently stabilized and positive economic activity is expected in the future.

PROJECT COMPARISONS

The proposed development will complement the market and should command prices within the current market price range. The project proposes County standard roads, passive and active park space, County water and design standards. These are generally accepted in the market place. The project should have sufficient consumer interest and acceptance, equating to sales activity for the subdivided lots.

The following is a summary of the regional and immediate area statistics of vacant and improved property sales. This summary is broken into two comparisons: (1) the regional activity for typically 1-acre properties and (2) the activity in the immediate area for residential-sized properties (Typically 10,000 to 21,780 square feet).

Regional Sales Activity

VACANT - Typical Land Area 1-acre

YEAR	# SOLD	PRICE RANGE	PREDOMINANT RANGE
1991	9	$ 40,500 - $131,000	$ 70,000 - $120,000
1992	18	$ 60,000 - $225,000	$120,000 - $155,000
1993	17	$ 80,000 - $155,000	$120,000 - $140,000
1994	10	$ 99,000 - $155,000	$110,000 - $125,000
1995	6	$105,000 - $165,000	$108,000 - $116,000
5 YEARS	60		

HOMES - Typical Land Area 1-acre

YEAR	# SOLD	PRICE RANGE	PREDOMINANT RANGE
1991	3	$216,000 - $365,000	$216,000 - $365,000
1992	3	$249,000 - $255,000	$249,000 - $255,000
1993	5	$230,000 - $399,500	$250,000 - $365,000
1994	6	$150,000 - $378,500	$200,000 - $350,000
1995	3	$135,000 - $375,000	$265,000 - $375,000
5 YEARS	20		

ACTIVE LISTINGS - Typical Land Area 1-acre

STATUS	# LISTED	LIST PRICE RANGE	PREDOMINANT RANGE
VACANT	20	$ 60,000 - $140,000	$110,000 - $125,000
HOMES	13	$195,000 - $459,000	$225,000 - $300,000

In addition to the properties with typical lot sizes in the vicinity of 1-acre, a statistical review of residential lots (10,000 square feet to 21,780 square feet) was made. Since the primary market for the subject properties is estimated to be for residential use, a review of residential activity is reasonable. Following is the statistical review of residential lots in the immediate vicinity of the subject.

Activity in the Immediate Vicinity of the Subject

VACANT - Typical Land Area 10,000 SqFt to 21,780 SqFt

YEAR	# SOLD	PRICE RANGE	PREDOMINANT RANGE
1994	41	$ 38,000 - $160,000	$ 75,000 - $118,000
1995	33	$ 55,000 - $122,000	$ 89,000 - $118,000
2 YEARS	74		

HOMES - Typical Land Area 10,000 SqFt to 21,780 SqFt

YEAR	# SOLD	PRICE RANGE	PREDOMINANT RANGE
1994	93	$ 90,000 - $360,000	$120,000 - $200,000
1995	87	$ 60,000 - $325,000	$130,000 - $215,000
2 YEARS	180		

ACTIVE LISTINGS - Typical Land Area 10,000 SqFt to 21,780 SqFt

STATUS	= LISTED	LIST PRICE RANGE	PREDOMINANT RANGE
VACANT	23	$ 32,000 - $105,000	$ 69,000 - $ 79,900
HOMES	43	$119,000 - $395,000	$145,000 - $200,000

Based on the indicated ranges of prices paid in competitive subdivisions, the following is a summary of the indicated price ranges for the proposed development. These ranges are put into several price groupings.

	RECOMMENDED PROJECT PRICING
Vacant Land	$ 90,000 to $100,000
House and Lot	$200,000 to $300,000

Differences are likely to occur between some of the properties including: net usable land area, views proximity, noise impact

from major roads, internal vs. external (main) road location. These differences are accounted for by making adjustments to the benchmark range.

NEARBY PROPOSED RESIDENTIAL PROJECT

After several public hearings, on December 14, 1995 the Hawaii County Planning Commission voted to recommend approval of a change of zone application for approximately 300 acres of land in Puueo, South Hilo. The request suggests changing the zoning from agriculture to residential and commercial.

The parcel is north of the Wailuku River. Like the subject property, this parcel was once in sugar production. Its present zoning is typically Ag 20-ac.

The proposal suggests ultimate development of 800 lots, which range in size from 7,500 to 20,000 square feet. The proposed price of the house/lot package would range from approximately $225,000 to $325,000 (1994 Dollars).

These prices are similar to the proposed price range for the subject property. The subject, however, is proposed to have land areas of approximately 1-acre for each lot. The subject should benefit from the price relative to land area comparison in the marketplace.

The Planning Commission approval suggests that they are receptive to removal of land from agricultural use for placement into residential uses. The subject proposal suggests retention of the agricultural use, though the probable primary use by the purchasers will be in residential with subordinate agricultural use.

MARKET TIME

Most similar agricultural/residential properties (vacant or improved) that have sold over the last year were on the market for less than a year. Due to size of the development, the overall market time for the proposed subdivided lots will likely be approximately three to five years after necessary land use entitlements are secured and subdivision development has been finalized.

Market evidence of competitive house/lot and vacant land transactions indicate that listings are typically 'on the market' for under a year. Most listings sell before their first anniversary and many sell within six months.

ABSORPTION

Due to the location of the proposed development and the likelihood of increased market demand in the area, the project, if offered on the market within the estimated 4 to 5 year term should have sufficient committed and qualified buyers so the proposed development will sell-out within three to five years. This indicates a 'sellout' approximately seven to ten years from today.

The following is a summary of the estimated time (and overall elapsed time) required for various phases of the proposed project. These items include planning, design and construction of the proposed development.

	Time (years)	
	Estimated	Elapsed
County Zoning Amendments	1.5-2.0	1.5-2.0
Final Planning and Design	1.0	2.0-3.0
Construction	1.0-2.0	4.0-5.0

The project should sell out within approximately three to five years after the land use entitlement, planning, design and construction phases have been completed. This estimate is based on the availability for sales activity occurring after the final subdivision approval has been granted.

It is assumed that pre-marketing efforts commence as soon as the decision and entitlements to go ahead with the development are in place. Pre-marketing efforts should increase sales activity in the initial stages of the sales program, with more lots selling in the beginning years of the marketing effort. Sales activity will likely be relatively steady during the remainder of the sales program.

The absorption estimates are based on the indicated project descriptions, apparent market conditions and the recommended prices. Project phasing should be considered and follow patterns of similar developments with consideration to several, small phases (ie. 25 to 50 units per phase) for the various unit types and locations. In addition, the absorption estimates assume that vacant lots, as well as house/lot packages will be marketed on the site.

AGRICULTURAL USE IN PROPOSED SUBDIVISION

This section of the report considers the possible and potential agricultural uses on the proposed subdivided lots.

Some have argued that a 1-acre minimum lot size will not provide substantial net profit to the farmer. For the part-time, hobbyist and self-sufficient resident farmer, however, the 1-acre minimum provides adequate space for residential and farm use. There is adequate justification to maintain the 1-acre minimum to satisfy the demand at the subject property and to provide alternatives to the small farmer.

The argument that larger land areas are required for successful and profitable operations contradicts the recent examples of bankruptcy and closure of the Big Island's large sugar plantations. Big is not always better and small farms can contribute to the overall agricultural future and economy.

An important component of the small-scale farmer on a 1-acre lot is the opportunity to have a residence on the site of the small farm with sufficient remaining land for agricultural use. This agricultural land also provides open space, maintaining the rural atmosphere and lifestyle in the area.

Considering an allocation of approximately 10,000 square feet for residential use (home and associated use), approximately 3/4 of an acre is available for farming for the typical 1-acre lot. There are numerous diversified agricultural opportunities that can be commercially grown on this land size and that can be implemented by the hobbyist and/or part-time farmer.

The County's General Plan, Agricultural Development Plan, Hilo Community Development Plan and other documents support the need for diversified agriculture and recognize that this farming alternative will be satisfied by the independent farmer. Each document cites the importance of diversified agriculture and the role of the entrepreneur for the future of agriculture.

Based on the subject's location, neighboring uses and proximity to the market the following are just a few of the commodity opportunities that can be considered for cultivation on subdivided lots.

The most probable farming opportunity for the subject sites is related to the 'subsistence farmer'. Subsistence farming includes not only the farmer that grows food for his own use, but it also includes the hobbyist farmer. Each occasionally may sell or give his excess crop to others through the farmers' market or other means. Not farming primarily for profit, this farmer grows his own food rather than purchasing at the local market thereby contributing to the agricultural effort.

The subsistence farmer has his primary residence on the same site as the farming operations. He typically has other employment and is farming on a part-time basis. Subsistence farming is summarized below:

- subsistence farming
  - family garden
  - hobbyist
  - excess crop sold at farmers market

In addition to the subsistence farmer, small-scale and part-time farming of diversified crops can be accomplished at the site. As noted in other sections of this report, the average production area of existing farms involved with these crops is typically small and in many cases well under 1-acre in size.

As in the case of the subsistence farmer, the small-scale, part-time diversified farmer likely lives on the property that he farms. He likely has another means of income and uses the farm to supplement his income, as well as provide food for his family.

This following list is not intended to be exhaustive of the various diversified agricultural opportunities for the site; it is summary in nature and is meant to be illustrative of the myriad examples that exist:

- floriculture
  - anthuriums
  - orchids
- foliage
  - heleconia
  - bird of paradise
  - ginger
  - ti leaves
  - potted plants
- vegetables
  - ginger root
  - beans
  - peas
  - cucumbers
  - onion
  - sweetpotato
  - taro

As you can see in the supporting documentation in this report, these crops are typical to the area and complement the diversified agricultural opportunities in the region. Most are grown on small farms and their production areas typically can be accommodated on 1-acre parcels.

AGRICULTURAL LAND USE DISTRICT - PERMITTED USES

According to state statute and various rules and regulations, there are four land use districts administered by the Land Use Commission to provide the basic legal framework of land uses in the State of Hawaii and help implement the long-range land use objectives of the state and the counties. The major districts are: urban, rural, agricultural and conservation.

Lands in the urban district are those that are now in urban use and a sufficient reserve area for foreseeable urban growth. The rural district lands are areas composed primarily of small farms mixed with low density residential lots. Agricultural districts include activities or uses characterized by the cultivation of crops, orchards, forage and forestry and general farming activities. Conservation districts include areas necessary for the protection of watersheds, scenic or historic sites, parklands and open space.

Land uses within the urban districts are administered exclusively by the counties in which they are located. In the agricultural and rural districts the state Land Use Commission establishes use regulations and the counties are responsible for their administration. The counties, however, may adopt more stringent controls than those imposed by the State within these two districts. The county has no jurisdiction in the conservation district; in this district, land uses are administered by the State Department of Land and Natural Resources.

By regulation the agricultural land use lands must meet standards such as "high capacity for agricultural production", "significant potential for grazing" and "high capacity for intensive agriculture". The implication is that lands suitable for agriculture will be in the agricultural land use district.

Another standard states that "Lands surrounded by or contiguous to agricultural lands and which are not suited to agricultural and ancillary activities by reason of topography, soils and other related characteristics may be included in the Agricultural District." Because of this standard, apparently many of the marginal agricultural lands are governed under the agricultural land use district and therefore subject to the rules and regulations of the Land Use Commission.

The Land Use Commission's rules and regulations are clear as to permitted uses in the various land use districts. Within the 'agricultural' district a variety of uses are permitted, most of which deal with conventional agricultural uses and various public uses (ie. recreational, utilities and roads).

'FARM DWELLINGS' ON AGRICULTURAL LANDS

'Farm dwellings' and other improvements relating to farming are permitted in the agricultural district. The regulations define 'farm dwelling' as: "a single-family dwelling located on and used in connection with a farm, including clusters of single-family farm dwellings permitted within agricultural parks developed by the State, or where agricultural activity provides income to the family occupying the dwelling."

While the regulations imply that activities within the various land use districts must be economically feasible, there is no direct statement requiring that farmers have to make a profit from their agricultural operations. Economic feasibility is difficult to require and/or enforce particularly in light of recent closures of large-scale agricultural operation (ie. Hamakua Sugar and Mauna Kea Sugar) indicating that even the large agricultural ventures are not always profitable.

The subject lands at Kaumana have apparently been used as part of a sugar operation. Like surrounding and neighboring lands the sugar use has ceased. The general area is developed with residential and small-scale ag/residential uses. Apparent agricultural uses in the vicinity of the subject include small-scale home farming, floriculture (ie. anthuriums), ginger root and pasture.

THE HAWAII COUNTY GENERAL PLAN

On December 15, 1971 the General Plan for the County of Hawaii was adopted. That plan was reviewed and amended and accepted as the present General Plan document for the County in November 1989.

The General Plan is the policy document for the long range comprehensive development of the Island of Hawaii. It provides the direction for balanced growth of the County. As a policy document, the General Plan provides the legal basis for all subdivision, zoning and related ordinances. It also provides the legal basis for the initiation and authorization for all public improvements and projects.

The General Plan establishes several generalized land use designations. These are: High Density Urban Development, Medium Density, Low Density, Industrial, Intensive Agricultural, Extensive Agricultural, Orchards, Resort, Open Area, Conservation, Flood Plain, Alternate Urban Expansion and University Use. All General Plan Designations are recorded on the Land Use Pattern Allocation Guide (LUPAG) Maps.

The General Plan Designations are administered by the County Council. Amendments to the General Plan Designations are

reviewed by the County Planning Director and the County Planning Commission. The Planning Director makes recommendations concerning General Plan Amendments to the County Planning Commission. The County Planning Commission reviews the proposed amendment and forwards its recommendation to the County Council. The amendment request is ultimately acted upon by the County Council.

The General Plan considers and analyzes various components; the following is a recap of the 'Agriculture' element.

