EXECUTIVE CHAMBERS

HONOLULU

JOHN WAIHEE
GOVERNOR

March 5, 1990

Mr. Joseph K. Conant
Executive Director
Housing Finance and Development Corporation
7 Waterfront Plaza, Suite 300
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Conant:

Based upon the recommendation of the Office of Environmental Quality Control, I am pleased to accept the Final Environmental Impact Statement for the Lahaina Master Planned Project, Lahaina, Maui, as satisfactory fulfillment of the requirements of Chapter 343, Hawaii Revised Statutes. This environmental impact statement will be a useful tool in the process of deciding whether the action described therein should be allowed to proceed. My acceptance of the statement is an affirmation of the adequacy of that statement under applicable laws and does not constitute an endorsement of the proposed action.

When the decision is made regarding the proposed action itself, I expect the proposing agency to weigh carefully whether the societal benefits justify the environmental impacts which will likely occur. These impacts are adequately described in the statement, and, together with the comments made by reviewers, provide a useful analysis of the proposed action.

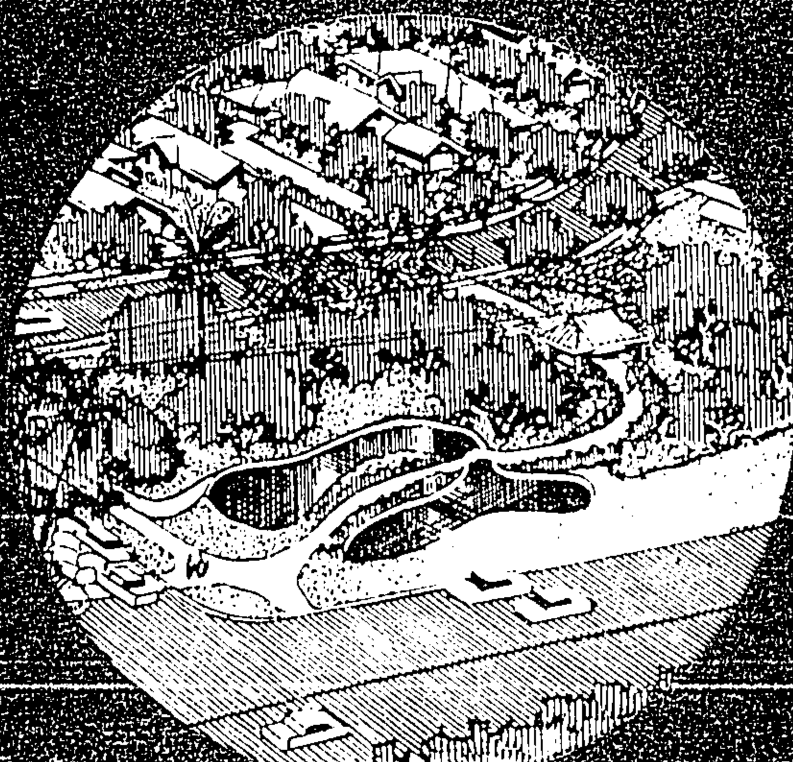
With kindest regards,

Sincerely,

JOHN WAIHEE

cc: Office of Environmental Quality Control

LAHAINA MASTER PLANNED PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT
FEBRUARY 1990



PREPARED BY
PBR HAWAII

PREPARED FOR
STATE OF HAWAII
HOUSING FINANCE AND DEVELOPMENT CORPORATION
DEPARTMENT OF BUDGET AND FINANCE

LAHAINA MASTER PLANNED PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT
FEBRUARY 1990

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The State of Hawaii, Housing Finance and Development Corporation (HFDC) is proposing to develop between about 4,800 and 3,800 residential units on approximately 1,120 acres in the Wahikuli area of Lahaina, Maui. The emphasis of residential product types will be those that fall within the affordable range. Approximately 60 percent of the units will be within the affordable price range and approximately 40 percent will be market priced. The proposed project will include single family homes and multifamily dwelling units. Both for-sale and rental units will be offered. A portion of the project will be dedicated to elderly and special needs groups. The proposed project also includes on- and off-site infrastructure components, including potable water source development, storage facilities, transmission and distribution lines; wastewater transmission and treatment facilities; and roadway improvements. The proposed project would also include public parks and recreation facilities, a public golf course and a limited amount of commercial property to serve the project.

HFDC estimates that at the planned absorption rates, it will take 10 years to complete the project. Construction of the first phase of homes is expected to begin in mid-1990. The first phase will be limited to between 240 and 280 homes due to limitations of the Lahaina Wastewater treatment plant. HFDC's role in the project will be to obtain the necessary land use designations, provide and/or arrange for possible tax or other economic incentives and contract for the construction of the necessary infrastructure and residential units. Actual development of the homes would be by private interests following guidelines established by HFDC. The project is being developed under the provisions of Act 15. The proposed project is estimated to cost between $660 and $700 million, excluding the golf course which would be developed by private interests.

The land on which the proposed project is planned is owned by the State of Hawaii as ceded lands and is presently designated Agriculture by the State land Use Commission. A Land Use Boundary Amendment to Urban will be required. Portions of the project (wastewater transmission and treatment facilities) that fall within the County's Special Management Area (SMA) will also require an SMA permit.

The proposed project is being master planned to assist in the alleviation of a severe shortage of housing, especially affordable housing, on Maui and particularly in West Maui. The principal positive environmental effects of the project will be on the social and economic characteristics of the community, island and State in general. The proposed project will not adversely affect air, noise or water quality, cultural or archaeological resources, or threatened or endangered species of plants or animals. The major potentially adverse impact of the project is the loss of the land for agricultural purposes. Other potential adverse environmental effects of the project are mitigable.

In addition to the proposed project, three alternative sites, several alternative configurations and layouts of the selected site and the alternative of "no-action" have been examined. All alternatives have been rejected due to their inability to meet the project objectives, higher costs of developing both the on- and off-site infrastructural components, adverse environmental effects or the lack of expansion capabilities.

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CHAPTER I
INTRODUCTION AND SUMMARY

CHAPTER I

INTRODUCTION AND SUMMARY

1. APPLICANT AND BRIEF PROJECT SUMMARY

The State of Hawaii, Housing Finance and Development Corporation (HFDC) is proposing to develop between about 4,800 and 3,800 residential units on approximately 1,120 acres in the Wahikuli area of Lahaina, Maui. The emphasis of residential product types will be those that fall within the affordable range. **NOTE:** As used in this EIS, the term "Affordable Housing", as defined in the State Housing Plan (HFDC, 1989), includes housing for persons or families whose incomes are identified as 120 percent or less of the area median income (in this instance, Maui County), as determined by the U.S. Department of Housing and Urban Development (HUD) from time to time, and as adjusted by family size. The proposed project will include single family homes and multifamily dwelling units. HFDC estimates that at the planned absorption rates, it will take 10 years to complete the project. HFDC's role in the project will be to obtain the necessary land use designations, provide and/or arrange for possible tax or other economic incentives and contract for the construction of the necessary infrastructure and residential units. Actual development of the homes would be by private interests following guidelines established by HFDC. The proposed project would also include two school sites, public parks and recreation facilities, a golf course and a limited amount of commercial property to serve the project.

2. PROPOSED GOVERNMENTAL ACTION

Following acceptance of the Final EIS, HFDC will be submitting a land use boundary amendment petition to the State Land Use Commission requesting redesignation of the majority of the property lands from Agriculture to Urban. It is anticipated that future land use approvals at the county level would be processed through the procedures established by Act 15, which provides for expedited approvals for affordable housing projects.

This EIS will support the land use boundary amendment petition, as well as other state and county permit applications that may be required. Other necessary approvals and permits are listed in Section 11 of this chapter.

3. PURPOSE AND CONTENT OF THIS EIS

This Environmental Impact Statement (EIS) has been prepared to identify and assess the potential environmental impacts that could result from the development of the proposed master planned residential community, including all on- and off-site infrastructural components. Through this process, as well as the technical studies performed in support of this EIS and a companion Master Plan, HFDC has proposed appropriate mitigation measures for potential negative impacts and to

ultimately create a well-planned, environmentally sound project.
Studies and surveys prepared for and used in the analysis and assessment process include the following:

- Master Planning
- Civil Engineering Studies (On- and Off-site Roads, Drainage, Water and Sewer Systems)
- Electrical Engineering Analysis
- Market Studies and Surveys
- Economic and Fiscal Impact Analyses
- Botanical Survey
- Landscape Architectural and Planning Analysis
- Avifauna and Feral Mammal Survey
- Archaeological Inventory Survey
- Noise Impact Assessment
- Air Quality Impact Assessment
- Nearshore Marine and Water Quality Survey
- Traffic Impact Assessment
- Social Impact Assessment
- Agricultural Lands Impact Assessment
- Soils and Hydrogeology Studies

With the exception of the master planning studies, design guidelines, landscape architectural plans and engineering studies coducerd outside the master planning contract, the above listed surveys and studies are included in this EIS as appendices. Reports and studies not included herein are referenced as separate documents and are available at HFDC offices for public review. The Master Plan is being published as a separate document and forms the basis of the project for which the potential environmental impacts are described herein.

This EIS has been prepared in compliance with the provisions of Hawaii Revised Statutes (HRS) Chapter 343 and Title 11, Department of Health, Chapter 200, Environmental Impact Rules, Sections 11-200-14 through 11-200-17. A description of the proposed project; the alternatives considered; the existing environmental conditions; the probable environmental consequences that could result from the project; the mitigation measures that would be employed to minimize potential adverse impacts; and the relationship of the proposed project to existing land use plans, policies and controls are provided in the following chapters of this EIS. The information contained herein has been developed from site visits, public informational meetings, studies conducted specifically for this document and/or the companion Master Plan and generally available information regarding the environmental characteristics of the project site and surrounding area.

4. STATEMENT OF OBJECTIVES

The primary goal of the proposed project is to create a master planned residential community with a high level of amenities and services that is available to people of all income levels; that is sensitive to environmental impacts; and provides the needed mix of housing products. The proposed project concept includes developing a mix of rental and for-sale single family and clustered multifamily residential units that would be priced at levels affordable to families with a range of incomes. A percentage of the rental and for-sale residential units would be set aside for elderly and special needs groups. Accomplishment of the project goal will provide greater opportunities for rental and home ownership for all income levels. The provision of affordable homes will satisfy the present and forecast demand for affordable homes in an area that has been identified as being a primary residential center serving the resort and tourism industry facilities in West Maui as well as businesses and other activities in Central and West Maui.

5. NEED FOR PROPOSED ACTION

The need for appropriate housing for all socioeconomic groups is a constant concern of both public and private agencies charged with assisting persons and families in finding suitable housing. This issue is especially critical to lower and moderate income groups as housing costs generally tend to be above their borrowing capabilities. Similarly, there is a continual need for housing, especially in those areas that are relatively close to employment centers, such as those in West Maui. The demand for increased residential opportunities on Maui, and especially affordable residential units in the West Maui area, has been identified by HFDC as having reached the critical stage. Present residents of Maui are experiencing extreme difficulty in finding rental and/or for purchase dwelling units, especially units in the affordable range. Forecast growth on Maui indicates that this problem will become even more acute in the near future when presently under construction and planned resort facilities in the Kaanapali and Kihei-Wailea-Makena areas come on line in 1990 and later. To assist in alleviating this problem, HFDC will be providing the incentives to attract private developers to design, construct and market for rent and for sale residential units at affordable prices.

6. PROJECT DESCRIPTION

6.1 PROJECT SETTING

The lands on which the proposed Lahaina Master Planned Project are located are owned by the State of Hawaii. They are situated adjacent to Lahaina town mauka of the Lahaina Civic Center and Wahikuli subdivision and north of Kelawea subdivision and Lahainaluna High School. The property to be developed is identified as Tax Map Keys (TMK) 4-5-21:03 (Portion), 4-5-21:04 (Portion), 4-5-21:05 (Portion) and 4-5-21:09. The parcels are primarily designated Agriculture by the State Land Use Commission. The project lands have also been determined to be ceded lands and HFDC and The Departments of Hawaiian Home Lands and Land and Natural Resources and The Office of Hawaiian Affairs are negotiating to purchase the lands and determine an equitable distribution of proceeds from the lands.

The project lands are presently leased to Pioneer Mill Company, Ltd. (PMCo), a wholly-owned subsidiary of Amfac/JMB Hawaii, Inc., for sugar cane cultivation. Lands adjacent to the project property are owned by the state and various private land owners. Pioneer Mill is located in the immediate vicinity of the proposed project but the mill site would not be directly affected by the project.

6.2 PLANNED RESIDENTIAL UNITS

The proposed project includes the development of detached single family residential units and multifamily townhouse type residential units. The single family units would include two-, three- and four-bedroom units. The multifamily units would include one-, two- and three-bedroom units. Between approximately 4,800 and 3,800 residential units are presently planned for the overall project. Approximately 60 percent of the residential units would be priced in the affordable range, with the remaining approximately 40 percent priced at prevailing market prices. The multifamily units would be developed in clusters within development areas of the project site.

6.3 OFF-SITE INFRASTRUCTURE

The planned off-site infrastructural components that would primarily serve the proposed project include the following elements:

- Potable Water Supply, Storage and Transmission System
- Sanitary Sewer System
- Electrical Distribution and Communications (Telephone and TV) Systems
- Surface Water Drainage System
- Highway Improvements and Access Ramps

6.4 ON-SITE INFRASTRUCTURE

The on-site infrastructural components that will serve the proposed project include the following elements:

- Internal Roadway System
- Potable Water Distribution System
- Sanitary Sewer Collection and Transmission System
- Underground Electrical Distribution System
- Underground Communications (Telephone and TV) Systems
- Public Parks and Related Recreational Facilities
- Landscaped Public Roadways and Walkways
- Storm Water Drainage System
- Tsunami/Civil Defense Warning System

7. SUMMARY OF IMPACTS

7.1 BENEFICIAL IMPACTS

- HOUSING - Project will provide increased availability of affordably priced for-sale and for-rent housing and a variety of housing types to attract a mix of income and special needs groups and family sizes.

- ENVIRONMENTAL - The physical characteristics of the land are suitable for urban development while affording the opportunity to retain some of the rural character of the area.

  The site is absent of threatened or endangered species of plants and animals and the one potentially significant archaeological site within the project boundaries could be retained as is and incorporated into a major, open space, passive park.

  Although a small portion of the project lands south and makai of the Lahaina Civic Center are subject to flooding (100-year floods), the majority of the site on which homes would be constructed are absent of flood hazards. Appropriate design and construction precautions would be taken for the small area within the flood zone. The site is also absent of natural hazards and no significant degradation of air, noise or water quality would occur as a result of the project.

- SOCIOECONOMIC - The project has been designed to provide affordable housing opportunities in West Maui, thereby enabling workers to live close to employment centers. The project will generate construction jobs and induce employment opportunities in those businesses that service residential communities. Recreational opportunities and facilities in the West Maui area will be increased. The project will enhance the area as a full-service residential community.

- PUBLIC FACILITIES - Public facilities and services are available or will be improved and upgraded, at minimum cost to taxpayers, to serve the project.

- TRAFFIC - The recent State Department of Transportation selection of Alignment B as the preferred Honoapiilani Bypass Highway route is expected to alleviate existing traffic congestion in the project area. The project residents will have direct access to the Bypass Highway, which traverses the project site, and an internal roadway system that has been designed to assure the smooth and safe flow of traffic. A major agricultural use roadway will be retained, thereby negating the need for cane haul and pineapple haul trucks to use public roadways.

- FISCAL - The projected fiscal impacts of the proposed project are estimated to be favorable in that expected state and county tax revenues will exceed public expenditures in both the short- and long-term.

7.2 ADVERSE IMPACTS

- LOSS OF AGRICULTURAL LAND - The project area is currently under sugar cane cultivation by Pioneer Mill Company. Based on the analysis conducted for this EIS, the project is not expected to threaten the economic viability of the state's overall agricultural industry, Pioneer Mill Company nor the growth of diversified agriculture within the state or on Maui.

- CONSTRUCTION - During construction there will be minor and temporary noise and dust problems and possibly some traffic disruptions. The contractors selected to construct the homes and infrastructure will be required to comply with all applicable state and county environmental protection and construction codes and standards. Construction activities (dust and noise) may also impact schools in the vicinity of the project site.

- UTILITIES - The proposed project will generate increased demand for potable water and sewer system services. Water consumption is expected to be less than present agricultural uses and there are sufficient undeveloped supplies to accommodate the proposed project. The sewer collection and treatment system will be improved and upgraded as required to service the project. Private developers will provide the internal water distribution and sewer collection/ transmission system.

- SERVICES - The proposed project will increase demands for police and fire protection, health care and educational services. The financial analysis conducted for the project indicates that public tax revenues from the project will exceed expenditures by a ratio of 1.6 to 1.0. Further, rather than being growth inducing, the project has been designed to accommodate existing Maui residents, presumably who are already receiving public services.

8. SUMMARY OF PROPOSED MITIGATION MEASURES

Various measures will be taken during the construction phases of the project to mitigate potential adverse short-term impacts. These measures will include water spraying construction areas for dust control, the use of retention basins to prevent siltation and erosion control planting as soon as practical. Construction noise will be controlled through the use of mufflers on all construction equipment and noise generated by various Lahaina Civic Center activities will be mitigated by locating the nearest mauka residential units approximately 1,200 feet mauka of the Civic Center apmhitheater and the use of sound attenuating construction materials.

Long-term mitigation measures will include appropriate preservation of archaeological features, the development of new recreational facilities, improvements to utility systems and services and the establishment of a community association(s) to regulate activities within the project area.

9. SUMMARY OF ALTERNATIVES CONSIDERED

Alternatives to the proposed project have included other locations in West Maui, alternative uses of the site, alternative layouts of the project and the alternative of no action. The alternatives have been investigated relative to their ability to meet the project objectives, potential environmental impacts relative to the selected alternative and ability to achieve the state's overall goals and objectives as stated in the Hawaii State Plan and State Functional Plans. In general, none of the alternatives investigated meet the objectives of the project as well as the proposed project, result in greater adverse environmental impacts than the project, or do not allow the state's overall goals and objectives to be met as well as the selected alternative. As such, the alternatives have been rejected for adverse environmental, economic or social reasons.

10. SUMMARY OF UNRESOLVED ISSUES

During the planning stages of the proposed project several informal and formal public and agency informational meetings have been held to determine specific concerns and issues. In general, the primary issue raised was one of timing of the project and the concern that the project would not move forward fast enough. HFDC is aware of this concern and is progressing as rapidly as possible with the project to ensure that the residential products are delivered as fast as possible. During the public and governmental agency review of the Draft EIS, other issues were raised; some of which have not been resolved to the complete satisfaction of all concerned. These issues include the sale and distribution of proceeds from ceded lands; the use of prime agricultural land for affordable housing; county permitting for off-site infrastructural components; and highway/roadway funding/construction. None of these issues appear to be cause to stop or delay the proposed project in that HFDC is discussing and negotiating the issues with the affected agencies. HFDC believes that all issues will be resolved to the satisfaction of all parties concerned.

11. SUMMARY OF COMPATIBILITY WITH LAND USE PLANS AND POLICIES

Following granting of the land use boundary amendment petition, the project will be consistent with state land use designations. The project is also consistent with the Maui County General Plan. The present Lahaina Community Plan will eventually require modification to accommodate the project. To move forward, the project will also require several governmental permits, as listed below (Table I-1).

12. NECESSARY APPROVALS AND PERMITS

This EIS has been prepared to support various state and Maui County permit applications. Table I-1 lists the *major* approvals and permits required for the Lahaina Master Planned Project. Other approvals will be required after the following have been obtained. It is noted that the proposed Lahaina Master Planned Project is being accomplished by HFDC under Act 15, which exempts affordable housing development projects from all statutes, ordinances, charter provisions, and rules of any governmental agency relating to planning, zoning, construction standards for subdivisions, development and improvement of land and the construction of units thereon provided the project meets certain requirements. Act 15 does not exempt the project from the Special Management Area (SMA) rules and regulations established by the county. Should any of the proposed improvements fall within the SMA boundary, that portion of the project will require and be the subject of a minor SMA application. In keeping with sound planning and building practices, the proposed project will, for the most part, observe local agency processes and practices.

TABLE I-1

MAJOR GOVERNMENTAL APPROVALS/PERMITS REQUIRED

APPROVAL	APPROVING AGENCY OR BODY
NOTE: The proposed project will comply with the following:	
Maui County	
Plan Approval	Department of Public Works
Grading Permit	Department of Public Works
Building Permit	Department of Public Works
Special Management Area (if required)	Planning Department
NOTE: The proposed project is exempt from the following four approvals under Act 15.	
Lahaina Community Plan Amendment	Planning Commission
Change of Zone	Planning Commission
Project District Ordinance	Planning Commission
Subdivision Approval	Department of Public Works
State of Hawaii	
Land Use Boundary Amendment	Land Use Commission
Ground Water Use Permit	Board of Land and Natural Resources
Historic Sites Review	Department of Land and Natural Resources - Historic Sites Section
Conservation District Use Application/Permit	Board and Department of Land and Natural Resources
Water Well Drilling/Development	Department of Land and Natural Resources, Water Resources Development Commission/Department of Health

13. LIST OF PREPARERS OF THIS EIS

NAME/AFFILIATION	TITLE	AREA OF EXPERTISE
Joseph Conant/HFDC	Executive Director	Project Management
Neal Wu/HFDC	Project Coordinator	Project Management
Wm. Frank Brandt/PBR HAWAII	President	Project Director/Master Plan-EIS Preparation
Michael Terry/PBR HAWAII	Vice President	Project Management/Master Plan-EIS Preparation
Jeri Yamaguchi/PBR HAWAII	Project Coordinator	Master Plan-EIS Preparation Coordination/Editing
Guy Tsutsui/PBR HAWAII	Cartographer	Master Plan-EIS Preparation
David Hulse/PBR HAWAII	Planner	Master Plan Preparation-EIS Contributor
Mary Aho/PBR HAWAII	Graphics Designer	Master Plan-EIS Graphics Preparation
Gordon A. Chapman/ Chapman Consulting Services	Owner/Project Manager	EIS Preparation/Principal Author
Winona Char/Char & Associates	Owner/Botanist	Botanical Survey
Phillip Bruner	Owner/Wildlife Biologist	Bird and Mammal Survey
Yoichi Ebisu/Y. Ebisu & Associates	Owner/Acoustical Consultant	Noise Analysis
James Morrow/J.W. Morrow	Owner/Air Quality Consultant	Air Quality Analysis
Warren S. Unemori/Warren S. Unemori Engineering, Inc.	Owner	Project Engineering

LIST OF PREPARERS OF THIS EIS (Continued)

NAME/AFFILIATION	TITLE	AREA OF EXPERTISE
John F. Mink	Owner	Groundwater/Potable Water Analysis
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Dr. John Knox/Community Resources, Inc.	President	Social Impact Analysis
Dr. John Kirkpatrick/ Community Resources, Inc.	Senior Research Associate	Social Impact Analysis
Dr. Richard E. Brock/ Environmental Assessment Co.	President	Marine Impact Analysis
Randall Y. C. Ho/ Ernst & Young	Senior Manager, Management Consulting Group	Financial/Fiscal Impact Analysis
Aileen Hoe/Ernst & Young	Manager, Management Consulting Group	Financial/Fiscal Impact Analysis
Dr. Michael Sklarz/ Locations, Inc.	Director of Research	Market Analysis
Colin Yasukochi/Locations, Inc.	Market Analyst	Market Analysis
Julian Ng/Parsons Brinkerhoff Quade & Douglas, Inc.	Traffic Engineer	Traffic Analysis
Dr. Paul H. Rosendahl/ Paul H. Rosendahl, Inc.	President	Archaeological Investigations
Paul Morimoto/Ernest K. Hirata & Associates	Project Engineer	Soils Engineering

CHAPTER II
DESCRIPTION OF THE PROPOSED PROJECT

CHAPTER II

DESCRIPTION OF THE PROPOSED PROJECT

1. REGIONAL SETTING

The regional extent of existing and planned land uses are shown in Figures II-1 and II-2. The project site is located adjacent to Lahaina town, mauka of the Lahaina Civic Center and Wahikuli subdivision and north of the Kelawea subdivision and Lahainaluna High School. The Civic Center contains a police station, post office, fire station, health center, gym, District Courts, meeting rooms and tennis courts.

The proposed project lands are owned by the State of Hawaii, and are presently leased to Pioneer Mill Company, Ltd., a wholly owned subsidiary of Amfac/JMB Hawaii, Inc., for sugar cane cultivation. The project lands, which are ceded lands, are in the Agricultural State Land Use District. The project lands are designated Prime and Unique agricultural lands under the Agricultural Lands of Importance to the State of Hawaii (ALISH) and A, B and C under the Land Study Bureau Detailed Land Use Classification (Land Study Bureau, 1967). The project property is identified as Tax Map Keys (TMK's) 4-5-21:03 (Portion), 4-5-21:04 (Portion), 4-5-21:05 (Portion) and 4-5-21:09 (Figure II-3). Lands adjacent to the project site are also owned by the state and various private land owners (Figure II-4). Pioneer Mill is located in the immediate vicinity of the proposed project but the mill site would be unaffected by the proposed project. The total land area of the proposed project site is about 1,120 acres. The general slope of the project lands varies from about 6 percent to 12 percent. HFDC is presently negotiating with the State Department of Land and Natural Resources to purchase the project lands. A portion of the revenue from the sale would be distributed to the State Department of Hawaiian Home Lands and the Office of Hawaiian Affairs.

The proposed State Department of Transportation Honoapiilani Bypass Highway Alternative B passes through and dissects the property in a northwesterly-southeasterly direction (Figure II-5). The Bypass Highway, as proposed by the State Department of Transportation, is not part of the Lahaina Master Planned Project. However, the roadway, access ramps and other highway improvements are presently or may become a part of the proposed project. These portions of the project are discussed in Section 3.2.3 of this chapter and in Chapter IV, Section 6.

North of the project site, approximately 2.5 and 7.5 miles respectively, are located the resort areas of Kaanapali and Kapalua and approximately 20 to 25 miles south of the project area is the Kihei-Wailea-Makena resort area, both of which are major employment centers. Other existing or planned residential projects in the immediate vicinity of the proposed project are Kapunakea subdivision, Wahikuli subdivision, Kelawea subdivision, Poinciana Place apartment building in Honokowai, Komohana Hale, a planned county affordable housing project in Lahaina, the state's planned Honokowai rental project and an "affordable" lot project planned by Maui Land and

Pineapple. Other public facilities in the area include Wahikuli Beach Park and the Mala Wharf small boat launch ramp and storage area.

Panoramic views of the West Maui Mountains, the ocean, shoreline and islands of Lanai and Molokai are available from the project site.

2. PROJECT BACKGROUND

The proposed Lahaina Master Planned Project is part of the State of Hawaii's overall goal of increasing rental and for-sale housing opportunities for all income levels. It is one of several HFDC sponsored projects throughout the state and is located in an area that has, through market and social impact assessment studies, been determined to be sorely lacking in housing of any kind. Based on the need for affordable housing in West Maui, HFDC is proposing to accomplish the proposed Lahaina Master Planned Project under the provisions of Act 15.

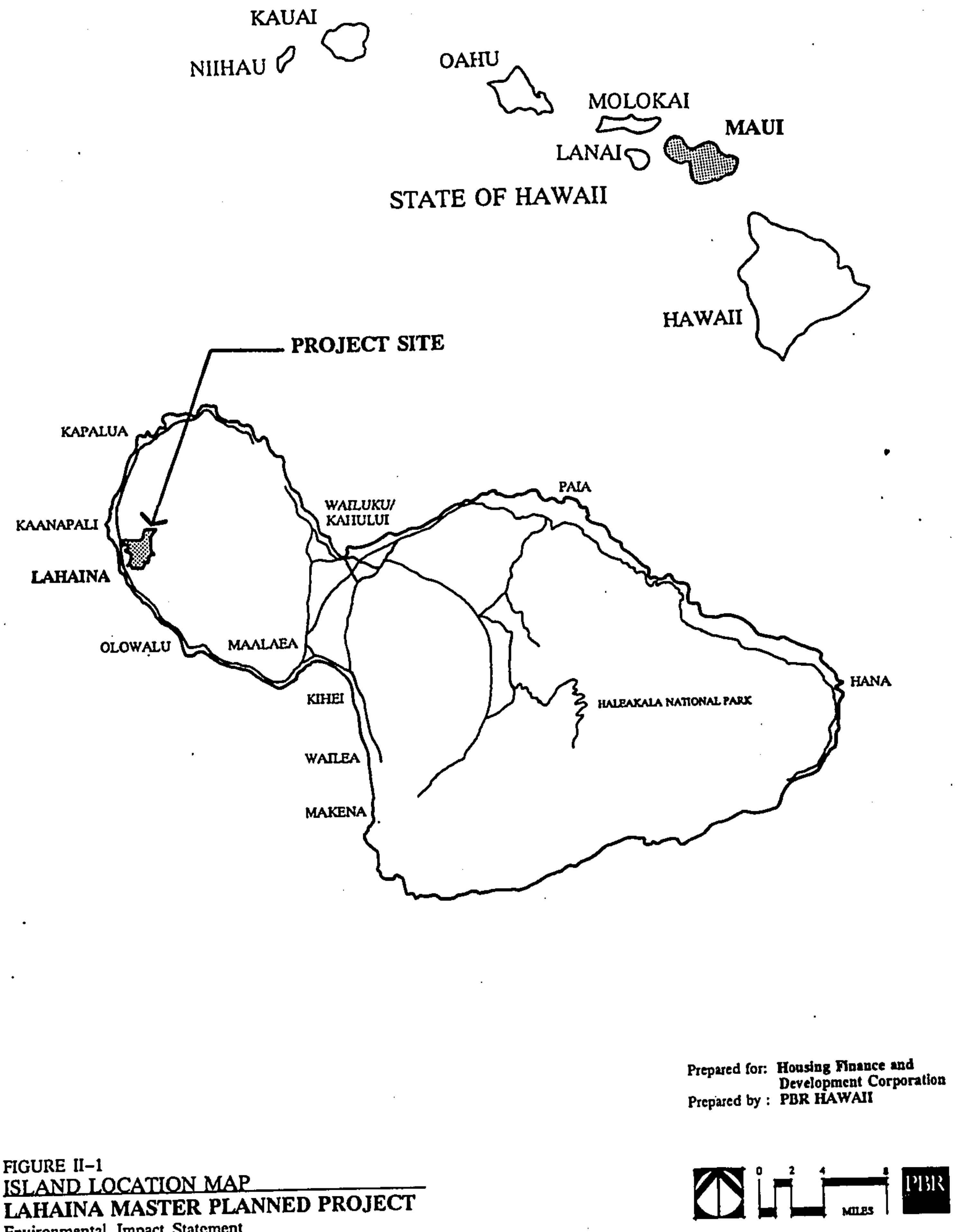
3. DEVELOPMENT CONCEPT

The basic concept of the proposed project is to develop the Lahaina Master Planned Project as a master planned residential community with a high level of amenities and services that is available to people of all income levels and sensitive to environmental impacts. The proposed project is in keeping with the State Housing Functional Plan and the concept includes developing a mix of for rent and for-sale single family and clustered multifamily residential units that would be priced for all income groups. As presently defined, of the between 4,800 and 3,800 residential units to be developed, 60 percent would be priced within the affordable range and 40 percent would be priced at market. Accomplishment of the stated project objectives will provide greater housing opportunities for all income levels. The provision of affordable homes will satisfy the present and forecast demand for affordable homes in an area that has been identified as being a primary residential center serving the resort and tourism industry facilities in West Maui, as well as businesses and other activities in Central and West Maui. The proposed project will also feature extensive landscaping and the protection of the natural, historical and scenic resources of the project area.

3.1 STATEMENT OF THE PROJECT OBJECTIVES

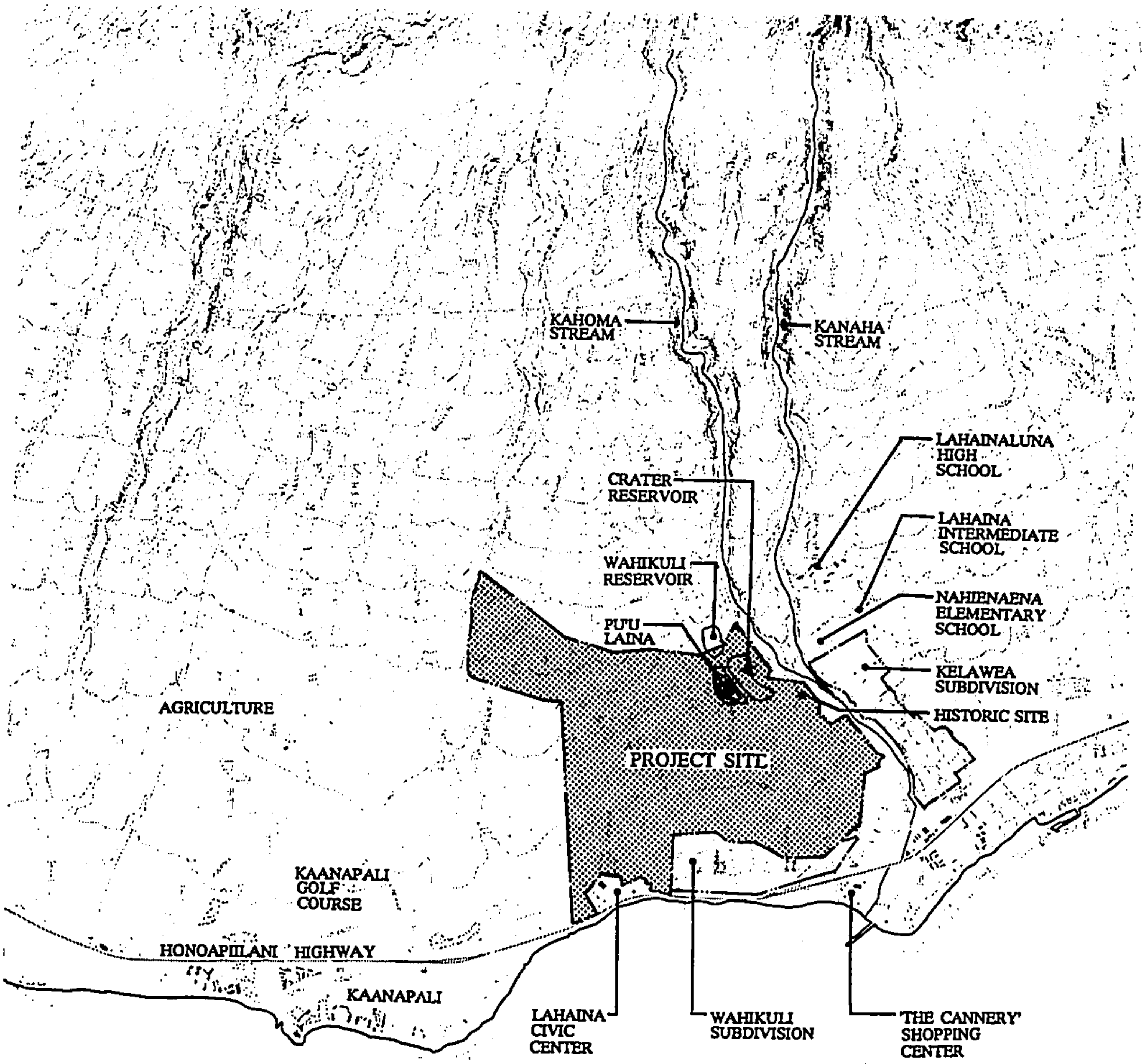
In developing the Lahaina Master Planned Project, HFDC's major objectives are as follows:

- To provide a master planned residential community in West Maui that consists primarily of "affordable" detached single family and multifamily residential units.
- To assist the state in satisfying the demand for affordable housing and facilities.
- To provide needed recreational, educational, public and commercial facilities in West Maui to serve the master planned community as well as all Maui residential areas.



Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE II-1
ISLAND LOCATION MAP
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement



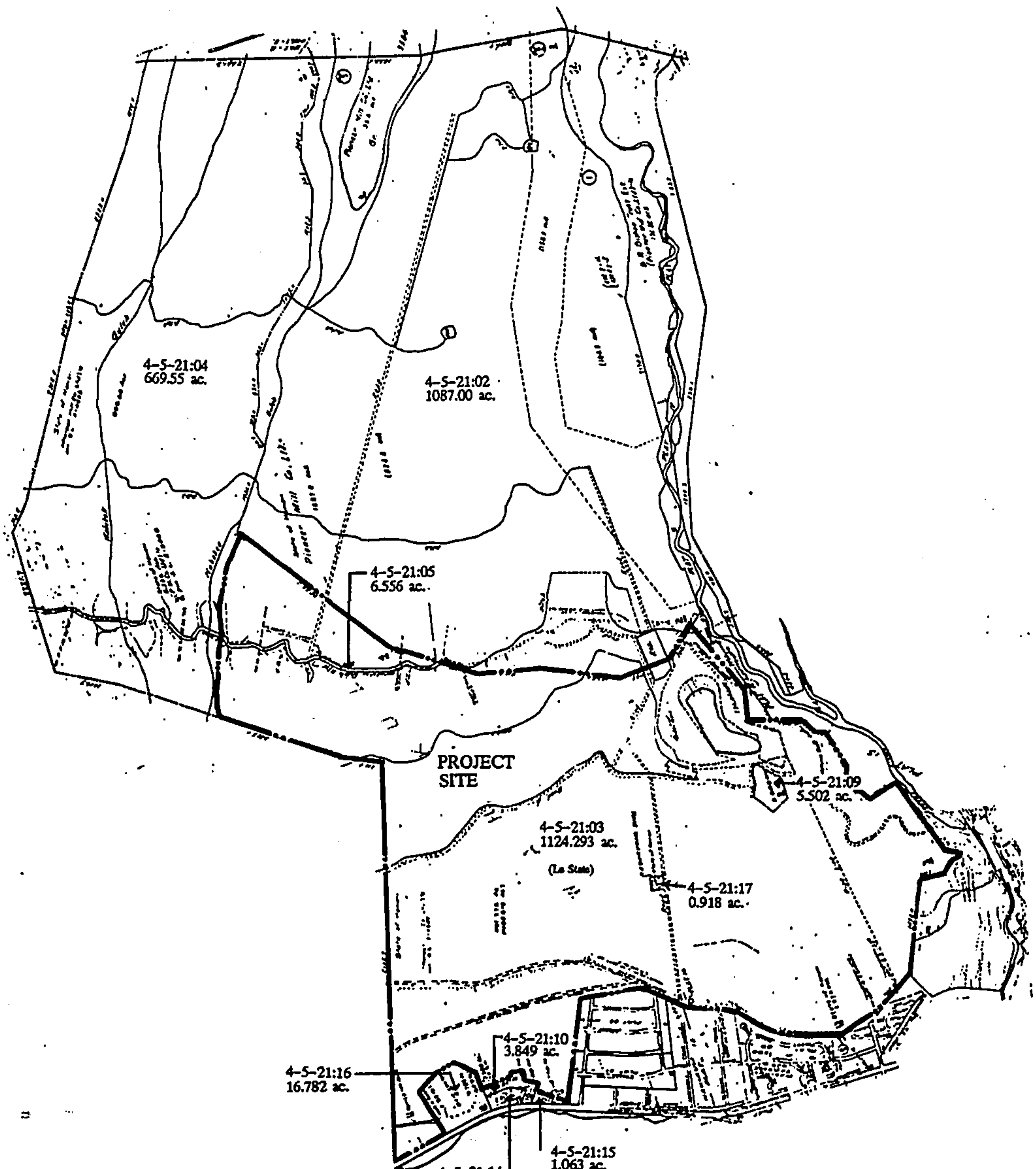
source: USGS 1983

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE II-2
REGIONAL LOCATION MAP w/surrounding land uses
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

0 1000 2000 4000 FEET

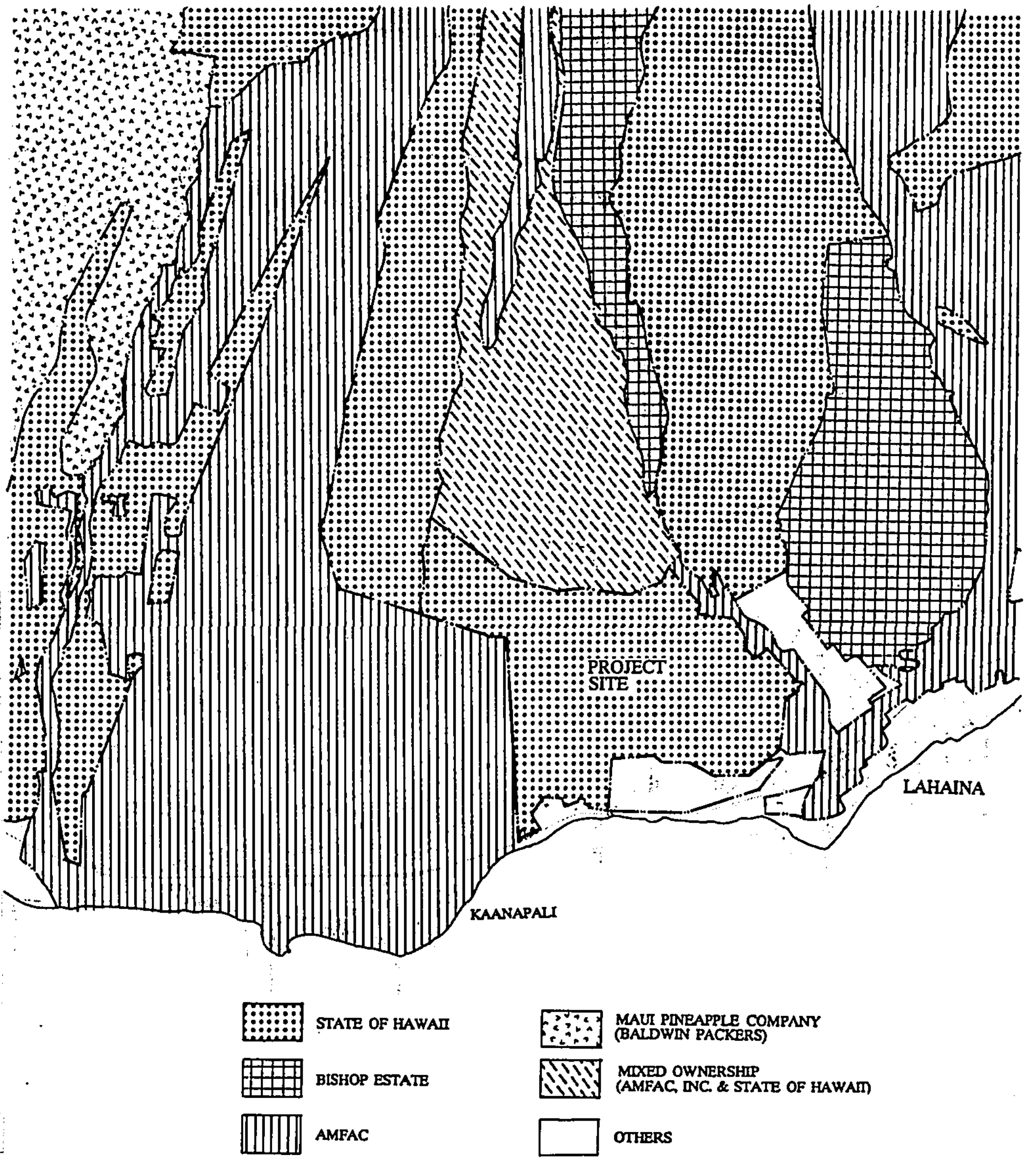
PBR



source: STATE TAX MAP OFFICE

Prepared for: **Housing Finance and Development Corporation**
Prepared by : **PBR HAWAII**

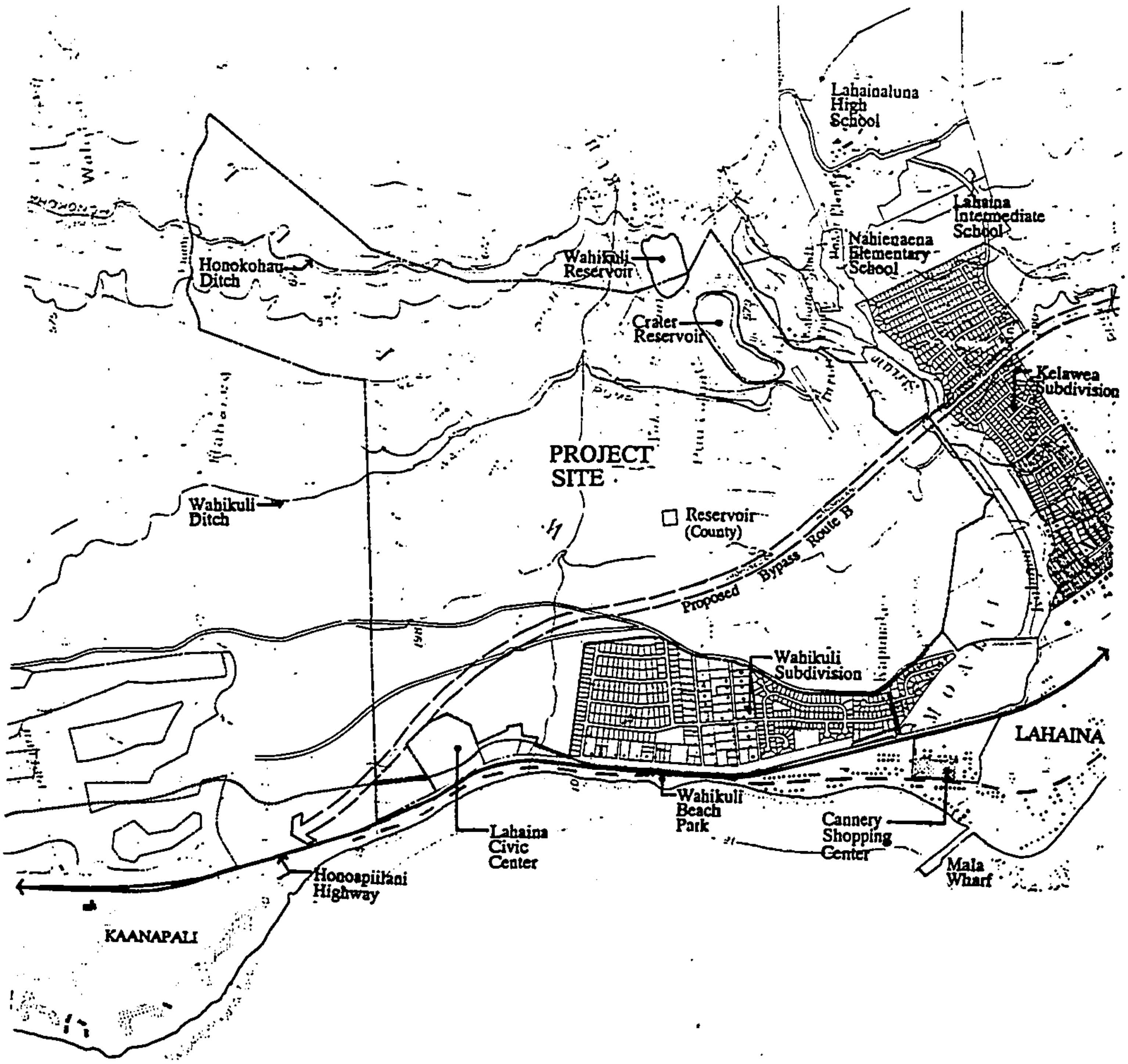
FIGURE II-3
TAX MAP KEYS
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement



source: DLNR, 1963

Prepared for: Housing Finance and Development Corporation
Prepared by: PBR HAWAII

FIGURE II-4
LAND OWNERSHIP
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement



Prepared for: Housing Finance and Development Corporation
Prepared by: PBR HAWAII

FIGURE II-5
SITE MAP
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

0 300 1000 2000 FEET

3.2 PROJECT DESCRIPTION

The following describes the various components, proposed uses and activities of the proposed Lahaina Master Planned Project. The various elements of the proposed project are shown on Figure II-6.

3.2.1 Residential Development

A total of between 4,800 and 3,800 residential units are planned for the proposed project. It is estimated that these homes would be constructed over a 10-year construction period. Residential unit construction is scheduled to begin in early 1991 and be completed in the year 2000. Table II-1 indicates the recommended absorption by price range, assuming a maximum of 4,800 units. The first increment of homes would be a total of between 280 and 240 units and would include a mix of "affordable" for-sale and for rent homes and possibly market priced for-sale homes. The first increment is limited to between 280 and 240 units due to the present capacity of the Lahaina Wastewater Treatment Plant (WWTP).

The residential portion of the project would be approximately 500 acres, or 45 percent of the site (see Table II-2). The average residential density would be about 9.6 units per acre (U/A). As indicated previously, 60 percent of the project would be within the affordable range with the remaining 40 percent at market prices.