The structure of commercial agriculture in Hawaii County is in a state of transition. While commercial agriculture was once dominated by sugar and ranching, trends indicate that a large number of small independent farmers producing a wide variety of commodities will play an increasingly important role in the future. At the same time, trends also indicate increasing efficiencies of operations resulting in overall reductions in land requirements.

As the prospects for sugar have declined and the acreage cultivated reduced, the large corporations have led the way in examining alternative uses for sugar land. Papaya, macadamia nuts, guava and ginger are some of the commodities which have been given a boost by the research and marketing efforts undertaken by these corporations. Although large corporations initially investigated new commodities, in numerous instances smaller farmers have provided innovative and efficient approaches to realize their potential.

While additional opportunities to develop new commodities may be expected to arise, the realization of these opportunities requires the cooperative effort of the large corporations, the small independent farmers and government. Large corporations can assist in the supply of land, water, marketing and capital; the small independent farmer can supply the human resources of imagination, determination and hard work; and government can provide an environment that supports the efforts.

One of the key factors in adjusting to the changing socio-economic conditions is the restructuring of the land use regulatory system to make a distinction between important agricultural land and marginal agricultural land. These distinctions should be made in the evaluative criteria for considering zoning changes, permitted uses, minimum lot size requirements and subdivision development standards.

Rural-style residential-agricultural developments may include either new small scale rural communities or expansions of existing rural communities. Such development provides opportunities for a mix of residential and small scale agricultural activities. However, the primary intent of these

developments would be to provide an added range to housing opportunities. Along with housing, the large lots of these rural areas will provide opportunities for part-time agriculture, gardening activities and the raising of livestock on a small scale. By providing opportunities to satisfy the demand for a rural lifestyle on marginal agricultural land, the pressures to develop important agricultural land for these purposes would be decreased.

In summary, diversified agriculture, including macadamia nuts, cattle, flowers and nursery products, papayas, vegetables and melons and coffee all have potential growth. Although the prospects for diversified agriculture are encouraging, there are problems which need to be overcome before the potential can be realized. These problems include, but are not necessarily limited to: land cost, cost/availability of water, cost/availability of transportation, cost of labor, marketing, developing and maintaining quality standards and disease and pest control.

Like other components of the plan, the 'Agriculture' element of the General Plan cites various goals and policies. The following, in part, support 'small-scale' agricultural uses:

> Rural-style residential-agricultural developments, such as small-scale rural communities or extensions of existing rural communities, shall be encouraged in appropriate locations.

In addition, an agriculture policy states:

> Designate, protect and maintain important agricultural lands from urban encroachment.

Under the Land Use section of the General Plan the following are a couple of the listed 'Courses of Action':

> The County shall provide for agricultural areas within proximity to the city for products consumed locally.
>
> The County shall encourage buffer zones or compatible uses between agricultural and urban/residential areas.

The suggested 1-acre use of the subject property complements the surrounding rural community. The land is not specifically identified as important agricultural land; it is former sugar land that is surrounded by lots with typically smaller land areas. By most accounts the proposed 1-acre ag/residential use is consistent with the intent of the General Plan.

COUNTY OF HAWAII AGRICULTURAL DEVELOPMENT PLAN - JULY 1992

The following recaps portions of the County of Hawaii Agricultural Development Plan. The document was prepared in July, 1992.

Agriculture has long been a dominant component of the economy of the island of Hawaii. The county of Hawaii has the largest agricultural acreage (63%) and volume of commodity production statewide. Economists estimate the overall farm and processed value of island-grown commodities at approximately $850 million.

Agriculture's contribution to the economy has been both direct, through production of crops and livestock, and indirect, through the maintenance of the island's rural lifestyle and visitor industry through open space and consumption of local products. It is, however, an industry which is at a crossroads in its own development on this island, having evolved from historically large-scale sugarcane and ranching activities mixed with secondary smaller traditional crops such as coffee and taro, to a more diversified mix of macadamia nut orchards, extensive acreage of floral and foliage nurseries, bananas, papayas, ginger root and other fruits and vegetables.

Recognizing the accelerated development on the island (commercial, resort, residential as well as agricultural) the County conducted several workshops throughout the island to address the concerns, issues and ideas that could assist local farmers and the island's agricultural activities. The Development Plan is the working document that reflects the consensus of the identification of priority areas for future agricultural development on the island.

The importance of maintaining a viable agriculture industry in the County of Hawaii is directly addressed in the Hawaii County General Plan. The Plan's General Economic Policies related to agriculture state, in part:

> The County of Hawaii shall assist the expansion of the agricultural industry, especially diversified agriculture, through the protection of important agricultural lands, capital improvements and other programs, and continued cooperation with appropriate State and Federal agencies.

Policies within the General Plan, in part, include:

> Rural-style residential-agricultural developments, such as small-scale rural communities or extensions of existing rural

communities, shall be encourage in appropriate locations.

The County's Agriculture Development Plan has a stated vision of:

> The County of Hawaii will continue to be the center of diversified agriculture in the State of Hawaii.

The Agriculture Development Plan's goals include:

> The County of Hawaii's agricultural character should be preserved because of its importance to local lifestyles and tourism industry.
>
> Agriculture should be further diversified such that no single crop accounts for more than 20% of the total agricultural production in order to minimize risk to the economy from adverse market conditions or drops in production from disease and environmental factors.
>
> County of Hawaii agriculture should produce at least 80% of the island's demand for fresh agricultural products.

Strategies within the Agriculture Development Plan include:

> County of Hawaii agriculture shall concentrate on producing products for which the island has comparative advantage.
>
> The private sector has the primary responsibility for agricultural development.
>
> The county shall be a catalyst for agricultural development by acting as an advocate for farmers and local agriculture commodity groups in securing them with various funding and favorable regulatory institutions and agencies.
>
> Environmentally sound sustainable agriculture shall be encouraged.

Subdivision of the subject site complements the intent of the Agricultural Development Plan by offering alternatives to farmers. The Agricultural Development Plan recognizes that the future of Hawaii Island agriculture lies in diversity of crops with no dominant commodity. There is an opportunity to reduce the dependence on imports and retain the rural lifestyle with the expansion of diversified agriculture throughout the island.

HILO COMMUNITY DEVELOPMENT PLAN - 1975

The Hilo Community Development Plan recognizes that future agricultural uses (including farm sizes, location and overall land allocation) are dependent on a variety of factors.

The Hilo Community Development Plan states: It is not realistic to project the amount of agricultural land required in the future because agricultural development is not necessarily related to local population growth but rather is a function of government policy, marketing and private entrepreneurship. However, there appears to be opportunity for additional agricultural development in the Hilo area, particularly for ornamentals and diversified crops. Hilo offers the locational advantages for diversified agriculture of providing the largest urban market on the Big Island for locally grown food items and an airport for air shipment of high value agricultural products grown for export.

The considerations in determining future agricultural boundaries are as follows:

- areas of high agricultural suitability
- areas of existing agricultural use
- location of the state agricultural district
- location of the agricultural homesteads on the Hawaiian Homes lands
- providing opportunity for both small scale and large scale agricultural operations
- areas of low urban suitability
- application of agricultural zoning as a holding zone for possible future urban expansion of areas which are not in agricultural use, do not have high agricultural suitability and which are not yet required for urban uses
- use of agricultural zones for "large lot development', e.g., one acre, single-family residential

The Community Development Plan promotes the rural lifestyle and need for agricultural diversity. Due to the location of the subject property and the adequate nature of the soils and terrain, rural, small-scale ("large-lot") residential-farms can be developed on the subject site providing a variety of commodity alternatives to the farmer.

HAWAII GROWN: FROM FARM TO RESTAURANT
DEVELOPMENT OF A STRATEGIC FARM-RESTAURANT ALLIANCE

In September 1993 a series of three all-day workshops were held in Hilo, Waimea and Kona. More than 130 farmers, chefs and other interested persons attended the informal sessions, sharing ideas on how farmers and chefs might best work together to understand and meet one another's needs.

The workshops concluded that a strong 'strategic alliance' between farmers and chefs would contribute to the sustainability of agriculture in Hawaii. Sustainable agriculture will benefit not only farmers and chefs, but also residents and visitors - in short, the entire state economy and population. This alliance seeks to achieve the following goals:

- the financial and culinary success of the restaurant in its effort to integrate Hawaii-grown produce into a regional cuisine

- the sustainability of the farmer, making Hawaii agriculture economically, ecologically and socially viable

- the promotion of a Hawaii-grown local produce for residents and visitors, enhancing the quality of life for both residents and visitors

- the promotion of the Big Island as a world-class destination with the highest quality and variety of locally-grown food and a characteristic cuisine

The alliance is a linkage to provide quality (quality produce and quality restaurant fare). But it is deeper than a link in the marketing chain because there will be ongoing dialogue in which chefs will influence what farmers will grow and farmers will influence the chefs will cook. The alliance is so interactive that it is almost a partnership, at least in the popular sense of the term. But it is not a partnership in the business sense because the chef does not have to (or want to) own any part of the farm, nor does the farmer want to own any part of the restaurant.

While strategic alliances are usually thought of in terms of large corporations, the strategic alliance principle holds equally well for smaller operations as well. Relative size does not play an important role in the farmer-chef strategic alliance.

While there is nothing to stop large-scale producers from supplying restaurants with quality produce, these larger

operations do not necessarily have a competitive advantage in this arena because the competition is not based solely on price-competition. Farmers in this market are competing on quality, service, availability, flavor, growing methods, variety, freshness and other unique characteristics of the product.

In considering the question: "What should a farmer grow?" there is no easy answer, nor unchanging answer. Traditionally, farmers have used a production-driven model when considering crops to grow, but farmers must now also consider a consumer-driven approach. The consumer is anyone who, at some point, pays money for the product. It may be a chef, the person who purchases in a supermarket or the processor who prepares a new product. The farmer must ask what the consumer wants.

Chefs indicate that twenty percent of what they use is grown in Hawaii, while the rest is brought in from the Mainland, so the market for what the farmer can grow is open. The specifics of the growing area must be considered for adaptability (ie. soil, rainfall, etc.

Chefs are looking for freshness, quality, cosmetics, flavor and availability (the season its produced in, amount and length of season). The uniqueness of a certain produce is an important factor. Farmers are encouraged to "grow something that is unique and hard to grow" and to consider a product that has broad demand, not just for a particular chef.

Hawaii agricultural production on the whole will not be sustainable if it must compete on price alone. There are many products produced here which might be imported more cheaply. These cheaper products however often depend upon exploitive wage rates, petroleum-based fuels for long distance shipping and high chemical inputs. To the extent that Hawaii growers can produce products which are of a quality equal to (or hopefully higher quality than) the same product produced elsewhere, the Hawaii grown product will be supporting a more sustainable Hawaii agriculture.

The location of the subject site creates an opportunity to address and support the goals outlined in the workshops. Small-scale farms (with residential opportunities to the farmer) can be developed on the site with relative proximity to the markets.

The Subject is situated in Kaumana above Hilo and within easy access to the Saddle Road linking the area with the resorts on the Kona-Kohala coast. This ease of access to the two primary markets on the island creates an ideal transportation opportunity to the small-scale farmer.

SOIL CONSERVATION SERVICE SOILS SERIES

To assist in evaluating the possible crops that could be considered for the Kaumana site, the Soil Conservation Service soils summaries were considered. Review of the Soil Conservation Service soils types at the subject indicates that the soils are primarily in the Kaiwiki Series. Following is a summary of this soils series and uses appropriate to it.

Kaiwiki Series

The Kaiwiki series consists of well-drained silty clay loams. These soils formed in a series of layers of volcanic ash and have a banded appearance. They are gently sloping to steep soils on uplands at an elevation ranging from 800 to 1,500 feet. They receive from 150 to 200 inches of rainfall annually and have a mean annual soil temperature of 70 degrees F. The natural vegetation consists of hilograss, ohia, tree fern, california-grass and wainakugrass. These soils and Akaka, Hilo and Honokaa soils are in the same general area. Kaiwiki soils are used for sugarcane.

The Kaiwiki soils are further broken down into three different categories. As the information states, the primary difference between these is the slopes where the soils are found. Following is a summary of the three Kaiwiki soils:

Kaiwiki silty clay loam, 0 to 10 percent slopes (KaC)

This soil is low on the windward side of Mauna Kea. The slopes are long and dissected by many narrow, deep gulches.

In a representative profile the surface layer is dark-brown silty clay loam about 15 inches thick. The subsoil is dark-brown and dark reddish-brown silty clay loam about 48 inches thick. The surface layer is very strongly acid and medium acid. This soil dehydrates irreversibly into fine gravel-size aggregates.

Permeability is rapid, runoff is slow and the erosion hazard is slight. Roots can penetrate to a depth of 5 feet or more. This soil is used for sugarcane.

Capability subclass IIIe, nonirrigated; sugarcane group 4; pasture group 9; woodland group 7.

Kaiwiki silty clay loam, 10 to 20 percent slopes (KaD)

This soil is similar to Kaiwiki silty clay loam, 0 to 10 percent slopes, except that it is moderately sloping. It is used mostly for sugarcane. Small areas are used for pasture and truck crops.

Capability subclass IVe, nonirrigated; sugarcane group 4; pasture group 9; woodland group 7.

Kaiwiki silty clay loam, 20 to 35 percent slopes (KaE)

This soil is on the sides of drainageways. It is similar to Kaiwiki silty clay loam, 0 to 10 percent slopes, except for the steep slopes. Runoff is medium and the erosion hazard is moderate. This soil is used mostly for sugarcane. A small acreage is used for pasture and woodland.

Capability subclass VIe, nonirrigated; sugarcane group 4; pasture group 9; woodland group 7.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects and does not apply to crops requiring special management.