- **Affordable Housing Units (780 - 1,200 sq. ft.)**: Rentals and "for-sale" housing will both be priced at rates affordable for families that earn between 80 and 120 percent of the median family income for the County of Maui. These units are comprised of apartments, condominiums, duplexes and single-family dwellings. The single-family units will have lots of approximately 4,000 square feet and be priced between $123,000 and $168,000. Condominiums and townhouses are priced at approximately $105,000. Approximately 216 to 319 acres of the project site will be necessary to accommodate the affordable units.

- **Market Units (1,300 - 1,800 sq. ft.)**: Market housing units are all single-family with minimum building lots (usable area) ranging between 4,700 and 5,500 square feet. Pricing for the units on smaller 4,500 square foot lots will range from $234,000 to $315,000. Larger lot products will be priced between $345,000 and $414,000. Unit density will range from 5.2 to 7.0 units per acre, requiring approximately 285 total acres for market priced units.

TABLE II-1

RECOMMENDED ABSORPTION BY PRICE RANGE
LAHAINA MASTER PLANNED PROJECT

Year	Total Units	27% 50-80% (430-689)	9% 80-88% (96-105k)	14% 88-103% (105-123k)	11% 103-120% (123-143k)	6% 120-140% (143-168k)	33% >140% (>168k)
1991	240	65	22	34	26	14	79
1992	860	232	77	120	94	52	285
1993	463	125	42	65	51	28	152
1994	463	125	42	65	51	28	152
1995	463	125	42	65	51	28	152
1996	463	125	42	65	51	28	152
1997	463	125	42	65	51	28	152
1998	463	125	42	65	51	28	152
1999	463	125	42	65	51	28	152
2000	459	124	42	64	50	28	151
TOTALS:	4800	1296	435	673	527	290	1579

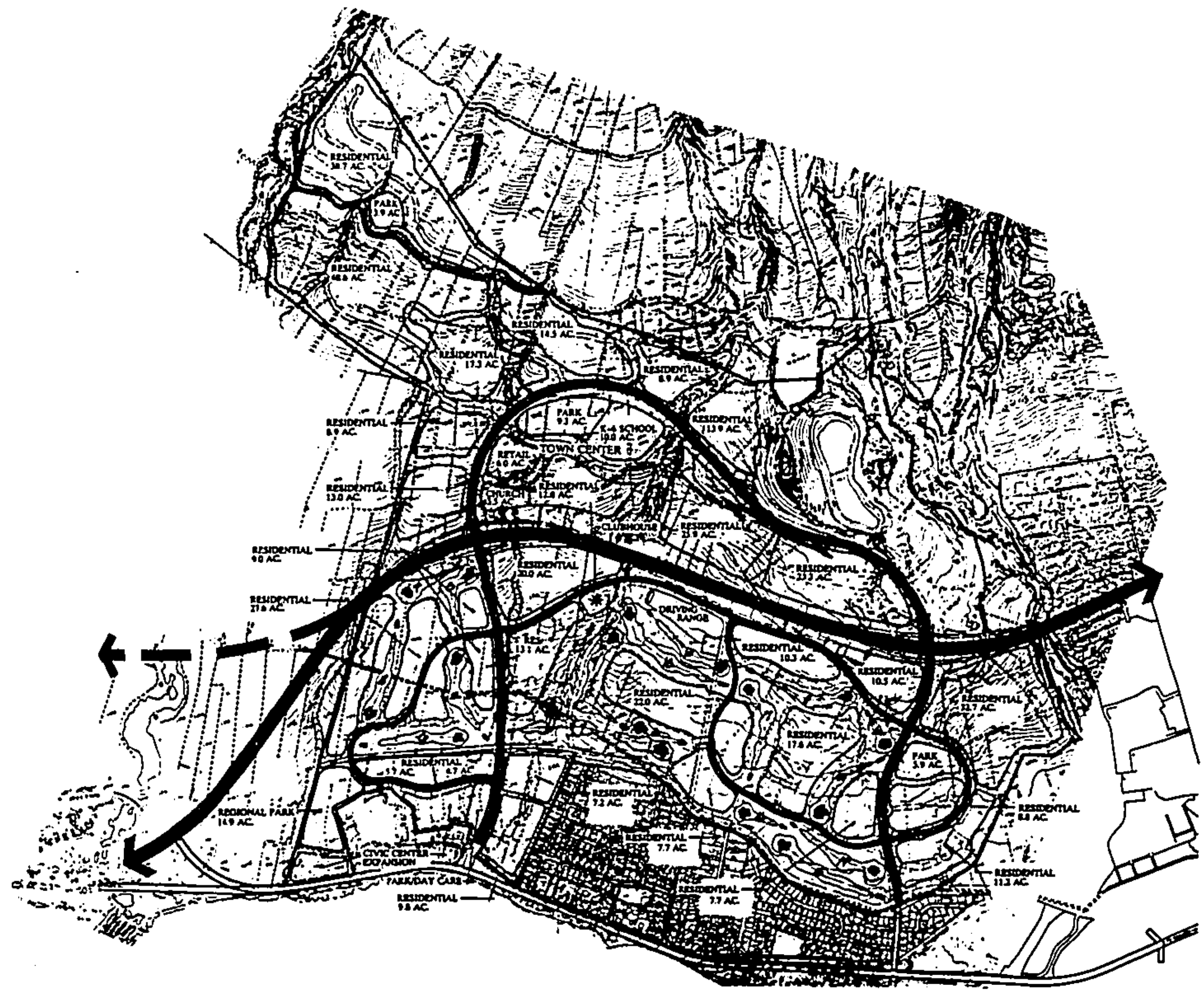


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FIGURE II-6
PREFERRED ALTERNATIVE PLAN
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

TABLE II-2

LAND USE SUMMARY
LAHAINA MASTER PLANNED PROJECT

	Acres (Net Useable)	Density (Net)	Dwelling Units (DU)	Percentage of Total DUs
P-1	36.7	16.0	587	15.7
P-2	12.7	16.0	203	5.4
P-3A	167.4	7.0	1172	31.4
P-4	103.1	7.0	722	19.3
P-5	100.5	6.4	643	17.2
P-6	39.4	5.2	203	7.1
L-1	29.4	5.2	153	4.1
Subtotal:	± 489.2	7.52	3683	100%

Community Parks (5)	-	33.4 Ac.
Retail/Commercial	-	5.9 Ac.
Elementary Schools (2)	-	19.5 Ac.
Church/Day Care (4)	-	7.4 Ac.
Golf Course	-	150.0 Ac.

3.2.2 Regional Park, Neighborhood Parks and Golf Course

- **Parks and Recreation:** The availability of park space and the impact of the new community on existing parks, was one of the primary concerns raised by the public during the initial design phases of the project. To accommodate the recreation and leisure time needs of project residents, one regional park and five neighborhood parks of at least six acres each will be developed throughout the project area. All community parks are located adjacent or proximate to day care centers, the school sites and multi-family residential dwellings. This type of locational orientation is intended to allow greater use of the parks by providing easy accessibility from adjoining land uses. It is anticipated that facility improvements for each park will be provided in accordance with generally accepted standards after dedication to the County of Maui.

  The regional park is located along the mauka side of the existing Honoapiilani Highway between Lahaina Town and the proposed project. It is intended to serve the growing Lahaina region with facilities complementing those of the existing Lahaina Civic Center. HFDC will continue to work closely with the County of Maui to determine the recreational needs of the larger Lahaina community suitable for inclusion in this major recreational center.

- **Golf Course:** An 18-hole golf course is included in the project, to address both economic and environmental considerations. Presently, the golf course operation is envisioned as primarily a municipal course with associated affordable fee structure. Memberships may be sold to supply revenue for golf course maintenance, public parks and public area landscaping and to subsidize affordable housing. Although park facilities may be dedicated to the County, they may be maintained by the golf course operator to assure that the parks are maintained in an appropriate manner. This arrangement could be economically beneficial to the County from a maintenance perspective and for HFDC, which could utilize excess revenue to support continued affordable housing development.

  Additionally, the sale of market dwelling units with golf course frontage will command a significant premium that would be used to support development of the affordable component. The golf course would be open to the public; however, local residents would be given priority status with regard to starting times and fees.

  From an environmental perspective, the golf course has been located in a linear configuration (Figure II-6) to serve as: (1) a buffer between existing residential areas and a cane haul road, (2) a major component of the drainage and sewer system, and (3) as a logical transition between project phases.

  The concept of a golf course buffer is important for several reasons. The first involves the safety and health impacts of the makai cane haul road traversing through residential areas. The golf course will reduce noise, dust, visual impacts, and place a physical barrier between the mauka residential developments (a potential source of pedestrian traffic) and the road.

The mauka/makai portion of the golf course is also located within an existing natural drainageway. For this reason, it is reasonable to limit high density development within the drainageway, but retain the use of this natural corridor for sewage transmission systems and drainage purposes. Tentative plans call for a central sewage collection line to run down-slope within the drainageway and connect with the Lahaina WWTP or existing transmission lines. Several runoff retention basins are also planned for the golf course to limit peak discharges during intense storm events and to serve as storage/siltation ponds.
According to the project phasing program, the golf course will be constructed during the second development phase. This early schedule will not only increase project revenues when the golf course comes on-line, but will also divide the earlier construction phases into logical sections. In this way, infrastructure can be easily terminated and construction activities buffered from surrounding residential areas.

To assure that operation and maintenance of the golf course is in keeping with sound business practices and environmental controls, the developer selected to design, construct and operate the course will be required to prepare and implement a golf course maintenance plan and program. This plan and program will be established on "Best Management Practices (BMP)" with regard to utilization of fertilizers and biocides as well as the irrigation schedule. The plan and program will be revised as an ongoing measure and the plan and program will be reviewed by the State Department of Health prior to implementation.

3.2.3 Commercial Facilities

One 5.9 acre commercial center has been incorporated into the conceptual design at a centralized location. This facility is intended to offer basic retail services to project residents such as grocery and drug stores, small specialty stores, restaurants and generalized retail service stores, i.e., beauty salons. By providing these basic retail services, the entire community becomes more self-sufficient with less trips generated to "outside" retail centers. This aspect may become especially critical as the vehicular traffic Level of Service (LOS) for surrounding and regional transportation systems declines. It is anticipated that the commercial center will provide a level of full-time employment opportunities that will also contribute to project self-sufficiency.

3.2.4 Schools, Church and Day Care Centers

- **Elementary Schools:** According to the State Department of Education, the projected population for the project at build-out is estimated at approximately

12,000 persons. This population growth translates into the probable need for two new elementary schools and expansion of Lahaina Intermediate and Lahainaluna High Schools. The school locations will be sited in compliance with State Department of Education School Site Selection Criteria.

- **Church/Day Care:** Based on demographic data compiled for this project, it is clear that a significant number of households, occupying both market and affordable units, will require two incomes to meet eligibility criteria for purchase or rental of project units. As such, facilities for at least 4 neighborhood day care centers have been located throughout the project area. Management of these facilities may be facilitated through agreements with church and/or various community groups. Parcels have been sized to accommodate churches.

3.2.5 Circulation and Access

Vehicular traffic to and within the residential project would be via two major access points as well as via the Lahaina Bypass Highway (once it is constructed). Internal roadways would be constructed in accordance with applicable state and county standards and include landscaping, which may be maintained by the golf course operator. Based on discussions with the State Department of Transportation, HFDC may fund and construct that portion of the Lahaina Bypass Highway that passes through the project site. The roadway would be designed and constructed in compliance with Maui County standards. Access to the highway would be limited to a maximum of three points to assure the safe and efficient flow of traffic through the proposed project.

3.2.6 Natural Resources

The gulches, gullies and areas around Puu Laina and the crater reservoir would be retained in their present natural setting. As such, these areas would continue to serve as wildlife habitat areas and assist in retaining the present natural green character of the project site. The recreation/open space plan is characterized by selective improvement of the existing drainageways and steep slope areas as recreational and scenic amenities. Portions of the major drainageways will be eventually cleared and planted to enhance the native vegetation with appropriate landscape material. The combination of landscaping in roadway corridors, areas of steep slopes, drainageways, golf course and parks, all serve to cumulatively establish an open space system. This landscape will serve as an important amenity for community residents and as a mauka visual amenity from the perspective of Lahaina.

3.2.7 On-site and Off-site Infrastructure

Infrastructure requirements for the project include improvements to off-site and on-site roadways, water, sewerage, drainage, electrical power and telephone systems. Design criteria for infrastructure are based on the County of Maui standards from the Department of Public Works and Department of Water Supply. A portion of the off-site wastewater transmission and treatment system would be constructed within the Special Management Area (SMA) as defined by maui County. However, the elements to be constructed would be below ground and/or less than four feet above ground. As such, they are exempt from county SMA permit requirements. Similarly, a portion of the off-site drainage system improvements may encroach into the Conservation District as defined by the State Land Use Commission. A Conservation District Use Application and Permit will be requested from the Board and Department of Land and Natural Resources prior to the construction of these elements of the project. Additionally, off-site potable water system components would be designed and constructed in compliance with State Water Resources Development Commission, State Department of Health and County Departments of Water Supply and Public Works requirements and standards. All on- and off-site infrastructural component work will be coordinated with the appropriate state and county agencies.

Off-site infrastructure improvements will be necessary to accommodate, not only the needs of the proposed development, but to also increase the capacity of existing systems for continued use of current residents. On-site infrastructure is intended for the use of project residents and consists of "backbone" collection or distribution systems, other infrastructure located within major street right-of-ways, and lot preparation. Both the on-site and off-site infrastructural components to be included in the proposed project are discussed in detail in Chapter IV, Section 6 of this EIS.

3.3 NEED FOR THE PROJECT - MARKET STUDY

The market study prepared specifically for the proposed project (Appendix A) clearly indicates a need for additional housing units on Maui, especially affordable units in West Maui. The West Maui residential resale and rental markets are mirroring the extremely tight conditions which exist for all of Maui. New construction in recent years has fallen short of the demands of a rapidly growing population. Household growth has been even more rapid as household sizes continue to decline. This has caused both home prices and rents to rise much faster than income levels in recent years, resulting in an "affordability" gap. This structural problem will only be solved by building a substantial number of new affordably priced housing units in the years ahead. It has been estimated that the island wide shortfall of homes is accruing at the rate of 800 to 900 housing units per year.

Results of housing surveys indicate a strong existing pent-up demand for approximately 6,000 units for Maui and 3,700 units for West Maui. Even with all of the new units planned, both in the proposed as well as other projects, total unmet housing needs will only decline to 4,412 units for Maui island and 502 units for West Maui by the year 2000.

The market study has also indicated that the mix of affordable and market units be two-thirds and one-third respectively. Of the total units, 9 percent should be rental units allocated to elderly and special needs groups; 18 percent should be rental units priced between $430 and $689 per month; 9 percent for-sale units priced between $96,000 and $105,000; 14 percent for-sale units priced between $105,000 and $123,000;, 11 percent for-sale units priced between $123,000 and $143,000; 6 percent for-sale units priced between $143,000 and $168,000; and 33 percent for-sale units priced near the prevailing market rate or about $180,000 to $230,000. Fuŗther, because of the tremendous demand that exists for affordable homes and rentals, the Lahaina Master Planned Project construction of 240 units and 860 units respectively for the first two years and approximately 463 units per year thereafter, should be readily absorbed. The limit on constructing 240 units for the first year is caused by the limited capacity of the present wastewater transmission, treatment and disposal system.

In addition to the housing units, the market analysis also indicates that, considering the current population and corresponding golf participation rate, it is estimated that there is an excess demand of 300 rounds per day. This translates into another 1.0 public golf courses needed at present. If no new public courses are built on Maui, the demand will grow to 1.5 new public golf courses needed by 1995 and 1.8 courses by 2000. As indicated previously, in addition to providing a much needed public recreational facility, the golf course will provide surface water runoff retention basins and act as a buffer between existing land uses and the proposed residential project.

A fiscal and financial impacts analysis of the proposed project has been performed (Appendix B). Based on the analyses conducted, the Lahaina Master Planned Project shows a revenue-cost ratio of 0.9 to 1.0. This indicates that an additional $0.90 in public revenue benefits would accrue to either the state or the county for every dollar of public cost caused by the proposed project. Based on this ratio, it might suggest that the project should not be developed. However, not included in the revenue-cost ratio are other benefits which cannot be easily quantified. These intangible benefits to the Lahaina community include:

- Providing affordable for-sale housing for Hawaii residents who would otherwise not be able to purchase their own homes;
- Addressing the high demand for all types of housing in the Lahaina area by both Lahaina residents and workers in the hotel industry; and
- Providing a well-planned aesthetic community with sufficient parks, open space and landscaping.

When these non-quantifiable benefits are considered, it would appear that the project should be pursued.

As presently planned, the estimated net present value of public costs associated with the project is $90.7 million (in 1989 dollars), while the estimated net present value of tax revenues is $83.6 million (Appendix B). Estimated costs of the entire project, as presently planned, range from $660 to $700 million (in 1989 dollars). this includes all off- and on-site infrastructure (roads, access ramps, water system, wastewater system, electrical system, etc), residential units, public parks and other spaces and land preparation for the commercial center and school site.

CHAPTER III
ALTERNATIVES CONSIDERED

CHAPTER III

ALTERNATIVES CONSIDERED

1. INTRODUCTION

The proposed Lahaina Master Planned Project has been designed to provide a mix of affordably priced rental and for-sale single and multifamily residential units and other amenities in West Maui that would be compatible with and add to housing inventory of the island.

In compliance with the provisions of Title 11, Department of Health, Chapter 200, Environmental Impact Statement Rules, Section 11-200-17(f), the "known feasible" alternatives to the proposed project are discussed in this chapter. Those alternatives which could "feasibly" attain the objectives of the project are described and evaluated. An exploration and evaluation of the environmental impacts of all reasonable alternative actions, particularly those that might enhance environmental quality or avoid or reduce some or all of the adverse environmental impacts, cost and risks, is included in order not to prematurely foreclose options which might enhance environmental quality or have less detrimental effects. In each case, the analyses have been sufficiently detailed to allow the comparative evaluation of the environmental benefits, costs and risks of the proposed action and each reasonable alternative. Also, in compliance with the applicable rules, the alternatives have been evaluated relative to their capability to meet the proposed project objectives as stated in Chapter II, Section 3.1. In addition to the preferred alternative (proposed project), the alternatives of no-action, alternative locations, alternative configurations of the project site and alternative uses of the project site property were evaluated.

2. EVALUATION OF ALTERNATIVES

2.1 PROPOSED ACTION - DEVELOPMENT AS DESCRIBED IN MASTER PLAN

The proposed project (Figure II-6) has been designed to provide a mix of residential units, in West Maui that would be affordably priced. The proposed project also includes a community center; expansion capabilities for the existing Lahaina Civic Center; public neighborhood parks and a major open space park; land for educational facilities; an internal roadway system and access ramps to the proposed Honoapiilani Bypass Highway; potable water supply, storage, transmission and distribution system; on- and off-site wastewater collection, transmission, treatment and disposal systems; on- and off-site electrical and communications distribution systems; on- and off-site surface water drainage system; a tsunami and civil defense warning system; and landscaped public roadways and walkways.

The analysis of the alternative configurations took into consideration several elements. This included the number of residential units that could be efficiently and economically located within the project boundaries, the opportunities and constraints of the site (Figure III-1) and public input and governmental agency input regarding the proposed project. Following the evaluation of all of the various elements, the preferred alternative (proposed project) was selected as the alternative that could best meet the objectives of the project; provides for the best internal and regional traffic flows and patterns; provides the greatest flexibility in phasing of construction; provides the most amenities; and allows the state's overall goals and objectives regarding affordable housing to be met in the most expeditious manner. As described in this EIS, development of the master planned community as described in the master plan and this EIS will have definite positive social and economic benefits. It is recognized that the proposed project will result in the loss of land that is currently under sugar cane cultivation. However, given the known pent-up demand and the forecast demand for affordable housing on Maui, particularly in the West Maui area; the lack of other state-owned land suitable for large-scale housing projects; the lack of significant adverse impacts on the state's overall diversified agricultural economy; the potential for increased diversified agricultural activity on Maui to serve the proposed project; and the general lack of adverse environmental impacts that would be caused by the proposed project, the proposed project is a beneficial use of the land. The proposed project will provide the necessary infrastructural system improvements required to serve the project; provide needed public parks and places (community center); enable the existing Lahaina Civic Center to be expanded as required to meet future needs; and provide needed recreational and commercial facilities.

2.2 "NO-ACTION" ALTERNATIVE

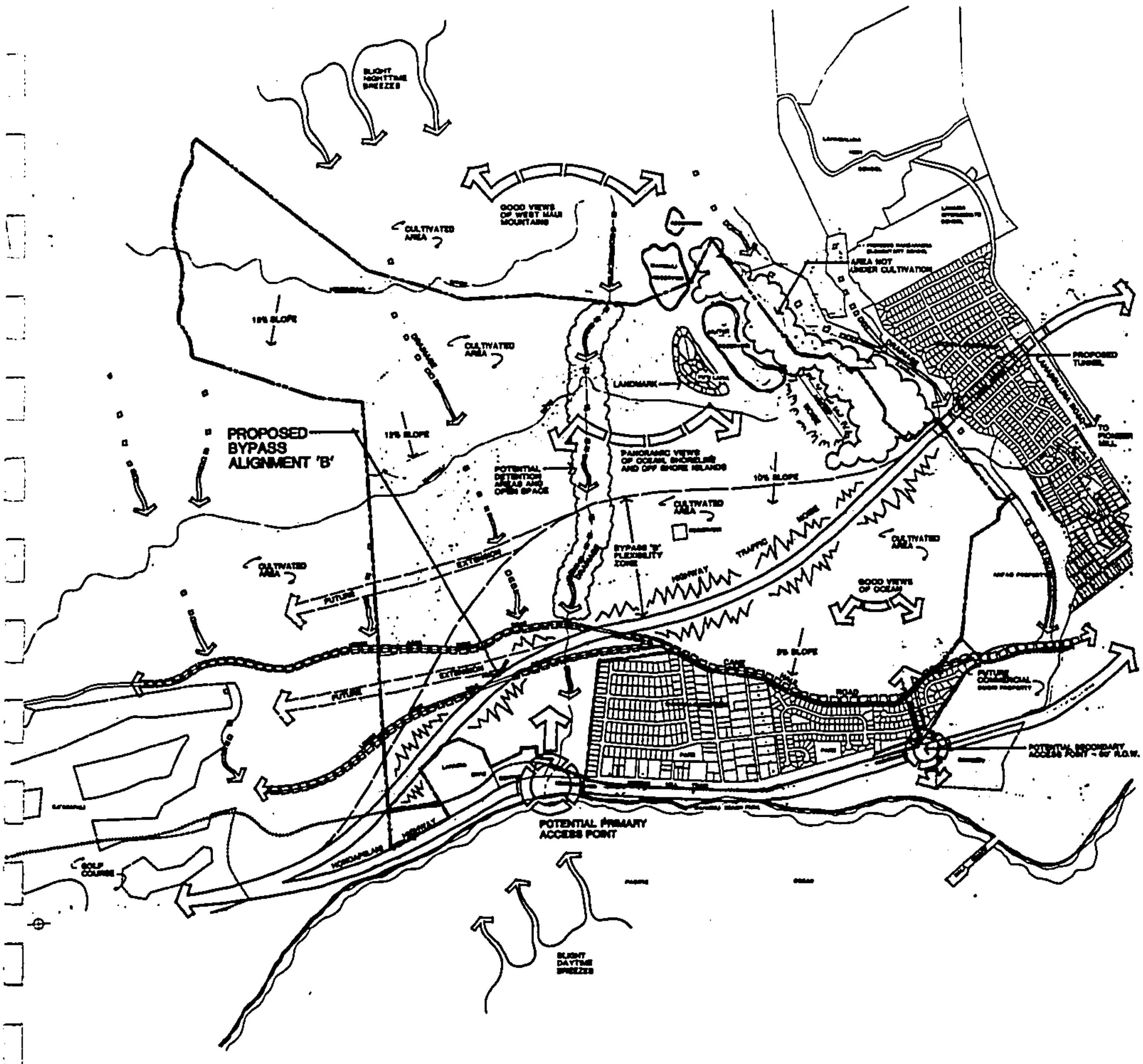
The "no-action" or "no-project" alternative would retain the present status of housing on Maui and retain the present agricultural use of the project lands. This alternative would not allow HFDC to attain its objective of increasing the affordable housing inventory on Maui, thereby retaining the present pent-up demand for affordable rental and for-sale housing. The adoption of this alternative would also be contrary to the objectives of the State Plan and State Housing Functional Plan; would be contrary to the state objectives of the proposed project; and would continue the present overcrowded housing condition on Maui and particularly in West Maui. Conversely, this alternative would retain the present agricultural uses of the land and the economic activity generated therefrom.

Because of the adverse social impacts of this alternative, i.e., not providing identified needed affordable housing, as well as not allowing HFDC to accomplish the purposes for which it exists and/or the objectives of the proposed project, this alternative was rejected.

2.3 ALTERNATIVE LOCATIONS

There were essentially three major state-owned parcels within the West Maui District that were considered by HFDC for housing use. All three were in agriculture at the time HFDC selected the Wahikuli site. The three sites included the selected Wahikuli site, a site at Honokowai and a site in Olowalu (Figure III-2).

The Honokowai site is closer to the Lahaina Wastewater Treatment plant than the selected site, which would reduce off-site infrastructure costs. However, because of its proximity to the flight



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Prepared by : **PBR HAWAII**

FIGURE III-1
OPPORTUNITIES AND CONSTRAINTS
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

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IGURE III-2
ALTERNATIVE SITES
LAHAINA MASTER PLANNED PROJECT
nvironmental Impact Statement

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patterns of the West Maui Airport, expansion capabilities were limited. Table III-1 compares the three sites that were examined by HFDC in terms of presently available services and accessibility.

Based on the comparative assessment conducted by HFDC, and confirmed in the Master Plan and this EIS, the selected Lahaina site had more existing support facilities and services than the other two sites. This has translated into less costs for on- and off-site infrastructure. Because of the lack of existing support facilities and services; higher development costs; and greater environmental impacts, the two alternative sites were rejected.

2.4 ALTERNATIVE SITE CONFIGURATIONS

In addition to the preferred alternative configuration for the Lahaina Master Planned Project, three other site configurations were examined in detail (Figures III-3 through III-5 and Tables III-2 through III-4). The three alternative layouts included essentially the same elements as the preferred alternative. However, phasing of construction, either regional or internal traffic flows and patterns or less than adequate locations of various elements, e.g., parks, schools, residential clusters, resulted in the rejection of the alternative layouts. Costs did not enter into the analyses because all four alternative layouts would be about equal in off- and on-site infrastructure and residential unit costs. Similarly, natural and/or physical environmental issues did not enter the site configuration decision process as impacts for any of the four sites would be about equal.

2.5 ALTERNATIVE USES OF SITE

The initial investigations of the project site and use of that site included a brief examination of other potential uses, i.e., for other than housing and/or existing agricultural purposes. Light and heavy industrial uses, possible resort uses and other agricultural uses, e.g. diversified agriculture, poultry, cut flower crops, etc. Industrial uses were rejected early in the analysis because of the proximity to existing residential subdivisions and the probable use of nearby privately-owned property for light industrial use. Following discussions with the present lessee of the property, continued and/or other agricultural uses were rejected because of market factors. That is, land for diversified agriculture is not limited on Maui and, as noted in the agricultural impact analysis report prepared for the proposed project (Appendix D), the Lahaina site does not offer climatic or other conditions that would favor the site for diversified agricultural use over another site on the island. In addition, use of the project site for something other than affordable housing would not allow the objectives of the project to be met. Because of the foregoing reasons, the alternative of using the site for other purposes was rejected.

TABLE III-1
COMPARISON OF ALTERNATIVE SITES

Evaluation Factor	Honokowai Site No. 1	Lahaina Site No. 2	Olowalu Site No. 3
Water Supply	None	None	None
Sewage Capacity	Limited	Limited	None
Drainage Capacity	Available	Available	None
Road Capacity	Available	None	None
Electricity Capacity	Available	Available	Only on Maui Hwy.
Public Transportation	None	None	None
Medical Center	None	None	None
Shopping Center	None	Available	None
Fire Station	None	Available	None
Medical/dental Clinic	None	Available	None
Police Station	None	Available	None
Post Office	None	Available	None
Private Transportation	Available	Available	Available
Pre-School	None	Available	None
Public School	None	Available	None

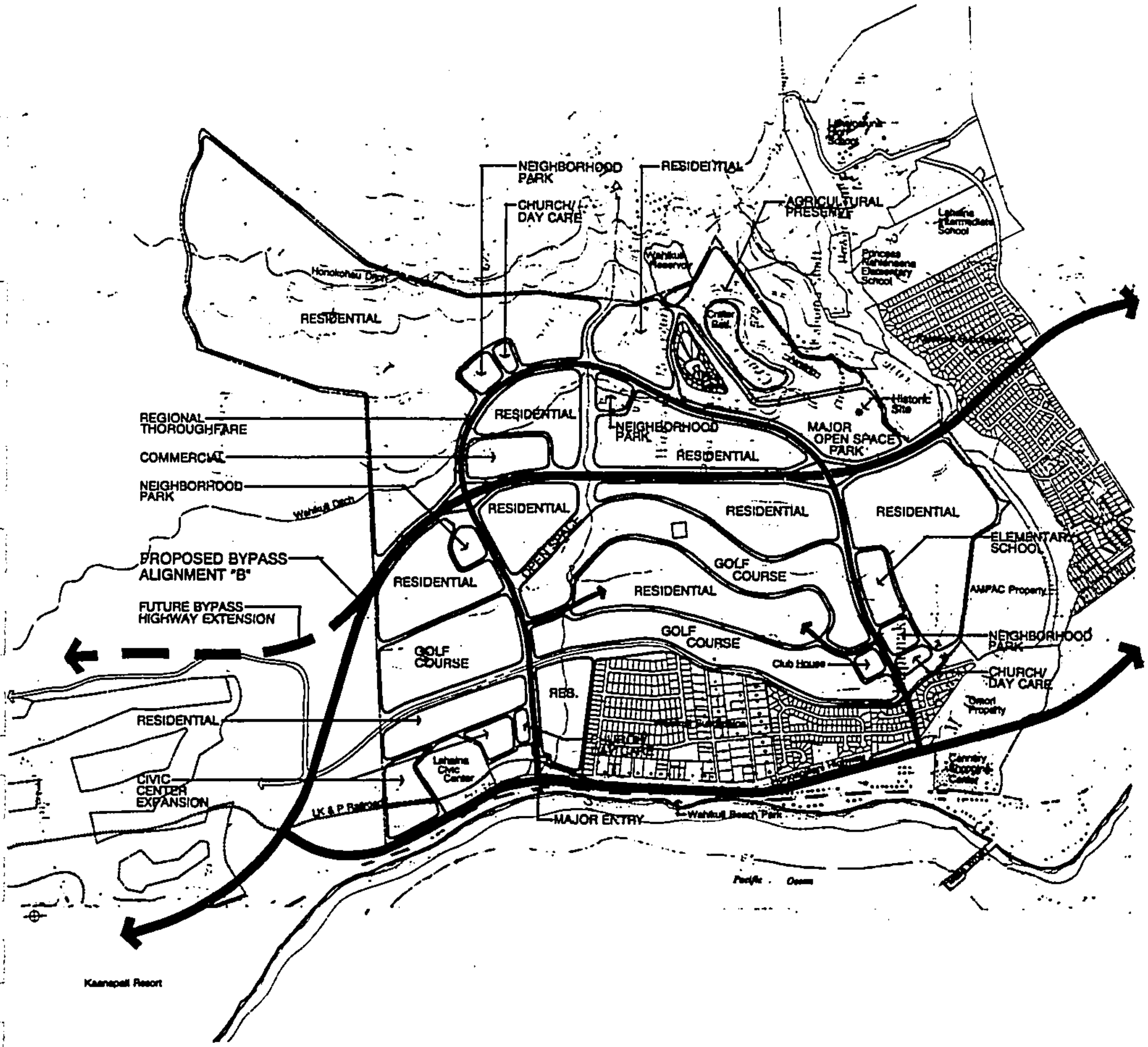

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FIGURE III-3
ALTERNATIVE MASTER PLAN A
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

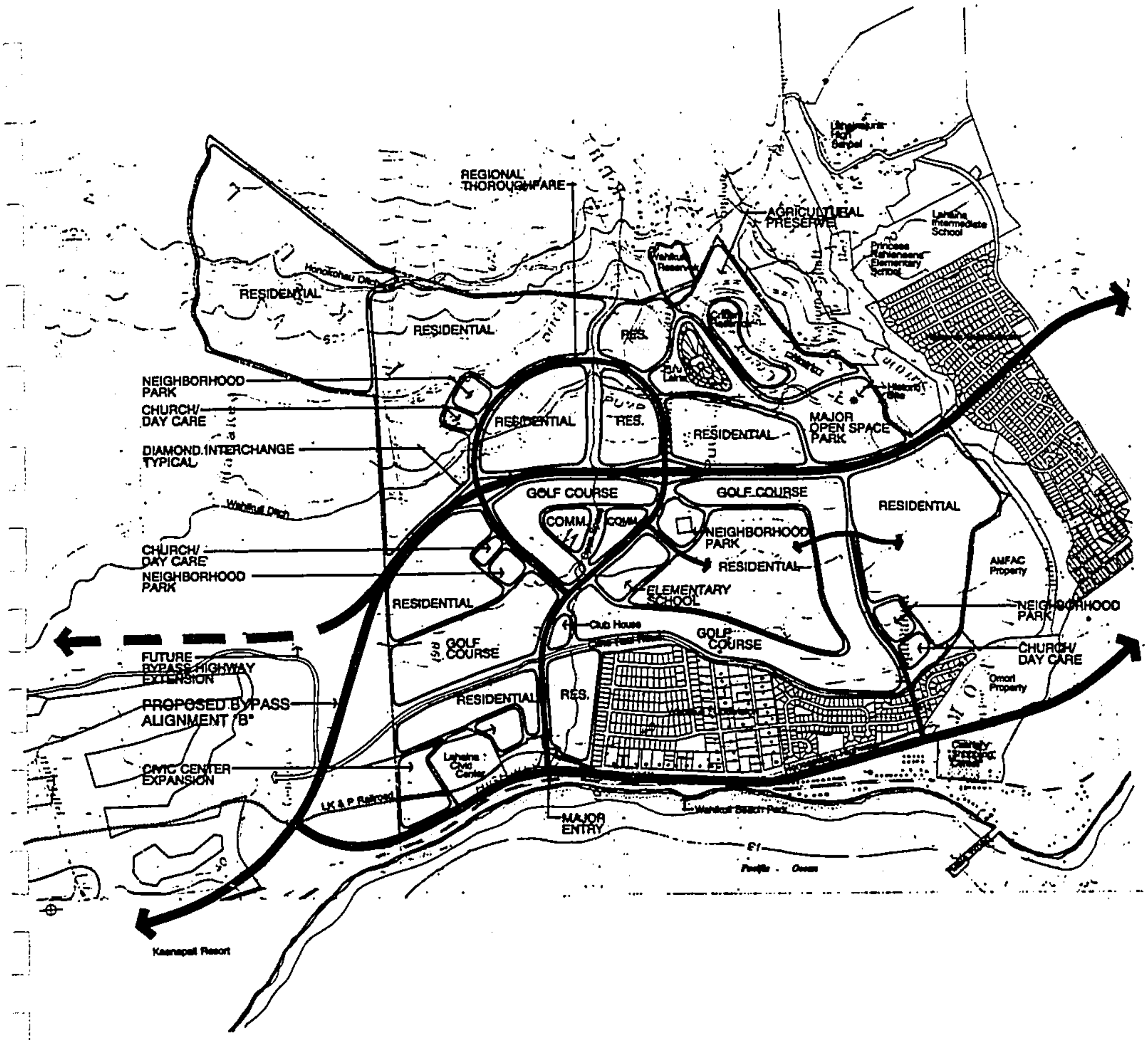

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FIGURE III-4
ALTERNATIVE MASTER PLAN B
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

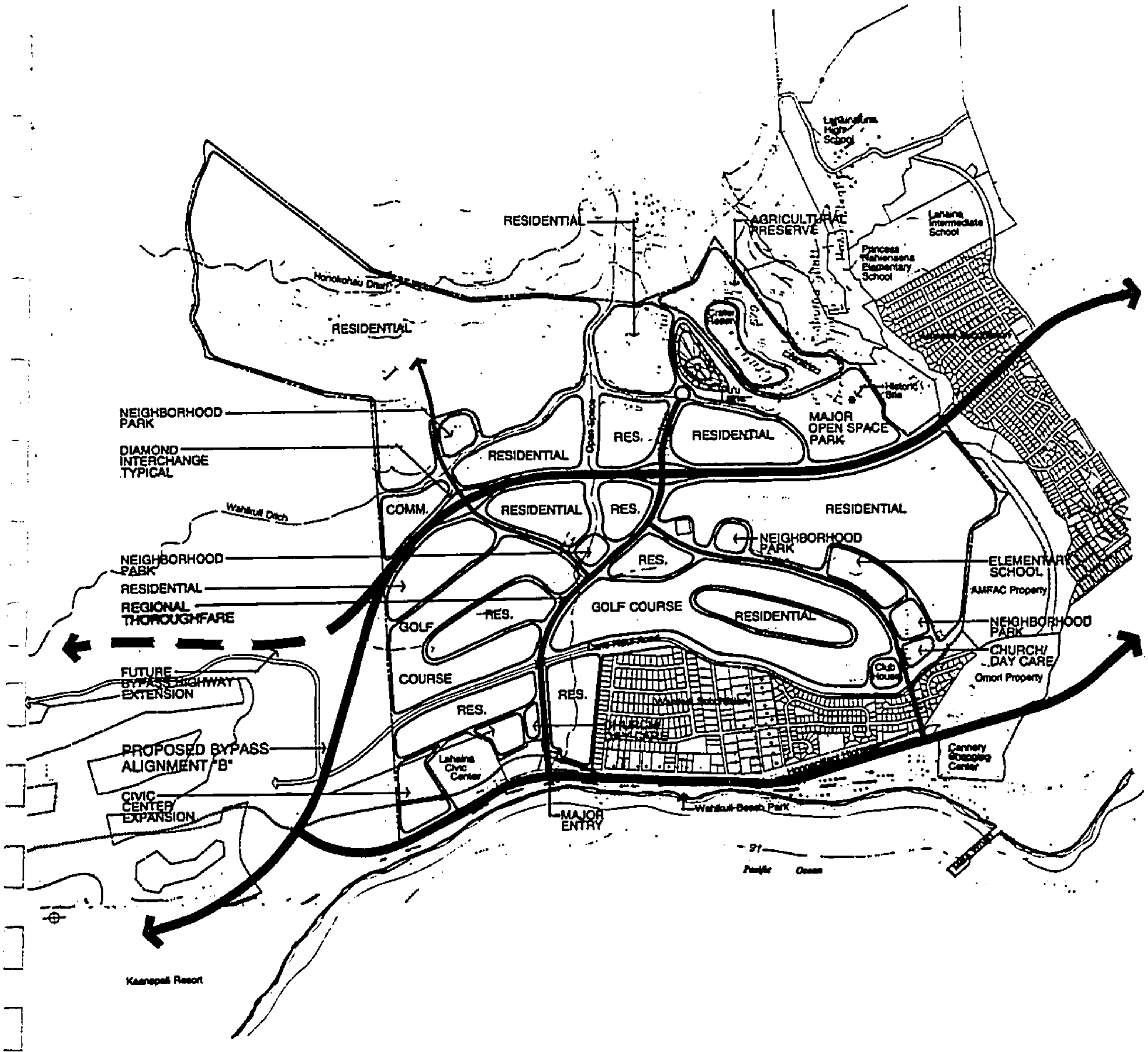

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FIGURE III-5
ALTERNATIVE MASTER PLAN C
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

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TABLE III-2

LAND USE SUMMARY
LAHAINA MASTER PLANNED PROJECT
ALTERNATIVE A

LAND USE	ACRES	PERCENT OF SITE	DENSITY	DU
Residential	± 730	65	6.56 DU/Ac	4,800
Parks/Open Space	± 60	5		
Commercial	± 16	1		
Elementary School	± 12	1		
AG Preserve	± 40	4		
Church/Day Care	± 6	1		
Civic Center Expansion	± 16	1		
Roads - Local (33) - Bypass Highway (27)	± 60	5		
Reservoir	± 1			
Golf Course	± 175	16		
Ditch	± 4	1		
TOTAL	±1120	100		4,800

TABLE III-3

LAND USE SUMMARY
LAHAINA MASTER PLANNED PROJECT
ALTERNATIVE B

LAND USE	ACRES	PERCENT OF SITE	DENSITY	DU
Residential	± 730	65	6.56 DU/Ac	4,800
Parks/Open Space	± 58	5		
Commercial	± 16	1		
Elementary School	± 12	1		
AG Preserve	± 40	3		
Church/Day Care	± 6	1		
Civic Center Expansion	± 16	1		
Roads - Local (33) - Bypass Highway (27)	± 62	5		
Reservoir	± 1			
Golf Course	± 175	17		
Ditch	± 4	1		
TOTAL	±1120	100		4,800

TABLE III-4

LAND USE SUMMARY
LAHAINA MASTER PLANNED PROJECT
ALTERNATIVE C

LAND USE	ACRES	PERCENT OF SITE	DENSITY	DU
Residential	± 730	65	6.56 DU/Ac	4,800
Parks/Open Space	± 60	5		
Commercial	± 16	2		
Elementary School	± 12	1		
AG Preserve	± 40	3		
Church/Day Care	± 6	1		
Civic Center Expansion	± 16	2		
Roads - Local (33) - Bypass Highway (27)	± 60	5		
Reservoir	± 1			
Golf Course	± 175	15		
Ditch	± 4	1		
TOTAL	±1120	100		4,800

3. COMPARATIVE EVALUATION

In general, none of the alternatives evaluated provide the degree of satisfaction of meeting the project objectives as well as the preferred alternative; have greater adverse environmental impacts; have higher on- and off-site infrastructural costs; have less expansion capabilities; are incompatible land uses for the area; and/or would not allow the state's overall goals and objectives regarding affordable housing to be met as well as the selected site and project. Because of potential adverse internal and regional traffic patters that would result from alternative configurations of the site, as well as potentially limiting construction phasing problems, the alternative configurations were rejected. Alternative uses of the property were also rejected because they do not meet the objectives of the proposed project by providing increased affordable housing opportunities in West Maui. Similarly, alternative locations are either too costly in terms of on- and off-site infrastructure costs or would not provide the level of services that the proposed project would. The alternative of no-action was also rejected because it would not allow the project objectives to be met and it would continue the present unsatisfied demand for affordable housing.

The preferred alternative satisfies the project objectives and provides the best opportunity to assist in the satisfaction of Maui's forecast residential/recreational/educational/commercial facility needs over the forecast period of development. Although each of the alternatives evaluated has merits that are worthy of consideration, none of the alternatives have as many or the degree of positive merits as the proposed project. The merits of each alternative investigated relative to the environmental resource issues discussed in Chapter IV are shown in Table III-5.

TABLE III-5

COMPARISON OF ALTERNATIVES, IMPACTS AND MITIGATION MEASURES

Environmental Resource	No Action	Alternative Sites	Alternative Configurations	Alternative Uses of Site	Preferred Alternative
Geology, Physiography, Soils		○	○m	○	■
Agricultural Potential		○	○m	●	○M
Groundwater, Hydrology, Surface Water, Drainage	○	○	○	○	■
Floods, Tsunamis			○		
Visual Attributes		○	○	○	■
Flora and Fauna		○		●	
Marine Environment	○	○	○	○	
Historical & Archaeological Resources	○	○	○	○	■
Socioeconomic Impacts	○	●	●	○	■
Transportation/ Traffic	○	●	●	○	■
Air Quality		○	○	○	■
Noise Quality		○	○	○	■
Water Supply		●	●	○	■

TABLE III-5

COMPARISON OF ALTERNATIVES, IMPACTS AND MITIGATION MEASURES
(Continued)

Environmental Resource	No Action	Alternative Sites	Alternative Configurations	Alternative Uses of Site	Preferred Alternative
Wastewater System	○	●	●	○	■
Solid Waste	○	●	●	○	■
Electrical Power, Communications	○	●	●	○	■
Police & Fire Protection	○	●	●	○	■
Health Care Services	○	●	●	○	■
Schools	○	●	●	○	■
Recreation Facilities	○	●	●	○	■
Land Use Plans, Policies, Controls	○	○	●	○	■

Legend: Blank = No Impact
○ = Potential Negative Impact
● = Potential Positive Impact
■ = Positive Impact
m = Potential Mitigation
M = Mitigation as Part of Alternative

See Chapter IV for discussion of existing conditions, probable impacts and mitigation measures.

CHAPTER IV
DESCRIPTION OF THE AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

CHAPTER IV

DESCRIPTION OF THE AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

1. INTRODUCTION

The general and/or specific physical, natural and social environmental characteristics, archaeological and cultural resources and infrastructure and public facilities serving the proposed project and area are described in the following sections of this chapter. The analyses presented herein are generally based on an assumed "worst case" situation that would include the construction of 4,800 residential units within the project boundaries. Should fewer units be constructed, it is presumed that potential impacts would be less for most environmental resource issue areas. Additionally, the information contained herein covers both the on- and off-site infrastructural components that will serve the proposed project. For ease of review and evaluation, information and analyses of the impacts of the proposed project are provided from the standpoint of existing conditions, probable impacts and mitigation measures that would be required to minimize potential adverse impacts. The information contained in this chapter has been developed from (1) specific field and/or office environmental, engineering or planning studies conducted specifically for this project, the Master Plan and this EIS; (2) the input, advice, guidance and information provided by public agencies, private groups, organizations and residents of the project area, prior to and during the development and review of this EIS; and (3) comparisons and evaluations by specialty consultants (see Chapter 1, Section 13) of the proposed project relative to similar planned or existing housing projects.

2. PHYSICAL ENVIRONMENT

2.1 GEOLOGY, PHYSIOGRAPHY, SOILS AND AGRICULTURAL POTENTIAL

2.1.1 Existing Conditions

2.1.1.1 Geology and Physiography

The project site is located at the base of the West Maui Mountains which are derived from volcanic eruptions of the West Maui Volcano and subsequent erosion which created the deep valleys and incisions found today (Figure IV-1). The project area geologically is characterized by Wailuku basalt as the parent rock and lavas of the Lahaina volcanic series. The Wailuku basalt is the primary and most widespread formation in West Maui while the Lahaina series is restricted to a few outcrops near Lahaina town. Puu Laina, in which Crater reservoir is located, is the focus of the Lahaina series rocks. Typically, the volcanic basalt in the project area is thin-bedded a'a and pahoehoe lavas which erupted chiefly through narrow cracks so that only a few cinder cones were produced. Toward the close of the eruptive period (Pleistocene), violent explosions are indicated by interstratified beds of tuff and agglomerate containing large blocks.

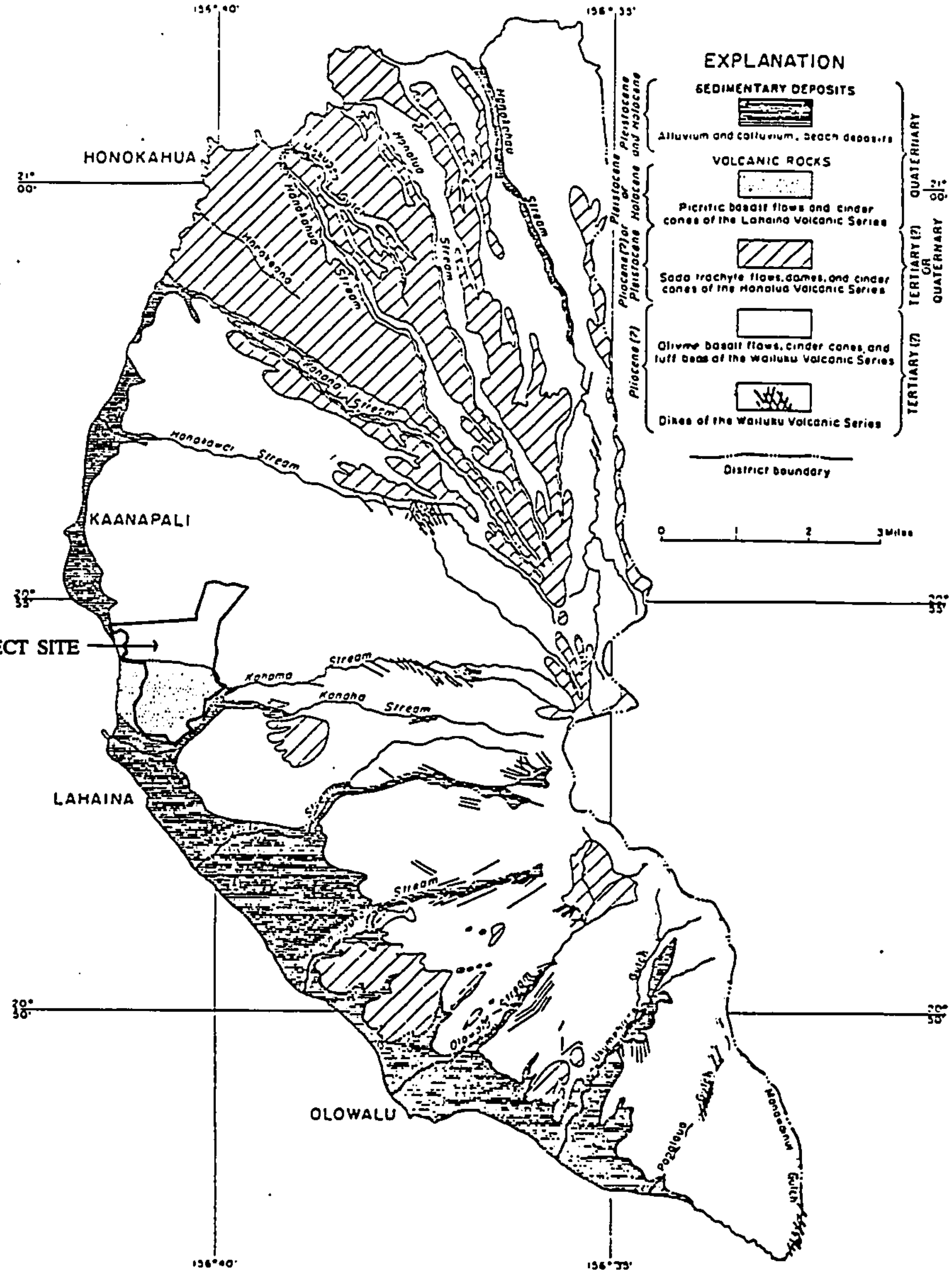
There are no known geothermal or other thermal resources below the project site. In the early 1980's, Pioneer Mill and others investigated the possibility of utilizing hot water found in the vicinity of the project site for mill steam purposes, the project was abandoned because of the low temperature of the water and high costs of development.

Physiographically, the site slopes downward in an easterly direction, from an elevation of about +800 feet Mean Sea level (MSL) at the northeast corner to about +10 feet MSL along the Honoapiilani Highway (Figure IV-2). The project area slopes range from about 6 percent to about 12 percent.

2.1.1.2 Soils

The soils of the project site include eight soil categories as defined by the US Department of Agriculture, Soil Conservation Service (1972), and as confirmed by soil borings on the project property. The project site soil categories are described below and shown on Figure IV-3. The soils of the project site are further described in Appendix C to this EIS.

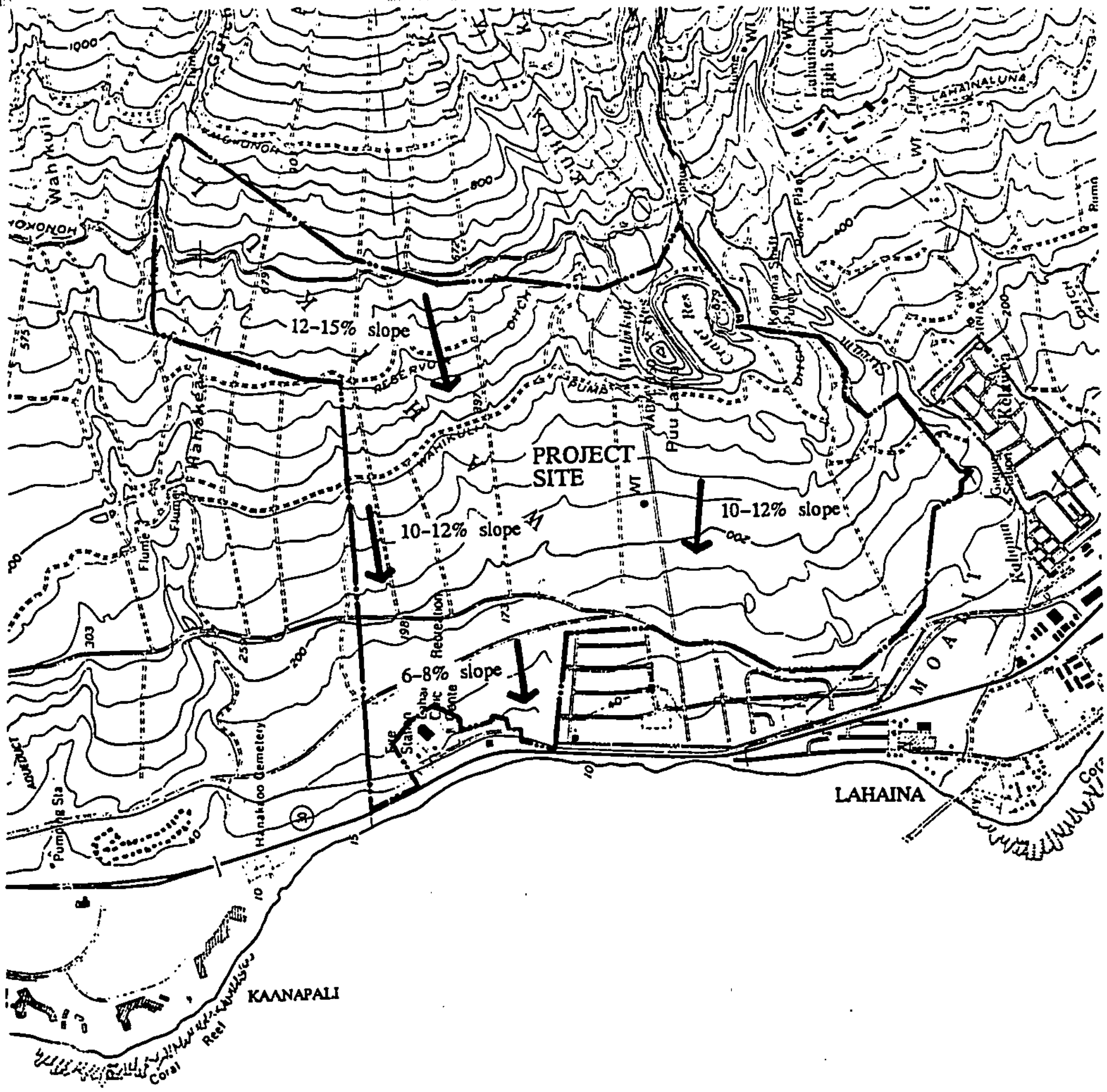
> Lahaina Silty Clay, 3 to 7 percent slopes, severely eroded (LaB): Approximately 39 acres of the site is of this soil type. This soil has a profile wherein most of the surface layer and, in places, part of the subsoil have been removed by erosion. A few areas are eroded to soft, weathered rock. In places there are small dunes formed by wind-drifted soil material. Blown-out spots occur between the dunes. The erosion hazard is moderate to severe. This soil is used for pasture and wildlife habitat. Capability classification is IIIe if irrigated, IVe if non-irrigated; sugar cane group 1; pineapple group 2; pasture group 3; and woodland group 1.
>
> Lahaina Silty Clay, 7 to 15 percent slopes (LaC): About 177 acres of the project site are in this soil type. In this soil, runoff is medium and the erosion hazard is moderate. In this category, there are small steep areas and areas where a few cobble stones and stones are on the surface. This soil is used for sugar cane and pineapple. Small acreages are used for truck crops, pasture and wildlife habitat. Capability classification is IIIe if irrigated or non-irrigated; sugar cane group 1; pineapple group 3; pasture group 3; and woodland group 1.
>
> Lahaina Silty Clay, 15 to 25 percent slopes (LaD): Approximately 19 acres of the project site are in this soil type. On this soil, runoff is medium and the erosion hazard is moderate. This group includes places where most of the surface layer and part of the subsurface has been removed by erosion. This soil is used for sugar cane. Capability classification is IVe, irrigated or non-irrigated; sugar cane group 1; pineapple group 3; pasture group 3; and woodland group 1.



source: GENERALIZED GEOL. MAP OF LAHAINA DISTRICT
YAMANAGA & HUXEL, 1969

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

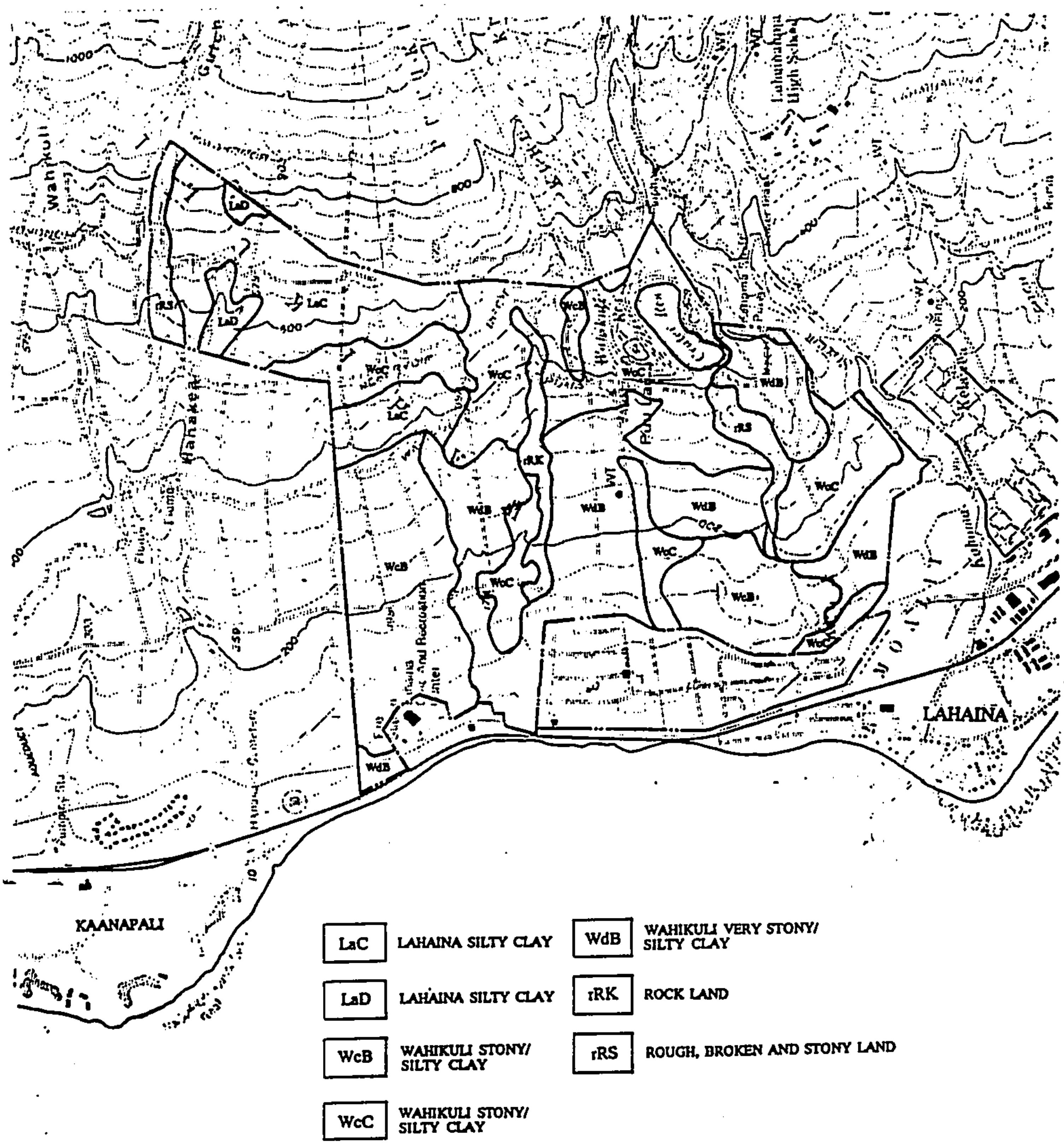
FIGURE IV-1
GEOLOGY
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement



source: USGS 1983

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE IV-2
TOPOGRAPHY
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement



source: DEPT. OF AGRICULTURE, SOIL CONSERVATION SERVICE AUGUST 1972

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE IV-3
SOILS
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

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Wahikuli Stony Silty Clay, 3 to 7 percent slopes (WcB): About 222 acres of the project site are in this soil type. This soil is used for sugar cane and some homesites. The soil is generally good for cultivation except that there are enough stones on the surface to hinder cultivation. Capability classification is IIe if irrigated; IVs is non-irrigated; sugar cane group 1; pasture group 3.

Wahikuli Stony Silty Clay, 7 to 15 percent slopes (WcC): This soil group is similar to WcB, except that there are enough stones in the surface layer to hinder cultivation. About 290 acres of the project site are in this soil group. Runoff is slow to medium and the erosion hazard is slight to moderate. This soil type is used mostly for sugar cane and a small amount is used for homesites. Capability classification is IIIe if irrigated, IVe if non-irrigated; sugar cane group 1, pasture group 3.

Wahikuli Very Stony Silty Clay, 3 to 7 percent slopes (WdB): About 302 acres of the project site are in this soil type. This soil is similar to Wahikuli silty clay, 3 to 7 percent slopes, except that as much of 3 percent of the surface is covered with stones. In some areas, as much as 15 percent of the surface is covered with stones. This soil is used mostly for sugar cane and a small acreage is used for homesites. Capability classification is IVs if irrigated, VIs if non-irrigated; sugar cane group 1; pasture group 3.

Rock Land (rRK): Rock land is made up of areas where exposed rock covers 25 to 90 percent of the surface. It occurs on all major Hawaiian islands. About 11 acres of the site, all within the gulches on the site, are Rock Land. The rock outcrops and very shallow soils are the main characteristics of this soil type, with basalt and andesite the principal rock types. This land type is nearly level to very steep. Rock Land is used for pasture, wildlife habitat and water supply. This land type is also used for urban development. The soil has high shrink-swell potential and buildings on steep slopes are susceptible to sliding when the soil is saturated. Foundations and retaining walls are susceptible to cracking. Capability classification is VIIs, non-irrigated.

Rough Broken and Stony Land (rRS): Rough broken and stony land consists of very steep stony gulches. The local relief is generally between 25 and 500 feet. Runoff is rapid and geologic erosion is active. About 60 acres of the project site, within the gulch at the northern boundary of the site and the gulch below Crater Reservoir, are in this soil type. The soil material is generally less than 20-inches deep over saprolite or bedrock. About 3 to 25 percent of the surface is covered with stones and there are a few rock outcrops. This land type is used for pasture, wildlife habitat and watershed. Capability classification is VIIs, non-irrigated. The dominant natural vegetation consists of lantana, koa haole, feather fingergrass, bermudagrass and ililma.

Based on project site soil borings, the predominant soil is the Wahikuli Stony Silty Clay (WcB), which is fine textured and dark reddish brown. The soil has been influenced to some extent by volcanic ash from local cinder cones. Laboratory testing on the silty clay indicated only slight to moderate expansion potentials, both in remolded and in situ sample testing (Appendix C).

2.1.1.3 Agricultural Potential

Agriculturally, the project site includes Prime Agricultural Land and Other Important Agricultural Land as defined under the Agricultural Lands of Importance to the State of Hawaii (ALISH) classification. Prime Agricultural Land is defined as land which has the soil quality, growing season and moisture supply needed to produce sustained high yields of crops economically when treated and managed according to modern farming methods. Other Important Agricultural land is defined as land other than Prime or Unique Agricultural land that is also of statewide or local importance for agricultural use. The project lands have been further classified as A, B and C with areas below and around Crater Reservoir and in the gulches, classified as E (Figure IV-4). These designation define the relative productive capabilities of the agricultural lands with A being the highest quality and E the lowest.

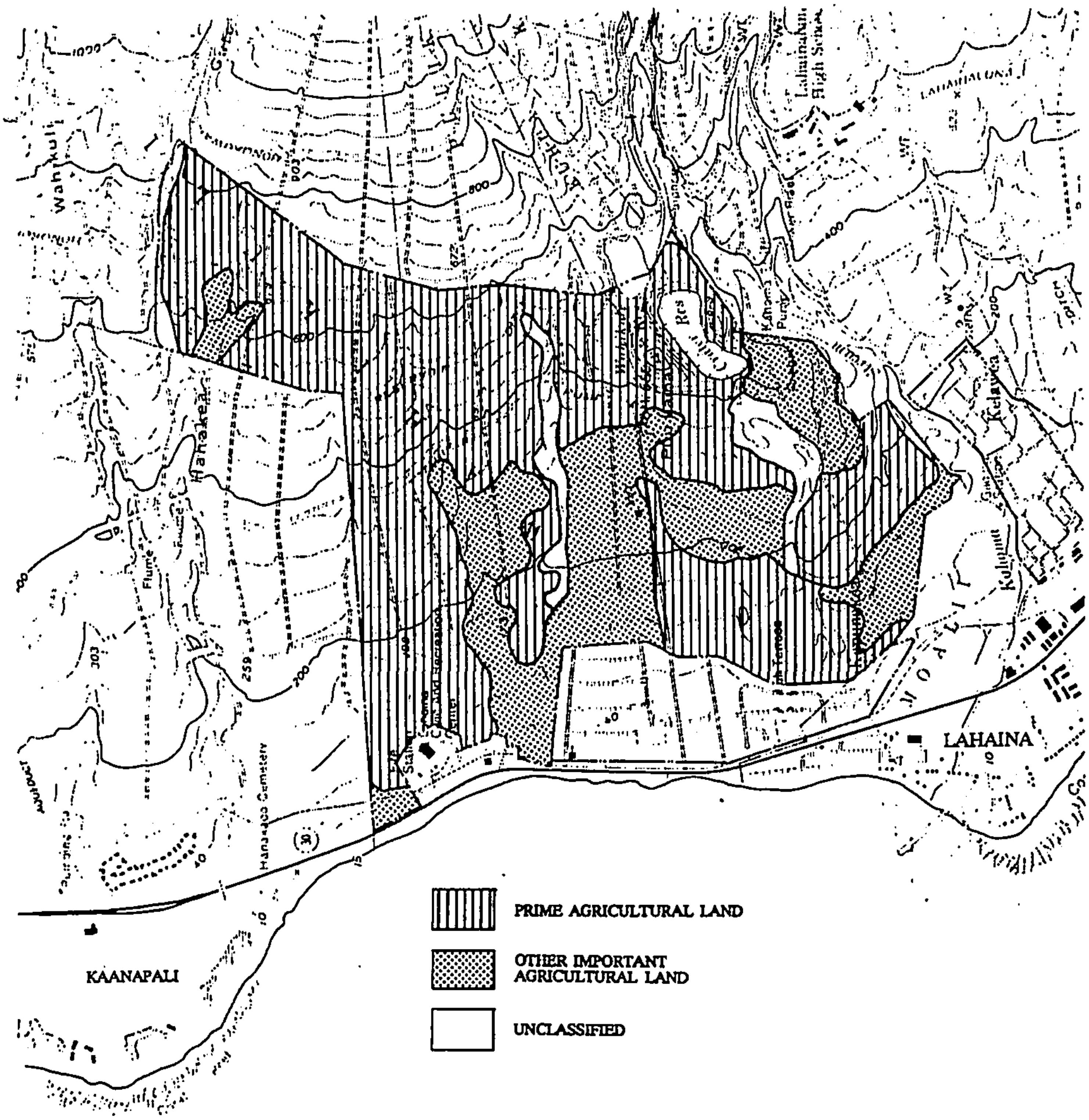
An agricultural impact analysis study, to determine the impact of the proposed project on the agricultural potential of the project site has been performed and is included as Appendix D to this EIS. The following is excerpted from that study.

<u>On-site Soil Characteristics and Agricultural Ratings</u>: The majority of the project site is currently under sugar cane cultivation by Pioneer Mill Company, Ltd. (PMCo), a subsidiary of AMFAC/JMB (Amfac).

Table IV-1 shows the soil types, approximate acreage, possible agricultural uses, and two soil ratings (explained below). The predominate soil types - LaC, WcB, WcC, and WdB - comprise about 88 percent of the Lahaina Master Planned Project area. Suitable agricultural activities associated with most of the affected soil types are primarily sugar cane, with about 19 percent of the land suitable for pineapple and truck crops (soil types LaB and LaC).

Agriculturally, the soils on-site have been rated (see Table IV-1) in terms of four classification systems commonly used in Hawaii: (1) Land Capability Grouping by the U.S. Department of Agriculture Soil Conservation Service (SCS); (2) Agricultural Lands of Importance to the State of Hawaii; (3) Overall Productivity Rating; and (4) Proposed Land Evaluation and Site Assessment (LESA). These classification systems are discussed in detail in Appendix D. Based on these surveys approximately two-thirds of the site is comprised of good soils.

Under the system of Agricultural Lands of Importance in the State of Hawaii (ALISH) [by the SCS, University of Hawaii (UH) College of Tropical Agriculture and Human Resources, and the State of Hawaii, Department of Agriculture] lands are classified into three categories: (a) prime agricultural land which is land that is best-suited for the production of crops; (b) unique agricultural land (non-prime, specific high-value crops); and (c) other agricultural land which is



source: DEPT. OF AGRICULTURE, STATE OF HAWAII JANUARY 1977

Prepared for: Housing Finance and Development Corporation
Prepared by: PBR HAWAII

FIGURE IV-4
ALISH
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

TABLE IV-I

SOIL TYPES, ACREAGES, AGRICULTURAL USES AND RATINGS

SOIL TYPE	ACREAGE	AGRICULTURE USES	SCS RATING	LESA RATING[1]
LaB	39	Sugar, Pineapple, Truck Crops, Pasture	IIe	90
LaC	177	Sugar, Pineapple, Truck Crops, Pasture	IIIe	82
LaD	19	Sugar	IVe	66
rRK	11	Pasture	VIIs	18
rRS	60	Pasture	VIIs	18
WcB	222	Sugar	IIe	82
WcC	290	Sugar	IIIe	74
WdB	302	Sugar	IVs	51

[1] SCS Land Capability Rating, ranging from highest (Level I) to lowest (Level VIII). Subclassification "e" indicates a risk of erosion; "s" represents problems of stoniness. Assumes all soils are irrigated except rRK and rRS which are not irrigated.

Source: U.S. Department of Agriculture, Soil Conservation Service, Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii, August 1972.

of importance to the production of crops. Approximately 68 percent of the land on-site is rated as "prime" agricultural lands, and 26 percent of the lands are rated as important to the production of crops.

The Overall Productivity Rating [UH Land Study Bureau (LSB)] classifies soils according to five levels, with "A" representing the class of highest productivity and "E" the lowest. About 16 percent of the site has soils rated "A," 40 percent rated "B," 33 percent rated "C," and 11 percent rate "E." None of the soils are rated "D."

The Proposed Land Evaluation and Site Assessment (LESA) System, (State of Hawaii Land Evaluation and Site Assessment Commission) evaluates soil quality, locational attributes, improvements, nearby activities and land use plans. If the proposed LESA classified approach were applied to the site (Table IV-1), 94 percent of the designated lands (all but soil types rRk and rRs) would be termed "important agricultural lands" (IAL), which would include all lands having a rating of 51 or above, out of a possible total of 100. The designation could be changed if an overriding public benefit were demonstrated.

Supply and Diversity of Prime Agricultural Land: The trend in Hawaii since 1968 is that much acreage of prime agricultural land has been freed from sugar and pineapple production, for conversion to other diversified agriculture, aquaculture and urban uses. This trend will likely continue on a statewide basis; sugar plantation closings and conversion to other uses are occurring due to the unfavorable outlook of sugar prices. The island of Maui, in comparison to other islands, has less land available for diversified agriculture due to a tight land market and urbanization pressures.

Agricultural Production: PMCo, founded in 1860, is the smallest sugar operation in the state. In 1987, PMCo cultivated 6,922 acres of sugar cane lands, (including the subject site), a reduction in size from 1981 of 8,386 acres. The reduction reflects the loss of land due to urbanization as well as requirements to compensate for loss of water to other activities. A portion of the PMCo property is owned by AmFac and a portion (including the project portion) is owned by the State of Hawaii and leased by PMCo.

Favorable conditions exist on-site for growing sugar cane, including good soil quality, favorable terrain and a leeward island location having many sunny days. In 1987, sugar yields of PMCo were slightly higher than the state average, and were higher than 1981 productivity on-site. The increased yields reflect a better water balance, conversion to drip irrigation, improved varieties of cane and improved farming practices. In terms of production, it is estimated that the project site acreage produces about 7,705 tons per year of sugar cane, about 2,586 tons of molasses and generates about 1.2 million kilowatt hours of electricity. This translates into about $3.0 million in export revenue to PMCo or about 18 percent of the total PMCo annual export revenues. (Refer to Appendix D for detailed discussion on agricultural production).

2.1.2 Probable Impacts

The proposed project is not expected to significantly affect the geology of the project site or area. The grading and excavation work required for the project home sites, parks and golf course, will affect the physiography of the site to a relatively minor extent. To the degree possible, existing grades will be used to provide visual relief and to reduce construction costs. The soils of the project will also be affected to a minor extent. The use of retention areas within the development will reduce the potential for soil erosion.

Subsurface soil conditions are not expected to adversely affect development of the site or be affected by development of the site. The silty clays are generally in a stiff condition and excessive settlement due to building loads, as well as fill placement, is not expected. The soils covering the project site generally exhibit low to moderate expansion potentials and will not require replacement with less expansive soils.

Impacts to the agricultural potential of the project site have been estimated in terms of the loss of sugar cane production (tons), loss of agricultural jobs, impact on growth of diversified agriculture on Maui and in the state and impact on the visual resources of the area.

In terms of the loss of agricultural jobs, the proposed project is estimated to result in the loss of about 52 jobs. However, given the extremely tight labor market on Maui, and in the state (see Section 5.0 below), it is likely that those workers would be transferred to other PMCo agricultural positions such that there would not be a loss of jobs.

In terms of diversified agriculture, the proposed project is not expected to adversely affect the statewide growth of diversified agriculture and probably would have little if any affect on diversified agriculture on Maui. The latter is due to a number of factors including competition for land and water resources, competition from other areas and the lack of unique locational characteristics favoring the project site.

2.1.3 Mitigation Measures

Because no significant impacts to the geology, physiography or soils of the project site or area are expected to result from or to the proposed project, mitigation measures, other than standard engineering and building design practices, are not warranted. Similarly, although the project area would be removed from productive agricultural use, significant adverse impacts to the overall statewide and/or Maui sugar cane production levels are not expected. There will be a loss of agricultural jobs at the project site but those jobs would be absorbed in other agricultural operations of PMCo. Appropriate engineering and landscape design measures will be taken to retain as much of the present green backdrop as possible.

2.2 GROUNDWATER, HYDROLOGY, SURFACE WATER AND DRAINAGE

2.2.1 <u>Groundwater and Hydrology</u>

2.2.1.1 Existing Conditions

The groundwater and hydrology of the project area have been analyzed specifically for the proposed project (Mink, 1989). Estimates of groundwater flow toward the shoreline of the area makai of the project site are in the range of 4.5 to 5.0 million gallons per day (mgd) per mile of coastline (Mink, 1989). In general, the groundwater aquifer below the project site is highly permeable and groundwater flow is not impeded by a caprock at the coast (Figure IV-5). The groundwater floats as a basal lens on sea water and, as noted above, discharges in a narrow band along the coast. Evidence of the freshwater lens along the coastline is seen in the salinity measurements taken as part of the marine survey performed for this project (see Section 3.3 below). To the north and south of the project site, small coastal plains of alluvium weakly retard groundwater outflow.

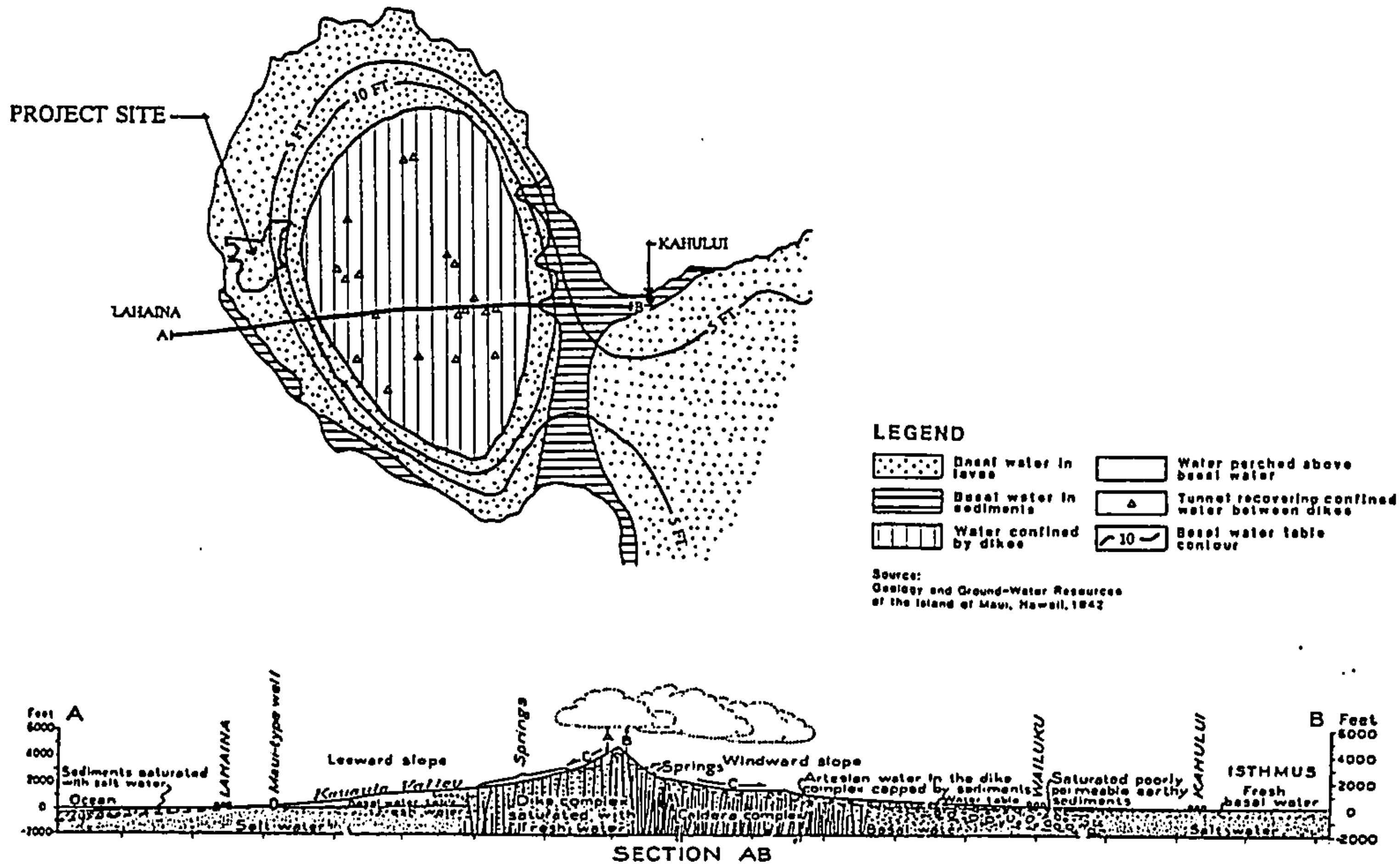
The groundwater lens is unconfined and the water table increases parabolically until the basal lens meets the high level dike compartment aquifers of the rift zone about at the Forest Reserve line. The groundwater head rises from near zero at the coastline to approximately 5 feet at a distance of about 11,000 feet inland. At the inland boundary of the project site property, the groundwater head is about 4 feet.

Groundwater development in the project area includes county (Kanaha and Waipuka wells) and private wells or pumps (Kaanapali Resort and Pioneer Mill Co. respectively). There are no wells presently located on the project property. In general, the county wells, which supply the town of Lahaina, provide good quality potable water. However, on occasion, water from the Kanaha wells is more saline than desireable, partially because of an oversize pump [900 gallons per minute (gpm)] on one well and an unusual depth of penetration (95 feet below sea level) of the other well.

The Pioneer Mill pump station (Pump M) is a principal supply station for the plantation and has a pumping capacity of 10.4 mgd and an averaged output of 7 to 9 mgd. The salinity reaches about 1,000 mg/l chloride, which is acceptable for irrigation purposes but not for potable water purposes. The Kaanapali Resort wells provide irrigation water that is moderately saline. Total quantities pumped are not known but the three wells are fitted with 1,000, 450 and 625 gpm pumps respectively.

2.2.1.2 Probable Impacts

Based on engineering analyses, average potable water demand for the completed Lahaina Master Planned Project is estimated to be about 4.2 mgd, equivalent to about 900 gpd/unit (see Section 6.5). Brackish groundwater and/or surface water will be used for irrigation of the golf course, parks and street landscaping. Existing supply sources cannot provide water to the proposed



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Prepared by : PBR HAWAII

FIGURE IV-5
HYDROGEOLOGIC SECTION
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

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project. Therefore, new water development will be required. Based on the preliminary analyses performed, the most feasible potable water source will be groundwater pumped from the basal lens in state and/or private land about 1.7 miles inland of the coastline at about the +880 to +900-foot [above mean sea level (MSL)] elevation. Groundwater opportunities reasonably close to the project site are constrained by allowable pump capacity. A single well would be limited to a capacity of 400 to 450 gpm and will require drilling from ground elevation of +1050 feet MSL to +35 feet MSL. It is estimated that six wells rated at 400 to 450 gpm will be needed for the project and two additional wells will be required for standby purposes. Individual capacities greater than 450 gpm will almost certainly lead to salinities that are unacceptable for domestic purposes. Brackish groundwater for golf course, etc. irrigation purposes would be developed on-site by the golf course operator.

2.2.1.3 Mitigation Measures

Given the existing quantity of groundwater flux (4.5 to 5.0 mgd per mile of coastline), the development of additional wells to supply the proposed project is not expected to adversely affect existing water supplies. As such, measures to minimize potential adverse impacts are not warranted. Detailed engineering analyses and design studies will be performed prior to construction of the proposed housing units and/or infrastructural components to assure that adequate groundwater is available for potable and golf course/parks irrigation purposes.

2.2.2 Surface Water and Drainage

2.2.2.1 Existing Conditions

Engineering analyses of present and future surface water and drainage patterns have been performed specifically for the proposed project (Unemori Engineering, Inc., 1989). In addition, a Flood Insurance Rate map (FIRM) for the project area has been produced by the Federal Emergency Management Agency (FEMA) (Figure IV-6). As shown on Figure IV-6, with the exception of a small are near the Lahaina Civic Center, the project site is absent of flood hazards. Flooding does, however, occur in the gullies and gulches on the northerly and southerly sides of the project site. As indicated in the engineering report (Unemori Engineering, Inc., 1989), and in preceding sections of this EIS, sugar cane is currently grown on nearly all of the project site. Sugar cane is also being cultivated on the slopes approximately 8000 feet above site. This cultivation limits surface water runoff from the project site. A small drainage gully on the north borders the project site. Kahoma Stream represents its southerly demarcation (Figure IV-7). Two large irrigation reservoirs for Pioneer Mill Company are also situated at the southeast corner of the site, adjacent to Kahoma Stream. Two other drainageways bisect the project site is a east to west (mauka-makai) direction. These gullies converge south of the Lahaina Civic Center. Flows in these gullies are presently conveyed across Honoapiilani Highway into the ocean by three 48-inch reinforced concrete culverts (RCP). The combined capacity of the three culverts is estimated to be 210 cubic feet per second (cfs).

Storm runoff in the north gully flows across Honoapiilani Highway through a 48-inch culvert. The capacity of this drainage culvert is estimated to be 70 cfs. Runoff from approximately 300 acres at the southwesterly corner of the project site presently flows along the cane haul road into Hawaii Omori's property mauka (east) of Honoapiilani Highway, then along Kapunakea Street to the ocean.

Assuming a situation where 50 percent of the field is in a harvested mode, the current estimate of total on-site runoff for a 100-year recurrence interval storm is 2,130 cfs. Off-site runoff from the mauka land is calculated to be 1,778 cfs.

2.2.2.2 Probable Impacts

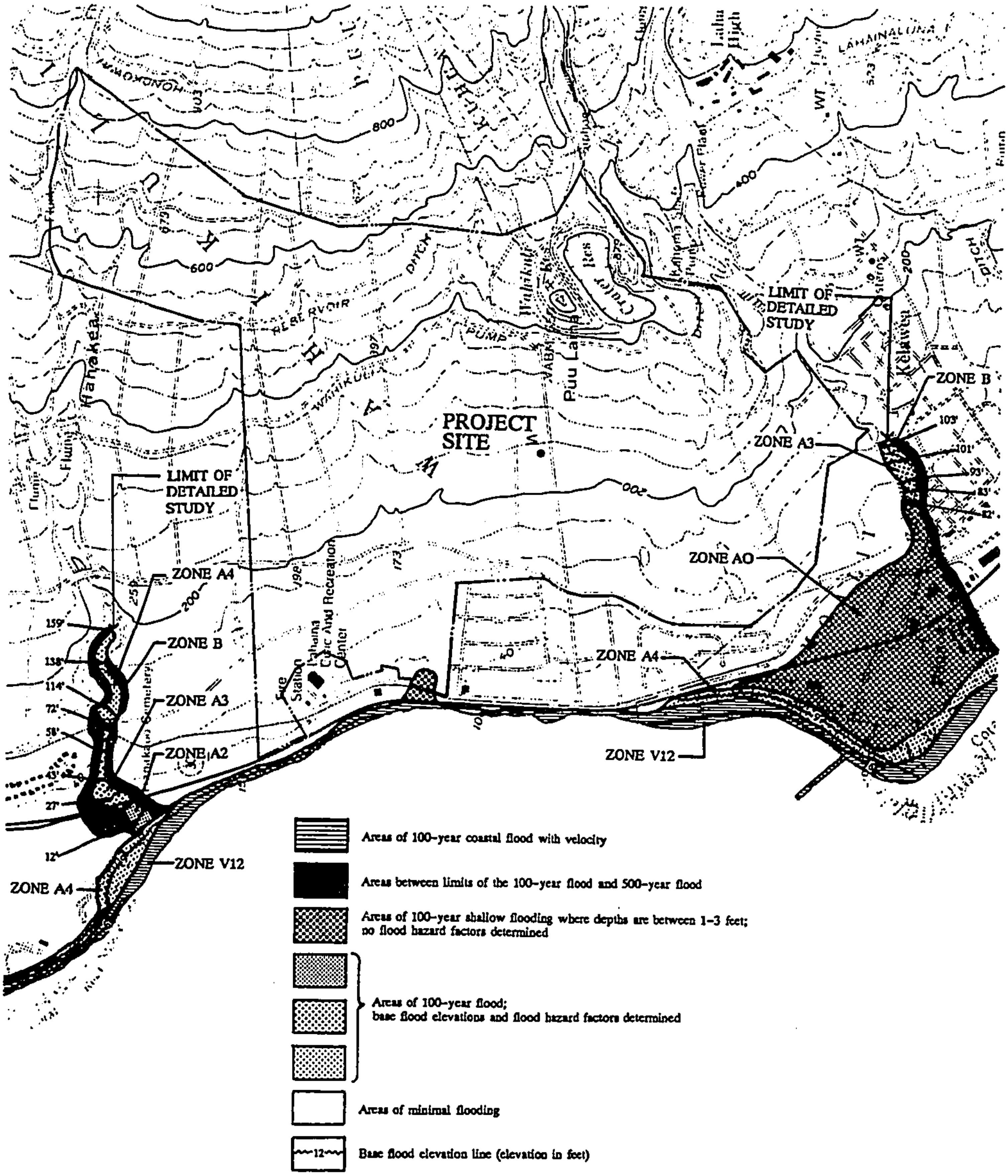
Based on engineering analyses, the project site and project drainage has been evaluated as six (6) drainage areas (Figure IV-7) (Unemori Engineering, Inc., 1989). Drainage Area No. 1 is the mauka lands; Drainage Area No. 2 is the area discharging into the existing 48-inch RCP culvert at the northwest corner of the site; Drainage Area No. 3 encompasses lands mauka of Pioneer Mill Company's cane haul road to the makai (west) boundary of Drainage Area No. 1; Drainage Area No. 4 includes land makai of the cane haul road which discharges into the existing three 48-inch RCP culverts; Drainage Area No. 5 includes lands at the southeast end of the project site which will discharge into Kahoma Stream; and Drainage Area No. 6 includes lands at the southwest corner of the site which will discharge through Hawaii Omori's property into Kahoma Stream.

Retention basins will be designed as part of open spaces and will be constructed in appropriate locations for Drainage Areas No. 2, 3, 4 and 6. The retention basins will serve to absorb the peak surface runoff volumes and provide sediment settling before the runoff is released at controlled rates to designated outlets.

Drainage Area No. 2 will continue to flow toward the existing 48-inch RCP culvert. This culvert size will need to be increased to handle approximately 478 cfs. As previously mentioned, the present capacity of the system is 70 cfs. This system needs to be upsized to the equivalence of a 102-inch diameter culvert.

The 130 cfs of surface runoff generated from Drainage Area No. 4 will continue to flow to the existing three 48-inch RCP culverts. Runoff from Drainage Area No. 3 will be collected in a retention basin, then released and combined with the runoff form Drainage Area No. 4 to allow a maximum of 210 cfs to be diverted to this culvert system.

Runoff from Drainage Area No. 6 will be collected in a retention basin and released at a maximum rate of 520 cfs (equivalent to the present volume), through Hawaii Omori's mauka parcel, into Kahoma Stream by means of a new concrete lined channel. Most of the off-site runoff from the cane lands mauka of the project site, estimated to be 1,778 cfs, will be intercepted by diversion ditches and conveyed into Kahoma Stream or the Crater Reservoir.



source: FEDERAL EMERGENCY MANAGEMENT AGENCY (Effective Date 06/01/81)
FEDERAL INSURANCE ADMINISTRATION

Prepared for: Housing Finance and Development Corporation
Prepared by: PBR HAWAII

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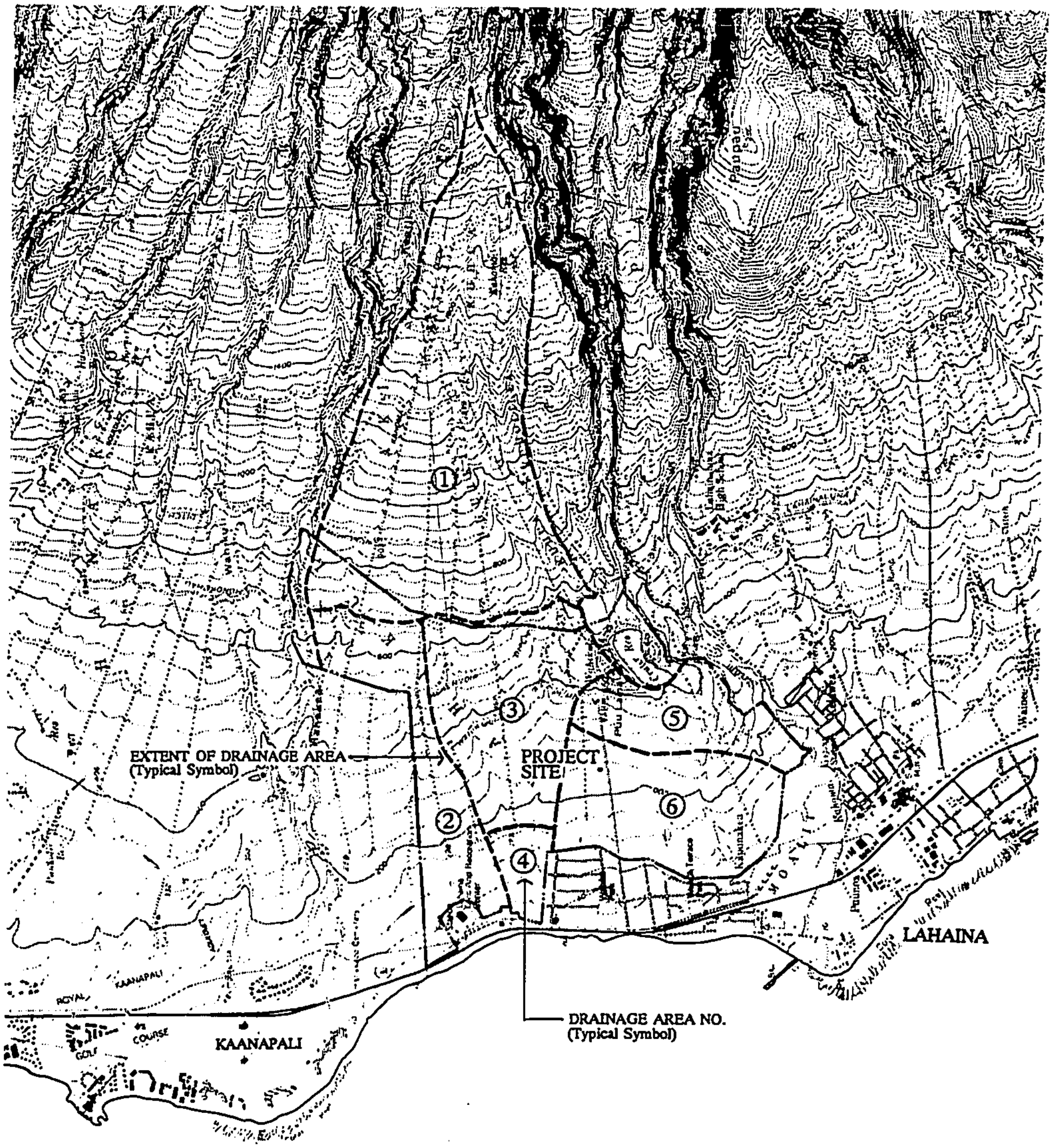
FIGURE IV-6
FIRM MAP
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement



source: WARREN S. UNEMORI ENGINEERING INC. 10/31/89

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE IV-7
FUTURE DRAINAGE PATTERNS/STRUCTURES
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

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Homes planned for the small area adjacent to the Lahaina Civic Center in which 100-year floods could occur would be constructed to withstand flooding and would be designed and constructed in compliance with governmental and private lending agency flood provision requirements.

The potential impacts of surface water runoff on the receiving marine environment are discussed in Section 3.3 below. In brief, based on the surveys and analyses performed, surface water runoff from the project is not expected to significantly affect the nearshore or offshore areas.

2.2.2.3 Mitigation Measures

To minimize and/or eliminate potential impacts from surface water runoff, the on-site drainage from the project will be channeled into culverts and retention basins as recommended in the preliminary project engineering report (Unemori Engineering, Inc., 1989). The final engineering drawings and specifications will be reviewed and approved by the County Engineering Department. Various RCP upsizing, new channels and retention basins will be required to attain acceptable drainage patterns and velocities. Detailed engineering and design analyses and studies will be performed prior to construction of project elements to assure that adequate drainage structures and methods are incorporated into the proposed project.

Off-site drainage (downstream) from the project shall be intercepted by diversion ditches or other means acceptable to the County in order to adequately handle and convey flows to Kahoma Stream or the Crater Reservoir. These drainage structures and facilities will incorporate erosion control and other devices to maintain water quality downstream plans subject to County approval. As indicated above, potential impacts and mitigation measures relative to potential impacts on the marine environment are provided in Section 3.3 below.

As noted previously, homes planned for the small area adjacent to the Lahaina Civic Center in which 100-year floods could occur would be constructed to withstand flooding and would be designed and constructed in compliance with governmental and private lending agency flood provision requirements.

2.3 NATURAL HAZARDS

2.3.1 Existing Conditions

The primary potential natural hazards to which the property could be subjected include flooding and volcanic eruptions. (Refer to the above discussion in Section 2.2 regarding drainage and flooding issues). The following paragraphs describe volcanic hazards on the island of Maui.

Volcanic hazards in Hawaii have been studied in detail (Mullineaux, et al., 1987). Lava-flow hazards on Maui have been defined (Mullineaux, et al, 1987) from highest (1) to lowest (5) degree of hazard. As an example, lava-flow hazard Zone 1 includes areas in which about 50 percent of the land surface has been covered by lava flows during the last 1,000 years, and it covers the crater of Haleakala and the southwest rift zone. The proposed project site lies within lava flow hazard Zone 5. Hazard Zone 5 includes all areas of Maui that have not been affected by lava flows for at least 20,000 years.

In addition to lava-flow hazard zones, hazard zones for tephra falls (ashfall) have also been defined for Maui (Mullineaux, et al, 1987). Because of the low frequency of eruptions on Maui in comparison with the Big Island, the likelihood of areas being affected by ashfall is much lower. The proposed project site lies within ashfall Zone 3, which includes areas in which less than 1 cm of ash is expected to fall at an average rate of once per 1,000 years. This zone also includes areas in which 10 cm or more of ash may fall at least once per 3,000 years.

Hazard zones are not designated on Maui for pyroclastic surges, volcanic gases, ground fracture and subsidence or earthquakes. However, it is postulated by Mullineaux, et al (1987) that most future destructive earthquakes on Maui probably would be generated along the Molokai fracture zone (located between Molokai and offshore of West Maui) and thus could affect all or most parts of the island. Seismic hazards in the Lahaina area are similar to other locations on Maui and are accounted for in design standards and the building codes. Pyroclastic surge hazards are more likely from vents near or beneath sea level and those in areas of high groundwater table. The most likely locations of such vents are near the coastline along the two rift zones of Haleakala. The area of greatest potential danger to human health from volcanic gases is probably within the crater of Haleakala. The most likely area of ground fracture and subsidence in the future coincides with the crater and southwest rift zone, the result of these events most likely being associated with an eruption.