Capability Classes

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, as defined as follows:

Class I soils have few limitations that restrict their use.
Class II soils have moderate limitations that reduce the choice of plants or that require moderate practices, or both.
Class III soils have severe limitations that reduce their choice of plants, require special conservation practices, or both.
Class IV soils have severe limitations that reduce the choice of plants, require very careful management, or both.
Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland or wildlife.
Class VI soils have severe limitations that make them generally unsuited to cultivation and limit

their use largely to pasture or range, woodland or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply, or to aesthetic purposes.

Capability Subclasses

Capability subclasses are soil groups within one class; they are designated by adding a small letter, e, w, s or c, to the class numeral. The 'e' shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; 'w' shows that water in or on the soil interferes with plant growth or cultivation; 's' shows that the soil is limited mainly because it is shallow, droughty or stony; and 'c' shows that the chief limitation is climate that is too cold or too dry. (The subject site indicates an 'e' subclass indicating the risk of erosion.

INPUT FROM UNIVERSITY OF HAWAII AGRICULTURAL EXTENSION SERVICE AND COUNTY OF HAWAII RESEARCH AND DEVELOPMENT OFFICE

In addition to the review and recommendations found in the soils series analysis, the University of Hawaii Agricultural Extension Service and County of Hawaii Research and Development Office were contacted for input concerning small-scale farms and crop recommendations for the vicinity of the subject site.

Each identified challenges facing the small farmer that were consistent with much of the literature relating to the subject. Items such as availability of land and water, the high cost of housing and labor, taxation concerns and marketing limitations were consistent areas of concern to the small farmer.

With respect to the subject area, the agricultural resource representatives indicated a variety of crops could be considered; many of the crops are already being produced.

The agricultural resource representatives indicated and acknowledged that the small-scale farm is typically an additional and subordinate income source to the farmer. This is true not only for the 1-acre farms, but is also representative of the other smaller-sized (ie. 3- and 5-acre) farms.

The 'back yard' (ie. subsistence) farmer is the probable user of the proposed subject development. The property serves

essentially as a primary residence and farming is a subordinate, though relevant additional use of the site. The farming activity could be for family use, an expanded hobby or small commercial operation. The crops grown are likely diverse. Some may not farm and leave their property in open space.

For those seeking a commercial farm, outright or for income supplementation, the area offers various alternatives of commodities. Floriculture (anthuriums, orchids, etc.) is a likely candidate for the site. The plants may be in the ground, grown in pots and/or under some form of shelter (saran shadehouse or plastic greenhouse).

A variety of fruits and vegetables are also likely candidates, primarily for the farmer seeking supplementary versus primary income from the farm. Recently ginger root and dryland taro have expanded in the area. These are typically in small plots on former sugarcane lands. Additionally, other vegetable crops can be grown in the area including beans, cucumbers, citrus, peas, etc.

STATISTICS OF HAWAIIAN AGRICULTURE

Based on the range of commodity alternatives for the subject site, a review of the Statistics of Hawaiian Agriculture was made to indicate the relative income opportunities available to the small farmer based on statistical information from existing operations.

Farmers are asked to complete surveys concerning their operations. These surveys are compiled to provide statistical relationships about various commodities typically identifying numbers of farms in operation, productions areas and gross returns to the farmer.

The following is a summary of some of the characteristics and statistical information for some of the crops identified as possible alternatives for cultivation on the subject site.

TROPICALS AND FOLIAGE

Tropical flowers and foliages, or "tropicals," comprises gingers (red, pink, and others), heliconia (perhaps 25 or more cultivars of commercial significance), bird of paradise, and cut foliages (including ti, fern and palm) and assorted others.

Production of tropicals in Hawaii is dominated by gingers and heliconias; combined they accounted for 67 percent of sales of tropicals. Percentages of total ginger and heliconia sales by county were: Maui, 36; Hawaii, 31; Oahu 26; and Kauai, 7.

The following is an annual statistical summary data concerning floriculture and nursery products indicating the number of farms in production, production area, gross sales and the computed sales per unit of production area. This statistical format is used throughout this review.

FLORICULTURE AND NURSERY PRODUCTS
(ISLAND OF HAWAII)

Crop Year	# of Farms	Total Acreage	Value of Grower Sales ($1000)	Sales /Acre
1987	320	1,002	23,668	$24,620
1988	325	1,094	29,036	$26,540
1989	320	1,139	28,888	$25,360
1990	325	1,176	33,794	$28,735
1991	335	1,361	31,329	$23,020
1992	314	1,458	34,764	$23,845
1993	307	1,320	33,768	$25,580

As an industry, tropical flowers and foliages have shown a dramatic increase in total production acreage in recent years. Since 1986, the industry has increased its production acreage an average of 40 percent each year with ginger and heleconias showing increases in excess of 40% per year. Increases in production acreage of bird of paradise and cut foliages has been steady but less spectacular.

Revenues per acre for tropical flowers have generally shown a decline. Production area increased far more rapidly than sales of units, value of total sales, or price per dozen. As a group, tropical flowers experienced an average annual decline in revenues per acre of about 6 percent.

HELICONIAS - CUT FLOWERS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1989	120	8,460	1,130	$ 134
1990	117	7,975	1,356	$ 170
1991	108	7,360	1,052	$ 143
1992	56	5,395	684	$ 127
1993	50	4,710	565	$ 120

Bird of Paradise

Originally from South Africa, the Bird of Paradise is a common garden and commercial flower crop in Hawaii. It has become well known because of its fine keeping quality and its unusual form, and because it is widely copied in plastic and distributed as an artificial flower. Closely related to bananas, the traveller's palm, and heliconias, "Birds" or "Strelitzias" were named after the wife of George III of England, Charlotte Sophia of the Mecklinburg-Strelitz family.

BIRDS OF PARADISE - CUT FLOWERS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1987	55	2,283	311	$ 136
1988	58	2,520	378	$ 150
1989	58	2,185	480	$ 220
1990	59	3,925	877	$ 223
1991	57	3,485	841	$ 241
1992	35	2,965	660	$ 223
1993	30	3,140	713	$ 227

Ginger

There are many species of ginger grown in Hawaii. A selected number of species are grown commercially as cut flowers. Surprisingly, 65% of the production is on Oahu. As should be expected, 90% of the sales were out of state.

Richard Criley of the University of Hawaii sets production, on a controlled small plot basis, at 12,500 to 15,000 dozens per acre per year. If this is cut back a bit to account for the problems of farming on a larger scale and estimate annual production per acre at 7,500 to 9,000 dozens, and apply a farm value of $3.00 per dozen, the annual gross revenue to the farmer per acre would be $22,500 to $27,000.

RED GINGER - CUT FLOWERS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1987	88	3,759	560	$ 149
1988	93	4,200	606	$ 144
1989	121	4,795	734	$ 153
1990	112	4,755	915	$ 192
1991	110	3,880	791	$ 204
1992	63	2,700	522	$ 193
1993	52	2,660	496	$ 186

Ti

Ti is the common Hawaiian name for the many variations of a member of the lily family from tropical Asia, Australia and the Pacific islands, cordyline terminalis. While a few other species of Cordylines are grown locally, they are not as common and are not usually referred to as ti.

Both green and some of the other colored leaved cultivars are exported as cut foliage. They are frequently packed with mixed tropical flowers for shipment directly to consumers on the mainland and to other countries. Although commercial growing

of ti is primarily for cut foliage, cane (stem pieces) and potted plants are also marketed.

Both green and colored ti are grown commercially on Hawaii. Hilo and Pahoa where there is frequent rain and often heavy cloud cover are the principal areas of production. Unlike Oahu, most of the ti on Hawaii is planted in the open with little protection against wind and sun.

TI LEAVES
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1987	46	1,751	636	$ 363
1988	51	2,740	733	$ 268
1989	60	2,660	478	$ 180
1990	65	2,615	442	$ 169
1991	64	2,790	676	$ 242
1992	44	2,265	462	$ 204
1993	39	2,090	495	$ 236

Industry leaders recognize that the tropicals industry has several serious shortcomings despite (or perhaps because of) its rapid growth in recent years. The major problem areas include the following:

Marketing: market potential and strategy;
Transportation: availability and high cost;
Postharvest: optimum postharvest protocol;
Pests and diseases: procedures to detect and guard against devastating pests and diseases;
Cultivars: new or improved cultivars to maintain competitive edge over producers in other countries;
Costs of production: investment analysis and enterprise budgeting;
Cultural practices: optimum nutritional practices, irrigation practices, pest control practices, manipulation of seasonal flowering, planting density and management practices.

FOLIAGE

A number of important factors have contributed to Hawaii's growth in foliage plant production and its rise to the number 4 position among foliage producing states, behind Florida, California and Texas. Foremost has been Hawaii's almost ideal climate for the production of foliage plants resulting in reduced production costs due to reduced energy costs and shorter production times. Hawaii is also developing a reputation for the production of a consistent supply of quality plants.

The market for Hawaii produced plants has remained strong in spite of a slow down in the mainland foliage market. The trend for larger specimen plants favors production in Hawaii due to our favorable growing conditions. Projections are that the growth of the Foliage Industry will continue strong in Hawaii and will continue to expand at the current 10 to 15 percent annual rate.

FOLIAGE - POTTED, PRIMARILY FOR INDOOR/PATIO USE
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1989	79	7,995	14,325	$ 1,792
1990	77	7,835	14,591	$ 1,862
1991	84	7,690	14,148	$ 1,840
1992	80	8,100	13,209	$ 1,631
1993	69	7,670	14,545	$ 1,896

FOLIAGE - POTTED, PRIMARILY FOR LANDSCAPE USE
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1990	66	NA	3,397	$ NA
1991	61	NA	3,620	$ NA
1992	63	NA	3,449	$ NA
1993	63	NA	3,381	$ NA

FOLIAGE - UNFINISHED STOCK (FOR FURTHER GROWING ON)
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1990	26	5,325	1,151	$ 216
1991	38	7,625	1,410	$ 185
1992	25	5,885	886	$ 150
1993	19	7,450	655	$ 90

Anthurium

The anthurium, a native of Colombia, was first brought to Hawaii from London in 1889 by Mr. S. M. Damon. Today, after 100 years of cultivation and hybridization, the Hawaiian anthurium is one of the islands' principal ornamental exports to the mainland, Canada, Japan, Italy, Germany, and other countries.

The anthurium is a perennial herbaceous plant usually cultivated for its attractive, long-lasting flowers. What is

commonly considered the flower is a complex of the colorful modified leaf (spathe) and hundreds of small flowers on the pencil-like protrusion (spadix) rising from the base of the spathe.

The anthurium industry in the State showed steady growth in flower sales until 1980, when 2,532,000 dozens were produced and marketed at a gross value of $6,878,000. In 1981, however, 2,104,000 dozens valued at $5,295,000 were produced and marketed, which was a decline of 23% (in gross value) from the previous year and the first decline since statistics began to be recorded. Flower sales in 1987, were the lowest since 1982 and sales continue to decline.

The reasons for the decreasing marketings since 1980 are attributable to the decline in foreign sales and the emergence and continuation of two very serious problems in production: bacterial blight, which causes a decline in productivity, and bleaching of flowers, which decreases the percentage of marketable flowers. Other problems such as insect pests, and other diseases such an anthracnose, have also contributed to the decline in production.

How good the quality and industry marketing job are will determine the price. In general, Hawaii anthuriums (cut flowers) compete favorably with those produced in other countries. The bulk of its sales within the floral trade is the traditional red anthuriums. However, importers and consumers are always looking for novelty products (different shape and colors). Nevertheless, foreign competitors have penetrated the European and Japanese markets. It is expected during this time of blight and intermittent supply that competitive growing areas will make inroads into markets that have traditionally used Hawaii sources.

ANTHURIUMS - FARMS TOTAL **
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1991	80	10,953	6,121	$ 560
1992	69	10,385	6,360	$ 615
1993	66	11,090	7,525	$ 680

ANTHURIUMS - POTTED FLOWERING PLANTS
(STATE OF HAWAII) *

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1991	15	155	291	$ 1,880
1992	9	115	374	$ 3,250
1993	7	130	283	$ 2,180

Orchids

The over 25,000 described species make the orchid family possibly the largest family of flowering plants. The crossing of both wild and cultivated forms by hobbyists and commercial growers has produced perhaps as many as 50,000 hybrids since the first hybrid was made in 1852. Orchids range in size from plants only a fraction of an inch tall to those with up to 10 foot stems and 15 foot tall inflorescences.

The orchid industry, as well as the ornamentals industry in general, generates the highest revenues per acre among all of agriculture in Hawaii. Orchid cultivation can also utilize marginal, but relatively level lands unsuitable for most any other type of agriculture since soil is not a requirement. Orchid cultivation is often the highest and best possible use for many types of land in Hawaii.

Orchids account for a very significant portion of total floricultural sales in Hawaii, comprising 13% of all cut flower sales, 33% of all lei flower sales, and 62% of all flowering potted plant sales.

Dendrobium

Dendrobium is one of the largest genera of orchids, with about 900 species. It is distributed in Asia (e.g., Thailand, India, China, Malaysia, the Philippines, and Japan), New Guinea, Australia, and New Zealand.

Dendrobiums do not require land with soil because plants can grow in pots on benches. Crops are normally protected from the sun with shade houses. In Thailand, the planting density among commercial orchid producers is between 25,000 and 48,000 plants per acre, while in Hawaii it ranges from 20,000 to 35,000 plants per acre.

The following is a statistical summary and historical trend of various economic factors involved in the flower and orchid industry. This information involves information concerning numbers of farms in the State and Hawaii County involved in the statistical reporting and quantifies aspects of the industry from various perspectives.

DENDROBIUM ORCHIDS - CUT SPRAYS
(STATE OF HAWAII) *

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1990	57	2,778	2,602	$ 936
1991	59	2,544	2,891	$ 1,135
1992	58	3,045	3,147	$ 1,035

DENDROBIUM ORCHIDS - POTTED PLANTS - IN BUD/BLOOM
(STATE OF HAWAII) *

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1990	53	907	2,355	$ 2,595
1991	47	691	2,359	$ 3,415
1992	50	786	3,333	$ 4,240

(* Includes only producers with total sales of $10,000 or more; Islands combined to avoid disclosure of individual operation.)

DENDROBIUM ORCHIDS - CUT SPRAYS
(STATE OF HAWAII - ALL FARMS)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1990	82	2,895	2,656	$ 917
1991	77	2,730	2,980	$ 1,091
1992	58	3,045	3,147	$ 1,033

DENDROBIUM ORCHIDS - POTTED PLANTS - IN BUD/BLOOM
(STATE OF HAWAII - ALL FARMS)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1990	75	1,085	2,885	$ 2,659
1991	73	1,085	3,061	$ 2,821
1992	55	830	3,471	$ 4,182

DENDROBIUM ORCHIDS - VALUE PER SPRAY/POTTED PLANT

Crop Year	CUT SPRAYS # Doz. (000)	CUT SPRAYS Value $ (000)	CUT SPRAYS Value Per Doz.	POTTED PLANTS (BUD/BLOOM) # Pots (000)	POTTED PLANTS (BUD/BLOOM) Value $ (000)	POTTED PLANTS (BUD/BLOOM) Value Per Pot
1990	408	2,656	6.51	540	2,885	5.34
1991	416	2,980	7.16	580	3,061	5.28
1992	423	3,147	7.44	635	3,471	5.47

Cattleya and Allied Hybrids

To most people, the word orchid is synonymous with the genus Cattleya. These large-flowered orchids are used by florist for corsages. Cattleya orchids are really a complex group of hybrids created by combining a number of closely allied species and genera from many parts of the tropical world. All of the wild orchids making up the hybrids originally came from South or Central America or from islands or land masses in these regions.

Phalaenopsis

These orchids, commonly called Philippine moth orchids, are among the loveliest of all spray orchids. They are primarily

white, pink, or lavender, but some of the novelty crosses are producing lovely pastel shades.

Oncidiums

Oncidiums are called "dancing ladies." The three basic types of oncidiums are miniature forms, nonbulbous, and large growing bulbous. Miniature forms: 'Delight', 'Golden Glow,' 'Agnes Ann,' 'Twinkle,' are some of the good ones.

ONCIDIUMS - CUT SPRAYS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1990	17	90	75	$ 833
1991	14	170	153	$ 900
1992	15	130	196	$ 1,508

Cymbidium

Cymbidium is an exciting genus with hybrids flowering in a wide range of colors including pink, red, yellow, green, maroon, bronze and, white, in bold and vibrant tones as well as more delicate pastels and art shades. Their tall, erect, arching, or hanging sprays, durability and longevity, ease of cultivation, and usefulness as a potted plant, landscape plant, or commercial cut-flower have led to tremendous worldwide popularity. Except as a florist corsage flower and to the small number of commercial growers in the Volcano area the Cymbidium orchid is little known in the Hawaiian Islands.

CYMBIDIUM ORCHIDS - CUT STEMS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Value to Grower Sales ($1,000)	Sales Per 1,000 SF
1990	18	540	280	$ 518
1991	10	325	261	$ 803
1992	9	285	262	$ 919

(* Includes only producers with total sales of $10,000 or more; Islands combined to avoid disclosure of individual operation.)

Vanda - Miss Joaquim

Vanda Miss Joaquim is field-grown commercially only in Hawaii. Its flowers are used for making leis, for decorating shops, floats, displays, etc., and as corsages and boutonnieres for promotion related to the tourist industry. In 1985, the local industry produced, on 10.6 hectares, 28 million flowers, valued at $1.1 million.

FRESH MARKET VEGETABLES

MARKET ACTIVITY, SUPPLY AND GENERALIZED GROSS RETURNS

The following compares recent import and local production of various commodities in the State of Hawaii. In the far right column the relative percentage of Hawaii produced commodities is computed.

Inshipments (Imports) versus Production in Hawaii
Sampling of Fresh Market Vegetable Crops

	1991		1992		1993		Hawaii Share
	Imports	Hawaii	Imports	Hawaii	Imports	Hawaii	
	1,000 pounds						- % -
Beans, snap	417/	900	636/	600	644/	400	38
Cucumbers	2,243/	3,700	2,280/	3,500	1,932/	3,600	65
Daikon	22/	3,270	11/	2,910	72/	3,090	98
Eggplant	449/	1,150	586/	1,030	594/	900	60
Ginger root	132/	12,000	234/	11,600	209/	9,900	98
Onions, dry	17,174/	1,300	17,430/	1,170	17,358/	1,800	9
Onions, grn	261/	1,600	230/	1,500	170/	1,400	89
Peas, Chinese	325/	10	235/	15	256/	15	6
Peppers, grn	2,545/	1,920	1,723/	2,800	2,153/	2,500	54
Sweetpotato	1,091/	1,700	944/	1,800	1,335/	1,600	55
Taro	757/	600	593/	900	740/	1,000	57

In all, Hawaii produces approximately thirty-one percent of the fresh market vegetable crops its residents consume. There is a significant opportunity to complement the existing market demand of fresh market vegetables by 'growing our own' and thereby substitute the imports with local grown products.

Following are summaries of recent statistical information for some of the sampled fresh market vegetables.

SNAP BEANS
(HAWAII/KAUAI - combined)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	35	131	$ 3,745
1991	20	73	$ 3,650
1992	25	73	$ 2,920
1993	30	100	$ 3,335

Yield: 3,700 to 3,800 pounds per acre
Farm price: $0.77 to $1.00 per pound

CUCUMBERS
(HAWAII)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	70	544	$ 7,770
1991	80	592	$ 7,400
1992	60	493	$ 8,215
1993	85	543	$ 6,390

Yield: 18,200 to 22,900 pounds per acre
Farm price: $0.34 to $0.38 per pound

DAIKON
(HAWAII)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	145	405	$ 2,795
1991	130	471	$ 2,625
1992	100	386	$ 3,860
1993	110	390	$ 3,545

Yield: 12,400 to 15,000 pounds per acre
Farm price: $0.23 to $0.26 per pound

EGGPLANT
(HAWAII/MAUI/MOLOKAI/KAUAI)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	25	380	$15,200
1991	25	419	$16,760
1992	20	299	$14,900
1993	15	266	$17,735

Yield: 24,000 to 26,700 pounds per acre
Farm price: $0.62 to $0.67 per pound

DRY ONIONS
(HAWAII/KAUAI/OAHU)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	5	67	$13,400
1991	5	50	$10,000
1992	10	73	$ 7,300
1993	10	49	$ 4,900

Yield: 5,000 to 12,000 pounds per acre
Farm price: $0.91 to $1.12 per pound

GREEN ONIONS
(HAWAII/KAUAI)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	15	59	$ 3,935
1991	20	65	$ 3,250
1992	15	69	$ 4,600
1993	15	75	$ 5,000

Yield: 3,200 to 4,700 pounds per acre
Farm price: $0.99 to $1.15 per pound

GREEN PEPPERS
(HAWAII)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	15	79	$ 5,270
1991	10	70	$ 7,000
1992	9	51	$ 5,670

Yield: 9,300 to 11,000 pounds per acre
Farm price: $0.56 to $0.64 per pound

SWEETPOTATOES
(HAWAII/KAUAI)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	15	80	$ 5,335
1991	15	65	$ 4,335
1992	15	69	$ 4,600
1993	30	141	$ 4,700

Yield: 10,000 to 12,700 pounds per acre
Farm price: $0.40 to $0.47 per pound

CHINESE TARO
(HAWAII)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	140	305	$ 2,180
1991	170	337	$ 1,980
1992	190	328	$ 1,725
1993	180	334	$ 1,855

Farm price: $0.40 to $0.43 per pound

CHINESE PEAS
(STATE OF HAWAII)

Crop Year	Production Area (Acres)	Value to Grower Sales ($1,000)	Sales Per Acre
1990	13	97	$ 7,460
1991	2	20	$10,000
1992	3	31	$10,335
1993	3	27	$ 9,000

Yield: 4,600 to 5,000 pounds per acre
Farm price: $1.61 to $2.05 per pound

RELATIVE SIZE OF AGRICULTURAL PRODUCTION AREAS

Review of the statistical data concerning the various agricultural crops indicates that many of the crops are produced on relatively small production areas.

Considering that Hawaii imports over two-thirds of what it consumes, it appears there is significant 'room to grow' in the area of 'import substitution' (grown in Hawaii versus imported).

Some examples clearly identify the gap between Hawaii's overall production and the relative sizes of average farm production area. All of these has been identified as possible crops in the upper Hilo area (under 2,000 foot elevation). Consider the following:

Commodity	Hawaii Share of Production	Existing Production Area
Chinese Peas	6%	3 Acres
Dry Onions	9%	10 Acres
Snap Beans	38%	30 Acres
Green Peppers	54%	9 Acres
Sweetpotato	55%	30 Acres
Cucumbers	65%	85 Acres

These examples indicate that many crops are already grown here (on the Big Island) and show significant room for expansion, particularly if we plan to reduce the dependance on imports. With such limited acreage in production (split between all the farms in production), the actual production area of each farm can also be expected to be small.

In addition, the following summarizes the relative sizes of the 'average production area' of the various farms involved with the respective crops.

HELICONIAS - CUT FLOWERS

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1991	108	7,360	68,150 SF
1992	56	5,395	96,340 SF
1993	50	4,710	94,200 SF

BIRDS OF PARADISE - CUT FLOWERS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1991	57	3,485	61,140 SF
1992	35	2,965	84,715 SF
1993	30	3,140	104,670 SF

RED GINGER - CUT FLOWERS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1991	110	3,880	35,270 SF
1992	63	2,700	42,860 SF
1993	52	2,660	51,155 SF

TI LEAVES
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1991	64	2,790	43,595 SF
1992	44	2,265	51,480 SF
1993	39	2,090	53,590 SF

FOLIAGE - POTTED, PRIMARILY FOR INDOOR/PATIO USE
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1991	84	7,690	91,550 SF
1992	80	8,100	101,250 SF
1993	69	7,670	111,160 SF

ANTHURIUMS - FARMS TOTAL **
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1991	80	10,953	136,910 SF
1992	69	10,385	150,500 SF
1993	64	10,890	170,155 SF
1994	61	10,810	177,210 SF

ANTHURIUMS - POTTED FLOWERING PLANTS
(STATE OF HAWAII) *

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1991	15	155	10,330 SF
1992	9	115	12,780 SF
1993	7	130	18,570 SF
1994	14	135	9,640 SF

DENDROBIUM ORCHIDS - CUT SPRAYS
(STATE OF HAWAII - ALL FARMS)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1990	82	2,895	35,320 SF
1991	77	2,730	35,450 SF
1992	58	3,045	52,500 SF

DENDROBIUM ORCHIDS - POTTED PLANTS - IN BUD/BLOOM
STATE OF HAWAII - ALL FARMS)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1990	75	1,085	14,470 SF
1991	73	1,085	14,865 SF
1992	55	830	15,100 SF

ONCIDIUMS - CUT SPRAYS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1990	17	90	5,295 SF
1991	14	170	12,140 SF
1992	15	130	8,670 SF

CYMBIDIUM ORCHIDS - CUT STEMS
(STATE OF HAWAII)

Crop Year	# of Farms	Production Area (1,000)	Average Production Area
1990	18	540	30,000 SF
1991	10	325	32,500 SF
1992	9	285	31,670 SF

As you can see, the average production area is in many cases well under an acre in size. Recall the statement from the General Plan that states, "trends also indicate increasing efficiencies of operations resulting in overall reductions in land requirements."

SUMMARY BIBLIOGRAPHY

The foregoing is included to give the reader a generalized background on the state, county, regional and local economy, planning activity and information concerning nursery crops, tropical flowers industry and a summary of fresh market vegetables. Sources reviewed and considered for this generalized text include:

- Hawaii County General Plan
- County of Hawaii Agricultural Development Plan
- Hilo Community Development Plan
- Hawaii Grown - From Farm to Restaurant workshop proceedings
- 'Hawaii Flowers and Nursery Products, Annual Summary', HASS
- 'Tropicals', Courtwright
- 'Statistics of Hawaiian Agriculture', HASS
- Summary brochures and reports on various agricultural components distributed by the Agricultural Extension Service and Hawaii Agricultural Statistics Service

LIMITING CONDITIONS AND ASSUMPTIONS

The certification of the Counselor/Market Analyst appearing in the Market Analysis Report is subject to the following conditions and to such other specific and limiting conditions as are set forth by the Counselor/Market Analyst in the report.

- The Counselor/Market Analyst assumes no responsibility for matters of a legal nature affecting the property appraised or the title thereto, nor does the Counselor/Market Analyst render any opinion as to the title. The property is reviewed as if under responsible ownership.

- The Counselor/Market Analyst has not reviewed a Title Report covering the properties and is not aware of any encumbrances, except those specifically noted, that could affect the value conclusions derived; nor has the Counselor/ Market Analyst reviewed surveys of the properties to ascertain an accurate description of the properties covered by this report.

- The Counselor/Market Analyst assumes there are no hidden or unapparent conditions on the property, subsoil, or structures, which would render it more or less valuable. The Counselor/Market Analyst assumes no responsibility for such conditions, or for engineering which might be required to discover such factors.

- Information, estimates, and opinions furnished to the Counselor/Market Analyst, and contained in the report, were obtained from sources considered reliable and believed to be true and correct. However, no responsibility for accuracy of such items furnished the Counselor/Market Analyst can be assumed by the Counselor/Market Analyst.