2.3.2 Probable Impacts

The proposed project is not expected to either significantly effect or be affected by volcanic or seismic hazards because of the engineering design standards that will be followed, in accordance with State and County rules and regulations. The project area could be impacted to some extent by volcanic eruptions and accompanying ashfalls. Based on the hazard analyses that have previously been performed (Mullineaux, et al, the project site is in the lowest range of volcanic and ashfall hazards.

2.3.3 Mitigation Measures

Due to the lack of expected significant impacts due to volcanic or seismic activity, mitigation measures, other than adherence to engineering design and building standards to minimize potential adverse impacts, do not appear warranted. No special precautions can be taken to mitigate potential volcanic hazards.

2.4 VISUAL ATTRIBUTES

2.4.1 Existing Conditions

The present visual character of the project site is characterized by the present sugar cane cultivation which provides a green backdrop to Lahaina town; Wahikuli subdivision and all other areas makai of the site. The green backdrop is an amenity that serves to attract visitors to the resort areas in the vicinity of the project site and is pleasing to the residents of and visitors to Lahaina town.

From within the project site, westerly views are of the shoreline, ocean and islands of Lanai and Molokai in the distance. To the north are limited views of the Kaanapali resort areas and West Maui Mountains and views to the south are views of Lahaina Town. Easterly views are toward the West Maui Mountains that form the backdrop for the project site.

2.4.2 Probable Impacts

The visual character of the project site will be changed from its present agricultural appearance to that of a residential character, with about 20 percent of the site left in landscaped golf course, parks and open space. The golf course, parks and open space will provide a significant amount of greenery, as will landscaping along the internal roadways and around the residential units, thereby softening the loss of present sugar cane cultivation and greenery. Design standards will be established by the Master Plan, requiring homes to be designed to blend in with the surrounding areas and backdrop. Appropriate color schemes will be used, as will extensive landscaping of public areas. Residential unit areas and types will be sited to maintain important views in all directions to the maximum extent possible.

2.4.3 Mitigation Measures

The primary mitigation measures that will be employed to minimize the loss of the present green backdrop to Lahaina town and locations makai of the project site will be the use of extensive landscaping in and around the proposed golf course, parks and public areas. In addition, design standards will be established, defining the extent and type of landscaping material that should be used in and around the residential units. Buildings and homes will be designed to blend in with and compliment the natural environmental setting of the project area.

3. NATURAL ENVIRONMENT

3.1 TERRESTRIAL FLORA

3.1.1 Existing Conditions

Field studies to assess the botanical resources on the site were conducted in August 1989, in addition to a literature search and aerial/topographic map examination. The primary objectives of the field studies were to (1) describe the major vegetation types; (2) inventory the terrestrial, vascular plants; and (3) search for threatened and endangered species on the project site. The following is a brief summary of the botanical survey report contained in Appendix E to this EIS.

Vegetation on the Lahaina Master Planned Project site consists almost exclusively of actively cultivated sugar cane fields along with associated weedy species found alongside the cane haul roads, margins of fields, on rock piles, and beside irrigation ditches. Uncultivated portions of the site, as around the two reservoirs, the quarry, and in gulches, support largely koa-haole scrub and stands of trees. Appendix E describes on-site vegetation in detail, categorized in three areas: (1) cane fields; (2) gulches; and (3) the reservoirs and quarry (Figure IV-8).

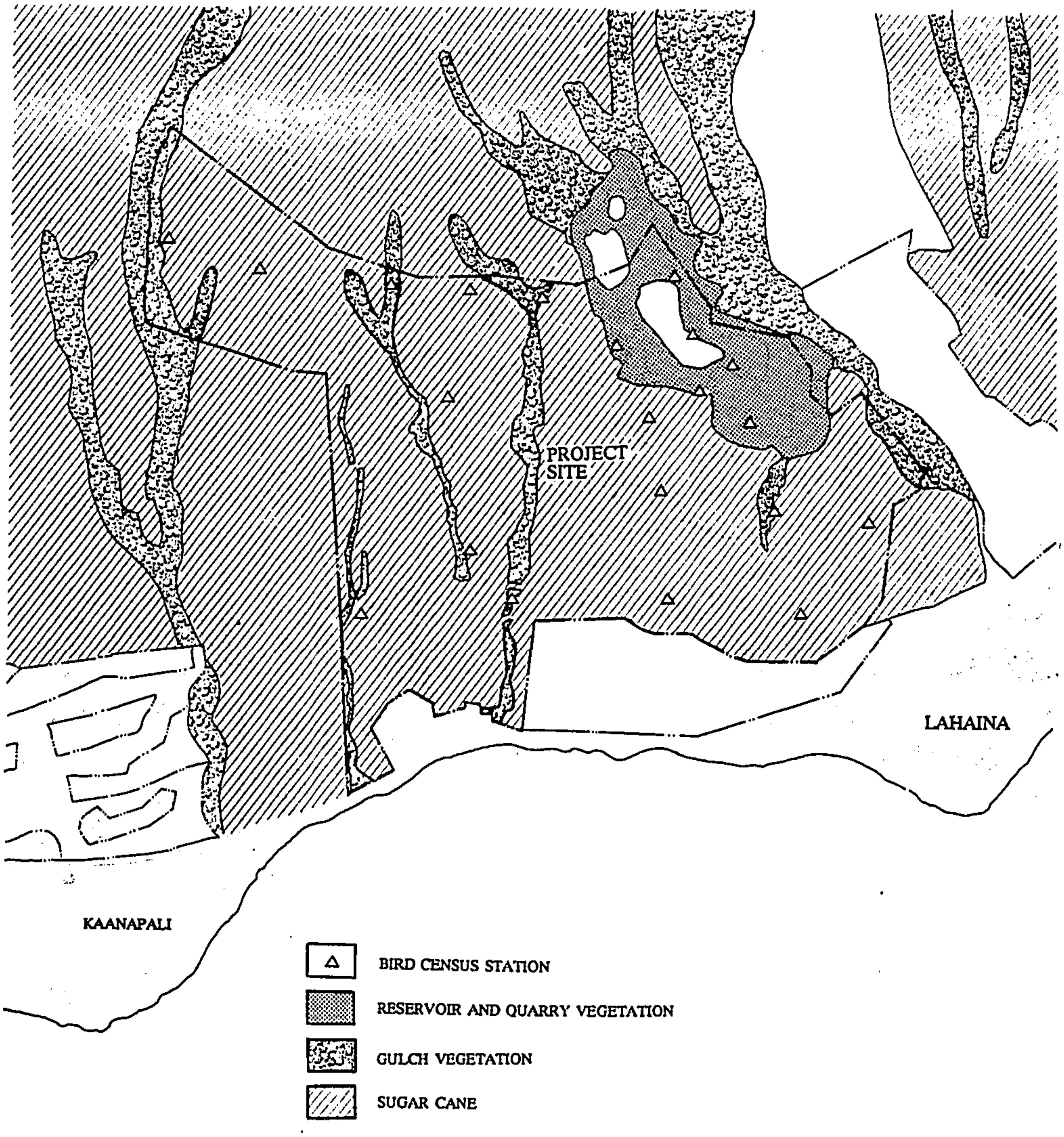
The majority of the plants occurring on the site are introduced or alien (see species checklist in Appendix E). Of a total of 88 species inventoried, 78 (88 percent) are introduced; 6 (7 percent) are native; and 4 (5 percent) are originally of Polynesian introduction. Among the native plants, one is endemic, i.e., native only to the Hawaiian Islands, and five are indigenous, i.e., native to the islands and elsewhere.

None of the native species are officially listed threatened or endangered species by the federal and/or state governments (U.S. Fish and Wildlife Service 1985; Herbst 1987); nor are any of them candidate or proposed for such status. The one endemic species, the nehe (*Lipochaeta* aff. *lavarum*), is found scattered to sometimes locally common to coastal habitats and dry forest areas of Moloka'i, Lana'i, Maui, Kaho'olawe, and Hawai'i (Wagner et al. in press).

In the cane fields, the fast growing sugar cane tends to shade out other plants and the majority of the weedy species associated with cultivated, agricultural lands occurs along the margins of fields, cane haul roads and irrigation ditches. Only the nut grass (*Cyperus rotundus*) has adapted to growing under the dense cane. Among the most frequently observed weedy species found along cane fields are two grasses: swollen finger grass (*Chloris barbata*) and buffel grass (*Cenchrus ciliaris*).

Three major irrigation ditches and a number of smaller ditches traverse the property and support more moisture-loving species. Honohono (*Commelina diffusa*), jungle rice (*Echinochloa colona*) and barnyard grass (*Echinochloa crus-galli*) are typical species in the ditches.

Within the gulches and gullies, koa-haole (*Leucaena leucocephala*), Guinea grass (*Panicum maximum*), California grass (*Brachiaria mutica*) and two vines of the morning-glory family, the moon flower (*Ipomoea alba*) and koali-'awania (*Ipomoea indica*), sometimes form a conspicuous tangle climbing over the koa-haole shrubs. In the larger gulches, scattered stands of trees that form a mixed forest are found. The trees are generally distributed along the gulch bottoms and include Java plum (*Syzygium cumini*), monkeypod (*Samanea saman*), 'opiuma (*Pithecellobium dulce*), kiawe (*Prosopis pallida*) and Siris tree (*Albizia lebbeck*). Buffel grass and Guinea grass are the most abundant ground cover plants.



source: CHAR & ASSOCIATES, SEPTEMBER 1989 and P.L. BRUNER, AUGUST 1989

Prepared for: **Housing Finance and Development Corporation**
Prepared by : **PBR HAWAII**

FIGURE IV-8
PLANT COMMUNITIES AND BIRD CENSUS STATIONS
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Around Crater Reservoir, a dense Java plum forest has become established. In places where seepage and standing water occur, taro (*Colocasia esculenta*) has been planted. Also found in these wet spots are honohono, jungle rice, California grass, primrose yellow (*Ludwigia octovalis*) and leptochloa (*Leptochloa uninervia*). On Puu Laina, the cinder cone that has been quarried in several places, a koa-haole scrub forest with dense buffel grass exists. In places, Natal redtop (*Rhynchelytrum repens*) may displace the buffel grass. Scattered through the koa-haole tress are kiawe, silk oak (*Grevillea robusta*), 'opiuma and Java plum.

3.1.2 Probable Impacts

There is little of botanical interest or concern on the project site as the majority of the site has been disturbed by agricultural activities. The greatest botanical impact that will occur as a result of the proposed project is the loss of the sugar cane. The proposed residential development should not have a significant negative impact on the total island populations of the species involved as they occur in similar lowland situations throughout the islands. Development of the proposed project would slightly contribute to a cumulative reduction in native plants in the area.

3.1.3. Mitigation Measures

Common areas such as parks could be landscaped with easy to grow, hardy, native lowland species such as wiliwili (*Erythrina sandwicensis*), nehe, "alahe'e (*Canthium odoratum*), pa'u-o-Hi'i'aka (*Jacquemontia ovalifolia*), etc. These plants are adapted to the local environmental conditions and would require less water and maintenance.

3.2 TERRESTRIAL FAUNA

3.2.1 Existing Conditions

Field Observations were made from 22 on-site census stations to survey fauna on the property. The following is based on field observations and consultation of similar surveys and guides (see Appendix F). Stations at which bird census counts were made are shown on Figure IV-8.

Resident Endemic (Native) Birds: No endemic birds were recorded during the actual survey. The Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) might occasionally be found at this site as they forage over open lowlands as well as at higher elevation. This species is common elsewhere on Maui, especially in Haleakala National Park (Hawaii Audubon Society 1984). The only other likely endemic species that may occur occasionally on the property are Black-necked Stilt (*Himantopus mexicanus knudseni*) and American Coot (*Fulica americana alai*). They may forage at the reservoirs or in flooded fields.

Resident Indigenous (Native) Birds: The Black-crowned Night Heron or Aku'u (*Nycticorax*) was the only indigenous species found on the property. A total of

25 Aku'u were observed foraging along ditches and around the reservoirs on the property. This species is the only native waterbird that is not endangered. In fact, their statewide population has grown dramatically in recent years due to the growth of the aquaculture industry. Shallenberger (1977) also records night heron from Crater and Wahikuli (Waihukuli) reservoirs.

Migratory Indigenous (Native) Birds: Pacific Golden Plover (*Pluvialis fulva*) prefers open areas for foraging such as exposed intertidal habitats, plowed fields and lawns. A total of 13 plover were recorded during the field survey. These birds were observed on the plowed sugar cane field, along haul cane roads, flying over the property and beside ditches. Johnson et al. (1989) and Bruner (1983) have shown plover are extremely site-faithful on their wintering grounds (returning each day to the same spot and maintaining this behavior throughout their lifetime). Plover also establish foraging territories which they defend vigorously.

Wandering Tattler (*Heteroscelus incanus*) are often found on rocky coastlines and along streams (Berger 1972, Pratt et al. 1987). One Tattler was observed along Wahikuli ditch. This species is usually solitary. No data are yet available that would indicate whether or not they are site-faithful on their wintering grounds as are Pacific Golden Plover.

The only other migratory shorebird species that probably occurs on the property, although not recorded on this survey, is the Ruddy Turnstone (*Arenaria interpres*). Turnstone usually occur in small flocks and forage in fields as well as in the intertidal zone. Shallenberger (1977) reports that migratory ducks "visit the reservoirs in winter months."

Seabirds: No seabirds were recorded on the property. Successful seabird colonies on the main Hawaiian Islands are relatively uncommon due to heavy predator pressure from introduced mammals and vandalism by humans. Some species such as Newell's Shearwater (*Puffinus newelli*) nest in upland forest habitat while Wedge-tailed Shearwaters (*Puffinus pacificus*) nest in burrows in coastal habitat. No seabirds would be expected to nest on the project site. Great Frigatebird (*Fregata minor*) drink fresh water and therefore utilize ponds and reservoirs. This species might occasionally be seen at Crater or Wahikuli reservoirs.

Exotic (Introduced) Birds: A total of 12 species of exotic birds were recorded during the field survey. Table 1 in Appendix F (Bruner, 1989) shows the relative abundance of these species. The most numerous during the three day survey were Common Myna (*Acridotheres tristis*), Japanese White-eye (*Zosterops japonicus*), and Zebra Dove (*Geopelia striata*). Gray Francolin (*Francolinus pondicerianus*) were common at this site as they were on adjacent lands (Bruner 1988a, 1988b). The metal building adjacent to Wahikuli reservoir is a roosting site for over 200 Common Myna. Five species recorded in similar habitat elsewhere on Maui

(Hawaii Audubon Society 1984, Pratt at al. 1987, Bruner, 1986, 1988a, 1988b, 1989) were not seen on this survey but potentially could occur on the property: Red-crested Cardinal (*Paroaria coronata*), Northern Mockingbird (*Mimus polyglottos*), Cattle Egret (*Bubulcus ibis*), Ring-necked Pheasant (*Phasianus colchicus*) and Melodious Laughing-thrush (*Garrulax canorus*).

Feral Mammals: Feral cats were seen during the survey. One Roof Rat (*Rattus rattus*) was also observed. A total of eight Small Indian Mongoose (*Herpestes auropunctatus*) were seen over the course of the three survey days. Without a trapping program it is difficult to conclude much about the relative abundance of rats, mice, cats and mongoose on this property, however, it is likely that their numbers are not dramatically different from what one would find elsewhere on Maui in similar habitat.

Records of the endemic and endangered Hawaiian Hoary Bat (*Lasiurus cinerus semotus*) are sketchy but the species has been recorded on Maui (Tomich 1986). Little is known of their natural history, distribution and ecological requirements. No bats were recorded on this project site despite nighttime observations.

3.2.2 Probable Impacts

The present environment at the project site provides a fairly limited range of habitats which are utilized by the typical array of exotic birds one would expect at this elevation and in this type of environment on Maui. The proposed development will effectively convert what is now a largely monoculture habitat of cultivated sugar cane to an urban residential and parkland environment. House sparrows (*Passer domesticus*) and House Finch (*Carposdacus mexicanus*) will undoubtedly increase in abundance when this site becomes more urban.

Migrant species, particularly Pacific Golden Plover, are usually benefitted by the kind of development that creates open spaces such as large lawns. The present habitat of sugar cane fields serves only as temporary foraging when the fields are plowed. Development would preclude this use to a certain extent. Permanent open space (i.e., parks and golf courses) would result in plover establishing territories and a more fixed size to the plover population on the property.

The Crater and Wahikuli Reservoirs and their surrounding vegetation are important foraging, resting and nesting areas for birds on this property. The native Black-crowned Night Heron uses these reservoirs for food resources and the large trees which surround Crater Reservoir are important roosting and resting areas.

3.2.3 Mitigation Measures

The proposed project site design avoids Crater Reservoir and retains an agricultural preserve around the reservoir and Puu Laina. Additionally, a major, open space park, which will remain largely undeveloped land would be located immediately south and west of the reservoir and puu. These areas will provide for protection, maintenance and buffering of Crater and Wahikuli Reservoirs. This protection of the reservoirs and surrounding habitat will promote the continued use of the reservoir environment by various bird species. Also, newly landscaped park and golf course areas will provide habitat for the birds that presently occur on the project property.

3.3 MARINE ENVIRONMENT

3.3.1 Existing Conditions

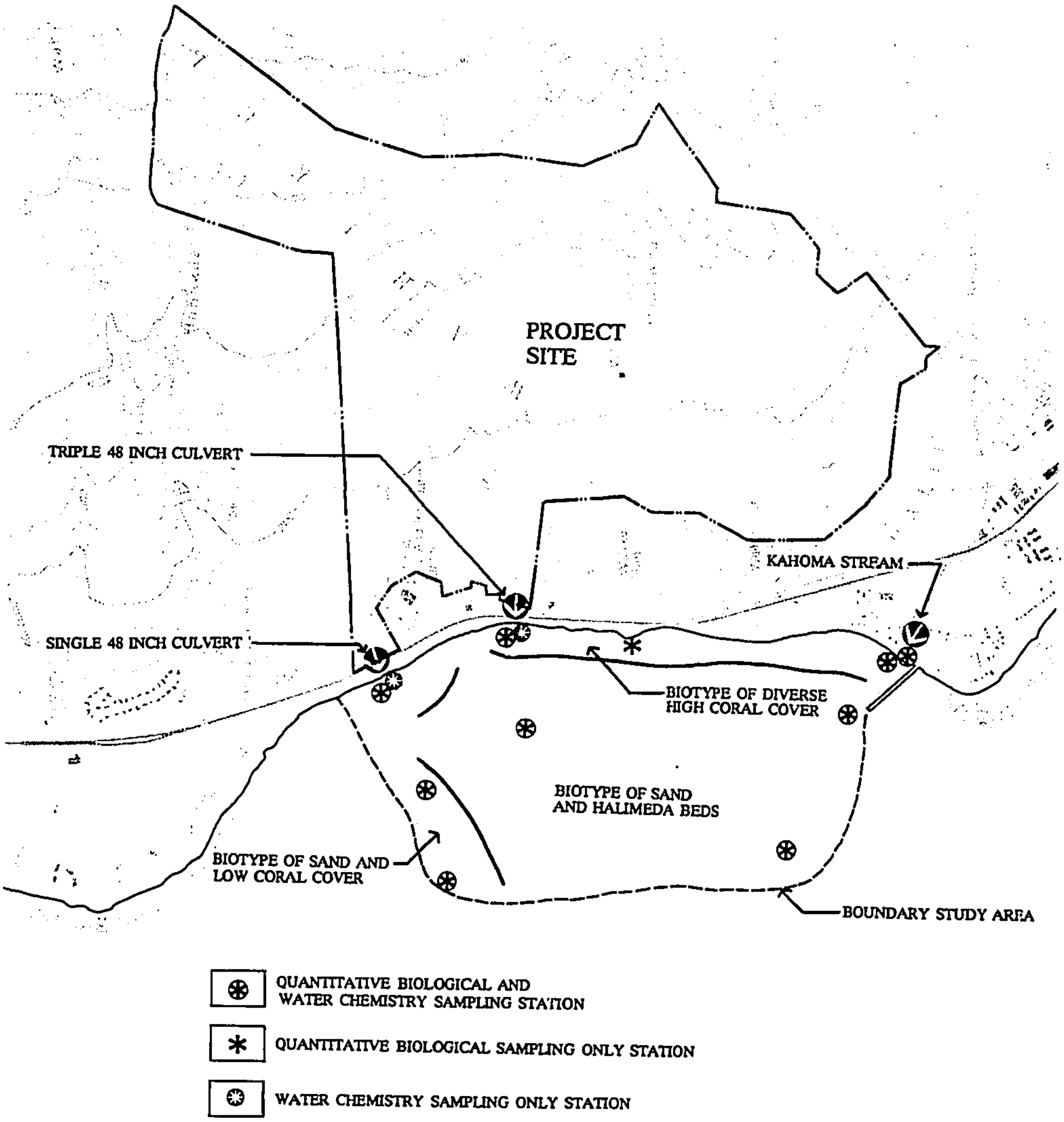
A baseline marine biological and water quality survey of the nearshore marine environment has been conducted specifically for the proposed project. The survey encompassed the area from Mala Wharf on the south to an unnamed drainline about 1.6 miles to the north at Wahikuli State Wayside Park and extended seaward to about the 20 meter (m) isobath. Water quality samples were collected, during both dry and wet conditions, at 11 stations within the study area, with all but three stations involving both surface and near-bottom samples. Three of the stations were in shallow water. precluding surface and bottom samples. The complete results of the marine survey and water sampling program are included in Appendix G. The purpose of the marine survey was to establish baseline conditions against which potential impacts, primarily resulting from storm water runoff, could be determined and evaluated.

3.3.1.1 Water Chemistry/Quality Characteristics

To determine the existing baseline water chemistry/quality characteristics of the area that could be impacted by the proposed project, water quality parameters were measured at 11 water quality stations (Figure IV-9). Water quality parameters measured were specific criteria designated for "open coastal waters" in Title 11, Chapter 54, Amended Administrative Rules for Water Quality Standards. These criteria include ammonia nitrogen, nitrate + nitrite nitrogen, total nitrogen, orthophosphate phosphorus, total phosphorus, chlorophyll *a* and nephelometric turbidity. Also measured were non-specific criteria, salinity and silica.

The results of the sample analyses performed indicate several trends: (1) the concentrations of dissolved nutrients (orthophosphate, nitrate + nitrite and silica) show an inverse relationship with distance from shore; (2) the concentration of these nutrients show a similar trend with respect to depth; (3) salinity displays an increase with distance from shore as well as depth. Stations further from shore and deeper have lower nutrient concentrations than do stations closer to shore and at shallower depths. These gradients are related to the probable diffuse input of groundwater along the shoreline. Both silica and nitrates (NO_3+NO_2) usually exist in high concentrations in groundwater owing to metabolism of organic material and mineral dissolution.

All of the concentrations of chemical parameters measured indicate that they are easily within State standards during periods of no runoff with the exception of chlorophyll *a*. High values of chlorophyll *a* are probably a response of high nutrient groundwater inputs.



source: ENVIRONMENTAL ASSESSMENT CO. 10/10/89

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE IV-9
WATER QUALITY SAMPLING AND MARINE SURVEY STATIONS
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3.3.1.2 Biological Community Structure

Based on the marine survey conducted for the proposed project, a diverse, high coral (biotype) community parallels the shoreline and extends about 600 feet from the beach. The coral community is a near continuous feature along the shoreline, occasionally broken by the continuation of sand from offshore areas to the shore where the latter forms small beaches. The diverse, high coral community is primarily comprised of six coral species: *Porites lobata*, *P. evermanni*, *Pocillopora meandrina*, *Montipora verillii* and *M. flabellata*. Other species, such as *Pavona varians* and *Pocillopora eydouxi*, are found in other parts of the diverse, high coral community. Shoreward of this community are numerous species of echinoderms, mollusks and algae. Tables 3 through 11 of Appendix G indicate the species of algae, corals, invertebrates and vertebrates observed during the marine survey.

It appears, from the numbers of corals and other benthic organisms encountered during the survey, that the area offshore of Wahikuli State Wayside Park has undergone stress due to storm water runoff, but that the species have adapted and a stable community exists.

Seaward of the diverse high coral community are sand and beds of Halimeda (*Halimeda opuntia*), an alga, which continues seaward to depths greater than the 20 m isobath boundary of the survey. The sand and Halimeda beds biotype is present over more than 85 percent of the survey area. Characteristic of this biotype is the presence of a sand substratum and individual *Halimeda opuntia* plants. in most places, the *Halimeda* has an epiphyte, *Cladophora* sp. either growing attached to it or just entangled in the branches. Macroinvertebrates, such as black sea urchins (*Tripneustes gratilla*) and oak cone (*Conus quercinus*), are also found in the sand-*Halimeda* biotype.

An unusual occurrence that was first reported in May or June 1989, is the outbreak of the green, stringy algae, *Cladophora* sp., which was abundant in waters from about 20 feet deep to the outer limits of the survey area. The same phenomenon is occurring offshore of Puako on the west coast of the island of Hawaii. The outbreak is not confined to just one area or island which suggests that the mechanism(s) responsible for triggering the event is a general one and not site specific.

3.3.2.3 Threatened and Endangered Species

During the course of the marine survey, four individual green turtles (*Chelonia mydas*), a threatened species, were observed. As indicated in Appendix G, the area from Mala Wharf to the northern boundary of the survey area is not known as an area harboring many green turtles. Local divers and the literature suggest that there are generally no more than 3 to 8 turtles present in the area. In addition to green turtles, the area off Lahaina is known as a wintering ground for the endangered humpback whales (*Megaptera novaeangliae*). Because the marine survey was conducted in September, no individuals were sighted.

3.3.3 Probable Impacts

As indicated in the Project Description (Chapter II, Section 3.2), the proposed project may impact the marine environment through an increase in the quantity of storm water runoff. In addition, the establishment of a golf course in the project area as well as the parks and other landscaped areas could potentially impact the marine environment through the infiltration of nutrients (fertilizers) and biocides (pesticides and herbicides).

Based on studies conducted in Hawaii and elsewhere, although not in the project site area, sedimentation has been implicated as a major environmental problem for coral reefs. Increases in turbidity may decrease light levels resulting in lowering of primary productivity. Similarly, sedimentation may be so intense as to cause corals and other benthic organisms to be buried. Many benthic species including corals are capable of removing sediment settling on them but there are threshold levels of deposition where cleaning mechanisms may be overwhelmed and the individual become buried. As a result of the proposed project, storm water runoff quantity will be increased. As noted in Section 2.2 above, assuming a situation where 50 percent of the project property is in a harvest mode, the current estimate of total on-site runoff for a 100-year recurrence interval storm is 2,130 cfs. Off-site runoff from the mauka lands has been calculated to be 1,778 cfs (Unemori Engineering, Inc., 1989). Retention basins are being designed into the project that will aid in maintaining the present rate of runoff and/or decreasing the rate or channeling the runoff into Kahoma Stream which the US Army Corps of Engineers is in the process of channelizing, constructing a debris basin and a rock sill to trap smaller materials at the mouth of the stream. No new drainage points will be established as part of the proposed project, but existing drainage structures will be enlarged to handle greater flows at specified rates of discharge. As a result of these actions, and given the evident persistence of the present marine fauna in the nearshore area, the proposed project is not expected to significantly affect the marine environment as a result of increased rain water runoff and the resultant potential increased sedimentation.

Potential impacts of golf courses and other landscaped areas on groundwater supplies and storm water runoff quality has been investigated for numerous projects on Oahu, Maui and the Big Island. The general consensus of all of these investigations is that, (1) although nutrient levels in nearshore receiving waters are elevated at times, there does not appear to be any short-or long-term adverse impact on marine biota; (2) that by the time most pesticides and herbicides enter receiving waters, they are either diluted or degraded to the point where they are non-toxic and do not pose either a hazard to humans or marine biota; and (3) the measures that are being taken with the Master Planned Lahaina Project, i.e., use of retention basins and channeling flow into defined streams, are adequate measures to prevent adverse impacts as a result of the use of fertilizers and biocides (see PBR HAWAII. 1988; Brock, et al., 1987; Bienfang, 1977 and 1980; Chang and Young, 1977; Cox, et al., 1969; Marsh, 1977; Kay, et al., 1977; Maciolek and Brock, 1974; Smith, et al., 1981; Sunn, Low, Tom & Hara, 1974; Sakoda, 1975; and U.S. Army Engineer District, 1975; Murdoch and Green in Group 70, 1988; and Murdoch and Green in W. E. Wanket, Inc., 1989). It is also noted that the present land use is sugar cane cultivation which generally requires the use of more chemicals, fertilizers and biocides, than are used on golf courses or residential properties. Additionally, because of the relatively low rainfall level (about 12 inches per year), evapotranspiration rates generally preclude irrigation waters entering groundwater supplies. Also, fertilizers and/or biocides are generally not applied to golf courses and/or residential areas during rainy periods. Because of these factors, fertilizers and biocides are not expected to enter the groundwater and/or surface water runoff streams.

3.3.4 Mitigation Measures

As indicated above and in Section 2.2, areas within the project property will be used as retention basins to hold storm water runoff and diversion ditches will direct storm water runoff to existing drainage channels. To aid in the uptake of fertilizers by the golf course and landscaped public areas, and to reduce the potential for these chemicals to reach the groundwater or surface water runoff streams, limited quantities and slow-release fertilizers can be used. The use of herbicides and insecticides would be limited to dry weather periods. These measures, along with natural percolation of storm water into the groundwater stream, will assist in minimizing potential impacts to the nearshore marine biota and maintenance of water quality standards in the waters makai of the proposed project site.

4. HISTORICAL AND ARCHAEOLOGICAL RESOURCES

4.1 EXISTING CONDITIONS

An archaeological inventory survey of the project site has been conducted in accordance with the standards for inventory level survey as recommended by the Hawaii State Department of Land and Natural Resources, Historic Sites Section/State Historic Preservation Office (DLNR-HSS/SHPO). These standards are currently being used by Maui County Planning Department as guidelines for review and evaluation of archaeological inventory survey reports submitted in conjunction with various development permit applications. The standards are also used by the State Land Use Commission in evaluating boundary amendment petitions. The significance of all archaeological remains identified within the project area were assessed in terms of (a) the National Register criteria contained in the Code of Federal Regulations (36 CFR Part 60) and (b) the criteria for evaluation of traditional cultural values prepared by the national Advisory Council on Historic Preservation. DLNR-HSS/SHPO uses these criteria to evaluate eligibility for both the Hawaii State and US National Register of Historic Places. The results of that survey are included in Appendix H. The following section is a summary of that report.

During the survey, 12 sites containing 44 component features were identified within or immediately adjacent to the project area (Figure IV-10). Of the 12 sites, one had been previously identified and partially recorded, with the remaining 11 sites representing newly identified resources. The 44 features observed among the 12 identified sites are summarized in Appendix H. Ranging in physical condition from poor to excellent, the identified sites include both single as well as multiple components, and display a range of feature types including overhangs/caves, platforms, walled enclosures, petroglyphs, possible graves, agricultural terraces, and a single historic agricultural access road alignment. Tentatively identified functional types included habitation, agricultural (both prehistoric as well as historic), ceremonial/religious activities, probable burial, recreation and some sites of probable indeterminant function.

General significance assessments and recommended general treatments were prepared for the 12 sites identified within or immediately adjacent to the HFDC project area (including the proposed Honoapiilani Alternative C Road Alignment Corridor). These assessments and recommendations are summarized in Table IV-2. Of the 12 sites identified, six are assessed as being significant solely for their scientific information content. For one of these sites (Site 2487, historic agricultural access road segment), no further work has been recommended as the present recording is seen as adequate mitigation of potential project effects to these values. For the five remaining sites within this category, further work in the form of vegetation clearing, detailed archaeological recording and further refinement of the evaluations of subsurface components has been recommended. The remaining six of the total of 12 sites are assessed as being good examples of site types. These sites include one complex in Hahakea Gulch which contains relatively well-preserved habitation features, the two site complexes identified within the two branches of Kahoma Stream and two well constructed wall enclosures located within the general vicinity of Puu Laina. For these five sites, further work in the form of vegetation clearing and further data collection would be followed by a decision as to whether preservation "as is" or preservation with some level of interpretive development is appropriate. This determination would be based on functional interpretations, dating results and evaluation of nearby areas for similar preserved examples. The last site is assessed as significant for information content and also as potentially culturally significant (if the site contains a burial).

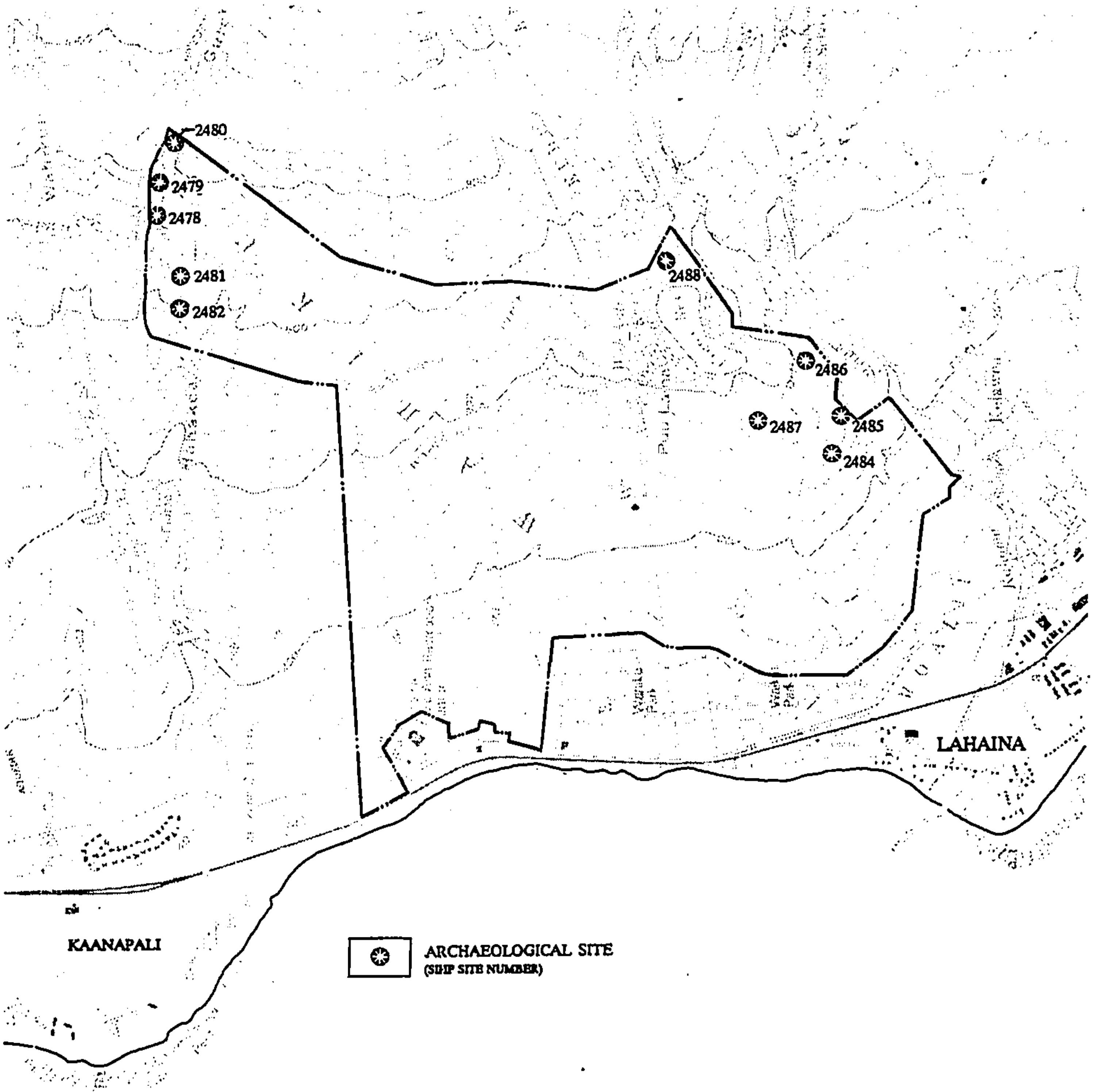
4.2 PROBABLE IMPACTS

The proposed project would impact various archaeological resources known to exist on-site. Table IV-2 lists the sites, each site's significance and recommended treatment. Adequate mitigation (see below) recommended in Appendix H will provide for further investigation and subsequent salvage or preservation of important resources, if determined necessary. Site 2486 will not be directly impacted by the proposed project as it will remain in the area designated as a major open space park and not subject to development.

Significance categories used in the evaluation process for the project area sites follow definitions derived from the Federal Register criteria for evaluation, as outlined in 36 CFR Part 60) Sites determined here to be potentially significant for information content (Category A, Table 3) are assessed under criterion D. Sites determined to be potentially significant as excellent examples of site types (Category B, Table 3) are assessed under Criterion C. Sites determined to be potentially culturally significant (Category C) are assessed under guidelines prepared by the Advisory Council on Historic Preservation (ACHP).

4.3 MITIGATION MEASURES

Subsequent recommended archaeological investigation identified in Table IV-2 would be performed by the project applicant in accordance with State and County procedures and



source: PHRI, OCTOBER 1989

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE IV-10
ARCHAEOLOGICAL SITE/FEATURE LOCATIONS
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

0 500 1000 2000 FEET

TABLE IV-2

SUMMARY OF GENERAL ARCHAEOLOGICAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Site Number	Significance Category[1]	Recommended Treatment[2]
2478	A	FDC
2479	A	FDC
2481	A	FDC
2482	A	FDC
2484	A	FDC
2480	A, B	FDC, PID*
2483	A, B	FDC, PID*
2485	A, B	FDC, PID*
2488	A, B	FDC, PID*
1203	A, B	FDC, PID*
2487	X	NFW
2486	A, C*	FDC, PAI*

[1] Significance Categories:

A = Important for information content, further data collection necessary (PHRI=research value);
X = Important for information content, no further data collection necessary (PHRI=research value, DLNR-HSS=not significant);
B = Excellent example of site type at local, region, island, State, or National level (PHRI=interpretive value); and
C = Culturally significant (PHRI=cultural value).

[2] Recommended Treatments:

FDC = Further data collection necessary (intensive survey and testing, and possibly subsequent data recovery/mitigation excavations);
NFW = No further work of any kind necessary, sufficient data collected, archaeological clearance recommended, no preservation potential;
PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work); and
PAI = Preservation "as is," with minimal further work (and possible inclusion into landscaping), or appropriate data recovery/disinterments.

* Provisional assessment; definite assessment pending further data collection (i.e., testing features for presence/absence of skeletal remains).

processing requirements. If any sites are recommended to be preserved or partially preserved, or if extensive salvage work is necessary, those activities would be conducted in accordance with appropriate federal, state and county procedures. As indicated above, the one site that may be significant in terms of informational and/or cultural content, would be retained as is.

5. SOCIOECONOMIC ENVIRONMENT

5.1 EXISTING CONDITIONS

5.1.1 Socioeconomic Overview

Maui County has experienced a severe housing shortage during the 1980's. The cost of housing has risen steadily. By December 1988, the mean price for a single family house on Maui island ($372,460) was roughly three times the price appropriate for a household earning the median income of $34,000. This situation partly reflects the development and sale of homes for a specialized luxury market, but it also points to a lack of units for less affluent markets.

Market studies for this EIS (Appendix A), identify unmet housing needs to be approximately 7,500 units for Maui and 2,900 units for West Maui. Assuming that approximately 10 percent of all households typically move in a given year, a pent-up demand for about 6,000 units on Maui exists. Every year, about a third of the households which are qualified and interested in buying houses make 80 percent to 140 percent of the median income, i.e., within the defined "affordable" range. However, housing sales at prices affordable for such households -- $175,000 or less -- amount to only 28 percent of recent sales on Maui (Locations, Inc., 1989).

In West Maui, rental prices are above County averages (by a factor ranging from 3 percent for studios to 29 percent for single family housing). Housing sales prices are also above average, but prices vary greatly in West Maui. Lahaina median prices (per square foot of single family housing) are near the average, while Napili prices are 220 percent of the average.

Many workers share rented quarters with others, or rent rooms in single family housing. The shortage of housing at prices suitable for hotel employees has been recognized as a problem for a decade (Farrell, 1982; SMS Research, 1983). Among West Maui residents, crowding, transience and the presence of multi-unit housing (with extra cars on the street and other irritants) in single family neighborhoods are recognized problems. With housing limited, many who work in West Maui live elsewhere and must commute 30 miles or more each workday.

5.1.2 Historic and Geographic Factors Affecting the Community

Lahaina was the home of Hawaiian royalty and functioned often as Hawaii's capital during the reign of Kamehameha III. Lahainaluna School served as a center of learning and publishing between 1820 and 1850. In the same period, Lahaina was a major whaling port.

West Maui is separated from the rest of the island by the West Maui Mountains and by tracts south of Oluwalu still in sugar cultivation. This separation affects agriculture, by limiting the amount of land available for cultivation, and other industries, as the distance between employment and population centers imposes a lengthy commute on many workers. In contrast, the growing resort area of Wailea/Makena is served by a highway that is both shorter and less crowded than West Maui's Honoapiilani Highway.

Sugar production in West Maui began in the 1840's. Pioneer Mill Company was founded in Lahaina in 1860. In 1885, Pioneer Mill was acquired by the company that is now Amfac, one of the two largest Hawaii conglomerates. Pioneer Mill is now the smallest sugar operation in the state, with 6,922 acres in use in 1987 (Decision Analysts Hawaii, Inc., 1989).

In the 1950's, Amfac withdrew about 500 acres of land from sugar and grazing to create the Kaanapali Resort. Kaanapali was Hawaii's first master planned resort. The master plan covers a total of 1,200 acres. After Kaanapali proved successful, the Kapalua resort began development, and visitor units have also been built at Honokawai, Kahana, and Napili in West Maui. As of early 1988, West Maui had 4,427 hotel rooms and 4,349 condo units for visitor use -- 60 percent of the visitor units in Maui County and nearly 13 percent of the units in the state (Hawaii Visitors Bureau, 1988).

5.2 EXISTING SOCIAL FACTORS

Maui's western coast, from Kapalua in West Maui south to Makena, has developed as Hawaii's second major visitor area since 1970. Visitors in Maui County account for about a third of the overall population and over half the West Maui de facto population. Steady growth in both visitor and resident counts is projected (shown in Figure IV-11). Much of the growth in the visitor industry will be located in West Maui, as new hotels are planned for Kaanapali's North Beach and Kapalua. Short-term increases in the number of visitors have fluctuated greatly (as shown in Figure IV-12), and will likely fluctuate in the future due to national economic trends.

5.2.1 Demographic Levels and Characteristics

By mid-1988, Maui County had 93,000 residents, while the Lahaina District had 14,000 (Unpublished tabulations, Hawaii State Department of Business and Economic Development). The County population amounted to 8.5 percent of Hawaii's 1,098,200 residents. Maui island residents were 90.3 percent of the county population. West Maui residents amounted to 15.1 percent of the Maui County population.

Table IV-3 shows that Maui's population declined slightly from 1950 to 1970, but that it has grown at high rates since 1970.

U.S. Census figures provide further demographic information. Maui County's people were mostly (64.9 percent) Hawaii-born in 1980. Nearly 75 percent had been Maui residents for five or more years (as shown in Table IV-4). In West Maui, the Hawaii-born were just half the population, although they form 61.7 percent of the Lahaina population.

The major ethnic groups represented in Maui County are Caucasian (33.6 percent in 1980), Japanese (22.1 percent), Filipino (18.9 percent) and Hawaiian (17.3 percent). During the 1970's, the Caucasian population grew, while the percentage of the population of Japanese ancestry declined. The same trends occurred in Lahaina. In West Maui as a whole, the increase in the Caucasian population was greater.

The average number of residents in each household dropped between 1970 and 1980 in Maui County and in West Maui as well (see Table IV-5). Since 1980, the growth in population has not been matched by a comparable growth in housing stock, so the average household size is now likely to be above the 1980 level -- perhaps as high as the 1970 figures (Bank of Hawaii, 1989a).

5.2.2 Community Concerns

Most West Maui residents surveyed in 1988 (63 percent) thought that the quality of life in their area had become worse over the last five years and only a few (16 percent) saw improvement (see Table IV-6). West Maui respondents reported a higher level of dissatisfaction than people from any other area in the state. Nearly all West Maui respondents identified traffic congestion and the cost of housing as problems in their community.

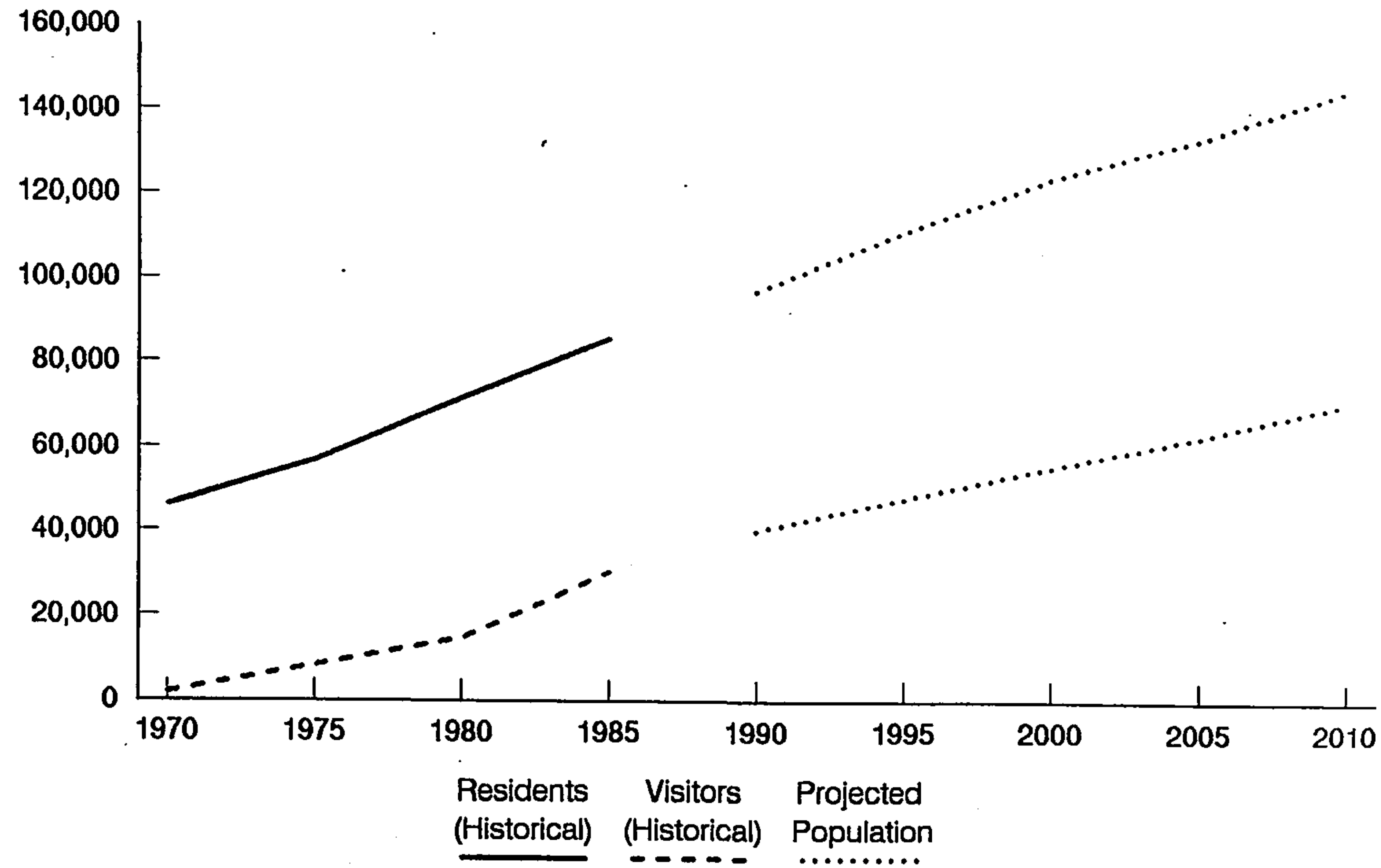
West Maui residents express, in interviews as well as this survey, strong concern that rapid growth in their area has created problems of infrastructure and housing. Many question whether new developments, including retail centers, are of value to residents.

The resorts of West Maui attract a young population, many of whom are only short-term residents. Young singles tend to live in fairly crowded conditions to meet high rental costs. Their living situation is often unstable with some moving as many as ten times a year because of rent increases, personal quarrels or other difficulties.

Drug use and dealing in West Maui has reached a level of grave concern to residents. West Maui residents identify the mobile resort population -- tourists, younger part-time residents and young workers -- as contributing to the problem.