- Neither all, nor any part of the content of the report shall be used for any purpose other than the stated purpose contained in the report without the expressed written consent of the Counselor/Market Analyst; nor shall it be copied nor conveyed by anyone to the public through advertising, public relations, news, sales, or other media, without the written consent of the Counselor/Market Analyst.

- The integrity of the site is assumed to be adequate to support any described improvements. It is assumed that there are no toxic materials within the site or the improvements that would reduce its utility, development potential, marketability or value. All improvements are assumed to be structurally sound unless otherwise noted.

- The achievement of any financial projections will be affected by fluctuating economic conditions and is dependent

upon the occurrence of other future events that cannot be assured. Therefore, the actual results achieved may well vary from the projections and such variation may be material.

- Except as discussed in the body of this report, the counselor takes no responsibility for and reaches no final conclusions regarding indirect costs of a project based on political processes including planning and other government functions whereby changes in standards of construction, density, etc. can occur; indirect charges for highways, education, or numerous other items that may be charged to a project; or various moratoria that can delay a project. Government processes can change suddenly and substantially affect costs and project values, and users of this report are cautioned to make their own inquiry and judgment regarding these matters.

- The Counselor/Market Analyst is not an expert in law, macroeconomics, or any field of specialization other than appraisal and bases all considerations of the future (such as inflation rates, vacancy factors, absorption rates, etc.) upon a reasonable use of data and opinions of others to derive usable opinions only for the purpose of customary appraisal calculations and assumes no responsibility for predicting actual events.

- Due to ever-changing economic, financial and other business conditions, the Counselor/Market Analyst assumes no liability for the owner/client/borrower finding a buyer or obtaining financing at the indicated values.

- The Counselor/Market Analyst assumes that there are no toxic or hazardous material present in the soil, subsoil, structures on the property or in the environment affecting the property which would render it more or less valuable. The Counselor/Market Analyst has no expertise which enables him to discover or take notice of toxic or hazardous materials or the effects of such materials; and the Counselor/Market Analyst shall have no responsibility to the presence or effects of toxic or hazardous materials on, in or affecting the property.

CERTIFICATION OF COUNSELOR/MARKET ANALYST

The undersigned hereby certifies that, except as otherwise noted in this counseling report:

- I have no present or contemplated future interest in the property that is the subject of this report.

- I have no personal interest or bias with respect to the parties involved.

- To the best of my knowledge and belief, the statements of fact contained in this report are true and correct.

- The reported analyses, opinions and conclusions are limited only by the reported assumptions and limiting conditions, and are my personal, unbiased professional analyses, opinions and conclusions.

- My compensation is not contingent on an action or event resulting from the analyses, opinions or conclusions in, or the use of, this report.

- My analyses, opinions and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Ethics and the Standards of Professional Practice of the Appraisal Institute and the Uniform Standards of Professional Appraisal Practice.

- The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives.

- No one provided significant professional assistance to the persons signing this report.

- I have made an overview inspection of the property that is the subject of this report.

- Disclosure of the contents of this counseling report is governed by the By-laws and Regulations of the Appraisal Institute.

Sincerely,
REAL ESTATE SERVICES, INC.

Peter T. Young, President
Hawaii State Certified General Appraiser

PETER T. YOUNG
POST OFFICE BOX 2665
KAMUELA, HAWAII 96743

	WAIMEA	HONOLULU
TELEPHONE	(808) 885-4200	524-0061
FACSIMILE	(808) 885-8869	545-2200

Area of Specialization: Real Estate Appraisal, Consulting, Arbitration, Market Analysis, Feasibility Studies, Land Use Planning, Project Management, Issues Management

Place/Date of Birth: Honolulu, Hawaii
January 28, 1952
(Lifetime Hawaii Resident)

Degrees/Schooling: Bachelor of Business Administration
Major: Real Estate
University of Hawaii
December 1974

Hawaii Preparatory Academy
Cum Laude Society
June 1970

Professional Career: Real Estate Services, Inc.
President, Owner 1982 - present
Appraisal, Market Analysis, Consulting, Arbitration, Land Use Planning, Issues Mgmt, Project Management, Feasibility

Real Estate Works Hawaii, Inc.
President, Owner 1980-1986
Sales, Property Management, Vacation Rentals, Appraisal

Kanaloa Realty
Sales Manager 1978-1980
Sales and Property Management

Licenses/Memberships: Realtor
Hawaii Certified General Appraiser
Certified Real Estate Brokerage Mgr-CRB
Certified Real Estate Appraiser - CREA
Registered Professional Member - RPM
Certified Review Appraiser - CRA
Registered Mortgage Underwriter - RMU

Real Estate Brokerage Experience:

- Active Realtor (RB-8479) since 1974
- Past President Kona Board of Realtors
- Certified Real Estate Brokerage Manager (CRB)
- Principal Broker of a staff of over 45 real estate licenses in two offices (1980-1987)
- Owned and operated property management company that supervised long-term and vacation rentals (1981-1987)
- Condominium association management
- Commercial property management
- Commercial leasing

Real Estate Appraisal Experience:

- Certified General Appraiser (CGA-015)
- Statewide coverage with appraisal experience on Oahu, Big Island, Kauai, Maui and Molokai.
- Arbitration and condemnation
- Full variety of property types: residential, commercial, proposed developments, farms, ranches, resort, golf courses, industrial properties, parks, warehouses, access and utility easements, subdivisions, condominiums, vacant lots and homes. Experience includes rental negotiations and full and partial acquisitions.
- Agricultural valuation and evaluation includes: taro, pasture, coffee, orchid, foliage, diversified and general agriculture, macadamia nut, anthurium and other agricultural properties.
- Property interests involved include fee simple, leases, full and partial interests, licenses, life estates and easements (term and perpetual).

Valuation and Evaluation Reporting Formats:

URAR form report, individual condominium and vacant lot form reports, letter, short and complete narrative reports. USPAP complete and limited reports.

Court Appointments and Expert Witness Qualification/Testimony:
United States District Court
Federal Bankruptcy Court
Los Angeles Superior Court
Hawaii State Circuit Court
Hawaii State District Court
Commissioner appointment for subdivision project
Receiver appointment for condominium and development project

Private Appraisal Assignments Reviewed and Accepted by:
Banks: First Hawaiian Bank, Bank of Hawaii, Central Pacific Bank, Hawaii National Bank, City Bank and others.
Local and Mainland Credit Unions
Mortgage Brokerages and Bankers: Honolulu Mortgage, Stanwell Mortgage, Countrywide Funding, Trust One Mortgage, Western Pacific Mortgage, Irvine Pacific Mortgage and others.
Law Firms: Case & Lynch, Carlsmith Law Firm, Torkildson Katz Law Firm, Cades Schutte Law Firm, Nakamoto, Yoshioka and Okamoto and others.

Government Appraisal Assignments Reviewed and Accepted by:
Federal Aviation Administration
United States Navy, PACNAVFACENGCOM
USDA Farmers Home Administration
United States Postal Service
Federal Highway Administration
State Department of Transportation
State Department of Land and Natural Resources
Hawaii Housing Authority
Housing Finance and Development Corp.
State Department of Agriculture
State Department of Hawaiian Home Lands
Hawaii County Parks Department
Hawaii County Finance Department
Hawaii County Corporation Counsel
Hawaii County Office of Housing and Community Development
Hawaii County Public Works Department

Planning, Market Analysis and Feasibility Studies:

Keahole to Kailua Sub-Area Development Plan (Hawaii County regional plan): member of core planning team, market analysis, infrastructure funding alternatives and financial feasibility.

Hawaii County Housing Project Master Plan for Waikoloa (300-acre affordable housing): market analysis, marketing plan, economic analysis and feasibility plan.

Department of Hawaiian Home Lands Master Plan at Kawaihae (10,000-acre mixed-use master plan): member of core planning team, market analysis, long-range and short-term development alternatives and feasibility analysis.

Kealakekua Development Corporation Master Plan (10,000-acre residential/golf plan): member of core planning team, market analysis and land use alternatives.

North West Hawaii Open Space and Community Development Plan (Hawaii County regional plan): member of core planning team, market analysis, feasibility and community involvement.

Puna Community Development Plan (Hawaii County regional plan): infrastructure identification, feasibility, economic analysis, and implementation alternatives

'Ke Kumu' Affordable Housing Project: market analysis and appraisal

'Ouli' Affordable Housing Project: market analysis and appraisal

'Mohala' Residential Development: market analysis, land use alternatives, pricing and absorption

Project Development, Permitting and Related Consulting:

Project and retainer agreements involving contact with all real estate and related fields. Assisted with project and association documentation drafting and review (covenants, conditions & restrictions, design standards, deed and other restrictions), cost review, valuation and land use analysis; evaluation of community concerns about various aspects of projects and assistance in mitigating the impact of project proposals on the community.

Project and individual permit processing and condition compliance, including: affordable housing compliance, ohana zoning, land use, preparation and submittal of environmental and marketing assessments, CDUA permit application and zoning permits.

Teaching/Educational Institution Experience

University of Hawaii, Manoa (CCECS)
Lecturer: Bus 40 & RE 300
Real Estate Prin&Econ 1977-80

State Department of Regulatory Agencies-Real Estate Commission
Real Estate Salesmen and Brokers Prelicensing Instructor

West Hawaii Today - Weekly newspaper
column on real estate 1978-79

Parker High School
Math & Science Teacher 1986-88
Business Math Teacher 1995
Boys Soccer Coach 1985-1988
Boys Baseball Coach 1987-1988
Girls Soccer Coach 1994-1996

Community Organization for Educational Development (COED); Chairman 1985-1986

Chancellor's Advisory Council
University of Hawaii, Hilo Campus & West Hawaii Campus; Member 1986-1992

Waimea Elementary and Intermediate
School Community Council '90-91
SCBM Management Committee 1991

Leadership Positions and Membership:

Kona Board of Realtors
- President - 1986
- President-elect - 1985
- Vice President - 1984
- Director - 1976
- Education, Chairman - 1977-1978
- Govrnmnt Affairs Chr-1982-1987
- Professional Standards 1989-96

Hawaii Association of Realtors
- Vice President - 1986
- Director - 1985
- Education Committee - 1978
- Government Affairs - 1982-1987

Kona-Kohala Chamber of Commerce
- President - 1989-1990
- President-elect - 1988-1989
- Director - 1986-1991
- Planning Committee, Chr '90-94

Hawaii Visitors Bureau
- Hawaii Island Chapter
  - Director 1984-86
  - Visitor Satisfaction
    - Chairman '85-87

Big Island Business Council
- President - 1992-1993
- Vice President - 1991-1992
- Secretary - 1990-1991
- Delegate - 1982-1993
- Economic Development Committee
  - Chair
- Government Affairs Committee

American Arbitration Association (AAA)
- Real Estate, Construction,
- Finance, Licensing

Hawaii Housing Authority 1984-1996
- Tenant Hearing Review Board
  - Chairman
- Lease Rent Disputes, Arbitrator

County of Hawaii Board of Appeals
- Member - 1985-1987

Department of Transportation Citizen's Advisory Committee 1989-1990

Leadership Positions and Membership:

Waimea Community Association
- President, 1987-1992, 1995-1996
- Executive Committee - 1985-1993
- Water Committee, Chr- 1985-1987
- Planning Committee - 1985-1992

American Red Cross
Hawaii State Chapter
- Board Member 1988-1996
- Vice Chairman 1994-1996
- Executive Committee 1993-1996
- Branch Operations Committee
  - Chairman, 1994-1996
- Disaster Services Committee
  - Vice Chairman, 1994-96

West Hawaii Advisory Council
- Chairman 1988-1996
- Disaster Services, Chairman

Hawaii Island United Way
- Board Member 1990-1996
- Executive Committee 1991-1996
- Nominating Committee
  - Chair 1990
- Bylaw Committee
  - Chair 1991-1996

Hawaii Committee for the Humanities
- West Hawaii Representative
- Secretary/Treasurer - 1984
- Executive Committee - 1983-1985
- Nominations Committee, Chairman
- Proposal Review Subcommittee
  - Chairman
- Management and Budget