FIGURE IV-11

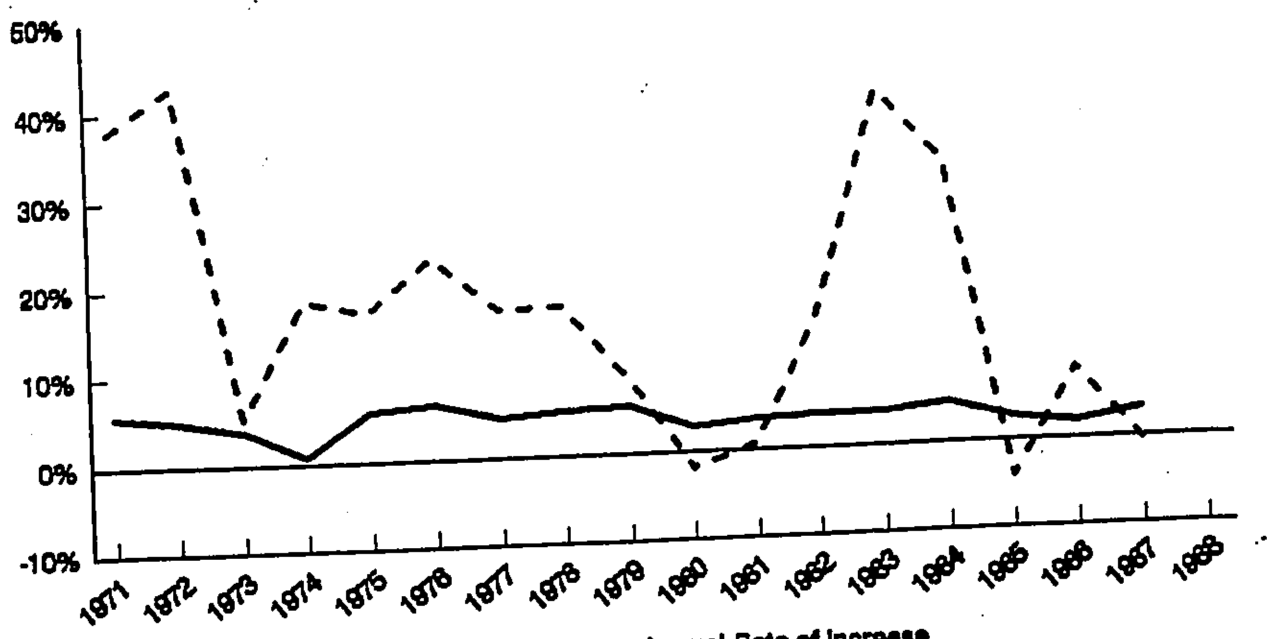
RECENT AND PROJECTED POPULATION, MAUI COUNTY

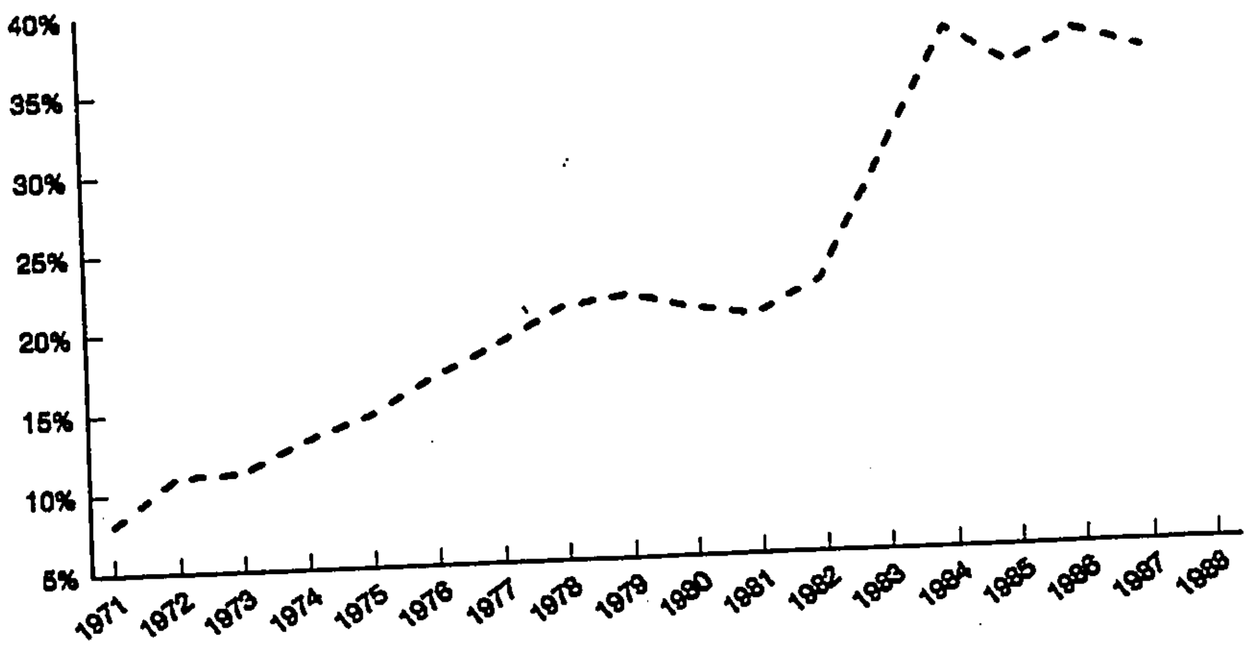


SOURCE: Hawaii State Department of Business and Economic Development, 1988b.

FIGURE IV-12

ANNUAL POPULATION GROWTH RATES, MAUI COUNTY, 1971–1988





SOURCES: Hawaii State Department of Business and Economic Development, 1988a, 1989.

TABLE IV-3

POPULATION TRENDS, MAUI COUNTY AND STUDY AREA
1950 TO 1988 (ESTIMATED)

	April 1, 1950	April 1, 1960	April 1, 1970	April 1, 1980	July 1, 1988
Maui County	48,859	42,855	46,156	70,847	93,000
Maui Island	40,103	35,717	38,691	62,823	84,000
Lahaina District	5,973	4,844	5,524	10,284	14,000
Lahaina CDP	4,025	3,423	3,718	6,095	N/A

AVERAGE ANNUAL RATE OF GROWTH

	1950-1960	1960-1970	1970-1980	1980-1988	1950-1988
Maui County	-1.3%	0.7%	4.4%	3.4%	1.7%
Maui Island	-1.2%	0.8%	5.0%	3.6%	2.0%
Lahaina District	-2.1%	1.3%	6.4%	3.8%	2.3%
Lahaina CDP	-1.6%	0.8%	5.1%	N/A	N/A

NOTES: "CDP" = Census Designated Place.
"N/A" = Not Available.

SOURCES: U.S. Bureau of the Census, 1972 and 1981a; Hawaii State Department of Planning and Economic Development, 1973; Hawaii State Department of Business and Economic Development, 1988.

TABLE IV-4

TOTAL POPULATION AND DEMOGRAPHIC BREAKDOWNS MAUI COUNTY AND STUDY AREA 1970 AND 1980

	MAUI COUNTY		LAHAINA DISTRICT		LAHAINA CENSUS DESIGNATED PLACE	
	1970	1980	1970	1980	1970	1980
TOTAL POPULATION	46,156	70,847	5,524	10,284	3,718	6,095
Ethnicity						
Caucasian	27.3%	33.6%	25.4%	42.9%	26.1%	36.5%
Japanese	31.7%	22.1%	31.2%	16.9%	36.8%	23.7%
Chinese	3.0%	1.8%	2.7%	1.2%	3.6%	1.5%
Filipino	21.2%	18.9%	24.7%	20.9%	18.7%	19.0%
Hawaiian	14.8%	17.3%	15.4%	13.7%	14.1%	15.6%
Other	2.0%	6.2%	0.7%	4.3%	0.7%	3.7%
Age						
Less than 5 yr.	8.7%	8.3%	8.5%	6.9%	8.7%	6.6%
5 to 17 yr.	27.5%	21.3%	25.1%	17.5%	25.1%	19.1%
18 to 64 yr.	54.7%	60.5%	58.0%	66.8%	57.8%	64.3%
65 or more yr.	9.0%	9.9%	8.3%	8.8%	8.4%	9.9%
Median age (yrs.)	29	29.6	32.0	29.5	27	30.3
Place of Birth*						
Hawaii	72.0%	64.9%	62.9%	51.7%	68.6%	61.7%
Other U.S.**	13.3%	21.7%	20.9%	34.6%	19.3%	27.4%
Foreign	14.7%	13.4%	16.2%	13.7%	12.1%	10.9%
Residence 5 Yrs. Before* (people aged 5 or more)						
Same house	59.8%	52.0%	50.7%	55.2%	53.0%	61.2%
Same county	20.2%	22.7%	25.4%	20.7%	28.4%	15.4%
Other county	4.8%	8.9%	4.9%	6.8%	4.5%	4.9%
Other state	5.2%	12.7%	8.1%	11.3%	9.1%	14.7%
Other country	10.0%	3.7%	10.8%	6.0%	5.0%	3.8%

NOTES: * Figures based on 15 percent sample; numbers hence represent estimates.
** Includes persons born in U.S. territories, or born abroad or at sea to U.S. parents.

SOURCES: U.S. Bureau of the Census, 1972, 1981a, 1981b; State Department of Planning and Economic Development, 1972; City and County of Honolulu, Department of General Planning, 1983.

TABLE IV-5

HOUSING STOCK AND CHARACTERISTICS

	MAUI COUNTY 1970	MAUI COUNTY 1980	LAHAINA DISTRICT 1970	LAHAINA DISTRICT 1980	LAHAINA CENSUS DESIGNATED PLACE 1970	LAHAINA CENSUS DESIGNATED PLACE 1980
TOTAL YEAR-ROUND HOUSING UNITS	13,922	32,728	1,762	7,756	1,132	2,377
vacant (total)	N/A	31.2%	N/A	55.2%	N/A	16.9%
vacant for sale	N/A	0.8%	N/A	0.5%	N/A	0.5%
vacant for rent	N/A	12.0%	N/A	5.8%	N/A	6.1%
held for occas. use	N/A	2.8%	N/A	1.3%	N/A	1.1%
other	N/A	15.6%	N/A	47.7%	N/A	9.2%
TOTAL YEAR-ROUND OCCUPIED UNITS	12,783	22,510	1,612	3,472	1,084	1,978
TENURE						
owner-occupied	58.5%	57.6%	44.5%	47.3%	55.5%	53.0%
renter-occupied	41.5%	42.4%	55.5%	52.7%	44.5%	47.0%
SELECTED CONDITIONS						
lacking some or all plumbing	13.9%	3.3%	22.1%	4.2%	16.1%	3.1%
1.51 or more persons/room	6.2%	7.3%	9.1%	9.4%	9.1%	7.6%
PERSONS PER HOUSEHOLD	3.54	3.11	3.40	2.94	3.39	3.08
MEDIAN CASH RENT (renter-occ'd)	$47	$305	$60	$392	$75	$321
as % of median family income**	5.8%	16.2%	N/A	19.2%	8.7%	17.6%
MEDIAN VALUE* (owner-occ'd)	$23,700	$113,600	$25,000-34,999	$138,200	$27,600	$150,800
MEDIAN MONTHLY MORTGAGE* (owner-occ'd)**	N/A	$99	N/A	$417	N/A	$438
as % of median family income	N/A	5.3%	N/A	20.4%	N/A	24.0%

NOTES: * For 1980, median values are for non-condominium housing units.
** Figures based on 15 percent sample; numbers hence represent estimates.
"N/A": Not Available.

SOURCES: U.S. Bureau of the Census, 1972, 1981a, 1981b; State Department of Planning and Economic Development, 1972; City and County of Honolulu, Department of General Planning, 1983.

TABLE IV-6

VIEWS OF COMMUNITY LIFE, FROM THE 1988 STATEWIDE TOURISM IMPACT CORE SURVEY (PRELIMINARY FINDINGS)

	STATE-WIDE	MAUI COUNTY	WEST MAUI
Quality of life, compared to 5 years ago			
BETTER	29%	32%	16%
WORSE	24%	31%	63%
% Thinking that item is a "Big Problem"			
Housing cost	64%	71%	83%
Traffic	56%	51%	87%
Cost food, clothing	43%	52%	66%
Population growth	38%	40%	49%
Crime	30%	22%	28%
New developments hurt natural beauty	25%	30%	44%
Crowded beach parks	23%	24%	19%
Not enough sports, rec. facilities	22%	25%	28%
Not enough stores, restaurants	14%	16%	13%
Problems, people with different backgrounds	9%	7%	9%
Too many tourists	7%	13%	21%
Reason for living in community			
Convenience	35%	33%	44%
Family, roots	23%	21%	23%
Uncrowded, little traffic	19%	20%	9%
Affordability	14%	11%	6%
Afraid to walk at night near home – YES	30%	29%	26%
Are children nearby abused or neglected? – YES	16%	12%	14%
BASE	(3,904)	(1,057)	(158)

SOURCE: Hawaii State Department of Business and Economic Development, Tourism Branch, 1989.

West Maui residents express appreciation for the beauty of their area, but many feel local resources are already strained by development. They expect that improvements needed to deal with current and expected problems will not be made. Most anticipate little help from the County government, which is seen as serving Central Maui to the detriment of West Maui. A sense of isolation from the rest of Maui was most strongly voiced by Caucasian interviewees.

Maui's leaders and community groups have been discussing the impacts of current and planned development extensively in the past year. Proposals for an impact fee ordinance, a golf course moratorium and other controls on growth testify to a widespread sense that development on Maui is not fully meeting residents' needs (Harada-Stone, 1988; Hart, 1988; Hooper, 1989; Kanoho, 1989; and Wachter, 1989). Elements of that concern are:

- The judgment that existing infrastructure, especially roadways, fails to meet current and future needs;
- The sense that increasing amounts of Maui's land are being dedicated to use by visitors for the profit of a few developers, rather than use by residents and visitors alike; and
- A sense that Maui residents' need for housing is not being met -- and some would add that the boom in construction of hotels and vacation homes makes it harder to build affordable housing.

Some of the concerns voiced by Maui residents at the end of the 1980's were raised earlier. West Maui citizens identified affordable housing, employee turnover and population distribution as highest priority problems when participating in the Community Plan process (Maui County, 1983). In the Community Plan meetings, traffic congestion and limited infrastructure were judged to be "second priority problems and issues."

Many West Maui residents, along with the largest study area citizens' organization, the West Maui Taxpayers Association, express concern that they and their problems are not addressed by the county and state.

5.2.3 Existing Housing Stock and Conditions

Maui's current major residential areas, Wailuku/Kahului and upcountry Maui, have experienced little economic growth. West Maui and Kihei/Wailea provide jobs, but housing there is largely dedicated to upscale markets and visitor use. Also, in-migrants are a growing sector of the West Maui population, while the people of Central Maui are more likely to have lived in the area for decades or their lifetime.

The current housing inventory for residents of Maui is estimated as about 26,800 units, of which about 3,400 (13 percent) are in West Maui (Locations, Inc., 1989). However, Maui's housing supply does not meet the needs of low- and moderate-income residents:

- Pent-up demand on Maui is estimated (Appendix A) at over 7,500 units. Pent-up demand from West Maui residents is estimated as about 2,900 units;

- The 1989 Maui Housing Survey indicated that about 8,700 households are interested in moving into different units, when the vacancies are "almost nonexistent," according to real estate professionals;

- At a meeting in Lahaina in October 1989, HFDC passed out 200 survey forms to persons interested in housing at the Lahaina Master Planned Project, and area residents have called to ask for more surveys, so the data are still being gathered and compiled; and

- In a two-month period in 1989, 546 pre-application forms were submitted by Maui families to Self-Help Housing Corporation of Hawaii, of which 232 (42.7 percent) specifically sought to own homes in West Maui (Shay, 1989).

Current housing conditions are unsatisfactory for many:

- In 6.7 percent of the homes surveyed, the number of people was greater than the number of rooms, this is "crowding" by the U.S. Census definition (SMS Research, 1989).

- In 11.7 percent of housing units on Maui, two families share a home. Conditions were worst in West Maui, where families double up in 21.5 percent of all units.

- In about 15 percent of Maui family households, at least one unrelated person was living with the family.

West Maui conditions are more severe than islandwide. In 25.1 percent of the West Maui households surveyed, an unrelated person is present. The total number of units affected by crowding, sharing and doubling up is estimated as 2,261, 36 percent of the housing supply (according to a separate data analysis by SMS Research, October 1989). Crowding and sharing are not just more frequent, they pose social problems for many in West Maui:

- West Maui key informants interviewed by Community Resources, Inc. report cases of up to 20 people sharing a single-family house.

- Realtors and young residents say that, with very little rental housing available, many young workers in West Maui rent expensive units and must live in relatively large households to afford the rent.

- Some younger renters move frequently because of unsatisfactory living situations, the housing crisis makes members of the "transient" population more transient than they would be otherwise.

- Employers have difficulty finding and retaining staff. Some rent houses where their workers live.

- Illegal rental units are dispersed in residential neighborhoods, where the additional cars, traffic and noise are irritants for neighbors and may make roadways so narrow that they are unsafe.

Informants active in social services and community organization in West Maui attest that the high cost of housing (and the cost of living in West Maui, generally) affects all segments of the community:

- It makes both young singles and families stay in crowded conditions, even when domestic tensions would be relieved if households lived apart;

- Many young and even middle-aged couples hope to own their own homes, but find that housing prices are increasing faster than they can save;

- To pay for housing or to save for a housing down payment, both parents in many families must work and many work long and variable hours;

- In families where both parents work, children may have little or no adult supervision and social service providers see such children as especially at risk for drugs and juvenile crime;

- Wage-earners with little time free apart from their jobs rarely participate in civic activities and so may not feel part of the community, while some community groups have disbanded for lack of participation;

- Domestic violence is expected to increase as adults work long hours to make ends meet;

- High property values, while welcome to many homeowners, bring increases in property taxes that are especially burdensome to older residents; and

- Homelessness increases.

Further evidence of the housing crisis comes from surveys and studies done before 1989:

- Maui officials have reported that the housing shortage has led to abuses of ohana zoning and construction of illegal units (Jaworowski, 1988). These infractions in turn create neighborhood tensions and crowding in residential areas.

- The 1988 Tourism Impact Core Survey indicated that West Maui households included about twice as many persons unrelated to the household head as elsewhere in the county or the state (preliminary results, Hawaii State Department of Business and Economic Development, 1989. See Table IV-7). The survey's estimates of household size cannot be taken as accurate, as larger households are more likely to include people available to participate in a survey. Nonetheless, the figures from different areas can be scanned to reach comparative conclusions, as any bias in the survey applies to all areas).

- In the same survey, the percentage of West Maui households with members ready to move out if housing were cheaper was appreciably higher than the countywide percentage.

A survey of West Hawaii hotel employees (Community Resources, Inc., 1987a) showed residential preference patterns which might be similar to those of West Maui workers.

Respondents would mostly prefer to continue to live where they were. However, the people living nearest their place of work were also those who were most happy with their current location. Newcomers to the island were more ready than long-term residents to move to new housing near their place of employment.

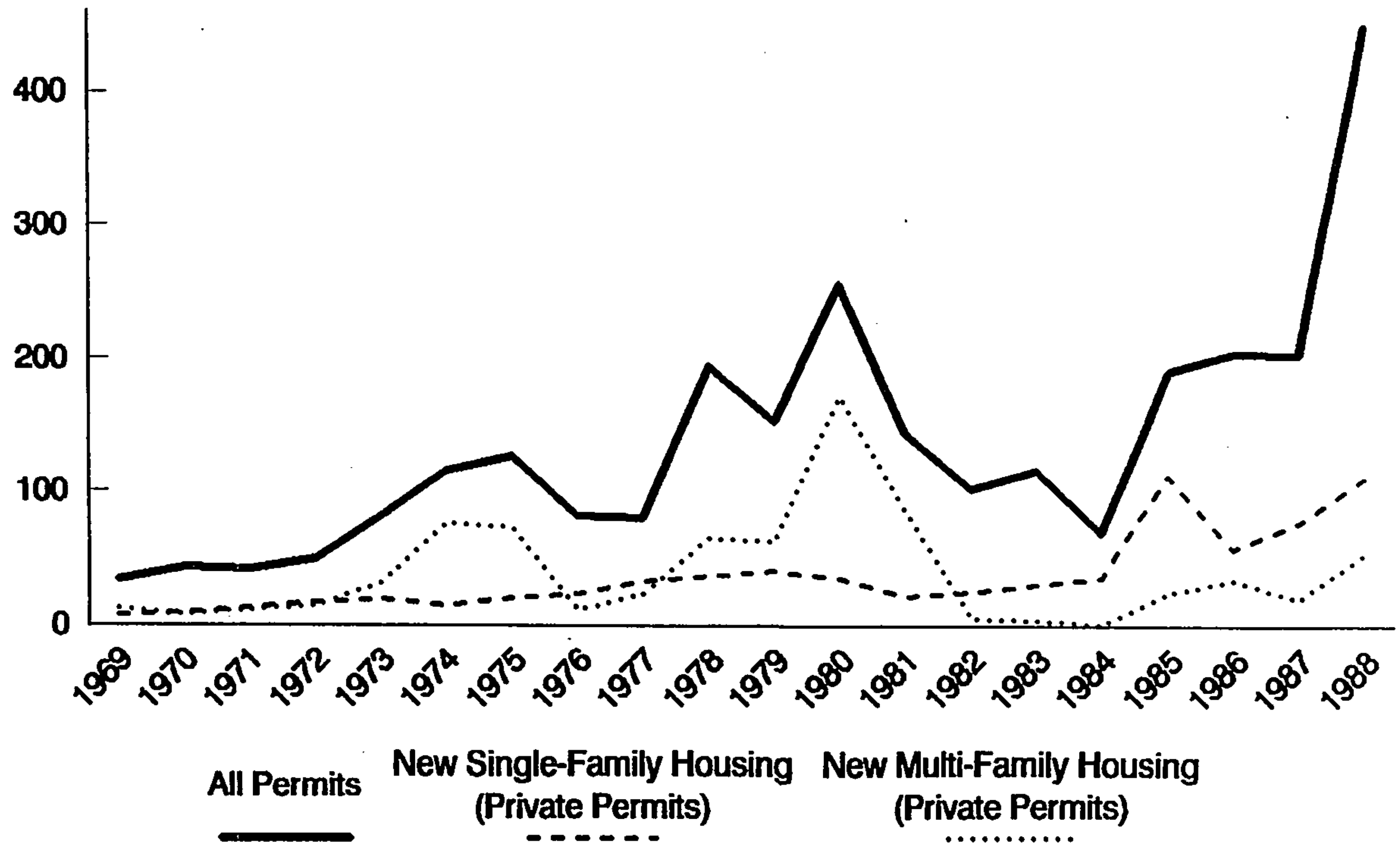
The county housing stock increased by 135 percent during the 1970's (see Table IV-5). The high 1980 vacancy rate shows that about 30 percent of the stock was probably held for visitor use and not available to residents. The increase in year-round occupied units, a better indicator of units for residents, was only 79 percent (5.8 percent per year). Estimates of the Maui housing inventory by Locations, Inc. (1989) show an average annual rate of increase of 6.5 percent during the 1970's and 3.7 percent from 1980 to 1988. This estimate suggests that changes in the overall number of units have kept up with population increases, as shown in Table IV-3. The relation of housing supply to population at different income levels is examined in the market report for this EIS (Appendix A). Construction of single family housing (for all markets, including vacation homes) did not increase much between 1970 and 1984 (as shown in Figure IV-13). During that time, investment in multifamily housing varied greatly from year to year.

This variation, reflecting economic trends, indicates that multifamily construction was largely aimed at a non-resident market. Since 1984, investments in new housing have increased substantially, but not as quickly as overall investment in new construction in Maui County (as shown in Figure IV-14).

Housing prices have risen over time, especially in recent years. The sudden increase in prices since 1986 has outpaced, in both amount and rate of change, increases in personal income. In the early 1980's, housing prices stayed stable while disposable income was rising, more and more residents could afford new housing. The recent trend reverses the situation.

FIGURE IV–13

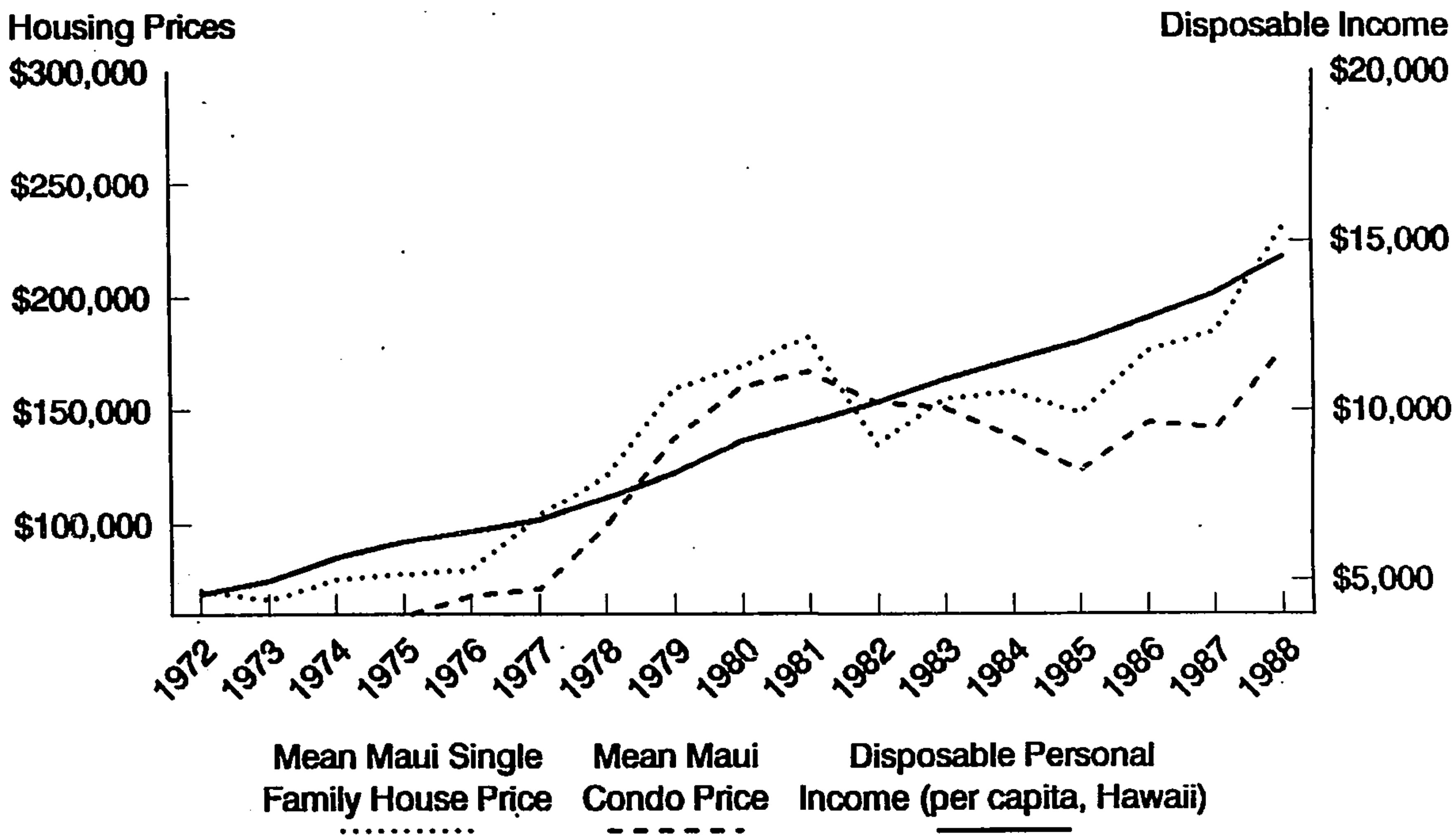
CONSTRUCTION TRENDS, MAUI, COUNTY, 1969 to 1988



NOTE: Values are in millions of dollars.
SOURCE: Bank of Hawaii, 1989b.

FIGURE IV–14

HOUSING SALES PRICES AND PERSONAL INCOME, 1972 to 1988



SOURCES: Hawaii State Department of Business and Economic Development, 1988a, 1989; Locations, Inc.

TABLE IV-7

HOUSING INDICATIONS FROM THE STATEWIDE TOURISM IMPACT CORE SURVEY (PRELIMINARY FINDINGS)

	STATE-WIDE	MAUI COUNTY	WEST MAUI
Average household size (1)	3.47	3.42	3.12
% of households with 5 or more members	22%	22%	20%
Average number of children under 17	0.92	0.89	0.58
% of Household members unrelated to respondent	5.8%	7.6%	15.4%
Housing type			
Single-family	67%	82%	60%
Townhouse	8%	3%	7%
Apartment	24%	14%	33%
% Owning home	55%	65%	53%
% of Households with 1987 incomes			
under $20,000	20%	18%	12%
$20,000-$29,999	15%	15%	16%
$30,000-$39,999	13%	13%	19%
Monthly mortgage or rent			
Nothing	20%	24%	14%
Under $400	23%	22%	20%
$401-$600	19%	14%	14%
$601-$800	13%	11%	11%
$801-$1,000	7%	6%	12%
Median (excl. "Nothing")	$550	$540	$670
Would any members leave if housing were cheaper? YES	29%	25%	32%
BASE	(3,904)	(1,057)	(158)

NOTE: (1) Larger households are probably over represented in the survey. Estimates of household size can be used for comparative purposes.

SOURCE: Hawaii State Department of Business and Economic Development, Tourism Branch, 1989.

By 1988, market housing prices bore about the same relation to personal income that they did in the early 1970's, when Maui's economy was much smaller and Maui's people much less affluent (see Figure IV-14).

As housing prices continue to rise sharply, the gap between income and market prices is widening. Single family homes listed for sale in September 1989 were priced out of the financial reach of most Maui residents (based on data from Locations, Inc.):

	% of Listings Priced at		
	$200,000 +	$300,000 +	(Base)
West Maui	98.6%	87.3%	(71)
Maui Island	85.1%	55.4%	(390)

5.2.4 Planned and Proposed Housing

Large new subdivisions and smaller projects proposed for Maui in the coming years could increase the housing stock on Maui by 70 percent. The increase would amount to 88 percent with the Lahaina Master Planned Project included. Even if these units are built, the demand for housing, especially at prices affordable to households with average incomes, will not likely be met (for demand estimates, see Appendix A).

An estimated 18,704 new housing units are planned, not including the proposed project. However, that figure includes resort units and many units concerning which no pricing information is available. Also, current announcements of plans are no guarantee that houses will be built.

Over 15,000 new housing units are likely to be built for Maui residents (including upscale part-time residents) by the end of 2000, including the proposed project (see Table IV-8). Some 6,600 units, 3,400 apart from the project, would be affordable.

Major developments which will include some affordable housing include:

- Maui Lani in Central Maui, with a total of 3,300 units proposed to be built between 1990 and 1999, of which 20 percent (660 units) would be affordable;

- The Piihana Project District near Wailuku, with 600 units, all affordable, to be built from 1993 to 1997;

- The Wailuku Project District, with 2,400 units to be built from 1993 to 2005, of which 902 (37.6 percent) would be affordable;

- HFDC's Waiehu planned development, near Wailuku, with over 600 units, all affordable, planned for families and special need populations, to be built between 1989 and 1993; and

- Kihei Village, in Kihei, with a total of 532 units, all affordable, proposed for construction between 1989 and 1992.

- Maui Palisades (Kihei) - 1050 units

- Piilani Residential Community (Kihei) - 785 units

The bulk of planned new housing is outside West Maui, less than 600 units are projected for West Maui, not including the proposed project. However, Amfac is developing plans for an unknown number of units on about 700 acres in the Lahaina and Oluwalu areas. New housing could be produced on Amfac land towards the end of the 1990's (Personal communication, David H. Gleason, Amfac Property Investment Corp., September 26, 1989).

Many of the units built on the Lahaina and Oluwalu lands could be affordable. Consequently, the size of the West Maui affordable housing supply at the end of the Lahaina Master Planned Project's construction period cannot be forecast with certainty.

5.3 ECONOMIC FACTORS

5.3.1 Existing Economic Base and Employment

Maui's economy has grown rapidly since 1970. The visitor unit inventory tripled between 1970 and 1987 (Bank of Hawaii, 1989a) and is expected to continue to increase (Figure IV-15). Hotel occupancy rates rose during the 1970's to a high of 85.1 percent for the County. In January 1989, the Maui Island occupancy rate had gone down to 68.8 percent, while West Maui hotels had a rate of 71.4 percent occupancy. These figures are high by nationwide standards, but below current Waikiki occupancy levels.

Maui's sugar plantations include the most profitable operation in the state, Hawaiian Commercial and Sugar, and Pioneer Mill, which is currently breaking even (Decision Analysts Hawaii, Inc.,1989). Production has been stable at about 300,000 tons of raw sugar during the 1980's. Pineapple cultivation takes up about 24,000 acres on Maui (compared to 44,000 acres for sugar). Diversified agriculture has grown since 1970 from sales worth $7.2 million to $33.3 million in 1987 (Bank of Hawaii, 1989a).

TABLE IV-8

PROJECTED NEW HOUSING, MAUI ISLAND, 1989-2000

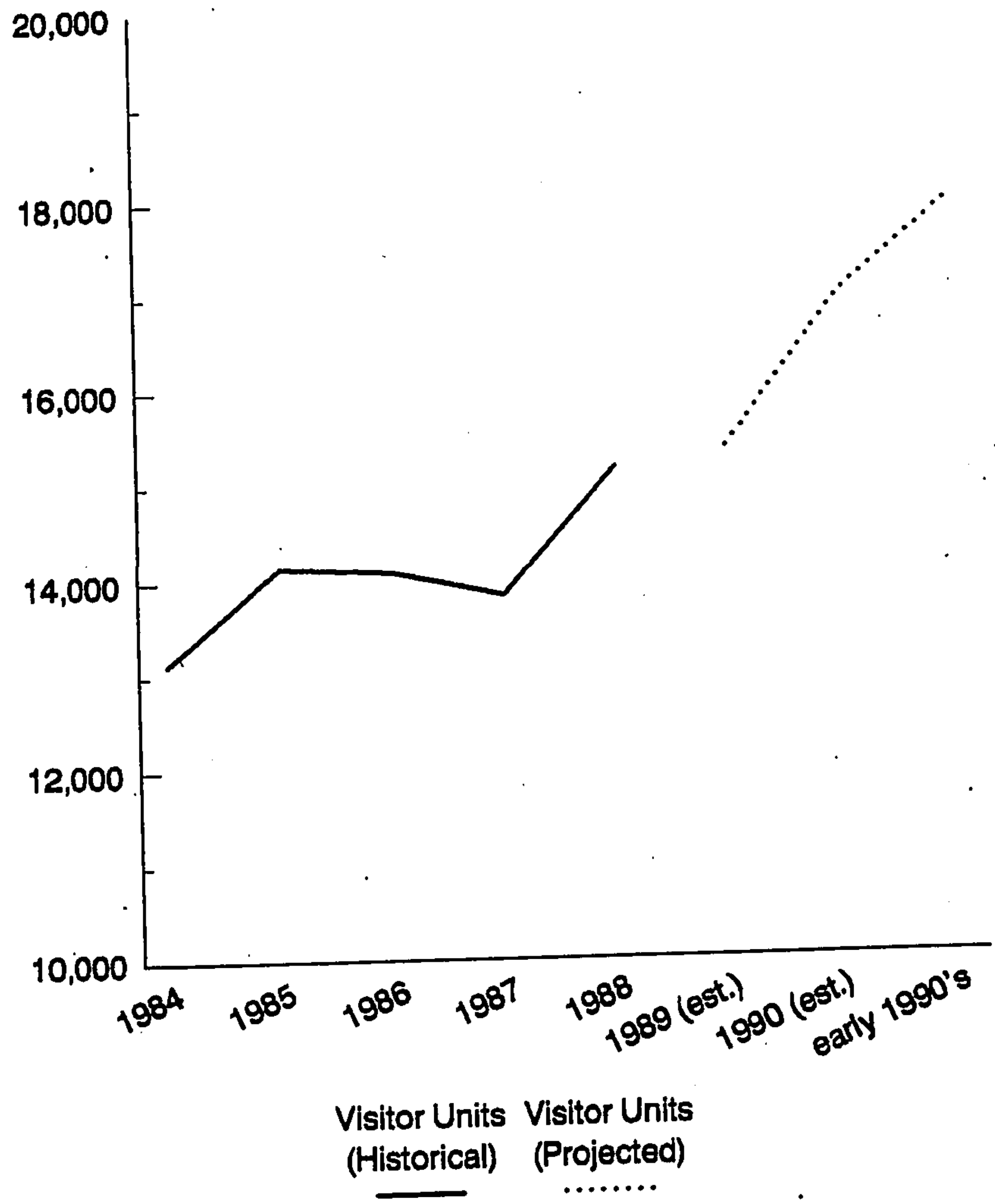
	Without Lahaina Project			With Project		
Year	Affordable Units	Market Units	Total	Affordable Units	Market Units	Total
1989	58	335	393	58	335	393
1990	632	782	1,414	632	782	1,414
1991	570	1,139	1,709	731	1,218	1,949
1992	288	952	1,240	863	1,237	2,100
1993	399	797	1,196	710	949	1,659
1994	282	508	790	593	660	1,253
1995	275	508	782	586	660	1,245
1996	275	508	782	586	660	1,245
1997	260	498	758	571	650	1,221
1998	140	377	518	451	529	981
1999	140	374	514	451	526	977
2000	97	204	301	405	355	760
Total	3,414	6,982	10,396	6,635	8,561	15,196

NOTES: After 1989, it is assumed that 75 percent of planned and announced housing will be built. When no data have been released about a project's affordability, it is assumed that 80 percent of stock is market and 20 percent is affordable.

SOURCE: Adapted from Locations, Inc., 1989, Figure VI-139.

FIGURE IV–15

MAUI COUNTY VISITOR UNIT INVENTORY



SOURCES: First Hawaiian Bank, 1989;
Hooper, 1989.

Labor force participation has been growing in Maui County (as shown in Table IV-9). By mid-1988, the labor force numbered 52,600, nearly 74 percent of the county's potential labor force (Hawaii State Department of Business and Economic Development, 1989). The increase on Maui is well above statewide trends (Bank of Hawaii, 1989a). It largely reflects an increase in two-income families, although in-migration of single workers to Maui may also be a contributing factor. Although West Maui workers come from all over the island and from Molokai, 75.4 percent are West Maui residents (SMS Research, 1989). In addition, of the household heads residing in West Maui, 91.1 percent work in West Maui.

Employment in retail trade and service industries has grown in recent years, while manufacturing and construction employed a smaller proportion of the Maui workforce in 1988 than in 1980. (However, construction employment has been growing, and 14.7 percent of primary household wage earners contacted for a 1989 survey were in the construction industry (SMS Research and Marketing Services, Inc., 1989).

The visitor industry has provided employment, service, retail and construction jobs above all, as shown in Table IV-10. The proportion of West Maui residents involved in the industry is higher than in any other area in the state.

In 1989, 37.8 percent of employed household heads surveyed in West Maui were in the visitor industry, as compared to 18.6 percent for the total Maui island sample (SMS Research, 1989). (See also Table IV-11 for a preliminary tabulation of 1988 data.)

The 1988 survey also showed that West Maui workers put in long hours, over 44 hours per week on average, and most work weekend and/or evening hours, not just a five-day work week.

The median family income in West Maui was above the county average in 1970 and remained well above the average in 1980 (as shown in Table IV-12). Lahaina's families were not so affluent, Lahaina residents' family income fell below the county average in 1980.

Unemployment is extremely low on Maui. In August 1989, Maui Island had the lowest unemployment in the State, while the State's unemployment level was the lowest in the nation (Aleshire and Smith, 1989). West Maui unemployment was negligible, as shown in Table IV-13 (personal communication, Paul McCarthy, Research Statistician, Hawaii State Department of Labor and Industrial Relations, October 13, 1989).

The lack of available workers affects expansion plans and other policies in the visitor industry and sugar (Eagar, 1989; Hooper, 1989b). Some retail and service businesses provide housing for workers, in order to find and retain staff.

TABLE IV-9

LABOR FORCE SIZE AND CHARACTERISTICS MAUI COUNTY AND STUDY AREA 1970 AND 1980

	MAUI COUNTY 1970	MAUI COUNTY 1980	LAHAINA DISTRICT 1970	LAHAINA DISTRICT 1980	LAHAINA CENSUS DESIGNATED PLACE 1970	LAHAINA CENSUS DESIGNATED PLACE 1980
POTENTIAL LABOR FORCE (Aged 16+)	31,308	52,598	5,268	8,179	2,444	4,730
not in labor force	39.7%	31.5%	51.3%	20.9%	33.9%	21.1%
armed forces	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
civil. labor force	60.1%	68.5%	48.7%	79.1%	66.1%	78.9%
CIVILIAN LABOR FORCE	18,810	36,040	2,568	6,467	1,615	3,732
unemployed	3.6%	4.0%	2.6%	2.4%	2.0%	2.3%
TOTAL EMPLOYED, CIVILIAN LABOR FORCE	18,133	34,613	2,502	6,312	1,583	3,645
OCCUPATION:						
service	NC	20.7%	NC	33.5%	NC	35.4%
manage./profes.	NC	18.8%	NC	17.5%	NC	15.0%
technical, sales & adminis.	NC	24.9%	NC	24.1%	NC	24.6%
farm/fish/forest	NC	0.3%	NC	6.4%	NC	5.4%
precision/craft/ repair	NC	12.8%	NC	8.0%	NC	8.4%
operators/fabri- cators/laborers	NC	9.4%	NC	10.5%	NC	11.2%
INDUSTRY (selected):						
agric., forest, fish, mining	N/A	8.9%	N/A	5.6%	N/A	4.3%
construction	7.3%	9.7%	N/A	4.8%	N/A	4.5%
manufacturing	13.5%	9.2%	N/A	8.5%	N/A	8.8%
retail trade	N/A	18.3%	N/A	27.9%	N/A	30.3%
financial, insur., real estate	N/A	6.5%	N/A	10.3%	N/A	9.3%
personal, entertain. & recreat. service	N/A	15.7%	N/A	28.3%	N/A	24.7%
health, educ., & professional	N/A	12.5%	N/A	5.4%	N/A	6.6%
public admin.	N/A	5.5%	N/A	1.8%	N/A	2.3%
COMMUTE TO WORK						
45 minutes or more	N/A	9.1%	N/A	2.3%	N/A	2.2%
mean travel (mins.)	N/A	18.1	N/A	11.4	N/A	11.4

NOTES: All figures based on 15 percent sample; numbers hence represent estimates.
"NC": 1970 categories not comparable to 1980 ones.
"N/A": Not Available.

SOURCES: U.S. Bureau of the Census, 1972, 1981a, 1981b; State Department of Planning and Economic Development, 1973; City and County of Honolulu, Department of General Planning, 1983.

TABLE IV-10

EMPLOYMENT IN MAUI COUNTY, 1988

Industry	Average Number of Employees	% of Total Listed Employees	% of Total Wages[1]	Average Annual Wage	Number of Employers[2]
Farming, forestry, fisheries	3,073	6.9%	7.3%	$18,937	87
Mining and Construction	2,007	4.5%	7.6%	$30,035	269
Manufacturing	2,086	4.7%	5.6%	$21,511	78
Transportation	1,719	3.9%	3.8%	$17,475	112
Communications and Utilities	639	1.4%	2.7%	$33,746	22
Wholesale trade	971	2.2%	2.4%	$19,721	126
Retail trade	11,016	24.9%	17.3%	$12,556	704
Finance, insurance and real estate	2,592	5.9%	6.7%	$20,497	322
Services	14,937	33.8%	31.3%	$16,722	868
Hotels	7,958	18.0%	16.3%	$16,313	49
Personal, Bus. Services	1,129	2.6%	1.8%	$12,489	174
Amusement and Recreation	1,109	2.5%	2.1%	$15,428	
Government	5,201	11.8%	15.3%	$23,544	3
TOTAL	44,241	100.0%	100.0%	$18,032	2,591

NOTES: [1] Total wages for Maui County in 1988 amounted to $797,767,103.
[2] For December 1988.

SOURCE: Hawaii State Department of Labor and Industrial Relations, 1989.

TABLE IV-11

EMPLOYMENT INDICATIONS FROM 1988 STATEWIDE TOURISM IMPACT CORE SURVEY (PRELIMINARY FINDINGS)

	STATE-WIDE	MAUI COUNTY	WEST MAUI
Civilian labor force (CLF) participation rate	69%	72%	83%
Female CLF participation rate	60%	67%	80%
Average number of hours worked weekly	41.5	42.3	44.4
% of respondents working over 48 hours weekly	22%	25%	35%
% working weekends and/or evenings			
Usually	47%	49%	63%
Sometimes	19%	18%	14%
Percent commuting over 40 minutes	13%	10%	5%
Job satisfaction			
Very satisfied	57%	61%	60%
Dissatisfied	11%	8%	5%
Average household size[1]	3.47	3.42	3.12
Average number of members employed	1.87	1.86	2.08
Average number employed in visitor industry	0.43	0.71	1.37
% Respondent households with member in visitor industry	26%	44%	71%
BASE	(3,904)	(1,057)	(158)

NOTE: [1] Larger households are probably over represented in the survey. Estimates of household size can be used for comparative purposes.

SOURCE: Hawaii State Department of Business and Economic Development, Tourism Branch, 1989.

TABLE IV-12

FAMILY CHARACTERISTICS AND INCOME LEVELS MAUI COUNTY AND STUDY AREA 1970 AND 1980

	MAUI COUNTY		LAHAINA DISTRICT		LAHAINA CENSUS DESIGNATED PLACE	
	1970	1980	1970	1980	1970	1980
POPULATION IN FAMILIES	N/A	61,823	N/A	8,161	N/A	5,088
as percentage of total population	N/A	87.3%	N/A	79.4%	N/A	83.5%
NUMBER OF FAMILIES	10,646	16,916	1,307	2,288	886	1,401
HEAD						
Husband/Wife	87.1%	82.6%	85.6%	79.1%	84.3%	78.1%
Male only	5.6%	5.4%	6.2%	7.0%	6.2%	6.1%
Female only	7.3%	12.0%	8.2%	13.9%	9.5%	15.8%
WITH OWN CHILDREN UNDER 18	56.5%	52.8%	N.A	49.3%	?	50.2%
Female head	3.9%	7.5%	N.A	9.7%	?	10.4%
BELOW POVERTY LEVEL	9.4%	7.6%	N.A	6.0%	5.4%	6.4%
MEDIAN FAMILY INCOME	$9,643	$22,579	$10,000-11,999	$24,536	$10,305	$21,909
NON-FAMILY HOUSEHOLDS	N/A	5,680	N/A	1,225	N/A	599
percentage below poverty level	N/A	21.7%	N/A	13.0%	N/A	15.7%

NOTES: All figures (except "Population in Families" and "Non-Family Households") based on 15 percent sample; numbers hence represent estimates.
"NC": 1970 categories not comparable to 1980 ones.
"N/A": Not Available.

SOURCES: U.S. Bureau of the Census, 1972, 1981a, 1981b; State Department of Planning and Economic Development, 1972; City and County of Honolulu, Department of General Planning, 1983.

TABLE IV-13

MAUI UNEMPLOYMENT CHARACTERISTICS
AUGUST 1989

	CIVILIAN LABOR FORCE	UNEMPLOYMENT RATE	NUMBER OF UNEMPLOYED
Maui County	54,700	1.7%	950
Maui Island	50,950	1.3%	650
Lahaina District (Census Tracts 314,315)	10,200	0.9%	100

Source: Hawaii State Department of Labor and Industrial Relations, October, 1989.

Even in 1980, unemployment was appreciably lower in West Maui than in Maui County as a whole. West Maui workers were then concentrated in service industries, retail trade and the financial sector far more than workers from other areas of the county. Table IV-9 also shows that average commuting time and the percentage of workers commuting long distances was lower in West Maui than elsewhere in the county.

5.3.2 Probable Economic Trends

Expansion of the visitor industry on Maui is underway and further expansion is proposed. These developments would create new employment and increased demand for housing. Planned work on roadways and new housing projects respond to an extent to Maui residents' concern that development has been uneven.

In West Maui, current development activity involves retail trade (at the Lahaina Cannery shopping center and the Lahaina Center, to open in January 1990). In the Wailea area, new hotels under construction are expected to add over 1,200 rooms in the next year and about 600 rooms later (First Hawaiian Bank, 1989). The new units will increase the island's visitor unit inventory by less than 10 percent. The increase in units in the Kihei/Wailea area amount to about 23 percent.

In the long-term, new development at Kapalua and the North Beach area of Kaanapali will add to the West Maui visitor plant and to the demand for employees in West Maui. In the next three years, however, new projects and demand for workers will be concentrated in the Wailea area.

Employment at the Ritz-Carlton Hotel at Kapalua and at the Kaanapali North Beach hotels is expected eventually to generate over 4,000 direct jobs (based on estimates in John Child and Co., 1986). The total statewide employment impact of those hotels would be over 8,000 jobs.

New, upscale resorts tend to attract skilled workers, so that other hotels and resorts experience staff turnover (as has occurred on both Kauai and the Big Island). Current plans for new developments make it likely that new Wailea hotels and shops will attract some employees now working in West Maui, so that West Maui employers will have to recruit new staff. Recruitment is viewed as difficult by employers interviewed for this EIS, given current high employment and the housing shortage.

5.4 PROBABLE IMPACTS

5.4.1 Probable Social Impacts

As a major response to the need for affordable housing on Maui, the proposed project will limit, and may even reduce, social problems such as crowding, neighborhood tensions and strains on workers and their families due to commuting. The project will have positive impacts on the regional society and economy of West Maui.

In the following sections, the socioeconomic impacts of the project are assessed by identifying:

- Quantitative impacts -- population, employment and income;
- The implications of the project for the island and region, with special attention paid to the impact of an increased housing supply; and
- Specific impacts of the project on adjacent areas and the Lahaina community.

5.4.1.1 Probable Population Impacts

The project's population impacts include the development of a resident population at a site that now lacks population and regional impacts deriving from the location of a major residential project in Lahaina.

Occupants of the affordable units are expected to consist mainly of young families. The affordable units will be allocated through a lottery conducted in compliance with HFDC rules and regulations (Hawaii Administrative Rules, Title 15, Subtitle 7, Chapter 73). Market units will be sold with few restrictions.

The resident population in the project is estimated in Table IV-14. At build-out, about 12,000 people would live on the project site.

TABLE IV-14

ON-SITE RESIDENT POPULATION[1]

	Affordable		Market		TOTAL
Year	Units	Population	Units	Population	POPULATION
1991	161	489	79	112	240
1992	736	2,237	364	514	1,100
1993	1,047	3,183	516	729	1,563
1994	1,358	4,128	668	944	2,026
1995	1,669	5,074	820	1,159	2,489
1996	1,980	6,019	972	1,374	2,952
1997	2,291	6,965	1,124	1,588	3,415
1998	2,602	7,910	1,276	1,803	3,878
1999	2,913	8,856	1,428	2,018	4,341
2000	3,221	9,792	1,579	2,231	12,023
TOTAL	3,221	9,792	1,579	2,231	12,023

ASSUMPTIONS:

1. Average household size will depend on unit type. As this development will mainly house families, average household size is assumed to be:

Affordable Units	3.2 persons/unit
Market Units	2.8 persons/unit

2. A vacancy rate of 5 percent is assumed. Otherwise all units are fully occupied, except vacation homes (among market units), which are assumed to be occupied 25 percent of the time.

SOURCES: Housing size assumptions derived from analysis of SMS Research 1989 survey of Maui households; Hawaii State Department of Business and Economic Development, Tourism Branch, 1988 survey; HFDC survey of persons interested in project housing; Community Resources, Inc., 1987b. Occupancy assumptions derived from studies of comparable Neighbor Island housing areas.

The de facto population, or population actually on-site at a particular time and date will vary. Non-residential elements of the project, the golf course and commercial center, will attract a few hundred people to the site, mainly during the daytime. The de facto population is expected to reach its highest level at night, when residents return from work. Given the residential nature of the project, the maximum de facto population can be treated as equivalent to the resident population at build-out.

The West Maui regional population will be determined by several factors, including employment and the availability of housing. The regional population will not simply increase by the number of people living on the project site, as most project residents are expected to already live in West Maui at the time they move to the project site. Most of the future resident households of the project will probably be supported by employment in West Maui. No precise breakdown of the current residences of future project residents can be provided, but indicators suggest that the bulk of the residents for the affordable units will come from West Maui, while most of the residents of the market units will be residents of areas outside Maui County.

The market study for this project (Appendix A) established that demand from Maui residents is greater than the number of units to be supplied in the project and that pent-up demand is higher among West Maui residents than in other areas of Maui. Based on the market study (Appendix A) and the 1989 Maui Housing Study, Community Resources, Inc. has estimated that at least 70 percent of the future residents of affordable units in the project will already be West Maui residents. Demand from Maui residents will account for the remaining affordable units.

A percentage, which cannot be specified precisely, of eventual occupants of affordable units in the project do not live on Maui at this time, but will move there at some future date. It is assumed that all occupants of affordable units will live on Maui immediately before moving to the project.

Assuming that buyers of market units will be similar to recent buyers of single family houses in West Maui, these buyers are likely to be from Maui (37.5%); the mainland US (50%); and other countries (12.5%). Non-Hawaii residents are likely to be second-home buyers and to spend about one quarter of their time on-site. Combining the preceding estimates, the population of the entire project, including the affordable and market units, is likely to be 94.5 percent from Hawaii and 5.5 percent from outside Hawaii.

As the project will be built over a ten-year period, most occupants will have lived in the project for some years. Even the residents who came to the project from outside the West Maui region will overwhelmingly be West Maui residents by the time of build-out.

5.4.2 Probable Employment and Income Impacts

This section provides estimates of (1) employment on the project site and associated with the development of a residential community and (2) employment impacts of the project. Employment "impacts" consist of new jobs due to spending that would not occur in the State of Hawaii if the project did not exist. Consequently, jobs that serve a population that would live on Maui even without the project are not counted as impacts of the project.

5.4.2.1 Employment

The project will generate employment of two types of employment: (1) Construction jobs will be created for a limited time; and (2) permanent jobs will be created to serve residents of the project and other users of the project site during the time the project is operational.

Construction of the project will cost an estimated $660 to $700 million. That money will be spent over a period of 10 years. Expenditures will be higher at the beginning of the project, as work proceeds on infrastructure, than in later years. As shown in Table IV-15, a total of 6,000 to 6,364 construction jobs are expected to be created over the life of the project, with an annual high of 923 to 979 jobs in the years when spending is highest (1991 and 1992). On the basis of industry practice, on-site construction jobs are estimated to amount to 80 percent of all construction jobs.

The indirect and induced jobs shown in Table IV-15 are discussed in Section IV-5.4.2.2. Permanent jobs on the project site would increase as the project is built. Table IV-16 provides estimates of the jobs created when the project is fully built. About 600 full-time jobs would be created.

In the period 1991-2000, both construction and operational employment would be generated by the project and its residents. Direct employment from both construction and operations would probably reach a high point in 12991 and 1992, when construction spending is highest and a limited amount of operational employment will be generated. Employment in 2000 would come near this high point, with construction employment at half the 1992 level, but operational employment approaching its build-out level.

Employment impacts of project construction are estimated in Table IV-15. In addition to the 6,000 to 6,364 direct jobs created, over 13,000 indirect and induced jobs would be generated during the construction phase. In most years, the total employment impact of project construction in the Hawaii economy would be about 6,500 jobs.

Some, but not all, permanent jobs at the project can be attributed to either visitors or new residents and can be identified as impacts, as shown in Table IV-17. The total direct, indirect and induced employment impact generated by the project is projected as 119 jobs.

TABLE IV-15

CONSTRUCTION PHASE EMPLOYMENT

A. ASSUMPTIONS

1. Total construction cost will be from $660 to $700 million.
2. Construction will take 11 years (1990 to 2000).
3. The amount spent for construction in the years 1990 and 1193-2000 will be the same, annually, in constant dollars.
4. The amount spent in the years 1991 and 1992 will be twice as much (each year) as the annual construction spending in later years, in constant dollars, because of infrastructure work and the large number of homes to be built in 1992. Relation of construction costs to jobs based on 1988 data, Statewide, for construction value and jobcount -- 1 full time worker per $110,000 of construction spending. (1)

B. CONSTRUCTION JOBS -- DIRECT, INDIRECT, AND INDUCED EMPLOYMENT IMPACTS

Year	Construction Spending	Direct Jobs	On-Site Direct Jobs (80%)	Indirect and Induced Jobs (2)	Total Jobs
1990	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
1991	$101,538,462 to $107,692,308	923 to 979	738 to 783	2,003 to 2,124	2,926 to 3,103
1992	$101,538,462 to $107,692,308	923 to 979	738 to 783	2,003 to 2,124	2,926 to 3,103
1993	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
1994	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
1995	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
1996	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
1997	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
1998	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
1999	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
2000	$50,769,231 to $53,846,154	462 to 490	369 to 392	1,002 to 1,062	1,463 to 1,552
TOTAL	$660,000,000 to $700,000,000	6,000 to 6,364	4,800 to 5,091	13,020 to 13,809	19,020 to 20,173

NOTES:

(1) Unpublished tabulations, Hawaii State Department of Business and Economic Development; Bank of Hawaii.

(2) Based on State of Hawaii 1982 Input-Output Model, Hawaii State Department of Business and Economic Development, Research and Economic Analysis Division.

TABLE IV-16

OPERATIONAL PHASE EMPLOYMENT AT BUILD-OUT[1]

DIRECT EMPLOYMENT

Area[1] Industry[2]	Jobs
Commercial Center	
Banking and Finance	15
Health, Professional Services	10
Eating and Drinking	55
Retail Trade	188[3]
Golf Course[4]	
Amusement Services	30
Eating and Drinking	4
Church/Day Care/Residential Areas	
Personal Services	82[5]
Professional Services	5
Other Industries	50[6]
Public Schools[7]	
State Government (DOE)	154
State government (After-School)	2[8]
TOTAL	595

[1] ASSUMPTIONS:

a. "Build-out" refers to build-out of all elements of the project, not just residential areas.

b. Commercial will serve as community retail and professional center, with offices as well as stores.

c. Golf course will have small pro shop and a snack bar.

d. With continuing high employment, residents' need for child care will be great, and will be met by providers (families and centers) based mainly at the project site.

TABLE IV-16
OPERATIONAL PHASE EMPLOYMENT AT BUILD-OUT
(Continued)

NOTES:

[1] New employment at the Lahaina Civic Center is considered to be generated by regional growth, and is excluded from consideration here.

[2] Industries are those listed in State Input-Output Models.

[3] Based on estimate of one job per 250 sq ft of leasable retail space, with 47,000 sq ft for retail (leasable space remaining after space allocated for offices and food outlets).

[4] Grounds personnel expected to care for grounds in some public areas outside the golf course.

[5] Includes personal services to elderly (3 jobs), family day care providers (34 jobs), center-based day care (13 jobs) and housecleaning (32 jobs).

[6] Includes landscaping and maintenance/security for market units.

[7] Calculated on the basis of expected age pyramid for year 2000 and current ratio of jobs in Maui public schools per pupil (M-K Series Projections).

[8] Most jobs in after-school programs assumed to be held by DOE staff, and not counted.

TABLE IV-17

DIRECT, INDIRECT, AND INDUCED EMPLOYMENT IMPACTS, OPERATIONAL PHASE AT BUILDOUT

INDUSTRY[1]	DIRECT JOBS	NON-RESIDENT SHARE	INDUSTRY MULTIPLIER	DIRECT, INDIRECT AND INDUCED EMPLOYMENT IMPACTS
Banking and Finance	15	5.5%[2]	2.07	2
Health, Professional Services	10	5.5%[2]	2.19	2
Eating and Drinking				
Community Center	55	5.5%[2]	1.89	6
Golf Course	4	50.0%[3]	1.89	4
Retail Trade	188	5.5%[2]	1.57	16
Amusement Services	30	50.0%[3]	1.49	22
Personal Services				
Personal Care	50	0.0%[4]	1.82	0
Housecleaning	32	29.4%[5]	1.82	17
Other Industries	50	62.5%[6]	1.61	50
Education	156	0.0%[4]	0.00	0
TOTAL	595			119

NOTES:

[1] Jobs in each industry broken out only if different non-resident shares involved for different categories of jobs.

[2] Based on non-residents' (vacation home occupants') share of project population.

[3] An estimated 40 percent of golf play would be by visitors staying in resorts and estimated 10 percent would be by non-residents staying elsewhere, according to Community Resources, Inc.

[4] These jobs would involve work only for full-time project residents.

[5] Jobs generated by market units in project; non-resident share based on non-residents' share of market unit population.

[6] Jobs generated by market units in project; non-resident share based on vacation homes' share of market units (because occupancy does not affect these jobs).

5.4.2.2 Income Impacts

Income impacts are calculated in much the same way as employment impacts. Construction phase income impacts include direct construction spending and the indirect and induced income generated in the state economy by that spending. The total income impact of construction is projected as about $1.5 billion over the entire construction period. In most years, that impact would amount to about $112 to $119 million.

Operational income impacts are shown in Table IV-18. On-site wages would total nearly $10 million annually and the direct income generated by on-site work is estimated as about $20 million per year. The total direct, indirect and induced income attributable to non-resident spending at the project, i.e., the total income impact, would amount to $3.3 million annually.

Based on 1988 wage levels, wages of on-site workers would total about $12.8 million. Of that, only $2.65 million can be treated as a direct income impact. The total income impact of the project is estimated as $4.5 million annually, at build-out and in subsequent years.

5.4.3 Islandwide and Regional Impacts

The socioeconomic impacts discussed thus far have been analyzed in terms of the development of the project rather than the society and economy of West Maui. In this section, the project's relation to social problems and concerns of West Maui in general is assessed. In the next section, the specific socioeconomic impacts of the project on Lahaina and parts of Lahaina adjacent to the project are identified.

5.4.3.1 Impacts of Increased Housing Supply

The project will provide homes for many who cannot now afford to buy homes in West Maui, and can only find cramped and expensive quarters. It will encourage some people to move from other areas of Maui to West Maui. As a result, the West Maui population is likely to change, with increases in the number of young families and in the Hawaii-born population in the region. The project's impact on the housing situation must be assessed in relation to expected future conditions. The current situation could easily become much worse in the next decade if the project were not built.

Demand for employees is already high, and new hotel projects are likely in the 1990's. Increases in the workforce would bring increased demand for housing in West Maui and more commuting from other areas of the island.

TABLE IV-18
DIRECT, INDIRECT, AND INDUCED INCOME IMPACTS, OPERATIONAL PHASE AT BUILDOUT

INDUSTRY	DIRECT JOBS	EST. 1989 MAUI AVERAGE WAGE[1]	DIRECT WAGES	OUTPUT ESTIMATE[2]	INCOME MULTIPLIER	NON-RESIDENT SHARE	TOTAL INCOME
Banking and Finance	15	$21,620	$ 324,300	$ 790,980	1.97	5.5%	$ 85,054
Health, Professional Services	15	$17,170	$ 257,550	$ 390,230	1.58	5.5%	$ 33,654
Eating and Drinking-							
Community center	55	$10,760	$ 591,800	$1,972,670	2.03	5.5%	$ 218,583
Golf course	4	$10,760	$ 43,040	$ 143,470	2.03	50.0%	$ 145,622
Retail Trade	188	$13,250	$2,491,000	$5,189,580	1.74	5.5%	$ 492,886
Amusement Services	30	$16,280	$ 488,400	$1,221,000	1.92	50.0%	$1,172,160
Personal Services							
Personal care	50	$13,180	$ 665,576	$1,210,140	1.70	0.0%	$ -0-
Housecleaning	32	$13,180	$ 415,184	$ 754,880	1.70	29.4%	$ 377,440
Other Industries[3]	50	$17,170	$ 858,500	$ 858,500	1.45	62.5%	$ 778,016
Education	156	$24,070	$3,755,591	$7,511,180	0.00	0.0%	$ -0-
TOTAL	595		$9,890,941	$20,042,630			$3,303,415

NOTES:
(1) Based on 1988 industry average wage, multiplied by estimated 1989 increase in Consumer Price Index-Urban.
(2) Based on direct income coefficient, State Input-Output Model.
(3) Wage data for "Other Services" used.

SOURCES:
Hawaii State Department of Labor and Industrial Relations, 1989; Hawaii State Department of Business and Economic Development, 1989, and unpublished tabulations.

Impacts of an enlarged housing supply for households with moderate incomes include:

- For many, the chance to own their own home;
- Less crowding in households where the project's inhabitants are now living;
- At a neighborhood level, lower population in residential areas where many future project inhabitants now live;
- Decrease in stresses and social problems that accompany dense or crowded living situations; and
- Changing child care arrangements. With some project residents moving away from family members in other areas on Maui, reliance on child care centers, rather than family, is likely to increase. However, with residents closer to their place of work, opportunities for working parents to supervise school-age children and to participate in their activities will increase.

5.4.3.2 Impacts on Commuters

Among primary wage-earners working in West Maui, only 24.5 percent of those surveyed in 1989 commute from other areas of Maui (SMS Research, 1989). In interviews for this EIS, high housing prices were mentioned as a reason why younger workers, both renters and home owners, live elsewhere. Older commuters tend to be rooted in their area of residence. As such, the project is likely to provide new opportunities for younger commuters and to affect older commuters little.

Survey respondents generally name their own area as the place where they expect to move next. West Maui was named as a possible place to move by 45 percent of those who expected to move in the coming years, a much higher percentage the in 1982 (SMS Research, 1983). Still, Central Maui was most often mentioned as a first choice and Upcountry Maui as a second choice of home site. In a hotel worker survey (Ward Research, 1988), more respondents were "interested" in new housing in the Kihei area than in West Maui.

The data suggest that many in Maui expect West Maui to have little or no housing acceptable and affordable to them. With increases in the housing supply for young families, views of the area could change appreciably.

Impacts on project residents' incomes will vary. Renters in the project are likely to benefit from lower rents than are currently available in West Maui. Most new homeowners will pay more for housing than they now do, but will be gaining equity.

The project will most obviously benefit its residents. However, others will also be affected by a larger housing supply:

- Rental prices elsewhere in West Maui are not expected to increase as quickly as they would if project residents were competing for existing rental units;

- With rental housing more available, younger renters may be able to find less expensive units, or form more stable households, than at present, leading to less transience; and

- Generally speaking, demand for existing single family houses will be affected. (For impacts on specific areas, see Section IV-5.4.4.2.)

5.4.3.3 Growth and Change of West Maui's Population

Indirect regional impacts of the project include:

- A larger voting population, hence a stronger political presence for West Maui at the County and State levels;

- A population with a different mix of household types, income levels, ages and ethnicities, possibly leading to a change in the values and concerns expressed by West Maui residents;

- Reduction of the split between West Maui and the rest of the County, as West Maui becomes home to more Hawaii-born families;

- More use of the Lahaina Civic Center and nearby retail centers on Honoapiilani Highway, increasing the role of this zone as a regional center;

- Increasing demand for facilities such as beach parks and medical services;

- With more employees living and owning homes near the resort areas, West Maui's workforce will be more stable than at present and West Maui enterprises will be less vulnerable to a possible loss of workers attracted to other areas; and

- Shorter commutes for some project residents and less traffic congestion on the Highway into West Maui and in Lahaina. However, increases in traffic volume independent of the project could offset this positive impact.

5.4.4 Project-Specific Impacts

The impacts listed above are largely independent of the specifics of the project's site, design and procedures for qualifying future residents. Some impacts of the project on Lahaina and adjoining areas in Lahaina are identified below. In addition, concerns voiced by area residents will be briefly summarized. The likelihood of socioeconomic impacts expected by informants to affect particular areas will be assessed in later subsections.

5.4.4.1 Issues and Concerns of Residents in Relation to the Project

Maui residents interviewed for this study were unanimously in support of increased housing for low and moderate income families. They viewed such housing as meeting needs of area residents and the regional economy. Additional concerns largely involved perceived impacts on adjacent neighborhoods and Lahaina in general, questions of equity for potential project occupants and project design and construction.

Perceived Impacts on Adjacent Neighborhoods: Many nearby residents want assurance that the project will not place a low-income area next to them, potentially lowering their property values. However, some see the project as lowering the demand for rental space and hence lessening residential densities in their own neighborhoods. Some were concerned that speculation in housing in the project could further inflate housing values and, thus increase their own property taxes.

Perceived Impacts on the Lahaina Civic Center: Many commented that the Center is poorly planned, facilities in the center cannot be expanded and some activities, such as concerts, interfere with Fire and Police Department response to emergencies. Concern was expressed that the project would further burden limited public resources at the Center. However, many saw the project as offering a chance to improve facilities for the region.

Perceived Impacts on Lahaina: Informants viewed additional housing as a great benefit to Lahaina, since it could relieve existing crowding and alleviate problems caused by crowding. Some thought that new housing in Lahaina will attract Mainland U.S. in-migrants above all, leading to a loss of "local" character. Others disagreed and viewed Lahaina's character as little affected by its mauka residential areas. Some hoped the project would be more closely linked with the historic center of Lahaina, while others considered that area to be over-developed and no longer a center for residents. Additional traffic in Lahaina was often mentioned as a possible adverse impact of the project. Several commented that they could not conceive of Lahaina with a large residential area stretching mauka. They were concerned that the project would make the area appear densely populated and detract from the general impression of greenery surrounding Lahaina.

Increased population was widely expected to bring more crime to Lahaina and to adjacent neighborhoods. Additional police protection was considered essential by most of those interviewed. Many informants viewed West Maui's parks as already crowded and thought the project would bring additional demand for parks, especially beach parks. Expanded medical services were also mentioned as a priority.

Most West Maui informants questioned whether the water supply was sufficient for the project. Some sought assurance that water reserves adequate to maintain fire hydrant pressure would be maintained. Some residents thought that by withdrawing land from cane, the project would harm Pioneer Mill and its workforce.

Equity: Some members of the community viewed the procedures for finding and qualifying potential residents as unfair to one or another part of the population. Some saw long-term Maui residents as deserving preferential treatment. Others were concerned that housing in the project will not be affordable for many Maui residents. Some considered the project site to be lands to which Native Hawaiians have special rights. Preferential treatment for persons of Hawaiian descent and monetary support for Hawaiian agencies were mentioned as possible ways to address this issue.

Project Design, Construction and Operations: Community members noted that good landscaping, housing quality and community amenities help residents to take pride in their neighborhood and would contribute to the project's success or failure. Recreational facilities and community areas were mentioned as essential for a successful community. Many expressed concern that if low-income units were isolated a "ghetto" would be created. Several questioned whether government agencies could build and operate a subdivision as well as private developers. These informants were concerned that an "instant ghetto" would be created if high construction standards were not followed. At a public meeting in October 1989, several residents questioned the appropriateness of golf and commercial elements in the project. Subsequent calls to West Maui residents made it clear that few had studied the specifics of the project's design. Community views concerning design elements will likely emerge in the coming months.

5.4.4.2 Impacts on Residents of Adjacent Areas in Lahaina

The project's impacts on nearby residential areas will be generally positive. Nearby residents are concerned that the Lahaina Master Planned Project, as a government development, could be poorly planned and could have negative impacts on adjacent areas. HFDC has taken steps to allay this expectation:

- No low-income "ghetto" will be created. Units of different sizes and prices will be mixed together in each increment of the project.
- A strong, adequately funded community association will be empowered to enforce maintenance and upkeep standards, inappropriate rental uses, illegal additions and parking violations as well as all other community standards established for the project.
- Housing areas adjacent to existing subdivisions will have relatively large lot sizes and market-priced units to assure that project housing will not be of less value than immediately adjacent existing housing.

The expected impacts mentioned by residents include changes in public safety, traffic, property values and property taxes.

Public Safety: A few residents expected the project to lower the chance of theft in the Wahikuli area since burglars now approach homes at the edge of the subdivision through the cane fields. The increase in population will likely result in an increase in the incidence of crime in the region, no specific impact on existing subdivisions is projected (personal communication, Captain Ricky Nakashima, September 15, 1989).

Traffic: The Lahaina Civic Center Road and Kapunakea Street will provide access to the project from Honoapiilani Highway. The Lahaina Bypass Highway will eventually to serve as a major access route for the project and access ramps to the highway are part of the proposed project. Traffic impacts are discussed in Section 6.1.

Property Values: The project will likely have mixed impacts on property values in adjacent neighborhoods due to its effect on the rental market, its impact on the market for single family homes and the impact of specific project elements on immediately adjacent properties:

- By providing additional rental housing the project will likely have a short-term stabilizing effect on rental prices. The number of renters in existing residential neighborhoods could decrease leading to improved neighborhood appearance and improved value.

These effects are considered short-term because the project will not exhaust demand for new housing in West Maui and new sources of employment could lead to additional demand for rental housing.

- The project will provide homes for sale at prices below and above the range listed for houses in existing nearby subdivisions ($185,000 to 250,000). Its overall impact on sales prices in those neighborhoods is considered neutral (Locations, Inc., 1989). Property values are expected to increase but more slowly than has occurred in recent years.

By giving preference to families of moderate means who do not yet own housing, the project makes home ownership possible for population, instead of drawing its market from people who would otherwise buy in existing subdivisions.

- The project elements adjacent to or in sight of existing subdivisions, market priced housing units and the golf course, are expected to have a positive impact on values (Locations, Inc., 1989).

Impacts on Property Taxes: Property tax assessments follow market trends so the overall stabilizing trend expected for nearby property values will likely lead to stabilized tax assessments. Tax assessors usually consider new developments to be separate "neighborhoods" from existing adjacent areas with different values unless market trends show that existing and new subdivisions are of similar value. However, properties immediately adjacent to the project could be assessed as gaining in value because the project will offer amenities, notably golf course views, for these lots. (Because the existing cane haul road runs between Wahikuli house lots and the project, view improvements could be of marginal value.)

5.4.4.3 Additional Impacts on the Lahaina Community

Lahaina currently includes both a historic district and neighborhoods with residents who have little to do with the historic center. The project will continue this trend toward decentralization, but will encourage both neighborhood-level community organization in Lahaina and the orderly development of regional services.

The creation of a large new community in Lahaina with an active community organization is likely to promote community cohesion in other residential areas. At present, neighborhood level community organization is rare and mainly limited to Neighborhood Watch anti-crime activities. The project's community organization is to have powers and funds needed to support community activities and enforce neighborhood standards. It will set an example others are likely to emulate. The project will provide additional acreage to the Lahaina Civic Center, allowing expansion to meet the needs of the region's population. With more families headed by working parents living in Lahaina, demand will grow for childcare centers and organized activities for the young. To an extent, this is a positive impact, increased demand increases the likelihood that the State, the County and major employers in the area will act to address potential problems.

The project is not expected to have a direct impact on Pioneer Mill's workforce. As land is withdrawn from cane cultivation, a smaller workforce will be needed. The plantation currently cannot fill vacancies in its workforce (personal communication, J.D. Hance, President and General Manager, Pioneer Mill, September 27, 1989). Over the next decade, reductions in acreage due to the project could justify reducing the workforce by five to ten percent. Staff reductions can be achieved through attrition, so long as the project is developed and land withdrawn from cultivation, in phases.

5.5 MITIGATION MEASURES

The social impacts of the project are largely positive. Potential adverse impacts are few and are mitigable largely through design, community organization and the timing of development:

- A strong, appropriately funded and staffed community organization will be formed to assure that all HFDC and other residential unit covenants, conditions and restrictions (CC&R's) are enforced, either by the community association or by the state. This measure is considered by HFDC to be the key socioeconomic mitigation measure that will be employed within the Lahaina Master Planned Project.

- Additional demand for public facilities and services will be met both by on-site improvements and by adding land to the Lahaina Civic Center, where County facilities can expand to meet regional needs;

- Extensive landscaping, parks and the golf course will minimize the impression that the project is highly urbanized;

- Community pride will be fostered by design and construction, by planning (for mixed increments, not single-income-level "ghettos") and by organizing an active and effective community association;

- Possible violations of project rules (illegal rentals and additions and speculative sales) will be prevented by the community association and by enforcement of covenants, with positive results for the project's appearance and value;

- Perceived negative impacts on adjacent neighborhoods will be avoided through the placement of market units and open space near project boundaries; and

- The phasing of the development will promote stability in residential housing markets in West Maui and will allow major economic actors in the area, Pioneer Mill, other employers and housing developers, to plan for long-term economic growth.

6. INFRASTRUCTURE AND PUBLIC FACILITIES

6.1 TRANSPORTATION FACILITIES

6.1.1 Highways and Public Access

6.1.1.1 Existing Conditions

Honoapiilani Highway serves as the only improved surface transportation link between the Kapalua/Kaanapali/Lahaina areas in West Maui and the Wailuku/Kahului areas of central Maui (Figure IV-16).

Traffic flows are described in terms of Levels of Service (LOS). Levels of Service are labelled A through F, reflecting best to worst conditions. For unsignalized intersections, LOS is an evaluation of gaps in major street traffic flow and a calculation of capacities available for left turns across oncoming traffic and for left and right turns onto a highway from a minor street. For unsignalized intersections, LOS A is little or no delay; LOS B is short delays; LOS C is average traffic delays; LOS D is long delays; LOS E is very long delays; and LOS F is a condition where traffic volume demand exceeds the capacity of the roadway, resulting in extreme delays with queuing that may cause severe congestion and affect other traffic movements at an intersection. For signalized intersections, the LOS definitions are close to those for unsignalized intersections. LOS is measured in terms of delay, with delay being a measure of driver discomfort, frustration, fuel consumption and lost travel time. For signalized intersections, LOS

A is less than 5.0 seconds delay per vehicle; LOS B is 5.1 to 15.0 seconds delay per vehicle; LOS C is 15.1 to 25.0 seconds delay per vehicle; LOS D is 25.1 to 40.0 seconds per vehicle; LOS E is 40.1 to 60.0 seconds delay per vehicle; and LOS F is delay in excess of 60 seconds per vehicle. With each increase in delay, for signalized intersections, there is also a corresponding effect on turning movements, passing capacity and ability and flow rates along the roadway. Complete descriptions of the LOS are included in Appendix N.

In the vicinity of the project site, Honoapiilani Highway is a state highway that is generally aligned in a north-south direction. It is the primary route that provides regional circulation through the West Maui region, linking Kapalua, Kaanapali and Lahaina with other regions around the island, including Kahului, Wailuku and Kihei. Honoapiilani Highway was recently widened from three to four lanes with two lanes in each direction. Public dedication of these improvements was in October 1989, The four-lane segment of the highway extends from Lahainaluna Road in Lahaina to Kaanapali Parkway in Kaanapali. North of Kaanapali, the highway is an improved two-lane arterial roadway with paved shoulders.

Within the project area, Honoapiilani Highway is a four-lane arterial roadway that is signal controlled at its intersections with Civic Center Road, Kaniau Road, Front Street/Flemming Road and Kapunakea Street. Civic Center Road is a two-lane roadway that is generally aligned in an east-west direction. It provides access to the Lahaina Civic Center. Kaniau Road is a two-lane residential roadway that is aligned in an east-west direction. It provides access to Wahikuli subdivision and forms a signalized T intersection with Honoapiilani Highway.

At the southwesterly end of the project site, Kapunakea Street would be the nearest link to Honoapiilani Highway. Kapunakea Street has a 60-foot right-of-way and 40 foot curb-to-curb travelway. Its intersection with Honoapiilani Highway is signalized with provisions for left turn storage lanes on Honoapiilani Highway for east and west bound traffic.

Traffic counts were made specifically for the proposed project and augmented with those taken by the State Department of Transportation for the Lahaina Bypass Highway EIS. Existing levels of service for the five critical intersections are LOS B or better during both the am and pm peak hours.

Public access in the project area is also provided by the Lahaina, Kaanapali and Pacific Railroad which runs adjacent to and mauka of Honoapiilani Highway. The project will not affect either the railroad operation or right-of-way.

6.1.1.2 Probable Impacts

The proposed project will be intersected by the proposed State Department of Transportation (DOT) Honoapiilani Bypass Highway. The alignment of the proposed Bypass Highway is such that it will enter the project property from Ikena Street in the Kelawea Subdivision and proceed in a north/south direction for about one mile at which point it will turn downslope and run in a mauka/makai direction to its intersection with Honoapiilani Highway about one-half mile north

CORRECTION

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

A is less than 5.0 seconds delay per vehicle; LOS B is 5.1 to 15.0 seconds delay per vehicle; LOS C is 15.1 to 25.0 seconds delay per vehicle; LOS D is 25.1 to 40.0 seconds per vehicle; LOS E is 40.1 to 60.0 seconds delay per vehicle; and LOS F is delay in excess of 60 seconds per vehicle. With each increase in delay, for signalized intersections, there is also a corresponding effect on turning movements, passing capacity and ability and flow rates along the roadway. Complete descriptions of the LOS are included in Appendix N.

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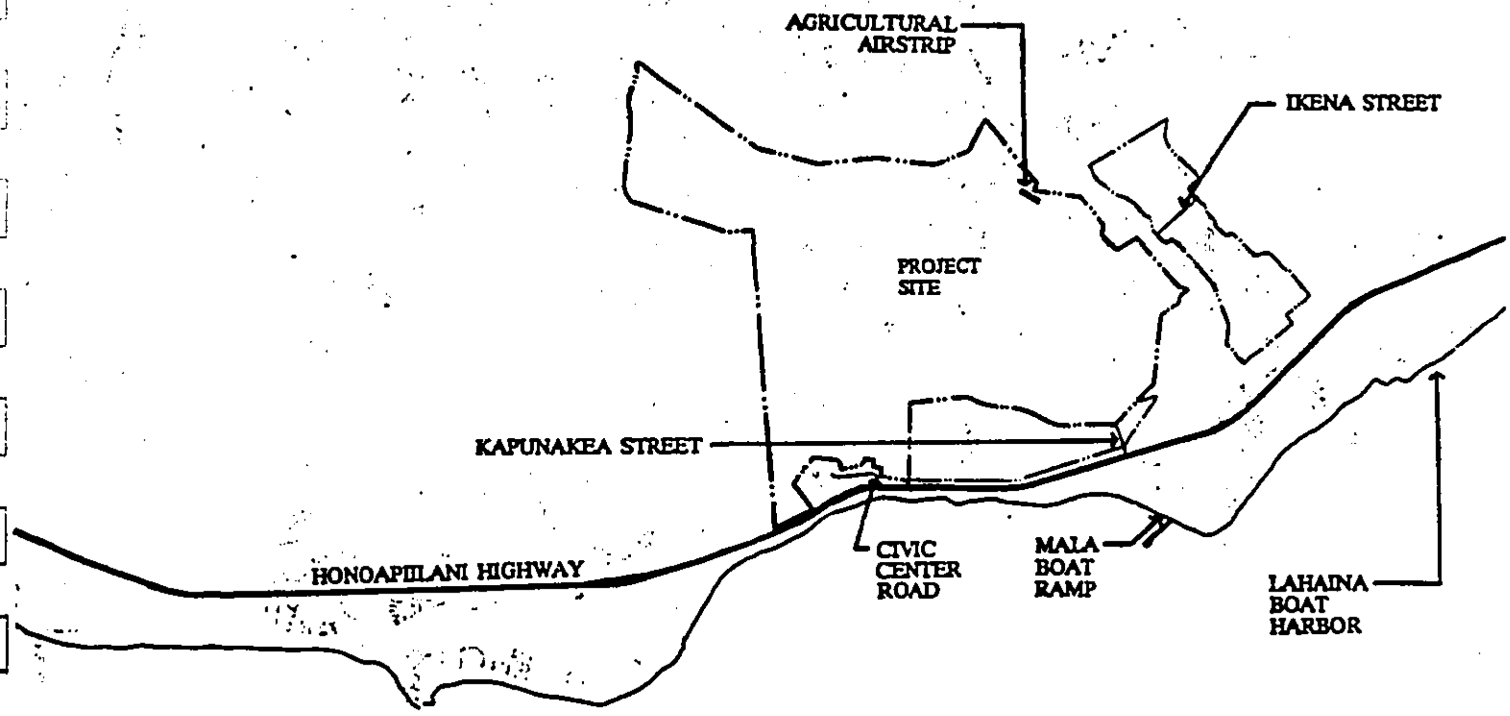


source: USGS 1983

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

0 1000 2000 4000 FEET

FIGURE IV-16
EXISTING TRANSPORTATION FACILITIES (ROADS, AIRPORTS, HARBORS)
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

of the Lahaina Civic Center. However, until the Bypass Highway is constructed, traffic generated by the proposed project will use the existing Honoapiilani Highway and internal roadway system to be constructed as part of the proposed project.

According to a sensitivity analysis conducted by the traffic engineers it is estimated that 60 percent of residential units of the HFDC project could be constructed before the four-lane capacity of Honoapiilani Highway is exceeded. It is anticipated that this limit would be reached after about 2,100 to 2,400 residential units had been constructed. Construction of the Bypass Highway would have to be completed by then, or shortly thereafter, to accommodate further development of the HFDC project. In the interim, various improvements will be required on the access road between Honoapiilani Highway and the HFDC project (see Mitigation Section). HFDC and DOT are discussing possible joint funding of the portion of the Bypass Highway that intersects the project site and/or HFDC funding of that portion of the highway.

Critical Movement Analysis, based on a "worst case" scenario of 4,800 residential units, performed at the intersections along Honoapiilani Highway at Civic Center Road, Kaniau Road and Front Street/Fleming Road indicate that these intersections would operate at LOS A during the am peak hour and at LOS B during the pm peak hour in 1991, i.e., without the bypass highway. The Honoapiilani Highway/Kapunakea Street intersection would operate at LOS A during the am peak hour and at LOS C during the pm peak hour. Also, the Honoapiilani Highway/Lahainaluna Road intersection would operate at LOS B during the am peak hour and at LOS C during the pm peak hour. These predicted conditions are without the bypass highway being constructed by 1991.

In 1994, without the Bypass Highway, the Honoapiilani Highway/Civic Center Road intersection could be expected to operate at LOS B during the am peak hour and at LOS D during the pm peak hour. The highway/Kaniau Road intersection and the highway/front Street-Fleming Road intersection would operate at LOS A during the am peak hour and at LOS C during the pm peak hour. The highway/Kapunakea Street intersection would operate at LOS A during the am peak hour and at LOS D during the pm peak hour. The highway/Lahainaluna Road intersection would operate at LOS C during the am peak hour and LOS E during the pm peak hour.

In 1995 with the Bypass Highway, the intersections of the Honoapiilani Highway and Civic Center Road, Kaniau road, Front Street/Fleming Road and at Kapunakea Street would operate at LOS B or better during both the am and pm peak hours. The Lahainaluna Road/highway intersection would operate at LOS A during the am peak hour and at LOS C conditions or better during the pm peak hour.

In the year 2000, with the Bypass Highway, the preceding intersections, with the exception of Kapunakea Street, would operate at LOS B or better during both the am and pm peak hours. The Kapunakea Street intersection would operate at LOS A during the am peak hour and at LOS C during the pm peak hour. The highway/Lahainaluna Road intersection would operate at LOS A during the am peak hour and at LOS D or better during the pm peak hour.

The analyses performed indicate that with the completion of between about 2,100 and 2,400 single and multifamily residential units as planned, any further development would be hindered by capacity limitations of Honoapiilani Highway.

The construction of the Bypass Highway, Alignment B (Figure IV-17), has been described in a separate environmental document (US Department of Transportation, Federal Highway Administration, 1989) and is planned to be constructed in three phases. In Phase 1 a two lane roadway will be constructed between Puamana and Kaanapali Parkway. Phase 2 will involve extending the two lane roadway from the Lahaina Civic Center area to North Kaanapali in vicinity of Low Honoapiilani Road/Honoapiilani Highway intersection. Widening of the 2 lanes installed in Phases 1 and 2 to four lanes will be accomplished in Phase 3. Additional improvements consisting of widening the Bypass Highway between the Kaunakea Street and the Lahaina Civic Center may be necessary if Phase 3 of the Bypass Highway does not occur in a timely manner.

Internal roadways serving the proposed project will be designed and constructed in accordance with applicable state and county standards. In addition, the roadways will be landscaped with appropriate street trees.

6.1.1.3 Mitigation Measures

The following roadway improvements would be made and mitigation measures taken in a time and manner determined appropriate to serve the proposed project and surrounding area:

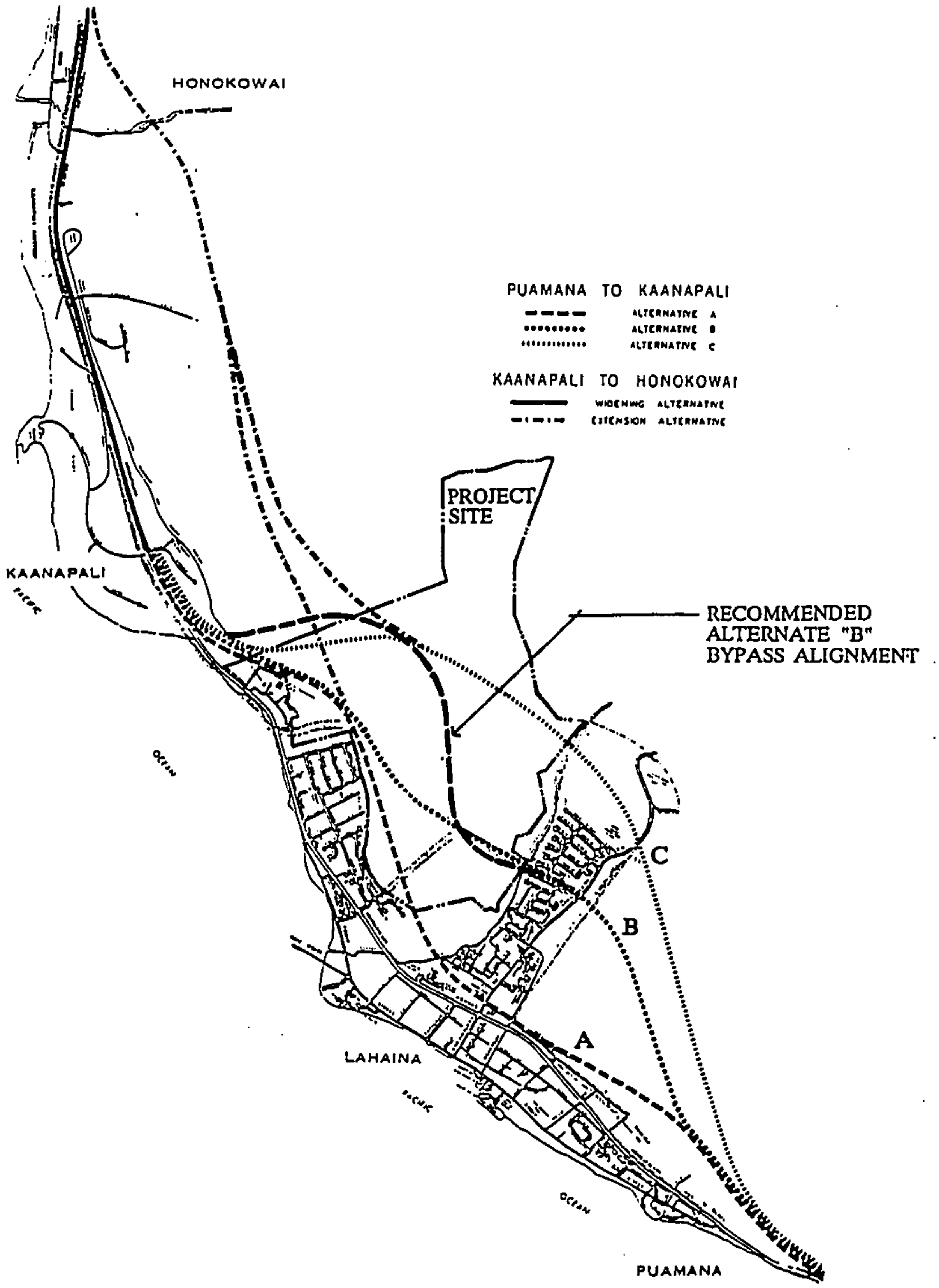
- Widening of Civic Center Road to a four-lane roadway with left turn channelization.

- Widening of Honoapiilani Highway to provide two northbound right turn lanes onto Civic Center Road.

- Widening of Honoapiilani Highway to provide a second southbound left turn lane onto Civic Center Road.

- Upgrading of existing traffic signal at the Civic Center Road/Honoapiilani Highway intersection.

- Construction of the Lahaina Bypass Highway in a timely manner. Crossings at the intersections of the Civic Center Road and Kapunakea Street should be grade-separated.



source: FEDERAL HIGHWAY ADMIN. AND HAWAII DEPT. OF TRANSPORTATION NOVEMBER 1988

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE IV-17
BYPASS HIGHWAY ALIGNMENT ALTERNATIVES
LAHAINA MASTER PLANNED PROJECT
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6.1.2 Air Transportation Facilities

6.1.2.1 Existing Conditions

The proposed project area and Maui are served by the Kahului Airport and Kapalua Airport. Kahului Airport is owned and operated by the State Department of Transportation while Kapalua Airport is privately owned and operated. As a result of existing as well as planned residential and resort developments in West Maui, passenger levels and aircraft operation at Kahului Airport are forecast to increase in the future. Present planning for the airport by the State Department of Transportation includes expansion of the airport facilities, including extension of the runway, to accommodate forecast increases in passenger levels and direct mainland US flights by wide-bodied aircraft and expansion of the terminal facilities. In addition to Kahului and Kapalua airports, there is an old agricultural airstrip on the project property that is used occasionally for crop dusting and plantation operations. This airstrip would continue to be used for agricultural purposes during and following development of the proposed project.

6.1.2.2 Probable Impacts

The proposed Lahaina Master Planned Project, in and of itself, is not expected to significantly affect air passenger and/or cargo levels at Kahului or any of the other state or private airports on the island. However, as part of the overall island development, it is likely that a portion of the visitors to and homeowners within the proposed project will transit through Kahului or Kapalua Airports. These visitors and owners are not expected to significantly affect the airport's service or facilities requirements.

6.1.2.3 Mitigation Measures

Because of the lack of significant impacts attributable to the proposed project, mitigation measures are not warranted. HFDC would continue to cooperate with the State Department of Transportation in the planning of the airports serving the island and project area.

6.1.3 Harbors

6.1.3.1 Existing Conditions

Kahului Harbor is the only deep water harbor on Maui and is used primarily by interisland barges. Cargo transiting through the harbor includes consumer goods, food stuffs, building materials, large equipment and machinery. The harbor is under the control of the State Department of Transportation. Lahaina and Maalaea Harbors are small boat harbors that cater to recreational and commercial fishing, sailing and pleasure boats. Both harbors have small boat launch ramps.

6.1.3.2 Probable Impacts

Kahului Harbor is expected to be the point through which the shipment of building materials, consumer goods and household goods for residents of the proposed project occurs. Also there is the possibility that Lahaina and Maalaea Harbors will be used by future residents of the proposed project. All of these facilities are either presently capable of handling increased cargo or small boats and/or are planned to be expanded by the state to handle forecast increased usage. The proposed project is not expected to significantly effect any of the island's harbors.

6.1.3.3 Mitigation Measures

Given the lack of expected impacts to the island's harbors, mitigation measures are not warranted.

6.2 CLIMATE AND METEOROLOGY

6.2.1 Existing Conditions

The project area climate is typical of Hawaii, with little seasonal or diurnal temperature variation. Monthly temperature averages vary only by a few degrees from the warmest months (July and August) to the coolest months (January and February) (NOAA, 1974). The area is dry with an annual rainfall of about 12 inches and a Thornwaite precipitation/evaporation (P/E) index of 14.9 (Thornwaite, 1931).

Local terrain on Maui plays an important role in determining both wind direction and speed at any particular location. Areas such as the project site that are within the "wind shadows" of the highest elevations of the West Maui Mountains or Haleakala are shielded from all but the strongest tradewinds and experience a very pronounced land-seabreeze regime. The northeasterly tradewinds are accelerated due to a venturi affect as they pass between the two major mountain masses. Daytime tradewinds in the project vicinity appear to have a more northerly component as they pass around the flank of Haleakala. At night, drainage winds coming down the mountains frequently prevail. Afternoon winds demonstrate a strong westerly component and predominance of northwesterly winds.

6.2.2 Probable Impacts

The proposed project is not expected to be impacted by or have any impact on the climate or meteorology of the project area or region. Planned structures would not be tall enough to significantly affect existing wind patterns; and new landscaping or residential vegetation is not expected to be great enough to significantly affect temperature or rainfall patterns. Residential design standards, as expressed in the Master Plan, take into account the usually warm temperatures and dry conditions of the project area.

6.2.3 Mitigation Measures

Due to the lack of expected environmental impacts on the existing climatological and meteorological characteristics of the project area or region, mitigation measures to minimize potential adverse impacts are not warranted.

6.3 AIR QUALITY

6.3.1 Existing Conditions

An air quality impact assessment of the proposed project has been completed and is included as Appendix J. A number of sources affect air quality in the project area. These include agricultural activities, bagasse and fossil fuel burning at the sugar mill, vehicular activity and agricultural pesticide. spraying. Studies in Lahaina (Anderson, et al., 1984) have indicated that carbon monoxide concentrations, due to resort related automobile traffic exceed state air quality standards. Occasionally, volcanic air pollution from Kilauea Volcano on the Island of Hawaii can also influence Maui's air quality.

The State Department of Health has recently installed particulate matter - 10 microns (PM-10) samplers at Lahaina and Kihei to the southwest of the project site. Sulphur dioxide (SO_2) has also been conducted in Kihei. The data, as shown in Table 2 and 3 of Appendix J, indicate that state and federal standards for inhalable particulates (PM-10) and SO_2 are being met. It is noted that the state has total suspended particulate (TSP) standards, but is measuring PM-10 particulates which are not directly comparable. The principal automotive pollutants, carbon monoxide (CO), nitrogen dioxide (NO_2) and ozone (O_3) are not routinely monitored on Maui.