North Hawaii Public Safety Committee
- President 1994-1996

Business Council on Dependent Care
- Member 1990-1991

Confrerie de la Chaine des Rotisseurs
- Chevalier

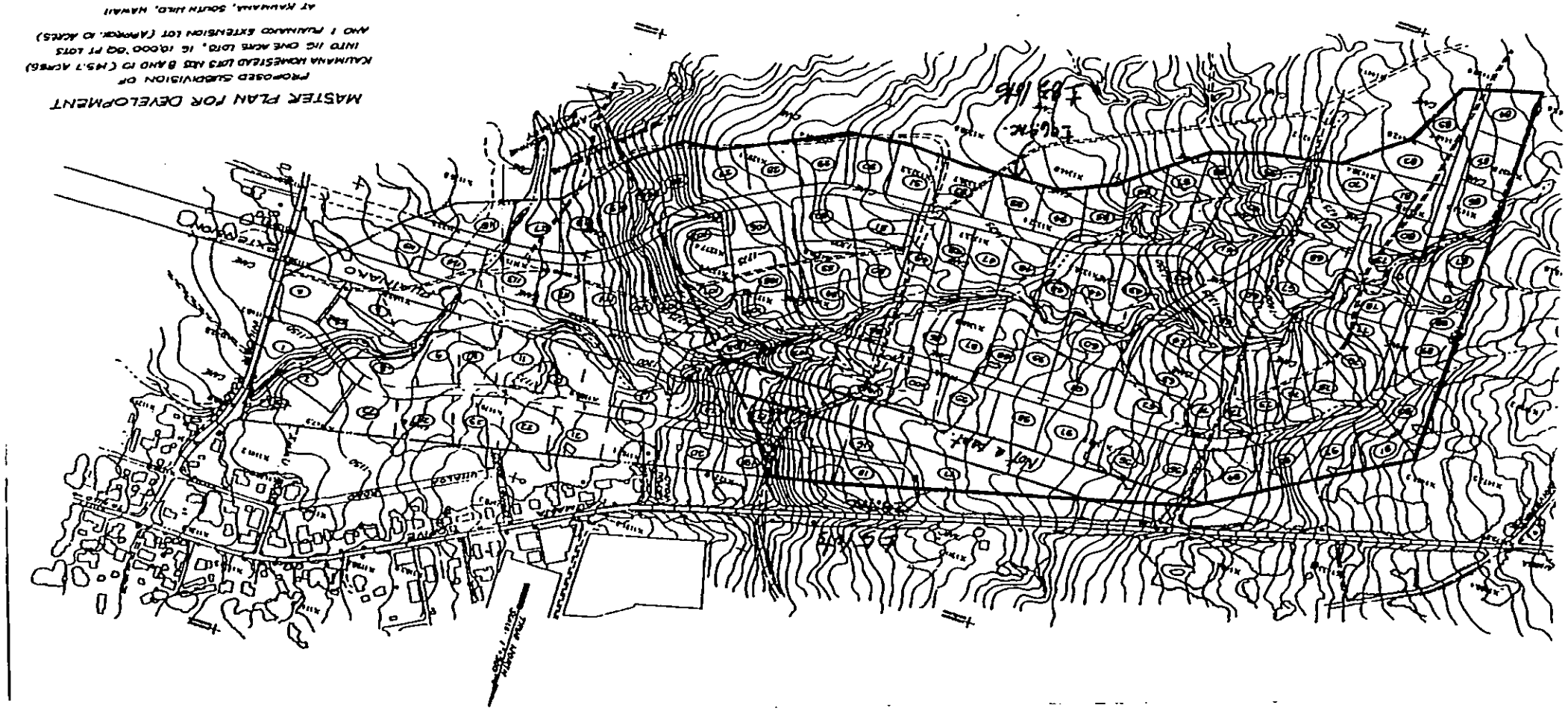
L'Ordre Mondial des Gourmets Degustateurs

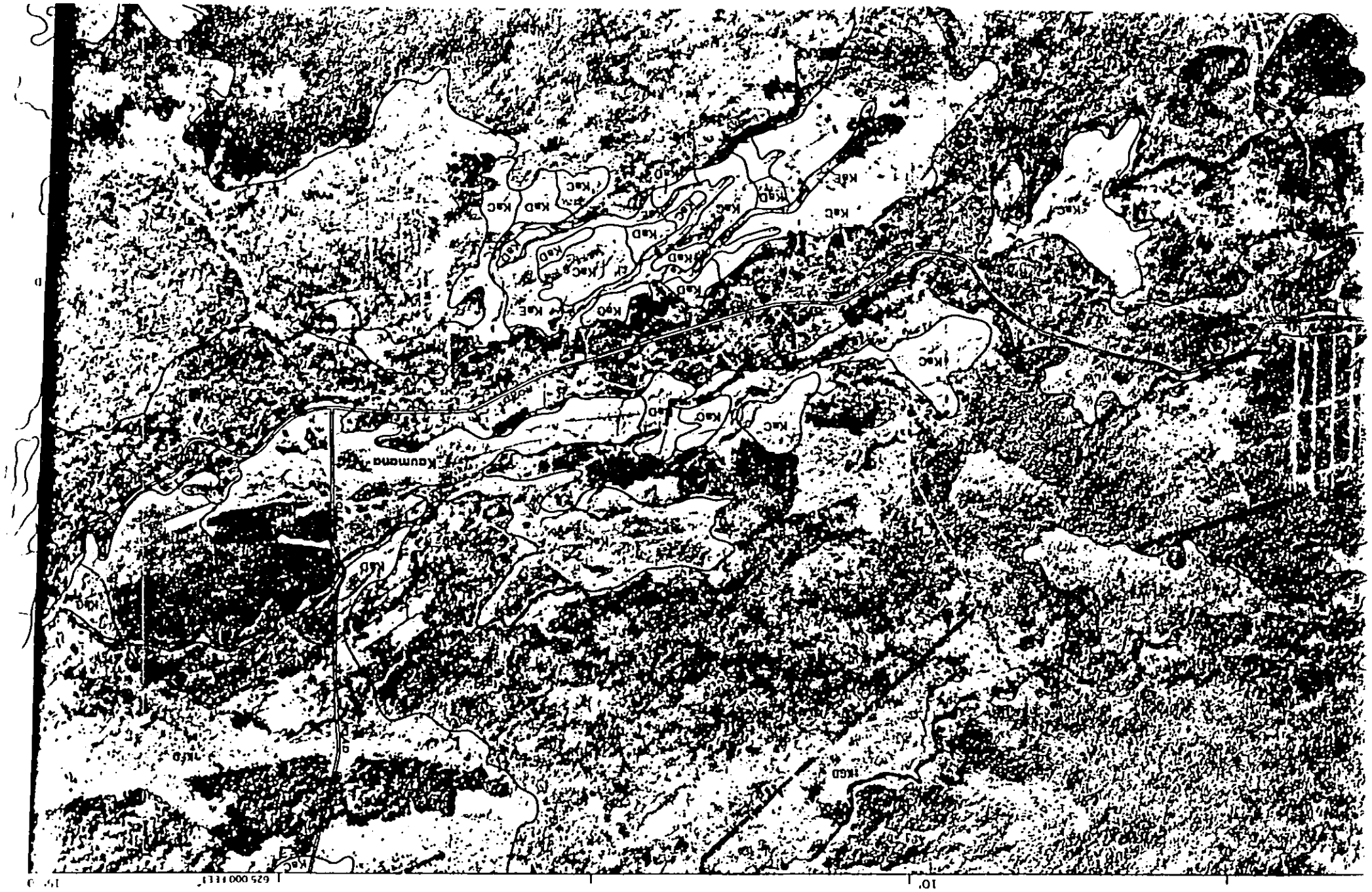
Ironman Triathlon
- Aid Stations Director 1990-96

Awards/Recognition:	Kona Board of Realtors Special Service Award
	American Red Cross Volunteer of the Year Clara Barton Leadership Award
	Mayor's Awards of Excellence Certificate of Appreciation
Who's Who Nominations:	Who's Who of Emerging Leaders in America
	Marquis Who's Who in the West
	Prominent People of Hawaii
	Who's Who in American Real Estate
	Who's Who in Real Estate: The Directory of the Real Estate Professions
	Who's Who Among Young American Professionals
	Who's Who of America's Best Real Estate Agents
	Marquis Who's Who in the World
	Who's Who Registry of Business Leaders
	Who's Who In Finance and Industry

Appraisal and Related Courses Successfully Completed:

COURSE	DATE	INSTITUTION
Principles of Real Estate	1972	Univ. of Denver
Commercial Real Estate Prin.	1973	Univ. of Denver
Real Estate Investments	1973	Univ. of Denver
Property Valuation	1974	Univ. of Hawaii
Land Dev. and Planning	1974	Univ. of Hawaii
Business Statistics	1974	Univ. of Hawaii
Real Estate Appraisal Prin.	1984	AIREA
Basic Valuation	1984	AIREA
Capitalization Theory - A	1986	AIREA
Capitalization Theory - B	1986	AIREA
Case Studies	1988	AIREA
Valuation Analysis	1988	AIREA
Stds. of Prof. Prac. - A	1991	Appraisal Institute
Stds. of Prof. Prac. - B	1991	Appraisal Institute
Appraising the Tough Ones	1993	Appraisal Institute
Valuation of Leased Fee Int.	1993	Appraisal Institute
Valuation of Leasehold Int.	1993	Appraisal Institute
USPAP Limited Appraisals & Reporting Options-General	1994	Appraisal Institute
USPAP Limited Appraisals & Reporting Options-Resdntl	1994	Appraisal Institute
Small Resdntl Income Prprty	1994	Appraisal institute





SHEET NUM . 82

Appendix E

Traffic Assessment Report

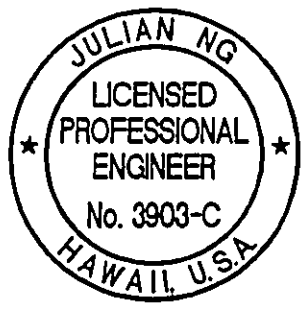
TRAFFIC ASSESSMENT REPORT

SUBDIVISION OF

KAUMANA HOMESTEAD LOTS NOS. 8 AND 10
Kaumana, South Hilo, Island of Hawaii, Hawaii
(TMK: 3RD DIV. 2-5-44: 1 and 2-5-45: 1

January 1996

Prepared For:
R. M. Towill Corporation



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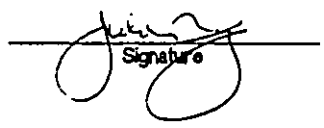

Prepared By:

Julian Ng, Inc.
P.O. Box 816
Kaneohe, Hawaii 96744

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TRAFFIC ASSESSMENT REPORT
Kaumana Homestead Subdivision

TRAFFIC ASSESSMENT REPORT
SUBDIVISION OF KAUMANA HOMESTEAD LOTS NOS. 8 AND 10
KAUMANA, SOUTH HILO, ISLAND OF HAWAII, HAWAII

TMK: 3RD DIV. 2-5-44: 1 and 2-5-45: 1

January 1996

A master plan to develop the Kaumana Homestead Lots numbers 8 and 10 has been prepared. The project is located in the upper Kaumana area of Hilo, south of Kaumana Drive in the vicinity of the proposed connection of the Puainako Street extension to Kaumana Drive (see Exhibit 1). The property, which totals about 146 acres, is adjacent to and extends westerly from Wilder Road and is presently vacant and generates no traffic. A change in zoning for a portion of the property will be required.

The project proposes to subdivide the two parcels and create ~~110~~ 112 lots for single family residential use. A roadway lot for the future Puainako Street extension traverses the development site; 24 lots would be located north of the future Puainako Street and 94 lots would be located to the south. The master plan shows two roadways accessing each area. The north area connects ~~to Wilder Road and~~ to Kaumana Drive. Access to the south area will include a roadway to Wilder Road and a roadway that would connect to the Puainako Street extension opposite the future connection of Kaumana Drive.

This traffic assessment was done to identify the potential traffic impacts of the proposed project, including future peak hour conditions at nearby intersections with the project completed and in full use. The assessment included estimates of future non-project traffic in the area, estimates of the project's traffic generation, analyses of peak hour intersection conditions, and recommendations for roadway improvements to provide adequate access to the site. This traffic assessment used recent traffic count data of Kaumana Drive collected and published by the State Highways Division.

Existing Conditions: The State Highways Division collected 24-hour traffic count data at several locations along Kaumana Drive in June, 1994. At the nearest count station to the west (east of Country Club Road), daily traffic on Kaumana Drive was about 1,600 vehicles (two-way traffic); the nearest station to the east (at Akolea Road) recorded 3,800 vehicles per day (vpd). Traffic on Kaumana Drive at Wilder Road was estimated to be approximately 3,200 vpd.

Peak hour volumes on Kaumana Road at Wilder Road were estimated to be less than 300 vpd. Traffic wishing to enter or cross Kaumana Road from the stop-controlled approaches on Wilder Road have little or no delay due to traffic on Kaumana Drive. Table 1 summarizes the State data and the estimates made for traffic on Kaumana Drive at Wilder Road.

Table 1
Existing Traffic Volumes

Kaumana Drive,	AM Peak Hour	PM Peak Hour
west of Country Club Road	104	123
east of Country Club Road	130	146
at Wilder Road (estimated)	280 *	266 *
west of Akolea Road	344	318
east of Akolea Road	355	325
at Kaumana Cave	401	359
west of Ainako Avenue	1,065	1,080
east of Ainako Avenue	1,391	1,316

Source: State of Hawaii, Department of Transportation Highways Planning Branch, except as noted by *

Future Non-Project Traffic: Future traffic volumes on Kaumana Drive are expected to be greater than existing. In a long-range highway plan completed in 1991, a volume of 4,500 vpd was shown for the year 2010 at the upper portion of Kaumana Drive if no improvements were made to the roadway system; with an improved highway system, 2010 volumes of 9,600 vpd on Kaumana Drive near Ainako Avenue and 8,600 vpd on the west end of Puainako Street were forecasted.

Traffic counts taken at the State Highways count stations in earlier years were reviewed to determine if a trend of increasing traffic exists for Kaumana Road. The daily volumes recorded in 1994 near Country Club Road were lower than the volumes recorded in 1988, 1990, or 1992. Daily volumes on Kaumana Drive east of the project all indicate that traffic volumes are increasing, with annual rates of growth of between 1% and 4%.

An increase in peak hour traffic on Kaumana Drive of 30% was assumed for the future without project condition, representing ten years' growth if future growth mirrors the recent past. In addition, traffic due other projects using Wilder Road that have already been approved or are pending approval were added: traffic from 256 single family dwelling units in the Hilo Country Club Estates and the surrounding area was added.

Two future cases were evaluated. In Case I, all of the project traffic was assumed to use Wilder Road and Kaumana Drive (although a second access to Kaumana Drive from the north project area is proposed via Hapuu Road, this connection was conservatively assumed to not exist). Case I represents a future condition before completion of the Puainako Street extension.

In Case II, 70% of the traffic to or from the east was assigned to the Puainako Street extension, with the remaining 30% assigned to Kaumana Drive. Project traffic from the area south of Puainako Street was assigned to Wilder Road and to the secondary access to

the south area opposite the Kaumana Drive connection. Case II represents a future condition with Puainako Street extended as proposed.

Project Traffic: The project will create 118 agricultural lots which could be used for residential purposes. Traffic impacts were estimated using trip rates for single family dwellings compiled in *Trip Generation* (5th Edition), an informational publication of the Institute of Transportation Engineers. Table 2 shows the trip generation computation.