In conjunction with the air quality impact assessment for the proposed project, air sampling was conducted at the Civic Center Road/Honoapiilani Highway intersection in November 1989. The sampling site was within 10 meters of the road edge and on the west side of the road in the morning and east side in the afternoon due to the prevailing winds at the time. A continuous CO instrument was set up and operated during the peak am and pm traffic hours as determined by the traffic assessment performed for the project (Appendix I). Additionally, an anemometer and wind vane were installed to record surface winds at the time of the measurements and manual traffic counts were made.

During the monitoring period, the synoptic weather pattern was characterized by light and variable winds with a southerly component that transported volcanic air pollution from Kilauea Volcano and resulted in the general deterioration in visibility due to "VOG" haze. During the afternoon sampling CO averaged 5.8 mg/m^3. During the am period, CO averaged 3.8 mg/m^3.

6.3.2 Probable Impacts

The principal source of short-term impacts to the air quality of the project area will be construction activities. Construction vehicle activity will increase automotive pollutant levels along Honoapiilani Highway as well as within the project site. Site preparation and earth moving will create particulate emissions as will building and on-site road construction. EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate silt content (30 percent) and a precipitation/evaporation (P/E) Index of 50 (Thornwaite, 1931 and US EPA, 1985). The silt content of the project site soils is about 55 percent and the P/E Index is 14.9. As such, there is a clear potential for fugitive dust generation during construction activities.

There will also be off-site air quality impacts due to the operation of concrete and asphalt batching plants. Because the concrete and asphalt requirements are not known at this time, it not possible to determine the exact air quality impacts from these sources. However, based on modeling of known concrete batch plants on Maui, it appears that the federal PM-10 standards would be met. The state does not have PM-10 standards. In addition, air quality modeling of a typical asphalt batch plant indicate that state and federal standards for NO_2, CO would be met.

Short- and long-term automotive emissions have also been modeled for worst case meteorological conditions with and without the proposed project. The results of this modeling indicate that the potential for exceeding the state but not the federal CO standards already exists at the intersections of Civic Center Road/Honoapiilani Highway, Kapunakea Street/Honoapiilani Highway and Lahainaluna Road/Honoapiilani Highway. At the Civic Center Road/Honoapiilani Highway intersection, CO levels tend to decline over the 1991-2000 period without the project. By 2000, no exceedance of the state 1-hour standard is predicted and only one exceedance of the 8-hour standard at a close-in receptor is predicted. With the addition of the project, the potential exceedance of the state standard continues into 2000 although less possible exceedances as the years go by. One possible exceedance of the federal standard is predicted 1994 with the project but disappears by 1995.

The Kapunakea Street intersection shows similar future conditions with the state's 1-hour standard being met by 2000 with or without the project. The 8-hour standard, in close proximity to the intersection, appears to be threatened through the year 2000 with or without the project. At the Lahainaluna Road intersection, air quality is somewhat better in that both the 1-hour and 8-hour standards are met by the year 2000 with or without the project.

Other long-term air quality impacts can be expected from continued cane field burning, use of the cane haul roads, continued operation of Pioneer Mill, continued agricultural pesticide spraying and continued generation of electricity to serve the project and island. In general, with proper dust control and pesticide use, and existing controls on the mill and electrical generation plants, state and federal standards should be met.

6.3.3 Mitigation Measures

There is a significant potential for short-term fugitive dust due to the dry climate and fine soils of the project area. This can be controlled adequate dust control, such as frequent water spraying of graded areas and planting of ground cover as soon as possible. In addition, construction vehicle activity on Honoapiilani Highway should be restricted to off-peak hours to the maximum extent possible. To reduce and minimize potential automotive generated air quality impacts, additional highway improvements could be made to promote increased traffic flow, a public transit system and/or car or van pooling operation could be established and residents can be made aware of the need to properly maintain their automobiles to reduce air quality impacts. To mitigate possible impacts resulting from agricultural activities, close attention should be given to meteorological conditions prior to burning and pesticide spraying activities and required notification of prospective home buyers that purchase of a residence in the project includes possible cane smoke exposure. HFDC will require all construction contractors to adhere to federal, state and county environmental protection rules and regulations, including air quality regulations and standards.

6.4 NOISE QUALITY

6.4.1 Existing Conditions

Existing traffic noise levels were measured at six locations in the project environs to provide a basis for developing forecasts of future traffic noise resulting from the proposed project. The locations of the measurements are shown on Figure IV-18. Additionally, aircraft noise measurements were made to determine existing and future aircraft noise levels in the vicinity of the project site. Lastly, an acoustical analysis of various activities at the Lahaina Civic Center amphitheater has also been performed to determine potential noise impacts resulting from those activities on the proposed project. The analyses performed are included in Appendix K.

Calculations of existing and future traffic noise levels, in terms of hourly Equivalent Sound Level (Leq) and Day-Night Average Sound Level (Ldn) noise descriptors, have been made. For the purposes of determining noise acceptability, the Federal Housing Administration (FHA), Department of Housing and Urban Development (HUD) and Veterans Administration (VA) standards have been used in the noise analysis. In general, an exterior noise level of 65 Ldn or lower is considered acceptable. This standard is applied nationally. For aircraft noise, the State of Hawaii Department of Transportation, Airports Division has recommended that 60 Ldn be used as the common level for determining land use compatibility or noise sensitive areas near airports. In addition, for those noise sensitive land uses that are exposed to aircraft noise greater than 55 Ldn, the division recommends that disclosure of the aircraft noise levels be provided prior to any real property transactions.

Based on the traffic noise measurements, existing noise levels in the project area are in the "Significant Exposure, Normally Unacceptable" category as defined by the US Department of Housing and Urban Development (HUD) at 50 feet distance from the centerline of Honoapiilani Highway. At greater setback distances of 100 to 200 feet from the centerline of the highway, traffic noise decreases to the "Moderate Exposure, Acceptable" category (Appendix K). Calculations of existing traffic noise levels during the pm peak traffic hour indicate that the hourly Leq or Equivalent Sound Level, in decibels (dB) along the highway ranges from 67.9 to 73.0 and at the west end of Lahainaluna Road the Leq decreases to 61.3. Generally, HUD guidelines indicate that traffic sound levels below 65.0 Leq are within an acceptable level. Existing traffic noise levels at the mauka portions of the project site are very low, i.e., less than 60 Ldn, due to their large setback distances from Honoapiilani Highway.

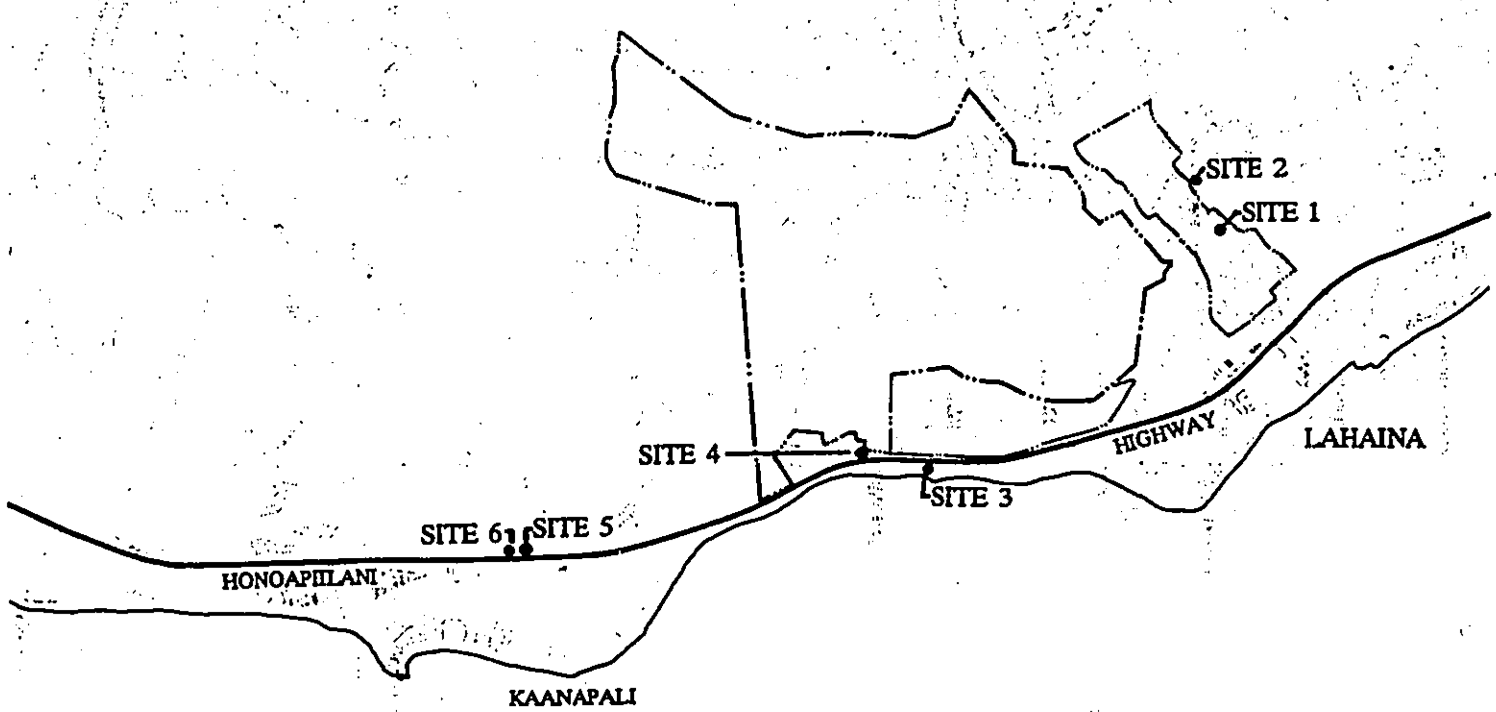
Existing aircraft noise levels in the project site are less than 55 Ldn, and, as such, are considered to be within the "Minimal Exposure, Unconditionally Acceptable" category for the planned land uses on the site.

In addition to traffic noise, acoustical measurements in and around the Lahaina Civic Center were also made (see Appendix K). These measurements included day and nighttime sports events (basketball games) and day time rock concert rehearsals. Based on the measurements, the maximum sound levels generated during the rock concert rehearsals ranged from a high of 97 dBA in the center of the amphitheater to 53 dBA at a site near the easterly edge of the Civic Center complex. If the 55 dB average sound level is used as an approximate complaint risk threshold, and present sound equipment methods are continued, risk of rock music concerts are expected to be high if noise sensitive developments, e.g., housing, are constructed within 1,400 to 2,000 feet distance east (mauka) and within 800 to 1,200 feet distance south of the amphitheater stage. Maximum outdoor sound levels measured during a basketball game at the Civic Center gymnasium ranged from 75 dBA along the roadway immediately west of the gymnasium to 60 dBA at a site near the northwesterly boundary of the Civic Center complex. Based on the measurements taken, there is a risk of noise complaints within the project area west of the industrial road due to the basketball scoreboard horn. However, because of its intermittent use, it is unlikely that the game horn would exceed the Department of Health noise limits of 55 and 60 dB more than 10 percent of the time.

The dominant noise sources in the project environs are heavy diesel and haul trucks that travel on the existing haul roads through the cane fields. These heavy trucks generate maximum noise levels of approximately 85 to 92 dBA at 50 feet setback distance. During a typical day of the harvesting season, cane haul and diesel trucks operate on the haul roads 24-hours per day at an average number of four to six trips per hour along the main north/south haul road. Existing noise exposure levels along the main road are between 65 and 70 Ldn at 50 feet distance from the centerline of the haul road.

6.4.2 Probable Impacts

Projections of future traffic noise levels were made using the traffic volume assignments shown in Appendix I. Traffic conditions on Honoapiilani Highway are expected to worsen and average vehicle speeds reduced by about five miles per hour (mph). The net result of these traffic conditions is that traffic noise levels during the pm peak hour will tend to remain the same as existing noise levels. Minimal to moderate increases of 0.5 to 1.5 Ldn are expected to occur along Honoapiilani Highway in the vicinity of the project. Similarly, increases in noise levels attributable to the proposed project traffic along Lahainaluna Road are expected to be small. The largest increases in noise levels attributable to the project are expected to occur along the Lahaina Bypass Highway that will cross through the project site.



source: Y. EBISU & ASSOCIATES 8/28/89

Prepared for: Housing Finance and Development Corporation
Prepared by: PBR HAWAII

FIGURE IV-18
TRAFFIC NOISE MONITORING SITES
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

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The increases in traffic noise levels attributable to the project from present levels to the year 2000 levels are predicted to range from 0.4 to 1.0 Ldn along Honoapiilani Highway, where traffic noise levels are expected to remain above 65 Ldn along the highway right-of-way. This degree of increase over an 11-year period will be difficult to perceive and is not considered to be significant. As such, traffic noise impacts resulting from the proposed project are not expected to be serious.

Relatively large increases in traffic noise levels along the proposed Bypass Highway are expected to occur as a result of the proposed project. By the year 2000, project traffic is expected to increase traffic noise levels along the Bypass Highway by approximately 4.0 Ldn. Maximum setback distances of approximately 200 feet from the Bypass Highway centerline could be required to meet FHA/HUD/VA noise standards if unobstructed line-of-sight conditions occur between the Bypass Highway and noise sensitive receptors. Should noise shielding by terrain features or man-made obstructions be used. setback distances could probably be reduced to less than 100 feet.

Along the new connector roadways within the project site, traffic noise levels are expected to be less than the FHA/HUD standard of 65 Ldn at distances ranging from 55 to 75 feet from the centerlines of connector roadways.

In addition, with construction of the Kapunakea Street connector to the Bypass Highway, traffic noise levels along the existing section of Kapunakea Street are expected to increase to levels between 65 to 70 Ldn, i.e., above the FHA/HUD VA noise standard.

Construction activities will be unavoidable during the entire construction period. The total time any one given location and noise receptor within the project site will be subjected to construction noise is not known. The noise sensitive properties that are predicted to experience the highest noise levels during construction are the existing subdivisions west and south of the project site and the Lahaina Civic Center area.

Future aircraft noise levels over the project site are predicted to be less than 55 Ldn based on noise modeling of the worst case condition at the West Maui Airport. As such, the proposed project is not expected to be impacted by aircraft noise. Similarly, because of planned setback distances from cane haul roads that will be retained, noise generated by cane and pineapple haul trucks is expected to be within the "Moderate Exposure, Acceptable" category at the lots closest to the haul roads.

Based on the analysis of noise generated by various activities at the Lahaina Civic Center Auditorium and Amphitheater, potential impacts, from loud concerts at the amphitheater (about six times per year) as well as sports activities in the gymnasium, could be experienced within the lower northwesterly portions of the project area, i.e., those closest to the Lahaina Civic Center. As indicated previously, if the 55 dB average sound level is used as an approximate complaint risk threshold, and present sound equipment methods are continued, risk of rock music concerts are expected to be high if noise sensitive developments, e.g., housing, are constructed within

1,400 to 2,000 feet distance east (mauka) and within 800 to 1,200 feet distance south of the amphitheater stage. Less impact would be experienced as a result of gymnasium activities.

6.4.3 Mitigation Measures

Because of potential traffic noise levels above the FHA/HUD/VA standard of 65 Ldn within specific areas of the project site and area, mitigation measures will be required to minimize traffic noise impacts resulting from the proposed project. Existing residences along Ikena Avenue may be required as part of the Bypass Highway project. Similarly, noise mitigation measures for those residences along Kapunakea Street may be required to meet federal standards. These mitigation measures may be in the form of sound attenuation walls; land purchase thereby increasing setback distances to potentially affected homes; closure and air conditioning of the homes; or the addition of sound attenuation windows. Further mitigation could be in the form of more detailed study prior to roadway construction to identify and design the final noise mitigation measures.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources and due to the exterior nature of the work. The use of properly muffled equipment will be required and all work will be limited to daytime hours.

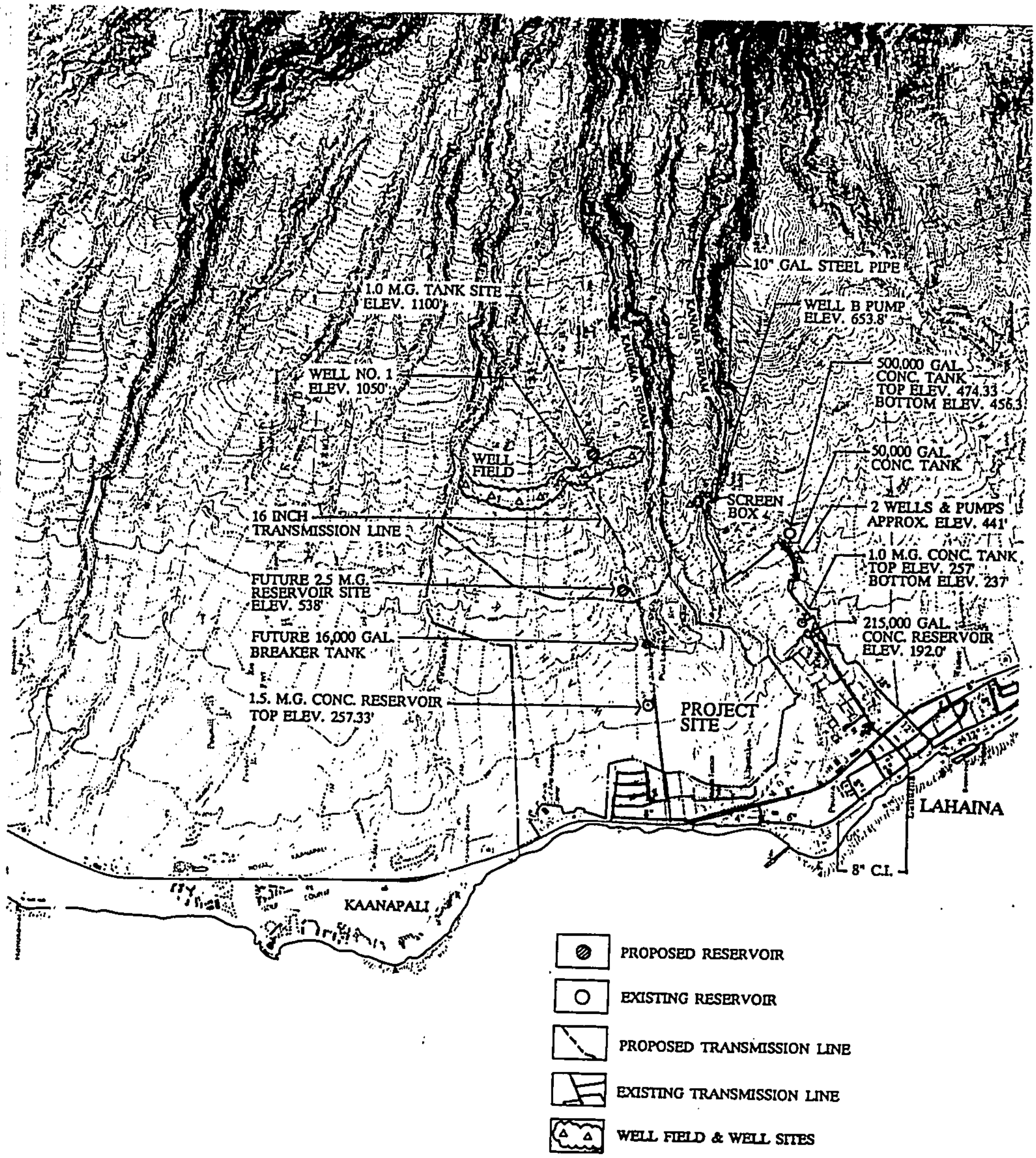
Mitigation of noise generated during rock concerts at the Civic Center amphitheater could be accomplished through the construction of sound attenuating walls mauka of the amphitheater and the installation and use of a distributed outdoor speaker system within the amphitheater; improvement of the gymnasium to accommodate rock concerts indoors as well as retaining noise generated during sports events within the gymnasium through sound attenuation improvements, such as total closure and air conditioning; and the use of sound attenuation construction techniques and materials for the residential units closest to the Civic Center complex. As shown in Figure II-6 (see Chapter II) the closest residential units immediately east of the Civic Center complex will be shielded by two golf holes such that the closest units would be about 1,200 feet east (mauka) of the amphitheater.

6.5 POTABLE WATER SYSTEM

6.5.1 Existing Conditions

Water Supply Source: The County water system in West Maui, which extends from Lahaina to Napili, is served by three surface sources and eight wells (Figure IV-19). (Kaanapali and Kapalua Resorts both have their own private water systems).

At the south (Lahaina) end the Kanaha sub-intake taps water from Kanaha Valley north of Lahainaluna High School. This is augmented by four (4) ground water or well sources, Kanaha 1 and 2 and Waipuka 1 and 2. At the northerly end of the County water system for West Maui, sub-intakes withdraw water from Maui Land & Pine Co.'s Honokahau Ditch at Honokahau and Alaeloa. This ditch receives its water from the Honolua and Honokahau Valleys. Four wells



source: WARREN S. UNEMORI ENGINEERING INC. 10/31/89

Prepared for: **Housing Finance and Development Corporation**
Prepared by : **PBR HAWAII**

FIGURE IV-19
<u>WATER SOURCE STORAGE TRANSMISSION SYSTEM</u>
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located mauka of the Napili Community and referred to as Napili Wells 1, 2 and 3 and Honokahau Well A also feed into the West Maui municipal system. The amount of water withdrawn from each source in Fiscal Year 1987 is shown in Appendix C, Table I. The total surface and ground water used in 1987 average 5.61 million gallons per day (mgd).

Transmission System: The Napili and Kanaha sources are interconnected by approximately 13 miles of 8, 12 and 16 inch lines. Due to the limited productive capacity of the Kanaha sources, all areas north of Dickenson Street in Lahaina Town to Napili are currently served by the Napili sources. Only areas south of Dickenson Street are fed by the Kanaha sources.

Storage Facilities: Storage for the West Maui municipal water system is provided by a 1.0 MG tank at Alaeloa, a 1.5 MG tank above Wahikuli and another 1.0 MG tank above Lahaina Town north of Lahainaluna Road. There are several other tanks located near the wells and intakes at Napili and Kanaha. These range in size between 100,000 gallons to 500,000 gallons. They serve primarily as control tanks.

6.5.2 Probable Impacts

Water Demand: Assuming a "worst case" scenario, estimates indicate that a 4,800 residential unit project could be expected to require an average daily demand of 2.8 million gallons per day (mgd). This is based on an average daily demand of 560 gallons per unit per day (gpud) for multifamily low rise project and 600 gpud for single family or duplex units. The maximum daily demand is estimated to be 150 percent of average daily demand. This translates to an estimated 4.2 mgd. These figures do not include water demand for schools or commercial zoned areas. Therefore they will have to be updated when detailed design and engineering studies for the entire project are finalized. The golf course, parks and streetscape areas will be watered with brackish water that is developed on-site.

Source: In order to satisfy the maximum projected water demand of the project, a new groundwater source will have to be developed. To produce the needed 4.2 mgd, six wells rated at 400 to 450 gpm will be required. Two additional standby wells also will be necessary. These wells can be developed in pairs at interval of three years to stay abreast of the project's implementation. The locations of these wells is shown on Figure IV-19.

Storage: The project site rises from an elevation of 14 feet above sea level at Honoapiilani Highway to about 680 feet at the northeast corner. The existing 1.5 MG Department of Water Supply Wahikuli storage reservoir at elevation 235 feet can serve the area between Honoapiilani Highway and elevation 130 feet. The area above elevation 130 feet will require two storage reservoirs, a 2.5 MG reservoir at approximate elevation 550 feet and a 1.0 MG reservoir at approximate elevation 1,100 feet in vicinity of the proposed well field. It is noted that at the time detailed design and engineering studies are prepared for the various phases of the project, water storage requirements will be reanalyzed to assure that adequate storage facilities are provided. The locations of the storage tanks are shown on Figure IV-19.

Transmission System: Approximately 8,000 feet of 16-inch diameter transmission line will be required to convey water from the proposed well source to the project and the 1.5 MG County reservoir at Wahikuli. This transmission system will have to be installed in conjunction with the first phase of the project. The project will require that an easement for the transmission system will be required and obtained from the property owner(s). Negotiations between HFDC and property owners are currently underway and will be completed prior to installation of new water system components.

HFDC has been and will continue to work with the County Department of Water Supply and private property owners to ensure that the project potable water system meets the requirements of the project, is developed in compliance with state and county standards and does not deny existing or other planned residential projects adequate water supplies (see Chapter IX).

6.5.3 Mitigation Measures

The project's required new wells, pumping system, storage tanks/reservoirs and transmission lines connecting the new water source to the Wahikuli Tank must be completed before occupancy of the project's first homes. Plans and an implementation schedule would be prepared in coordination with the County and Department of Water Supply. Based on preliminary analyses, it appears that the island's groundwater resources are adequate to supply the required potable and brackish water demand. Detailed analyses will be performed prior to construction of individual phases to assure adequate supplies of both potable and brackish water are provided to the project site. All potable water system improvements and enhancements will be designed engineered and constructed in compliance with applicable State Department of Health and Water Resources Development Commission rules and regulations and permit requirements.

6.6 WASTEWATER TREATMENT AND DISPOSAL

6.6.1 Existing Conditions

Wastewater Transmission System: The existing wastewater transmission system between the proposed HFDC project site and the Lahaina Wastewater Treatment Plant (WWTP) at north Kaanapali consists of three major sewage pump stations and force mains and two gravity transmission sewers. Wastewater from the Lahaina Town area is pumped by County Sewage Pump Station (SPS) No. 3 to a manhole at the upstream end of Sewer Line B. Sewer B conveys the wastewater by gravity to SPS No. 2 located east of the Kaanapali Parkway/Honoapiilani Highway intersection. Wastewater from the Kaanapali and Lahaina areas is pumped by SPS No. 2 to a manhole at the upstream end of Sewer Line C. Sewer line C then conveys the combined wastewater flows by gravity to SPS No. 1. The wastewater is then pumped by SPS No. 1 via a 20-inch force main to the headworks of the Lahaina WWTP.

Lahaina Wastewater Treatment Plant (WWTP): The Lahaina WWTP serves the Lahaina, Kaanapali, Napili-Honokawai and Kapalua areas of West Maui. The existing treatment plant has a design average daily flow capacity of 6.7 MGD. Approximately 3.16 MGD of the plant capacity has been allocated to the Kaanapali resort.

At present, there are no flow measurement devices that provide a direct indication of individual flows from the Lahaina Town, Kaanapali, and Napili-Honokawai areas. Plant operators estimate that the Lahaina and Kaanapali areas account for approximately 3.5 MGD of the average influent flow to the treatment plant. Average daily wastewater flow to the plant ranges from 2-3 MGD during periods of low visitor occupancy to 6-7 MGD during periods of high visitor occupancy (average flow of 5.6 MGD).

6.6.2 Probable Impacts

Wastewater Flows: Assuming a "worst case" scenario, a 4,800 unit HFDC residential development is estimated to generate 2.5 mgd of average daily wastewater flow. The existing County wastewater transmission system and treatment plant are rapidly reaching capacity. Therefore improvements to the transmission and treatment facilities will be necessary. These improvements are described below and shown on Figure IV-20.

Wastewater Transmission System: Two alternatives are being considered for the Wastewater Transmission System. In general, Alternative I involves upgrading and replacing portions of the existing system. In Alternative II, a new transmission and pumping system would be installed between the project site and the Lahaina WWTP. Approximately 14,000 feet of new 27-inch diameter gravity line would be installed along the cane haul road to a point 2,000 feet southwest of the WWTP. A pump station would be installed at this location to pump he wastewater into the headworks of the existing treatment plant through a 20-inch force main. Alternative II has been recommended as the preferred system (Unemori Engineering, Inc., 1989).

Wastewater Treatment Plant: The capacity of the existing treatment plant is 6.7 mgd. Of this, 3.16 mgd has been allocated to Kaanapali Resort in return for their prior participation in the treatment plant expansion. According to County sources the remaining 3.54 mgd of the County's allocated capacity is being fully utilized by current municipal flows. However, according to County Public Works personnel, there is sufficient treatment plant capacity to allow the first phase of residential development to proceed and utilize the treatment plant. However, to augment the treatment facility's capabilities for future project phases of residential development, a modular, package treatment plant will be erected adjacent to the present WWTP. Wastewater will be treated (secondary treatment) in the package plant and be disposed of via the WWTP offshore outfall. The package treatment plant would be abandoned following improvements to the Lahaina WWTP. This is in keeping with Department of Health policies that are generally against package treatment plants.

The County of Maui has retained a consultant to conduct preliminary engineering studies and to design the next increment of Lahaina Wastewater Treatment Plant expansion. Proposed improvements are estimated to expand the treatment plant capacity to 10.2 mgd. The expansion is not expected to be completed before 1993 or 1994 at the earliest. To address the interim need for sewage treatment for the Lahaina Master Planned Project, the cost of installing a packaged treatment plant at the project site or some other appropriate location as an interim means of sewage disposal was evaluated. The preliminary estimated cost of a 0.50 mgd package treatment plant including site work, injection wells, standby power generator, etc. is $2.0 million. Increasing the capacity by another 0.50 mgd after three years is project to cost another $1.4 million. Upon completion of improvements and expansion of the municipal collection and treatment facilities the package plant will have to be abandoned in favor of connection to the municipal system. In general, a portion of the wastewater transmission system will be located within the County Special Management Area (SMA). As such, generally an SMA permit is required. However, because the transmission lines, pump stations and other facilities will be located below ground and/or less than four feet above ground, the portion of the system within the SMA is exempted from the permit requirements. Installation of the wastewater transmission system within the SMA is not expected to result in any adverse environmental impacts in that the majority of the system would be installed adjacent to the Industrial Road and/or below ground.

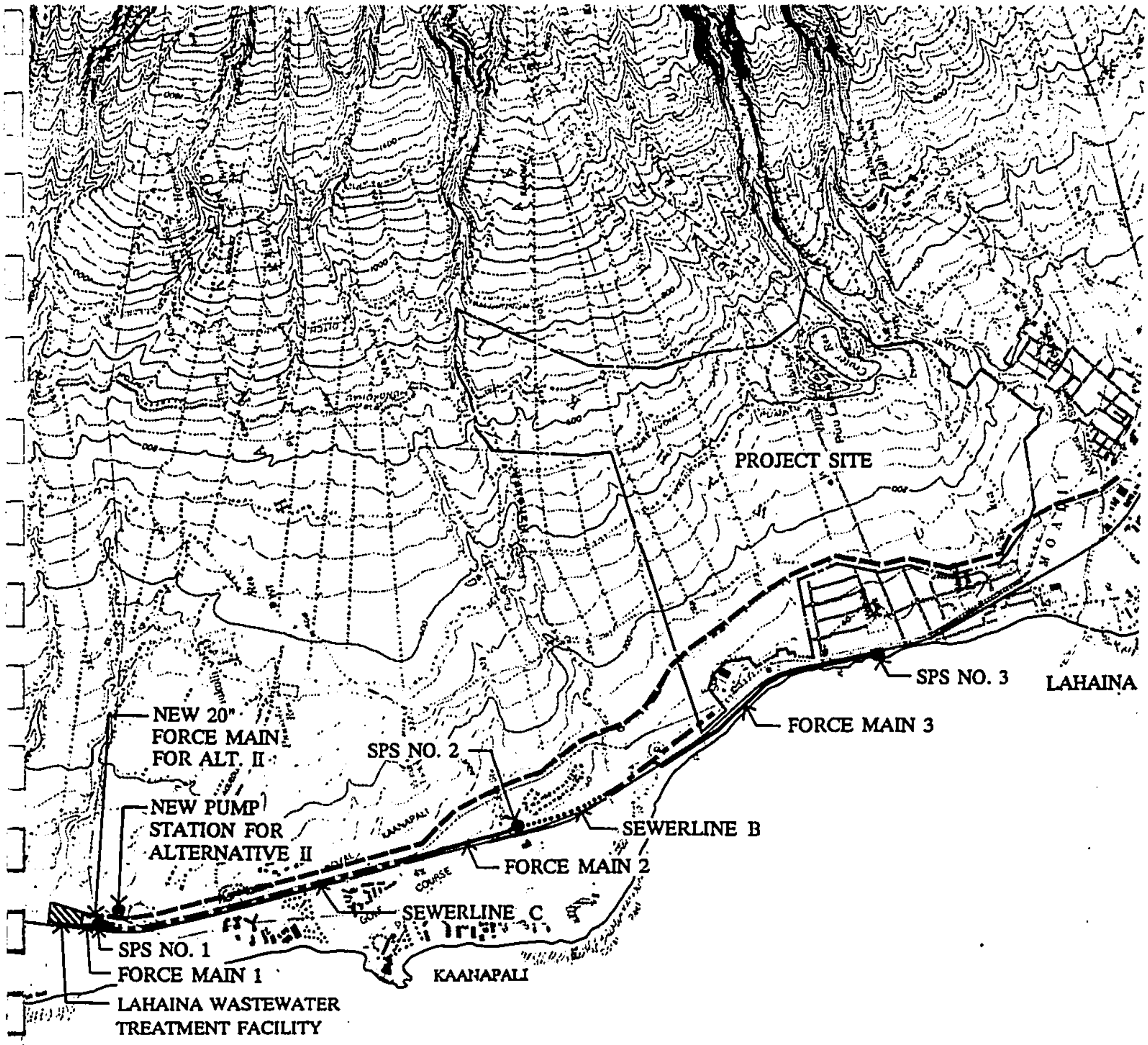
6.6.3 Mitigation Measures

The Department of Public Works for the County of Maui has conditioned wastewater system connection approval for Phase I on replacing the existing constant flow pumps in Pump Station No. 1 with variable speed pumps. Off-site major improvements to the existing wastewater transmission system between the project site and the Lahaina WWTP will be required after Phase I. These improvements would be installed in accordance with requirements and scheduling set forth by the Maui County Public Works Department.

Alternative II is the recommended route for the new transmission and pumping system. Wastewater would be collected and pumped through new transmission lines to the Lahaina WWTP. Provisions for this (Alternative I or II) wastewater transmission system will be approved prior to any subdivision approvals for the project and installed in accordance with requirements and scheduling established by the county.

A temporary package treatment plant adjacent to the Lahaina WWTP will be constructed as part of the proposed project off-site improvements. This package plant would be installed in conjunction with the new transmission system in Alternative II mentioned above, subject to approval of the county and appropriate land owners. The temporary system or other treatment acceptable by the county would be utilized until which time the Lahaina WWTP expansion is complete. All wastewater system improvements and enhancements will be designed, engineered and constructed in compliance with applicable State Department of Health and County Department of Public Works rules and regulations and permit requirements.

As an added mitigation measure, HFDC could contribute, on a prorata basis, to the expansion of the Lahaina WWTP. Fees or payment would be subject to the approval of the county and would be administered by the county.



source: WARREN S. UNEMORI ENGINEERING INC. 10/31/89

Prepared for: Housing Finance and Development Corporation
Prepared by : PBR HAWAII

FIGURE IV-20
WASTEWATER TRANSMISSION SYSTEM
LAHAINA MASTER PLANNED PROJECT
Environmental Impact Statement

0 750 1500 3000 FEET

6.7 SOLID WASTE COLLECTION AND DISPOSAL

6.7.1 Existing Conditions

At present, solid waste generated in the area is collected and disposed of by the county and private contractors. Residential waste is disposed at the new Puunene landfill site in Central Maui. The County Public Works Department is in the process of bidding a new Olowalu Convenience Center which would receive residential waste. Once constructed, waste delivered to the convenience center would be transported by the county to the Puunene landfill site. In an effort to reduce the quantities of solid waste presently generated on Maui and requiring disposal at landfill sites, community organizations and the county have begun recycling programs whereby organizations earn income from paper and metal wastes that are sold to recycling companies.

6.7.2 Probable Impacts

It is estimated that the quantities of solid waste to be generated by the proposed project will be about 3.5 pounds per person per day, based on the national average, or a total of about 42,000 pounds per day at build-out for the entire project. It is expected that existing and/or planned public or private waste disposal sites would be adequate to handle increased amounts of solid waste to be generated. Further, the county has been considering the possibility of constructing a refuse fueled electrical generating station that would relieve pressure on existing landfill disposal sites. It is possible that the proposed residences and other facilities could be equipped with waste compaction equipment to reduce the volume of solid waste generated by the proposed project, thereby assisting to extend the life of solid waste landfill sites. In addition, HFDC will encourage the project community association(s) that will be established to pursue recycling programs to further reduce the quantities of solid wastes that would require disposal in a landfill and to earn income for the community association.

6.7.3 Mitigation Measures

As indicated, the community association(s) will be encouraged to pursue recycling programs and home designers will be encouraged to utilize trash compactors in the residential units.

6.8 ELECTRICAL POWER AND COMMUNICATIONS

6.8.1 Existing Conditions

Electrical service to the project site would be provided by Maui Electric Company (MECO). Present systems consist of a combined overhead and underground distribution system. Hawaiian Telephone Company provides telephone service to the area. The current system consists of an overhead cable along Honoapiilani Highway.

6.8.2 Probable Impacts

MECO and Pioneer Mill Company main transmission lines are now located along the west edge of the proposed golf course, above the present Wahikuli subdivision on the cane haul road. The road and line branch near the north end of Wahikuli subdivision into an upper and lower road. The upper transmission line would be relocated to the lower road. The relocated line would be reconnected to the remaining portion of the upper line outside the project boundary.

The other one-half of the overhead loop (69Kv) passes over part of the proposed golf course at the 13th fairway at approximately the 435-foot elevation and through the proposed Village 11 at the 675-foot elevation. An overhead extension from the 675-foot level is required to the substation as described below. These sections will be located outside the project boundaries and require acquisition of new easements by MECO.

An electrical substation will be required to service the project. The location of the substation is proposed at the northern boundary of the project site, near the proposed 9th tee. This location will minimize the length of feeder conductors. The substation will require a lot size of between 16,000 and 18,000 square feet.

Based on the availability of present adequate service capabilities and/or planned improvements to the electrical and telephone utilities, significant impacts to or from these services are not expected to result from the proposed project. Electrical and telephone transmission lines would be buried along roadway rights-of-way within the project site and, as such, not present a visual intrusion. In addition, in keeping with State energy policies, energy efficient lighting, water heating and cooling would be encouraged in the design of the residential units.

HFDC and the various developers of the residential units will work with MECO in determining the specific transmission, distribution and substation requirements for the project. Similarly, HFDC and the developers will work with Hawaiian Telephone Company and other communication service companies to determine project needs and solutions.

6.8.3 Mitigation Measures

The proposed project is not expected to cause significant adverse impacts to the electrical or communication systems of the island. As such, mitigation measures are not warranted. As noted previously, HFDC and the developers of the residential units would continue to work with the utilities to determine the most efficient and cost effective means to provide electrical and communication services to the proposed project.

6.9 POLICE AND FIRE PROTECTION SYSTEMS

6.9.1 Existing Conditions

The Lahaina Police Station, located at Wahikuli within the Lahaina Civic Center, built in the early 1970's, provides police services for the entire Lahaina District. The district is divided into five beats with five patrolmen on duty each watch per beat. The police Department has indicated that in addition to residents, the large amount of visitors to the area contribute to calls for service. A Police Department study in 1987 indicated that an additional beat and personnel to man that beat were required in the Lahaina District. However, the Police Department recognizes the problems associated with recruitment for another beat and that provision of the sixth beat may be difficult. However, development of the proposed project would appear to provide the justification and necessity for the sixth beat. Based on discussions with the Police Department (Personal Communication, Captain R. Nakashima, November 1989), the department is considering various alternatives to increasing the physical and personnel size and capabilities of the Lahaina station to handle the expected increase in residential units and visitors to the area. Fire protection services are provided by the Lahaina Fire Station in the Lahaina Civic and Recreation Center. The fire station has one 1,250 gallon pumper truck with a crew of nine fire fighters per 24-hour shift. In addition, there is one ladder truck (75-foot aerial ladder, 1,500 GPM apparatus). The station is operating at near capacity because of its large service area. Emergency access is difficult when traffic exists on Honoapiilani Highway, an identified ongoing problem. As with the Police Department, the Fire Department is also exploring means to provide increased protection to the community.

6.9.2 Probable Impacts

The project population will increase the demand for police and fire protection services in the area. With adequate staffing, facilities and services provided by the County Police and Fire Departments would be sufficient to service the project. HFDC would continue to work with the county to assure that police and fire protection services are provided for the proposed project.

6.9.3 Mitigation Measures

HFDC would continue to work with the county to assure that adequate police and fire protection services are provided to the project.

6.10 HEALTH CARE FACILITIES

6.10.1 Existing Conditions

Maui Memorial Hospital, located between Wailuku and Kahului, is the nearest major medical facility to the project area. The hospital contains sufficient space to operate to the year 2000. Based on discussions with HFDC personnel, Maui Memorial Hospital is in the process of reviewing their service capabilities and future needs as well as those of West Maui. Health care services, especially for the elderly are provided by Hale Makua and other private clinics and medical service providers in Wailuku and Lahaina. For example the Maui Medical Group, Lahaina Physicians, West Maui Healthcare Center and Kaiser Permanente Medical Care Program provide regular hours and/or emergency medical services in the West Maui area. In addition, there are numerous general and specialized doctors offices in West Maui.

6.10.2 Probable Impacts

As the population of West Maui increases, both as a result of the proposed project as well as others, the need for increased healthcare facilities will grow. As indicated above, Maui Memorial Hospital is assessing future needs and could possibly open an emergency clinic in the West maui area. Also, it is presumed that private medical services would increase in the West Maui area to accommodate future growth. Because many of the proposed project's residents will be persons presently living on Maui and specifically in West Maui, future healthcare requirements in West Maui will be driven by other projects rather than the Lahaina Master Planned Project, especially those that cater to tourism and residential unit buyers from outside Hawaii. As such, although the proposed project will generate some need for increased healthcare services, it is likely that increased future health care services in West Maui will result without the proposed project.

6.10.3 Mitigation Measures

To assure that the future health care needs of West Maui are met, HFDC will continue to work with appropriate state, county and private providers of health care services. As indicated in Section 5 of this Chapter, it is presumed that the community center area of the proposed project will include doctors offices. These measures are expected to provide the levels of service that will be generated by the proposed project.

6.11 SCHOOLS

6.11.1 Existing Conditions

The proposed project site is served by Lahainaluna High School (9-12), Lahaina Intermediate School (6-8), King Kamehameha III (K-5) Elementary School and Princess Nahienaena (K-3) Elementary School which opened in the fall of 1988. In addition to the public schools, there are several privately operated elementary, intermediate and high schools on Maui. State Department of Education projected 1989 - 1990 enrollment for the schools serving Lahaina (DOE, 1989) are as follows:

Lahainaluna High School	760
Lahaina Intermediate School	452
King Kamehameha Elementary School	654
Princess Nahienaena Elementary School	280

6.11.2 Probable Impacts

The proposed project is expected to have a population of about 12,000 persons at build-out. This translates into the probable need for two new elementary schools and expansion of Lahaina Intermediate and Lahainaluna High Schools. As noted in Table IV-16 (Section 5.4.2.2), it is forecast that an additional 75 elementary school and 25 intermediate/high school employees would be required to serve the project. As shown on the Preferred Alternative drawing, Figure II-6, two elementary school sites and four church/day care centers are planned for the project. To assure that the educational needs of the future residents of the project are adequately met, HFDC will continue to coordinate the project planning and development with the Department of Education. School sites and facilities will be located, planned and constructed in a timely manner and in compliance with State Department of Education criteria to meet the needs of the community.

6.11.3 Mitigation Measures

As indicated above, HFDC will continue to coordinate the project planning and development with the Department of Education to assure that the educational needs of the community are met in a timely manner.

6.12 RECREATION FACILITIES

6.12.1 Existing Conditions

The West Maui area has an abundance of landbased and coastal recreational areas, including 17 County parks and three State beach parks, the closest being Wahikuli State Wayside and Wahikuli State Beach Park. Wahikuli Terrace and Wahikuli Parks are located within Wahikuli subdivision and recreation facilities are provided at Lahaina Civic Center. In addition, Mala Wharf and small boat harbor is close to the project site as is Lahaina Harbor. Table IV-19 indicates the type, number and location of recreational facilities in West Maui.

6.12.2 Probable Impacts

As noted in Section 5, Socioeconomic Environment, one of the concerns raised by the public regarding the proposed project has been the impact of the project on existing parks and recreation facilities, especially beach parks. The project population will increase the demand for recreational facilities in the area, but is not expected to significantly impact services or facilities due to the existing abundance of recreational opportunities in the area. Included in the proposed project are a regional park, a golf course, five neighborhood parks, two elementary school sites and civic center expansion lands. Based on the master plan analysis of park space requirements for the population that would exist in the Lahaina area following completion of the proposed project (utilizing recreation standards of the City and County of Honolulu as none for Maui County exist), it has been determined that at build-out, six new baseball fields, 1 new softball field, one new pool, one new gym/recreation center, two new recreation buildings and two new child play areas will be required to service the proposed project and surrounding Lahaina area. Based on the preceding, it appears that more than ample park space and facilities would be provided for the community. Other facilities for each community park would probably include comfort stations and areas for passive recreation. The recreation/ open space plan proposed for the project is characterized by selective improvement of the existing drainageways and steep slope areas as recreational and scenic amenities.

6.12.3 Mitigation Measures

The planned neighborhood and open space parks plus the golf course are expected to accommodate the increased recreational needs generated by the proposed project, serve as an important amenity for community residents and as a mauka visual amenity from the perspective of Lahaina. Additional mitigation measures do not appear warranted at this time.

TABLE IV-19

RECREATIONAL FACILITIES IN WEST MAUI

PARK	TYPES OF ACTIVITIES[1]										
	BB	SB	TN	BSK	FB	PG	SH	RR	PK	FH	PKG
Hanakaoo Beach Park							1	1	1		
Lahaina Civic Center			5	1							
Wahikuli Beach Park		1						1			
Wahikuli State Wayside Park		1				1					
Mala Boat Ramp										1	1
Mala Beach Park										1	1
Kelawea Park		1									
Paunau Park						1					
Lahaina Boat Harbor								1	1	1	1
Lahaina Recreation Center	2				1			1			1
Maluulu O Lele Park	1	1	4	1	1	1					
TOTALS	3	4	9	4	2	3	1	3	1	2	3

[1] Types of Activities Legend: BB= Baseball; SB= Softball; TN= Tennis; BSK= Basketball; FB= Football; PG= Playground; SH= Showers; RR= Restrooms; PK= Picnic; FH= Fishing; PKG= Parking.

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

CHAPTER V

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

1. INTRODUCTION

The applicable governmental land use plans, policies and controls affecting the proposed project include Act 15, Hawaii Revised Statutes (HRS), Chapter 205 (HRS) Land Use Commission Rules (Title 15, Subtitle 3, Chapter 15), the Hawaii State Plan and State Functional Plans for Agriculture, Conservation Lands, Employment, Energy, Health, Historic Preservation, Housing, Human Resources, Recreation, Tourism, Transportation and Water Resources Development; Maui County General Plan; the Lahaina Community Plan; and Maui County Zoning. The proposed project's relationship to these plans, policies and controls is described in the sections that follow. Following receipt of all necessary permits and approvals (see Chapter I, Section 11.0), the proposed project would be consistent with the above noted plans and land use controls.

1.1 ACT 15 (SLH 1988) AN ACT RELATING TO HOUSING

The purpose of this Act is to institute a *five-year moratorium on certain provisions of* Part III of Chapter 201E which relate to the development of housing projects, to establish temporary legislation to reduce and eliminate the critical shortage of affordable housing, create and maintain stable housing development costs, prevent speculation on affordable units and to provide the Housing Finance and Development Corporation (HFDC) with sufficient flexibility to develop affordable housing units on its own behalf or in concert with eligible developers within a self-regulatory environment, without sacrificing health, safety, environmental and shoreline management requirements. The Act enables HFDC to develop fee simple or leasehold property, construct dwelling units thereon, including condominiums, planned units and cluster developments and sell, lease or rent or cause to be leased or rented, at the lowest possible price to qualified residents of the state, with an eligible developer or in its own behalf either: (1) Fully completed dwelling units with appropriate interest in the land on which the dwelling unit is located; or (2) Units which are substantially complete and habitable with the appropriate interest in the land on which the dwelling unit is located; or (3) the land and site improvements (other than dwelling unit) either partially or fully developed. Further, the Act exempts housing developments by HFDC from all statutes, ordinances, charter provisions and rules of any governmental agency relating to planning, zoning, construction standards for subdivisions, development and improvement of land and the construction of units thereon provided that the project is consistent with the purpose and intent of Act 15, meets minimum health and safety standards, does not contravene any safety standards or tariffs approved by the public utilities commission and has first conducted a public hearing after reasonable notice which includes a description of the project.