Table 2
Trip Generation

	Average	AM Peak Hour		PM Peak Hour	
	Weekday	enter	exit	enter	exit
Trip rates	9.55	0.19	0.55	0.66	0.35
north of Puainako Street extension	230	5	13	16	8
south of Puainako St. ext. (Wilder Rd.)	330	7	19	22	12
south of Puainako St. ext. (west road)	570	12	33	39	21
Total project	1,130	24	65	77	41

The traffic generated by the project was distributed onto the roadway system in proportion to the other traffic approaching or departing the area and added to the base case traffic assignments. Exhibit 2 shows the base condition and with-project traffic estimates for Case I (without Puainako Street extension). Exhibit 3 shows the base condition for Case II (with Puainako Street extension) and Exhibit 4 shows the with-project condition for Case II.

Traffic Analyses: The project is estimated to generate a daily total (entering plus exiting) of 1,130 vehicular trips. Of these trips, an estimated 70-75% would be from or to the east. The project volume to the east (790-850 vpd) would be between 4 and 5 percent of the projected future daily volume of 18,400 vehicles per day on Kaumana Drive and Puainako Street.

Completion of the project and occupancy of dwellings are expected to occur over a period of several years. However, if project traffic were added to the latest counted volumes, there would be noticeable increases in traffic along Kaumana Drive at Akolea Road and near Kaumana Cave (about 20% increase); however, the project traffic would be about 7% of the higher existing traffic west of Ainako Avenue and about 5% of the traffic east of Ainako Avenue. Lower percentages can be expected when comparisons are made with future volumes, which are expected to be larger than existing.

While the project could be considered part of the growth in the Kaumana area that has been accounted for in the projections of future traffic, project traffic has been added to the future base condition for the peak hour analyses of the local intersections, in order that the impact analysis be conservative; i.e., identify "worse case" impacts.

The intersections of Wilder Road and Kaumana Drive, Puainako Street and Wilder Road, and Puainako Street and Kaumana Drive were evaluated using the unsignalized intersection analysis procedure from the *Highway Capacity Manual (Third Edition)*. The procedure estimates the delays to vehicles which have to stop or yield at unsignalized intersections and assigns a level of service (LOS) to the delay, as described in the attached appendix. Level of service D or better conditions are considered acceptable. The project's impact was found to be minor and each location would have acceptable conditions in the peak hours. Table 3 summarizes the findings of the analyses.

Table 3
INTERSECTION LEVELS OF SERVICE

	Base Condition		With Project	
	AM	PM	AM	PM
Case I				
Kaumana Drive & Wilder Road				
Wilder Road SB shared lane	B	B	B	B
Kaumana Drive WB left turn	A	A	A	A
Kaumana Drive EB left turn	A	A	A	A
Wilder Road NB shared lane	A	A	B	B
Case II				
Kaumana Drive & Wilder Road				
Wilder Road SB shared lane	A	A	A	A
Kaumana Drive WB left turn	A	A	A	A
Kaumana Drive EB left turn	A	A	A	A
Wilder Road NB shared lane	A	A	A	A
Puainako Street & Wilder Road				
Wilder Road SB shared lane	A	B	B	B
Puainako Street WB left turn	A	A	A	A
Puainako Street EB left turn	A	A	A	A
Wilder Road NB shared lane	A	A	A	B
Puainako Street & Kaumana Drive				
Kaumana Drive SB shared lane	A	A	A	A
Puainako Street WB left turn	A	A	A	A
Puainako Street EB left turn	A	A	A	A
Project road NB shared lane	A	A	A	A

At unsignalized intersections, left turns off of the major road can cause delays to following traffic which desire to continue through the intersection. A procedure to determine if separate left turn lanes are required is described in an article published in 1967 (M.D. Harmelink, *Volume Warrants for Left-Turn Storage Lanes At Unsignalized*

Grade Intersections) which is cited by the American Association of State Highway and Transportation Officials. This procedure was applied to the traffic assignments to identify any requirements for left turn lanes.

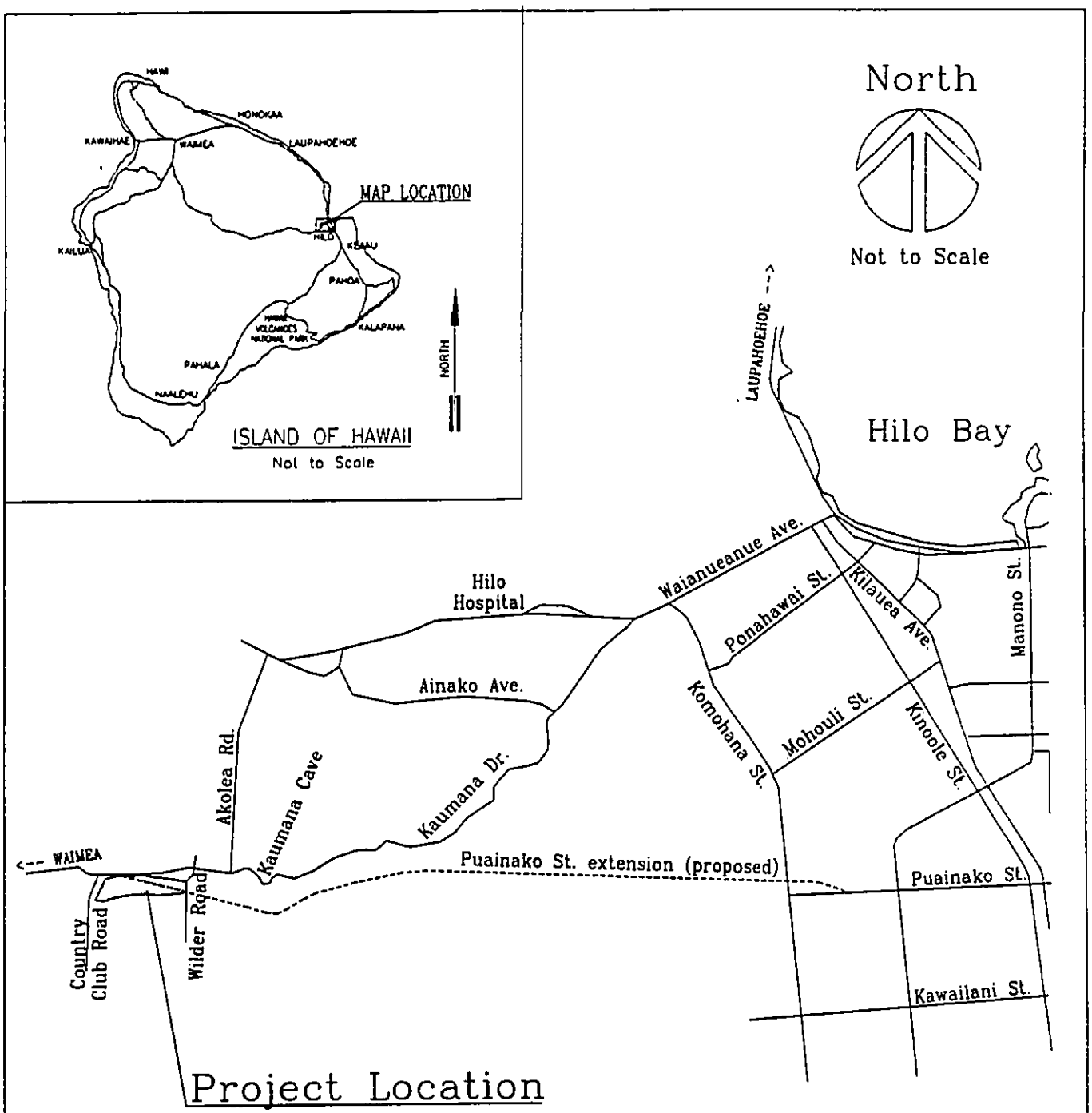
The greatest opportunity for delay to through traffic occurs in the PM Peak Hour with Case I and the project. Westbound traffic on Kaumana Drive would total 373 vehicles per hour (vph), with approximately 51% of this volume turning left to Wilder Road against an opposing volume of 144 vph. If this condition were to occur, a left turn lane with a storage length of 75 feet would be warranted. The volumes for the base condition in Case I (without project) would also require a separate left turn lane.

With Case II, turning movements are served at several locations; the worst case would be the westbound left turn from Puainako Street to Wilder Road in the PM Peak Hour with the project, where 40% of the 248 vph approaching volume turns left with an opposing volume of 104 vph. This condition does not require a separate left turn lane. Left turn lanes at other locations are also not warranted.

A left turn lane would satisfy warrants with or without the addition of project traffic in Case I (if traffic on Kaumana Road were to increase by 30% and the Puainako Street extension were not completed). Timely completion of the planned extension of Puainako Street, which currently is awaiting federal environmental approval, would mitigate the need to add a left turn lane; the master plan for the proposed project includes a right-of-way for the street extension.

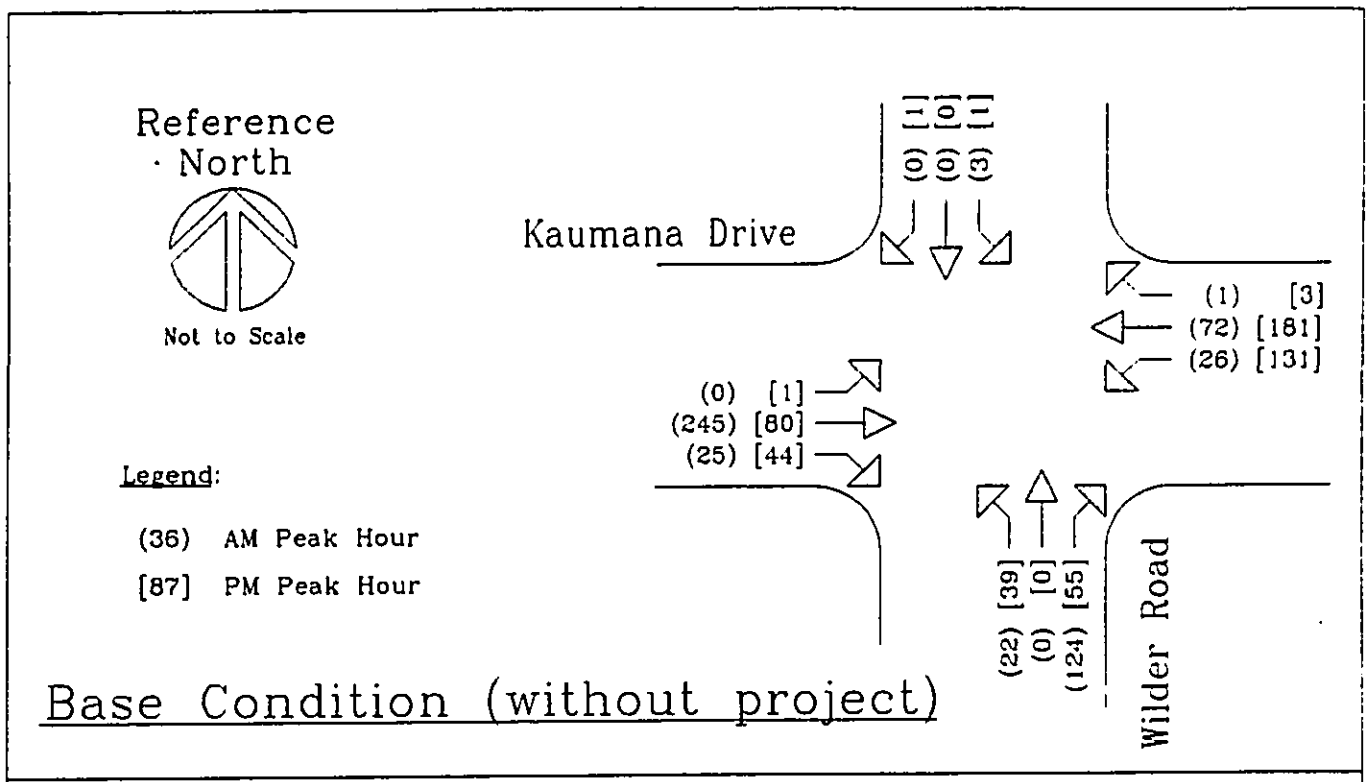
Conclusions and Recommendations: Increases in traffic volumes in the Kaumana area indicate a need to improve Kaumana Drive in the future. The widening of Kaumana Drive to four lanes west of Ainako Avenue is one of the improvements which may be needed. A total increase in traffic volumes by 30% over existing volumes would be appropriate for a ten-year period, based on recent increases in traffic volumes in the area. With the expected growth in traffic volumes, the traffic due to the proposed project would be approximately five percent of future traffic on Kaumana Road near Ainako Avenue. The extension of Puainako Street from the Waiakea area of Hilo to Kaumana has also been identified as a desirable roadway improvement; the proposed project will reserve a right-of-way for this improvement.

The proposed project will have a greater relative impact to traffic volumes at the intersections which provide access into the project area. This assessment has evaluated these intersections and has found that the addition of project traffic would have minimal impact on operating conditions at these intersections. No mitigative measures are needed to accommodate project traffic because acceptable intersection conditions will continue with or without the project. The analyses also indicate that a left turn lane may be necessary, with or without the project traffic, at the westbound approach of Kaumana Drive to Wilder Road, if the Puainako Street extension is not constructed.

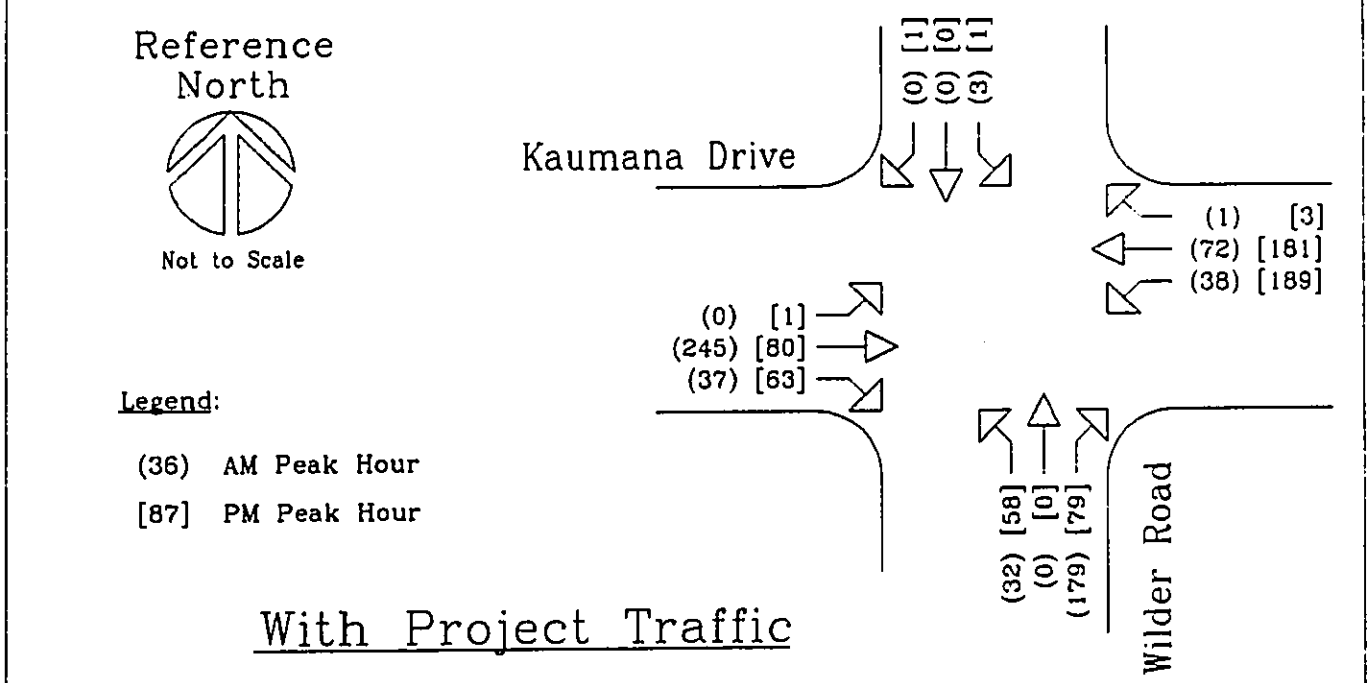


Traffic Assessment Kaumana Homestead Subdivision	Location Map Hilo, Hawaii prepared by: Julian Ng, Inc. January 1996	Exhibit 1

EXH.SKD 01/31/96



Base Condition (without project)



With Project Traffic

Traffic Assessment Kaumana Homestead Subdivision	Future Traffic Case I prepared by: Julian Ng, Inc. January 1996	Exhibit 2

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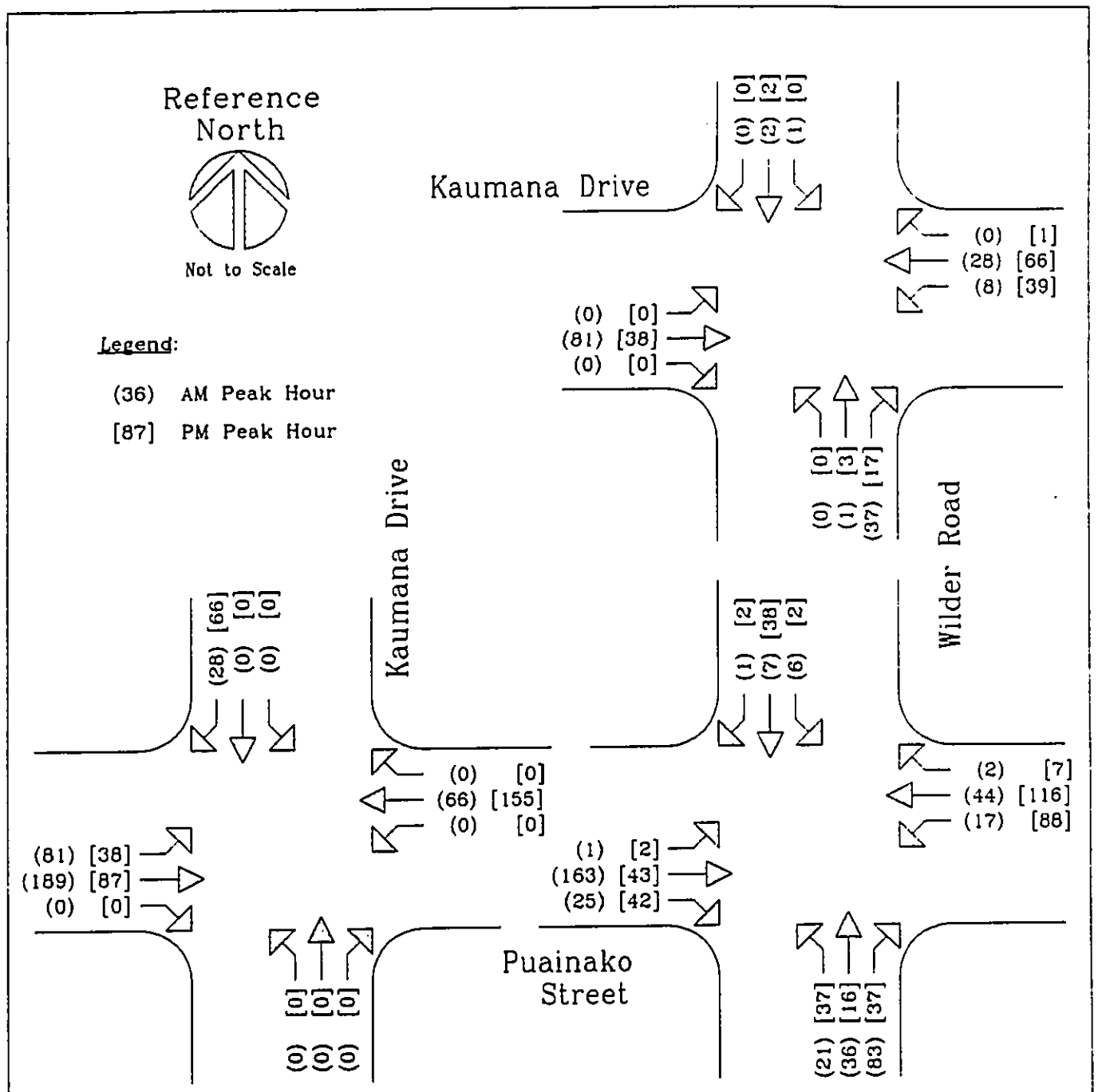

Base Condition (without project)

Traffic Assessment	Future Traffic Case II (Base)	Exhibit
Kaumana Homestead Subdivision	prepared by: Julian Ng, Inc. January 1996	3

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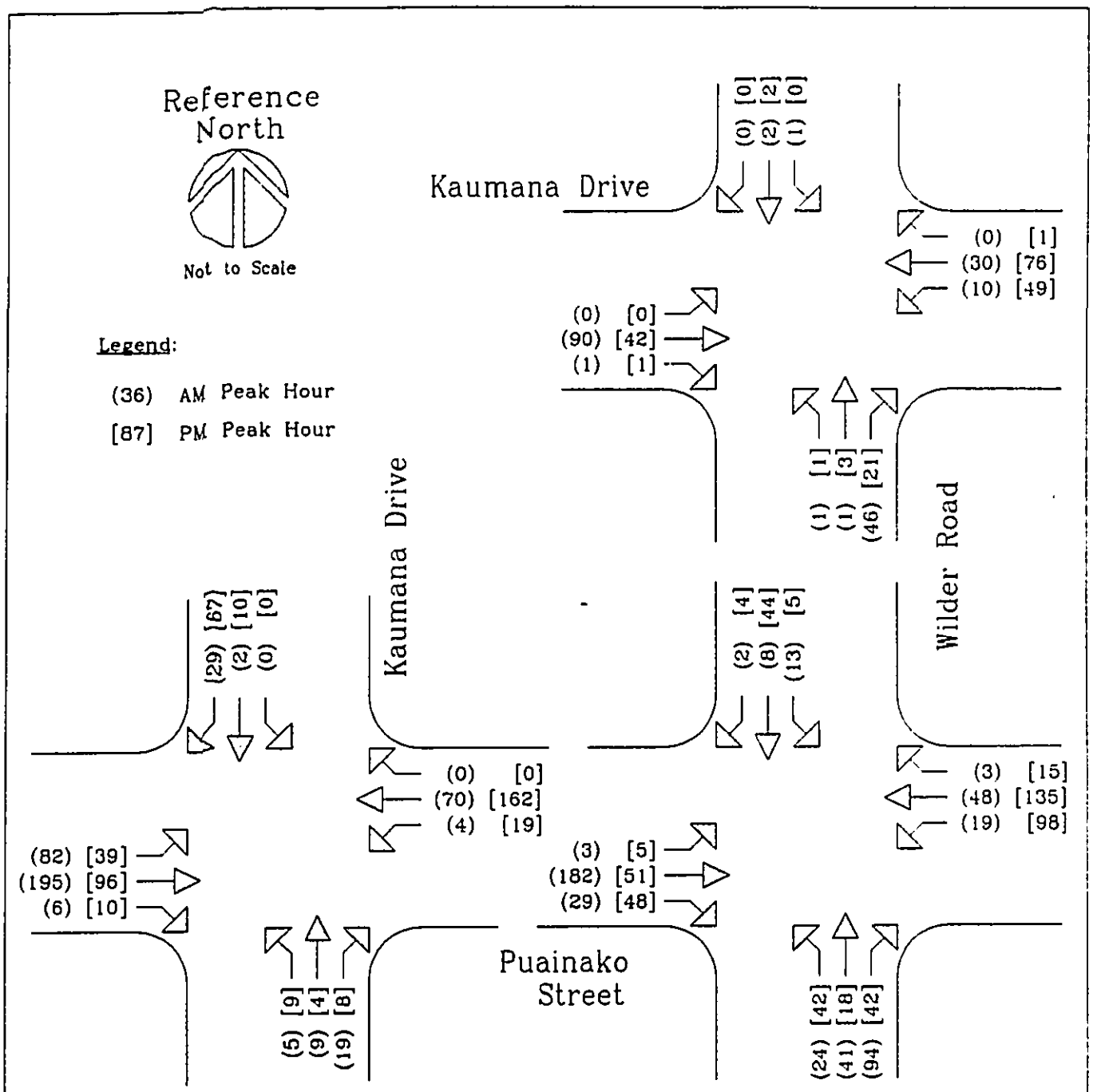

With Project Traffic

Traffic Assessment Kaumana Homestead Subdivision	Future Traffic Case II prepared by: Julian Ng, Inc. January 1996	Exhibit 4

EXH.SKD 01/31/96

APPENDIX - LEVELS OF SERVICE

A qualitative measure used by traffic engineers to describe traffic operational conditions is the level of service (LOS). Six levels have been defined, from LOS A (best operating condition) to LOS F (worst). The *Highway Capacity Manual* describes analysis procedures for different types of facilities. For uninterrupted flow facilities such as freeways, other divided highways, and two-lane rural highways, factors such as speed and travel time, freedom to maneuver, comfort and safety, and continuity of flow are used to determine levels of service.

On multi-lane highways, levels of service are related to maneuverability within the traffic stream travelling in the same direction; directional volume and traffic density are used to determine capacities and levels of service. On two-lane highways, levels of service are affected by a driver's ability to pass slow-moving vehicles; opposing volume is also a factor. Descriptions of the levels of service for two-lane rural highways are:

LOS A represents free flow. Travel at desired speeds is unimpeded, as passing of any slow-moving vehicles is infrequent and can be done easily. Platoons of vehicles would be three or less.

LOS B describes stable flow. Passing to maintain desired speed becomes significant and platooning of vehicles increases.

LOS C also describes stable flow. Platooning and restrictions to passing become noticeable and while flow remains stable, some congestion may occur because of slow-moving vehicles or turning movements.

LOS D is characterized by opposing traffic flows operating separately. Passing is extremely difficult as opportunities are very limited.

LOS E describes unstable operation at or near capacity levels. There are no usable gaps in the traffic stream and any disruption to flow causes congestion. Flow is unstable as slow-moving vehicles and other interruptions cause intense platooning and congestion; passing is virtually impossible.

LOS F represents a forced or breakdown flow caused by traffic demand volume exceeding capacity; actual volume served will drop as speed decreases and congestion increases. LOS F is used to identify bottlenecks, or points of congestion, and operations within the queue behind these bottlenecks.

Levels of service are also identified for signalized intersections and for the controlled movements at unsignalized intersections. These levels of service are based on average delays, which in turn are based on volumes and capacities. For signalized intersections, an operational analysis is used to determine these delays for each lane group of each approach. For unsignalized intersections, the procedures from the *Highway Capacity Manual - Third Edition* were used to calculate delays. Criteria for levels of service are:

LOS	General Description of Estimated Delay	Range of Intersection Delay (seconds) Signalized	Unsignalized
A	Little or no delay	≤5	≤5
B	Short traffic delays	>5 and ≤15	>5 and ≤10
C	Average traffic delays	>15 and ≤25	>10 and ≤20
D	Long traffic delays	>25 and ≤40	>20 and ≤30
E	Very long traffic delays	>40 and ≤60	>30 and ≤45
F	Very long traffic delays	>60	>45

References: Transportation Research Board, National Research Council, *Highway Capacity Manual*, Special Report 209, Washington, D.C., 1985

Transportation Research Board, National Research Council, *Highway Capacity Manual - Third Edition, Updated 1994*, Special Report 209, Washington, D.C., 1994