Response: The proposed Lahaina Master Planned Project clearly meets all of the requirements of Act 15 and would be developed to assist in the alleviation of affordable housing on Maui and specifically in West Maui. Although certain subdivision standards are not required to be met under the Act, the proposed project will meet all applicable Maui County and state building and design standards and codes. Additionally, those elements of the proposed project that fall within the Special Management Area (SMA) as defined by the county will be subject to the county SMA regulations. Several public meetings and hearings have been held on Maui regarding the proposed project and HFDC is continuing to meet with appropriate county agencies, including the Mayor's Office, Department of Public Works and Planning Department.

1.2 CHAPTER 205 (HRS) LAND USE COMMISSION RULES

1.2.1 Land Use District Boundary Amendment

Chapter 205, Hawaii Revised Statutes (HRS), establishes the State Land Use Commission (LUC) and provides this body with the authority to designate all lands in the State as within either the Urban, Rural, Agricultural, or Conservation District. The majority of the project area is currently designated by the LUC as within the State Agricultural District. Consequently, a Land Use District Boundary Amendment (LUDBA) is necessary to reclassify the Agriculture designated property from the Agricultural District to the State Urban District to permit the proposed development.

In its review of the proposed reclassification, Chapter 205-17, Hawaii Revised Statutes, mandates that the Commission shall specifically consider (1) the Hawaii State Plan, (2) the applicable district standards, and (3) the impact of the proposed reclassification on the following areas of State concern: maintenance of important natural systems, cultural or natural resources, other natural resources, commitment of State funds, provision for employment opportunities, and provision for affordable housing.

Consideration of these criteria are also embodied in the LUC Administrative Rules, Chapter 15-15, Hawaii Administrative Rules, Subchapter 2. More specifically, the following "Standards for determining urban district boundaries" as set forth in Section 15-15-18, Hawaii Administrative Rules, are applicable to the proposed reclassification as follows:

Section 15-15-18 Standards for determining "U" urban district Boundaries.

In determining the boundaries for the "U" urban district, the following standards shall be used:

(1) It (urban district) shall include lands characterized by "city-like" concentrations of people, structures, streets, urban level of services and other related land uses.

(2)(A) Proximity to centers of trading and employment except where the development would generate new centers of trading and employment.

(2)(B) Substantiation of economic feasibility by the petitioner.

(2)(D) Sufficient reserve areas for urban growth in appropriate locations based on a 10-year projection.

(3) It shall include lands with satisfactory topography and drainage and reasonably free from the danger of floods, tsunami, unstable soil conditions, and other adverse environmental effects.

(4) . . . in amending the boundary, land contiguous with existing urban areas shall be given more consideration than non-contiguous land, and particularly when indicated for future urban use on State or County general plans.

(7) It shall not include lands, the urbanization of which will contribute toward scattered spot urban development, necessitating unreasonable investment in public infrastructure or support services.

Response: The proposed project area is adjacent to Lahaina, one of Maui's fastest growing regions. Population projections for the project, when combined with the existing population base, will clearly establish the area as a "city-like" concentration of activities. Although significant centers of trading and employment exist in the Lahaina and West Maui environs, the proposed project will generate new opportunities for economic growth of this kind.
The proposed project is clearly supported by the solid financial base of the State of Hawaii. However, State funds are not intended as the primary revenue source. A primary objective of the proposed project is financial self-sufficiency. Revenue generated from the sale of the market units will supplement construction of the affordable units to the extent that no additional "outside" funds from the State will be necessary. An existing HFDC revolving fund will be used, to provide the necessary cash flow during project development.

Site selection has been carefully considered to mitigate potential problems associated with future urban growth needs, topography, and contiguous integration with existing urban development. The Hawaii State Plan and Functional Plan for Housing clearly designate the Lahaina region of Maui as a primary target for the development of significant affordable housing.

1.2.2 Processing Housing Project Petitions

To provide for prompt development of affordable, yet economically integrated housing, Section 359G-4.1 of Chapter 205 (HRS), establishes the procedures under which the Land Use Commission shall process housing development project land use boundary amendment petitions. The statute also establishes a processing procedure time-frame necessary to accomplish the land use review on a "fast-track" basis. Hawaii Administrative Rules, Chapter 15-15-97 requires that 359G-4.1, Hawaii Revised Statutes, housing projects be acted upon by the Land Use Commission within 45 days after a petition is filed. If no action is taken during this period, the petition is automatically approved. As noted in Section 1.1 above, the provisions of Act 15 will be followed in the development of the proposed project.

1.3 COASTAL ZONE MANAGEMENT ACT (CHAPTER 205-A, HRS)

The objectives of the Hawaii Coastal Zone Management (CZM) Program, as set forth in Chapter 205A (HRS), include the protection and maintenance of valuable coastal resources. The proposed residential elements of the project are outside the coastal zone management area of Maui. However, portions of the wastewater disposal system improvements would be within the coastal zone management area (SMA) of the county. As such, county SMA rules and regulations will be followed. Other than improvements to the wastewater disposal system and storm water runoff that reaches the nearshore areas, the project will not directly affect the coastline of Maui. As indicated in Chapter IV, Section 2.3, storm water runoff is expected to have little or no effect on the nearshore environment. The proposed project has been planned to comply with and be consistent with the Coastal Zone Management Act.

1.4 HAWAII STATE PLAN (REVISED 1986)

The Hawaii State Plan (Chapter 226, Hawaii Revised Statutes, as amended and approved May 29, 1986), establishes a set of goals, objectives and policies that are to serve as long-range guidelines for the growth and development of the state. The Plan is divided into three parts. Part I (Overall Theme, Goals, Objectives and Policies); Part II (Planning, Coordination and Implementation); and Part III (Priority Guidelines). Part II elements of the State Plan pertain primarily to the administrative structure and implementation process of the Plan. As such, comments regarding the applicability of this part to the proposed project are not appropriate. The following sections of the Hawaii State Plan are directly applicable to the proposed project:

1.4.1 Part I. Overall Theme, Goals, Objectives and Policies

The Hawaii State Plan lists three "Overall Themes" relating to: (1) Individual and family self-sufficiency; (2) Social and economic mobility; and (3) Community or social well-being (Section 226-3 (1-3). These themes are viewed as "basic functions of society" and goals toward which government must strive. To guarantee the elements of choice and mobility embodied in the three themes, three goals were formulated (Section 226-4 (1-3):

(1) A strong, viable economy, characterized by stability, diversity and growth that enables fulfillment of the needs and expectations of Hawaii's present and future generations.

(2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems and uniqueness, that enhances the mental and physical well-being of the people.

(3) Physical, social and economic well-being, for individuals and families in Hawaii, that nourishes a sense of community responsibility, of caring and of participation in community life.

Response: The proposed Lahaina Master Planned Project would contribute to the attainment of the three goals. The project would provide direct and indirect short- and long-term employment opportunities for the present and future residents of Maui in general and specifically the West Maui area; the proposed project would generate increased state and county tax revenues; the project would contribute to the stability, diversity and growth of local and regional economies; and the archaeological, historic and natural site features would be protected. Key elements of the proposed project relative to the above noted goals are that the proposed project would provide increased home ownership opportunities for present and future residents in all income levels; that it would provide these opportunities in a planned setting wherein living conditions and environmental protection provisions can be effectively, efficiently and economically controlled; that it would provide these housing opportunities close to existing and planned employment and community activity centers such that travel times are minimized and yet separated such that the activities within the proposed project are not adversely affected by outside activities; and the proposed project would enhance the sense of community responsibility and participation.

Specific objectives, policies and priority directions of the State Plan most relevant to the proposed project are discussed below. Note, objectives and policies not listed are those that are not applicable to the proposed project.

Section 226-5 Objectives and Policies for Population

Objective:

(a) To guide population growth to be consistent with the achievement of the physical, economic and social objectives of the state.

Policies:

(b)(1) manage the population growth statewide in a manner that provides increased opportunities for Hawaii's people to pursue their physical, social and economic aspirations while recognizing the unique needs of each county.

(b)(2) Encourage an increase in economic activities and employment opportunities on the Neighbor Islands consistent with community needs and desires.

(b)(3) Promote increased opportunities for Hawaii's people to pursue their socio-economic aspirations throughout the state.

Response: Rapidly increasing population levels in the West Maui area are presently a concern to both state and county planners because of the present lack of affordable for sale and/or rental housing, limited public facilities and services and increased demands on those facilities and services. The proposed residential project of affordable homes is essential to just meet the needs of current West Maui residents. Further, the proposed project will have the effect of providing the impetus to improve and upgrade public facilities and services and allow West Maui residents greater opportunities to pursue fundamental socioeconomic aspirations. The Lahaina project is expected to provide long-term economic and employment opportunities for businesses servicing residential communities, such as food markets, nurseries, drug stores, restaurants, etc. The development of The residential community will also contribute to the overall growth of the Lahaina area in a well-planned manner that is consistent with the community's desires and needs as demonstrated in the marketing studies performed for the project.

226-6 Objectives and Policies for the Economy - General

Objective:

(a)(1) To increase and diversify employment opportunities to achieve full employment, increased income and job choice, and improved living standards for Hawaii's people.

(a)(2) A steadily growing and diversified economic base that is not overly dependent on a few industries.

Policies:

(b)(6) Strive to achieve a level of construction activity responsive to, and consistent with, state growth objectives.

(b)(9) Foster greater cooperation and coordination between the public and private sectors in developing Hawaii's employment and economic growth opportunities.

(b)(10) Stimulate the development and expansion of economic activities which will benefit areas with substantial or expected employment problems.

(b)(11) Maintain acceptable working conditions and standards for Hawaii's workers.

(b)(13) Encourage businesses that have favorable financial multiplier effects within Hawaii's economy.

Response: Development of significant affordable housing opportunities in West Maui will greatly improve living standards for Hawaii's people and provide continued construction activity in the West Maui area that would closely follow and/or be concurrent with the construction of new tourism related facilities, thereby ensuring local construction workers continued employment as well as provide employment opportunities for other types of construction trades. Adoption of the requested land use approvals would allow the proposed project to be consistent with state growth objectives. The project can only be achieved with the continued cooperation and coordination between the state and county governments and would foster cooperation and coordination between the public and private sectors in developing Maui's employment and economic opportunities in an area that already serves as an employment center. The development of the proposed project would also increase the opportunities to control the working and living conditions of the residents and businesses that would service the project; and provide a climate conducive to the stimulation of the development of new and expansion of existing businesses.

226-7 Objectives and policies for the economy - agriculture

Objective:

(a) Planning for the State's economy with regard to agriculture shall be directed toward achievement of the following:

(a)(1) Continued viability in Hawaii's sugar and pineapple industries.

(a)(2) Continued growth and development of diversified agriculture throughout the state.

Policies:

(b)(6) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.

Response: A majority of the project site is intensively utilized for production of sugar cane. Development of the housing project will result in the irretrievable loss of approximately 1,120 acres of important agricultural land. However, based on the analyses performed for this EIS (see Appendix D), this lost production will not significantly impact Hawaii's sugar industry, nor the availability of agriculturally suitable lands with adequate water. Existing agricultural irrigation infrastructure will be maintained to the greatest extent possible.

226-10 Objectives and policies for the economy - potential growth activities

Objective:

(a) Planning for the State's economy with regard to potential growth activities shall be directed towards achievement of the objectives of development and expansion of potential growth activities that serve to increase and diversify hawaii's economic base.

Policies:

(b)(1) Facilitate investment and employment in economic activities that have the potential for growth such as diversified agriculture, aquaculture, apparel and textile manufacturing, film and television production and energy and marine-related industries.

(b)(2) Expand Hawaii's capacity to attract and service international programs and activities that generate employment for Hawaii's people.

(b)(3) Enhance and promote Hawaii's role as a center for international relations, trade, finance, services, technology, education, culture and the arts.

(b)(5) Promote Hawaii's geographic, environmental, social and technological advantages to attract new economic activities into the state.

(b)(6) Provide public incentives and encourage private initiative to attract new industries that best support Hawaii's social, economic, physical and environmental objectives.

Response: The proposed project would assist in the achievement of the above state objectives and policies by providing housing opportunities for all income levels in an area that presently serves growth inducing industries (tourism and recreation); and, through the provision of housing close to employment opportunities, will encourage existing business to expand and provide the impetus for the creation of new businesses to service the residential community. Granting of the requested land use change and future zoning and permit requests would represent a strong public incentive required to encourage private interests to construct the homes and related community infrastructure, thereby supporting the State's social, economic, physical and environmental objectives.

226-11 Objectives and policies for the physical environment - land-based, shoreline and marine resources.

Objectives:

(a) Planning for the State's physical environment with regard to land-based, shoreline and marine resources shall be directed towards the achievement of the following objectives:

(a)(1) Prudent use of Hawaii's land-based, shoreline, and marine resources.

(a)(2) Effective protection of Hawaii's unique and fragile environmental resources.

Policies:

(b)(1) Exercise an overall conservation ethic in the use of Hawaii's resources.

(b)(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.

(b)(3) Take into account the physical attributes of areas when planning and designing activities and facilities.

(b)(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.

(b)(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.

(b)(7) Provide public incentives that encourage private actions to protect significant natural resources from degradation or unnecessary depletion.

(b)(8) Pursue compatible relationships among activities, facilities, and natural resources.

(b)(9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational and scientific purposes.

Response: The long-standing and demonstrated policy of HFDC has been to exercise an overall conservation ethic in the use of Hawaii's resources and the planning and construction of residential communities. This same ethic would be continued with the proposed Lahaina Master Planned Project to ensure compatibility between the land- and water-based activities in which residents of the project would be engaged, natural resources and ecological systems that would be affected by the proposed project. As indicated previously in this EIS, the planning and design of the project has taken into account the physical attributes of the project area. Further, it is the intention of HFDC to manage the natural resources and environs of the project area such that beneficial and multiple uses are encouraged in such a manner as to not cause damage to those resources. Endangered and threatened plant and animal species and habitats native to Hawaii would be protected and serve as educational and scientific resources. The proposed project would also promote increased accessibility and prudent use of inland areas for public recreational, educational and scientific purposes.

Plans for the proposed Lahaina project are being developed and prepared in conjunction with extensive environmental studies of the site. This EIS documents the process by which these environmental considerations have been integrated into the planning process. Although no rare (threatened) or endangered species were encountered through these studies, any threatened or candidate species would be respected through appropriate site planning considerations as would significant historical and archaeological sites.

226-12 Objectives and policies for the physical environment - scenic, natural beauty and historic resources.

Objectives:

(a) Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaii's scenic assets, natural beauty, and multicultural/historical resources.

Policies:

(b)(1) Promote the preservation and restoration of significant natural and historic resources.

(b)(2) Provide incentives to maintain and enhance historic, cultural and scenic amenities.

(b)(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.

(b)(4) Protect those special areas, structures, and elements that are an integral and functional part of Hawaii's ethnic and cultural heritage.

(b)(5) Encourage the design of developments and activities that complement the natural beauty of the islands.

Response: The proposed Lahaina Master Planned Project has been planned and designed to maintain and/or enhance the natural features of the site. Significant historical/cultural/archaeological sites will be protected; buildings have been planned and sited to maintain the primary vistas to the mountains and ocean. The heavily landscaped character of the project and residences would provide a means for the development to accommodate and be complemented by the surrounding environment.

226-13 Objectives and policies for the physical environment - land, air and water quality.

Objectives:

(a) Planning for the State's physical environment with regard to land, air and water quality shall be directed towards achievement of the following objectives:

(a)(1) Maintenance and pursuit of improved quality in Hawaii's land, air and water resources.

(a)(2) Greater awareness and appreciation of Hawaii's environmental resources.

Policies:

(b)(1) Foster educational activities that promote a better understanding of Hawaii's environmental resources.

(b)(2) Promote the proper management of Hawaii's land and water resources.

(b)(3) Promote effective measures to achieve desired quality in Hawaii's surface, ground and coastal waters.

(b)(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

(b)(6) Encourage design and construction practices that enhance the physical qualities of Hawaii's communities.

(b)(7) Encourage urban developments in close proximity to existing services and facilities.

(b)(8) Foster recognition of the importance and value of land, air and water resources to Hawaii's people, their cultures and visitors.

Response: The proposed project has been planned and designed, and would be constructed in such a manner that the land and water resources of the area can be managed in an environmentally compatible and beneficial manner and foster the recognition of the importance and value of the area land, air and water resources to Hawaii's people, their cultures and visitors.

The project site is situated between urbanized areas of Lahaina and Kapunakea. The proposed Honoapiilani Highway Bypass will traverse through the site, thereby reducing the efficient use of the site for agricultural purposes. The site is not subject to unusual hazards associated with erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters. Design and construction will both take advantage of the existing aesthetic quality of the area while enhancing the physical quality of Maui's second largest community outside of the Wailuku-Kahului urban area.

226-14 Objectives and policies for facility systems - in general.

Objectives:

(a) Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation waste disposal and energy and telecommunications systems that support statewide social, economic and physical objectives.

Policies:

(b)(1) Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.

(b)(2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.

(b)(3) Ensure that required facility systems can be supported within resource capabilities and at reasonable costs to the user.

(b)(4) Pursue alternative methods of financing programs and projects and cost-saving techniques in the planning, construction and maintenance of facility systems.

Response: The proposed project includes HFDC providing the necessary infrastructural components to serve the project. Infrastructural components within the project will be provided by the private developers. Further, the planning and design of these systems is being coordinated with county plans so that the final systems meet both the immediate and future requirements of the communities that they will serve. Also, funding for the systems will be derived from both public and private sources.

226-15 Objectives and policies for facility systems - solid and liquid wastes.

Objectives:

(a) Planning for the State's solid and liquid waste systems shall be directed toward the achievement of the following:

(a)(1) Maintenance of basic public health and sanitation standards relating to treatment and disposal of solid and liquid wastes.

(a)(2) Provision of adequate sewerage facilities for physical and economic activities that alleviate problems in housing, employment, mobility and other areas.

Policies:

(b)(1) Encourage adequate development of sewerage facilities that complement planned growth.

(b)(2) Promote re-use and recycling to reduce solid and liquid wastes and employ a conservation ethic.

Response: As indicated in Chapter IV, Sections 6.3 and 6.4, the proposed project includes improvements and upgrading of the Lahaina sewage treatment plant and the installation of the necessary main transmission lines to handle the waste water generated within the residential community. All State Department of Health standards will be strictly complied with and no cesspools will be permitted within the project boundaries. HFDC would work with the County Department of Public works to determine if a solid waste recycling program could and should be established. Maui, as are other counties, is rapidly depleting its supply of suitable solid waste landfill sites. Therefore, recycling may be come a necessity to reduce the quantity of waste generated.

226-16 Objectives and policies for facility systems - water.

Objectives:

(a) Planning for the State's water systems shall be directed toward achievement of the objective of providing water to adequately accommodate domestic, agricultural, commercial, industrial, recreational and other needs within resource capabilities.

Policies:

(b)(1) Coordinate development of land use activities with existing and potential water supply.

(b)(3) Reclaim and encourage the productive use of runoff water and waste water discharges.

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

(b)(6) Promote water conservation programs and practices in government, private industry and the general public to help ensure adequate water to meet long-term needs.

Response: The proposed project has been planned in consultation with Amfac/JMB, Pioneer Mill Co., the county and the State Department of Land and Natural Resources, Division of Water and Land Development to ensure that there will be adequate supplies of water to serve the project. New potable water source, storage and transmission facilities will be developed for the proposed project. Estimated sustainable yield from the proposed mauka well sites is adequate to provide necessary potable water to the project. In addition, the Master Plan identifies various water saving landscape ideas that could be used by both the state and individual homeowners in the landscaping of their homes and the public areas.

226-17 Objectives and policies for facility systems - transportation.

Objectives:

(a) Planning for the State's facility systems with regard to transportation shall be directed towards the achievement of the following objectives:

(a)(1) An integrated multi-modal transportation system that services statewide needs and promotes the efficient, economical, safe and convenient movement of people and goods.

(a)(2) A statewide transportation system consistent with planned growth objectives throughout the State.

Policies:

(b)(2) Coordinate state, county, federal and private transportation activities and programs toward the achievement of statewide objectives.

(b)(3) Encourage a reasonable distribution of financial responsibilities for transportation among participating governmental and private parties.

(b)(6) Encourage transportation systems that serve to accommodate present and future development needs of communities.

(b)(9) Encourage the development of transportation systems and programs which would assist statewide economic growth and diversification.

(b)(10) Encourage the design and development of transportation systems sensitive to the needs of affected communities and the quality of Hawaii's natural environment.

Response: The proposed Lahaina Master Planned Project is consonant with on-going and planned State sponsored highways on Maui; is being planned to accommodate the proposed Honoapiilani Bypass Highway and future roadway development in West Maui; assists in promoting statewide economic growth and diversification; and is being designed to be sensitive to the needs of the affected community and quality of the area's natural environment. Innovative approaches to encourage the use of various transportation alternatives will be implemented.

226-19 Objectives and policies for socio-cultural advancement - housing.

Objectives:

(a) Planning for the State's socio-cultural advancement with regard to housing shall be directed towards achievement of the following objectives:

(a)(2) The orderly development of residential areas sensitive to community needs and other land uses.

Policies:

(b)(1) Effectively accommodate the housing needs of Hawaii's people.

(b)(2) Stimulate and promote feasible approaches that increase housing choices for low-income, moderate-income and gap-group households.

(b)(3) Increase home ownership and rental opportunities and choices in terms of quality, location, cost, densities, style and size of housing.

(b)(5) Promote design and location of housing developments taking into account the physical setting, accessibility to public facilities and services and other concerns of existing communities and surrounding areas.

(b)(7) Foster a variety of lifestyles traditional to Hawaii through the design and maintenance of neighborhoods that reflect the cultures and values of the community.

Response: The proposed Lahaina Master Planned Project concept has been planned and designed to lend itself toward the development of for sale and rental housing for all income groups and fostering a sense of community and cohesiveness. The project concept provides a minimum 60/40 percentage split respectively between affordable and market housing. Special needs and elderly housing units will also be included to address the special design-related requirements of these groups. It is the intent of the proposed project to create a character that reflects the values that are traditional to Hawaii and an appreciation and respect for the beauty of the land and a caring for the community. Further, the housing would be located in an area that has demonstrated a crying need for affordable and market priced homes and all of the proposed facilities will be available to residents of existing communities and surrounding rural areas.

226-21 Objective and Policies for Socio-Cultural Advancement - education

(b)(2) Ensure the provision of adequate and accessible educational services and facilities that are designed to meet individual and community needs.

(b)(3) Provide appropriate educational opportunities for groups with special needs.

Response: The projected population increase of approximately 13,600 persons within the project, is expected to generate the need for a 12-acre school site. The site location will be carefully planned to address adjoining land uses, traffic, proximity to residential areas, and physical features that may impact site utility and accessibility.

1.4.2 Part II. Planning, Coordinating and Implementation

As indicated previously, this part of the Hawaii State Plan pertains to the administrative structure and implementation process of the Plan. As such, comments are not deemed appropriate.

1.4.3 Part III. Priority Guidelines

The purpose of this part of the Plan is to establish overall priority guidelines to address areas of statewide concern. The Plan notes (Section 226-102) that the State shall strive to improve the quality of life for Hawaii's present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: Economic development, population growth and land resource management, affordable housing, crime and criminal justice and quality education. The priority guidelines applicable to the proposed project are discussed below:

226-103 Economic Priority Guidelines

(a) Priority guidelines to stimulate economic growth and encourage business expansion and development to provide needed jobs for Hawaii's people and achieve a stable and diversified economy:

(a)(1) Seek a variety of means to increase the availability of investment capital for new and expanding enterprises.

(b) Priority guidelines to promote the economic health and quality of the visitor industry:

(b)(1) Promote visitor satisfaction by fostering an environment which enhances the Aloha Spirit and minimizes inconveniences to Hawaii's residents and visitors.

(f) Priority guidelines for energy use and development:

(f)(3) Provide incentives to encourage the use of energy conserving technology in residential, industrial and other buildings.

Response: The proposed Lahaina Master Planned Project would assist in meeting the above stated guidelines by allowing public and private investment in facilities that would assist in expanding existing businesses that serve residential communities as well as provide the impetus for new businesses to be created to serve an expanded market; assist in the development of housing in a location where it is required and desired. The proposed project would also aid in the attainment of the energy related guidelines through the energy conservation measures that would be suggested to new homeowners.

226-104 Population Growth and Land Resources Priority Guidelines

(a) Priority guidelines to effect desired statewide growth and distribution:

(a)(1) Encourage planning and resource management to insure population growth rates throughout the State that are consistent with available and planned resource capacities and reflect the needs and desires of Hawaii's people.

(a)(2) Manage a growth rate for Hawaii's economy that will parallel future employment needs for Hawaii's people.

(a)(4) Encourage major state and federal investments and services to promote economic development and private investment to the neighbor islands, as appropriate.

(b) Priority guidelines for regional growth distribution and land resource utilization:

(b)(5) In order to preserve green belts, give priority to state capital-improvement funds which encourage location of urban development within existing urban areas except where compelling public interest dictates development of a non-contiguous urban core.

(b)(6) Seek participation from the private sector for the cost of building infrastructure and utilities and maintaining open spaces.

(b)(12) Utilize Hawaii's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands and other limited resources for future generations.

Response: The proposed project would comply with and assist in the achievement of the above stated population growth and land resources priority guidelines and objectives. The proposed project would provide the means by which the developers would make available investment capital for the infrastructure and homes, thereby providing additional housing in an area in which it is needed. As such, growth would continue to be focused on an urban area. The proposed development would provide employment opportunities paralleling future employment needs; encourage private investment on a neighbor island; and profitably utilize lands for urban uses. Infrastructural components required by and for the project would be provided by both the state and developers at minimal cost to the state.

226-106 Affordable housing

(1) Seek to use marginal or non-essential agricultural land and public land to meet housing needs of low and moderate-income and gap-group households.

(2) Encourage the use of alternative construction and development methods as a means of reducing production costs.

(3) Improve information and analysis relative to land availability and suitability for housing.

(4) Create incentives for development which would increase home ownership and rental opportunities for Hawaii's low and moderate-income households, gap-group households and residents with special needs.

(5) Encourage continued support for government or private housing programs that provide low interest mortgages to Hawaii's people for the purchase of initial owner-occupied housing.

(6) Encourage public and private sector cooperation in the development of rental housing alternatives.

(7) Encourage improved coordination between carious agencies and levels of government to deal with housing policies and regulations.

(8) Give higher priority to the provision of quality housing that is affordable for Hawaii's residents and less priority to development of housing intended primarily for individuals outside of Hawaii.

Response: The Lahaina Master Planned Project has been conceived and designed to meet all of the State Plan Priority Guidelines regarding affordable housing. The project will use lands that are not absolutely required for agriculture; will, through the design and construction guidelines established in the Master Plan, encourage the use of alternative construction materials and methods to reduce costs; through this EIS and the Master Plan provided information relative to the availability and suitability of the land for housing; includes incentives for private developers to increase the supply of both for sale and rental housing in an area in which it is critically needed; is part of a larger overall state program to provided low interest mortgages; will be a joint public/private sector development; and has included coordination meetings between the public and various state and county agencies.

1.5 STATE FUNCTIONAL PLANS

The Hawaii State Plan directs the appropriate state agencies to prepare functional plans for their respective program areas. There are fourteen State Functional Plans that serve as the primary implementing vehicle for the goals, objectives and policies of the Hawaii State Plan. The following sections of the listed State Functional Plans are directly applicable to the proposed project.

1.5.1 State Agriculture Functional Plan (1985)

The entire project site is located on SLUC designated Agriculture lands that are currently in sugar cultivation. The lands are also designated as important agricultural land on the ALISH (Agricultural Lands of Importance to the State of Hawaii) map of the area. Consequently, a land use boundary amendment petition to the SLUC will be filed, requesting that the lands be redesignated Urban. Based on the Agricultural Impact Analysis study (Appendix D) performed for the proposed project, the redesignation of the project lands and subsequent loss of agricultural lands will *not significantly impact* agricultural activities on Maui or in the state. Because the lands are to be redesignated Urban, the implementing actions of the State Agriculture Functional Plan do not apply either directly or indirectly to the proposed project. However, the proposed project may appear to be in opposition to the overall policies of the State Agriculture Functional Plan in that 1,120 acres of agricultural land will be removed from production. By the very existence of a complex system of land use policies, plans, goals, objectives and controls at both the state and county levels of government, development proposals requiring land reclassification are often faced with inherent contradictions and conflicts within the land use regulatory system. As such, the Lahaina Master Planned Project must be reconciled against those privately and publicly planned elements that may appear to conflict with the proposed project. The proposed project is consistent with the State Housing Functional Plan and County General Plan goals, policies and standards relating to the future growth of the West Maui area. Based on the agricultural impact analysis and housing needs analysis conducted for the proposed project, the overriding need in West Maui is for affordable housing, and the project site is an appropriate location for that housing.

1.5.2 State Conservation Lands Functional Plan (1984)

Because the project lands will be designated Urban, the implementing actions of the State Conservation Lands Functional Plan are not directly applicable to the project. However, this functional plan addresses more than officially designated Conservation District lands in that it establishes a conservation ethic that the state should strive to attain and maintain. As noted in several of the subsections of Chapter IV, measures have and will be taken to assure that the community to be established is done so in a manner that fosters the conservation ethic envisioned in the functional plan. For example, runoff water will be retained on-site in a manner that facilitates percolation into the groundwater supply; extensive landscaping will be provided and encouraged around residential units to reduce solar radiation and to assist in maintaining air and noise quality; and studies will be performed regarding the potential use of solar water heating and/or the use of heat pumps and energy efficient lighting.

In addition to the above, in keeping with the Conservation Lands Functional Plan (Management of Natural Resources, Objective A), to determine the extent and nature of historic and cultural resources within the project boundaries, an archaeological survey of the project site was conducted. The survey was performed in compliance with draft guidelines that are being established by the State Department of Land and Natural Resources, Historic Sites Section and guidelines developed by the Advisory Council on Historic Preservation. Significance determinations have been assessed in compliance with the criteria established by the above noted groups and those published in the National Register (36 CFR Part 60). The results of the archaeological survey indicated that there are 12 sites within the project boundaries, 11 of which require no further work. For the remaining site, additional subsurface excavation work will be performed prior to construction of the residential units. The one site has provisionally been considered significant for cultural value in view of the possible presence of burials. Additional data collection will be performed prior to development and it is possible that the site will be retained in an "as-is" condition.

1.5.3 State Education Functional Plan (1989)

The State Education Functional Plan reflects the Department of Education's strategies to address the policies and priority guidelines of the Hawaii State Plan and the goals of the Board of Education and the concerns of the Education Functional Plan Advisory Committee. As such, it serves as a mechanism for implementing the Hawaii State Plan as it relates to the directions of the Board of Education and the programs of the Department. All of the actions are to be undertaken by the Department of Education. Therefore they are not applicable to the proposed Lahaina Master Planned Project. HFDC would continue working with the Department of Education to ensure that adequate public schools are available to serve the project area.

1.5.4 State Higher Education Functional Plan (1984)

There are no objectives, policies or implementing actions in this functional plan that are directly applicable to the proposed project.

1.5.5 State Employment Functional Plan (1989)

The State Employment Functional Plan, the preparation of which was coordinated by the Department of Labor and Industrial Relations, lists four major issue areas under which specific objectives have been defined. These issue areas and objectives are as follows:

ISSUE AREA I. EDUCATION AND PREPARATION SERVICES FOR EMPLOYMENT

Objectives:

I.A Improve the qualifications of entry level workers and their transition to employment.

I.B Develop and deliver education, training and related services to ensure and maintain a quality and competitive workforce.

ISSUE AREA II. JOB PLACEMENT

Objective:

II.A Improve labor exchange.

ISSUE AREA III. QUALITY OF WORKLIFE

Objective:

III.A Improve the quality of life for workers and families.

ISSUE AREA IV. EMPLOYMENT PLANNING INFORMATION AND EMPLOYMENT COORDINATION

Objective:

IV.A Improve planning of economic development, employment and training activities.

Response: Under each of the above listed objectives are defined policies to implement the objectives. The implementation actions are primarily the responsibility of the Department of Industrial Relations (DILR) with assistance from other agencies and groups.

The proposed project is generally in concert with the objectives of the State Employment Functional Plan in that new jobs will be created and/or others, such as in construction, continued for a period of time. By providing additional employment opportunities in several areas (food services, landscaping and maintenance, etc.), the proposed project would be one more element of the West Maui area job picture, thereby assisting in the improvement of the quality of life for workers and families. The greatest contribution the project makes toward the attainment of the Employment Functional Plan objectives is providing housing near an existing and expanding center of employment.

1.5.6 State Energy Functional Plan (1984)

The State Energy Functional Plan has as an objective the promotion of energy-efficient design. This relates to both overall land use planning and to specific building design and equipment selection decisions. While specific building designs have not been completed, the proposed project will adhere to energy conservation standards whenever possible. Elements of energy conservation that may be incorporated into the project include the use of solar energy for water heating and air conditioning purposes and the use of heat recovery pumps.

1.5.7 State Health Functional Plan (1989)

The State Health Functional Plan identifies four major priority issue areas on which the plan focuses. These are (1) preventive health; (2) access to health care; (3) environmental protection; and (4) internal administrative issues. Of these four, the environmental protection issue is the most relevant to the proposed project.

Objective:

> Environmental programs to protect and enhance the environment. Continued development of new environmental protection and health services programs to protect, monitor and enhance the quality of life in Hawaii.

Policy:

> Air, land and water quality programs. The Department of Health (DOH) will develop and implement new programs to prevent degradation ad enhance the quality of Hawaii's air, land and water.

Response: The objective and policy of the DOH will be implemented through programs that will include development and implementation of a comprehensive air toxic control. program; development and implementation of a comprehensive solid and hazardous waste management program; development and implementation of a comprehensive recreational water quality monitoring strategy; development and implementation of a non-point source pollution program to protect recreational and other surface waters; development and implementation of an indoor air pollution control program; and development and implementation of a groundwater protection program including groundwater monitoring, safe drinking water and underground injection control. These actions, in concert with existing duties and responsibilities of the DOH, form the primary environmental protection elements of the department.

The proposed project will be in compliance with applicable DOH rules and regulations as well as those established by Maui County. During construction of the infrastructure and residential units, appropriate environmental monitoring will be conducted to ensure that there are no long-term adverse impacts to the area as a result of the project. In addition, applicable DOH permit/approval requirements will be complied with, including Water Quality Certification. The proposed project will comply with all necessary requirements related to the DOH permitting procedures.

1.5.8 State Historic Preservation Functional Plan (1984)

The objectives, policies and implementing actions of the State Historic Preservation Functional Plan are directed toward state agencies, primarily the Department of Land and Natural Resources, Historic Sites Section (DLNR-HSS). The archaeological resources at the project site have been surveyed and evaluated by DLNR-HSS. The developers of the project, with approval from the County Planning Department, will implement the mitigation measures recommended by the consulting archaeologist for the one site that requires additional investigation.

1.5.9 State Housing Functional Plan (1989)

The State Housing Functional Plan, prepared by the State Housing Finance and Development Corporation and was given final approval by the Governor in May, 1989. The plan addresses six major areas of concern: (1) increasing home ownership; (2) expanding rental housing opportunities; (3) expanding rental housing opportunities for the elderly and other special need groups; (4) preserving housing stock; (5) designating and acquiring land that is suitable for residential development; and (6) establishing and maintaining a housing information system. The plan assumes the continued use of existing programs at both the state and county levels to attain the goals of the Hawaii State Plan. Most of the objectives, policies and implementing actions of the State Housing Functional Plan apply to the government sector. The proposed project has been designed and conceived to assist in the attainment of the objectives of the State Housing Functional Plan.

The Housing Functional Plan identifies several indicators that point to a crisis in housing evidenced by Hawaii's position as the state with highest housing costs for both owner-occupied and rental housing. To address this critical shortage of affordable housing, the Housing Functional Plan was revised to "develop and implement a bold plan of action to address Hawaii's many housing problems." The plan establishes a policy to encourage public/private efforts to finance, build, and maintain an adequate supply of affordable housing.

As indicated in Chapter I, Section 1, for the purposes of this EIS and the Housing Functional Plan, "affordable housing" is defined as housing for persons or families whose incomes are identified as 140 percent or less of the area median income for each of the counties of Hawaii as determined by the United States Department of Housing and Urban Development and as adjusted for family size.

Response: To meet the objectives of the Plan, the proposed project will offer a wide range of housing types at a wide range of pricing. Affordable units will be provided through development of "for-sale" housing and various rental programs. Housing within the Lahaina Master Planned Project will include approximately 4,800 units, of which 67 percent will meet the above definition of "affordable," i.e., 50 percent to 140 percent of median income, while the remaining balance of 33 percent will be market priced housing. Funds derived from the sale of market housing will be used to support price reductions for sales of the affordable units. Special needs housing will also be provided in accordance with the requirements of the Housing Functional Plan.

1.5.10 State Human Services Functional Plan (1989)

The State Human Services Functional Plan identifies elderly care, children and family support, self-sufficiency and service delivery improvements as the priority issues of the Human Services Plan. The objectives, policies and implementing actions of the plan are directed toward state and county agencies for accomplishment. In general, the proposed project is in concert with the basic philosophy of the Human Services Functional Plan in that it will assist, through the provision of housing and employment opportunities, families in achieving economic and social self-sufficiency.

1.5.11 State Recreation Functional Plan (1984)

The objectives, policies and implementing actions of the State Recreation Functional Plan are oriented toward improving public recreation opportunities both now and in the future. The State Recreation Functional Plan evaluates existing and future recreation demand and facilities, and establishes policies to promote an overall conservation ethic, preservation and restoration of significant natural and historic resources, proper management of resources, enhance educational programs, and consolidate State and County governmental functions. Other objectives of the plan include "guiding State and County agencies in acquiring and preserving lands of recreational value, and ensuring public access to recreational areas."

No existing recreational facilities are located within the project area; however, several beach parks are in close proximity to the project. Specific recreation needs identified in the Plan include community-oriented park facilities for field and court games, picnicking, a swimming pool, and youth center.

The proposed project will provide a wide range of recreational opportunities in conjunction with Functional Plan guidelines and objectives. Both passive and active facilities including neighborhood parks, a regional park and a recreation center are all planned within the development. In addition, the Petitioner will adhere to all applicable County of Maui park dedication requirements should the parks be dedicated to the county.

The proposed project includes provisions to maintain public access to those lands that have public recreation value. Further, the proposed project, acting in concert with previously established public recreational facilities in the Lahaina area, will ensure that both residents and visitors are enhanced and facilitated.

1.5.12 State Tourism Functional Plan (1984)

The State Tourism Functional Plan is a guide to help coordinate the various sectors of government and private industry toward achieving the statewide objectives of the Hawaii State Plan and is an expression of legislative policy toward tourism. The overall theme of the State Tourism Functional Plan is "The achievement of a visitor industry that constitutes a major component of steady growth for Hawaii's economy." Although the proposed project is not directly related to tourism, it is indirectly related in that it is expected that many of the future residents of the project will be employed in the tourism industry. This is especially true for the rental units. The following objective and policies of the State Tourism Functional Plan are relevant to the proposed project.

PHYSICAL DEVELOPMENT

Objective:

B. Development and maintenance of a well-designed and adequately serviced industry and related developments in keeping with the needs and aspirations of Hawaii's people.

Policy:

B(4) Ensure that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities.

Implementing Action:

B(4)(c) Ensure the construction, as necessary in conjunction with both new hotel and large resort condominium projects, of affordable dwelling units adequate to accommodate employee households.

Response: The proposed project has been conceived and is being designed to provide needed employee housing as well as resident housing for all income levels. As indicated previously in this EIS, it is expected that a majority of the multifamily rental units will be occupied by resort and hotel workers. It is also likely that a percentage of the detached single family units will also be occupied by resort and hotel workers as well as those employed in jobs that service the tourism industry.

1.5.13 State Transportation Functional Plan (1984)

The overall objective of the State Transportation Functional Plan is to provide for the efficient, safe and convenient movement of people and goods. As such, none of the policies or implementing actions of the plan apply specifically to the proposed project. However, the

Honoapiilani Bypass Highway will serve the proposed project and would assist in the safe and efficient movement of traffic through the project area.

1.5.14 State Water Resources Development Functional Plan (1984)

This functional plan primarily affects governmental operations. The specific purpose of the plan is to set forth specific water-related objectives, policies, programs and projects to guide state and county governments in implementing the broader objectives, policies and priority guidelines of the Hawaii State Plan. In essence, the plan presents guidelines for the regulation of the development and use of water to assure adequate supplies in the future; development of water resources to meet municipal, agriculture and industrial requirements, and the reduction of flood damage; and preservation of water-related ecological, recreational and aesthetic values and the quality of water resources. The proposed project has been planned with water conservation as one of the underlying goals of the project. Within this context, the proposed project is in concert with the State Water Resources Development Functional Plan.

1.6 STATE ENVIRONMENTAL IMPACT STATEMENT REQUIREMENTS - CHAPTER 343 (HAWAII REVISED STATUTES)

Section 343-5(a)(1) of Chapter 343 HRS (Revised) states that except as otherwise provided, an environmental assessment shall be required for actions that "Propose the use of state or county lands or the use of state or county funds, other than funds to be used for feasibility or planning studies for possible future programs or projects which the agency has not approved, adopted, or funded, or funds to be used for the acquisition of unimproved real property; provided that the agency shall consider environmental factors and available alternatives in its feasibility or planning studies." Accordingly, this Environmental Impact Statement for the proposed Lahaina Master Planned Project has been prepared and is submitted pursuant to the provisions of Chapter 343. Upon acceptance of this EIS and approval of the requested land use boundary amendment, the proposed development would conform with relevant state land use regulations, as well as other regulations pertinent to the proposed development. Beyond this, the master planned community will provide increased housing opportunities for all income levels on Maui, which is in keeping with the goals and objectives of the state and the county.

2. MAUI COUNTY PLANS AND CONTROLS

2.1 MAUI COUNTY SPECIAL MANAGEMENT AREA

The majority of the proposed project is outside the Special Management Area. As such, the Maui County Special Management Area provisions do not apply. However, portions of the off-site infrastructure improvements (wastewater transmission, treatment and disposal) will be within the SMA. County SMA rules and regulations will be followed for those portions of the project that are within the SMA.

2.2 MAUI COUNTY GENERAL PLAN

Although the proposed project is being accomplished under Act 15, the following identifies the elements of the project that generally comply with the Maui County General Plan.

The Maui County General Plan is the policy document for the long-range comprehensive development of the island of Maui and provides direction for balanced growth of the County. The Plan contains objectives and policies in the areas of land use, environments, economic, urban design, public utilities and facilities and recreation and culture.

The proposed project generally implements the objectives of the County General Plan as follows:

> Population Objective A: To manage the planned growth of the resident and visitor populations in order to avoid social, economic, and environmental disruptions.
> Land Use Objective A: To use the land within the County for the social and economic betterment of the County's residents.
>
> Land Use Objective C: To preserve existing lifestyles through the careful and effective use of land.
>
> Housing Objective A: To make available attractive, sanitary, and affordable homes for all County residents.
>
> Urban Design Objective A: To encourage all developments to be well-designed and in harmony with the environment in which they will be located.
>
> Special Programs Objective A: To create a community in which the needs of all segments of the population will be recognized and met.
>
> General Objective A: To achieve stabilization, expansion, and diversification of the County's economic base.
>
> Transportation Objective A: To support a transportation system which will enable people and goods to move safely, efficiently, and economically.
>
> Water Objective A: To provide adequate quantity and quality of water to meet the needs of the people of Maui County.
>
> Water Objective B: To make more efficient use of existing supplies of water.
>
> Public Utilities and Facilities Objective A: To provide public utilities and facilities which will effectively meet community needs.

Response: Development of the project will result in a reasonable use of the land in keeping with the adjoining urbanized residential areas. Natural topographic features, visual resources, potential hazards and other features will have been evaluated during the design process.

The provision of affordable housing will provide expanded opportunities to enjoy existing lifestyles associated with home ownership. Without development of affordable housing, social and economic opportunities will also become disrupted affecting the lifestyle of Maui residents. As previously described, the project design will incorporate features to harmonize with existing landforms.

Both the General and Transportation Objectives will be achieved through the provision of jobs associated with project construction, and economic benefits derived from efficiencies gained from the investment of new transportation infrastructure.

As with efficiencies gained from improved transportation infrastructure, improvements to any public utility infrastructure will result in greater efficiency of resulting productivity of Maui's economic base.

The proposed Lahaina Master Planned Project has been planned to be in concert with the overall population, land use, environmental, economic, urban design and recreation and culture objectives of the plan. The project would manage the planned growth of resident populations in a manner that would avoid social, economic and environmental disruptions; it would use land for the social and economic betterment of the county's residents; it is a judicious use of the county's inland resources; it will allow residents to enjoy their lifestyle; it will assist in stabilizing the housing market on Maui and assist in the diversification of the county's economic base; it will be designed to be in harmony with the surrounding environment; and it will provide high quality recreational facilities to meet the present and future needs of county residents.

2.3 MAUI COUNTY ZONING

The majority of the project site is presently zoned as agriculture. A change in zoning for the planned urban use will be required at the appropriate time. Because the Lahaina Master Planned Project is being accomplished under Act 15, standard zoning process practices and procedures will not be followed. However, the Master Plan has been developed with those procedures and practices in mind.

3. PLANS OF NEARBY COMMUNITIES

3.1 LAHAINA COMMUNITY PLAN

Because the proposed Lahaina Master Planned Project is an Act 15 project, the provisions of the Lahaina Community Plan do not apply. However, the project will aid in the expansion of the Lahaina Civic Center, which is a Project District that includes residential and civic center uses. The proposed project will add a major open space park and neighborhood parks to the Lahaina area. As such, although the land use designation for the project property in the Lahaina Community Plan is Agriculture, the proposed project will assist in accomplishing the recommendations of the plan relating to economic activity, agriculture, population, environment, land use, urban design and support systems.

3.2 PRIVATE PLANS

Amfac/JMB Hawaii, Inc. has plans to develop the North Beach Kaanapali resort and it is possible that they may have plans to develop their lands adjacent to the proposed project site. It is also likely that other private developers/landowners have plans to develop housing and/or other resort projects in the vicinity of the proposed project. However, the extent, if any, of these plans are unknown at this time. Pioneer Mill Company will continue to operate on lands adjacent to the proposed project and it is presumed that Maui Land and Pineapple will continue its present operations in the vicinity of the project site.

CHAPTER VI
TOPICAL ISSUES

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TOPICAL ISSUES

1. RELATIONSHIP BETWEEN SHORT-TERM USES AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

Analyses of various on-site environmental features have found the Lahaina Master Planned Project property to possess physical attributes that are desirable both as amenities in a residential development and for their own sake. These attributes include magnificent ocean and mountain views, gently sloping terrain and dry, warm climate. The studies performed (see Chapter I, Section 3.0) have also indicated that the proposed project is compatible with and will enhance the existing natural environment. The specific measures that will be employed to mitigate potential adverse environmental impacts, as discussed in Chapter I, Section 7.0 and Chapter IV, would be followed in the design, construction and operations phases of the project.

No short-term exploitation of resources that will have negative long-term consequences have been identified. The proposed residential project, as envisioned by HFDC, will be a high quality project and will be designed to last for decades. The principal long-term benefits of the proposed project include the productive use of the property for residential and recreational purposes, and the provision of needed affordable housing units for West Maui residents. Increased residential and economic opportunities for all socioeconomic levels would be provided along with increased community services and activities. Open spaces surrounding the project site and vistas to the ocean and mountains would be retained for the long-term benefit of the immediate area residents and visitors to the area.

As noted in the discussion of Alternatives to the Proposed Project (Chapter III), one short-term use of the property would be to retain the present agricultural status and use of the property. This appears to be less than optimum use of the property. As residential units and amenities are developed, significant socioeconomic benefits to the community will result, in the form of increased job opportunities and increased tax revenues. Direct, full-time employment opportunities and temporary construction employment will be generated by the project and these in turn will have benefits that ripple through the regional and island economy. Similarly, indirect, induced employment will be generated in those industries and services that cater to the construction and service related businesses serving the proposed project.

2. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The development of the proposed project and resultant construction of detached single family and clustered multifamily units, ancillary facilities (neighborhood parks, regional park, school, etc.) would result in the irreversible and irretrievable commitment of certain agricultural, natural and fiscal resources. Major resource commitments include the land on which the project is located and on which the facilities would be constructed, as well as money, construction materials, manpower and energy. The impacts of using these resources should be weighed against the expected positive socioeconomic benefits to be derived from the project versus the consequences of taking no action or adopting another less beneficial use of the property.

A significant portion of the property would remain as open space (golf course, parks, public rights-of-way). In addition, the project would include landscaping planted along the streets and public areas, around the residential units and around the golf course, adding to the aesthetic character of the area and assisting in maintaining a feeling of the present rural character of the area.

The commitment of resources required to accomplish the project includes building materials and labor, both of which are generally non-renewable and irretrievable. Construction of and resultant travel to/from the project by residents, would require the consumption of petroleum products and petroleum based electrical generation. This, too, represents an irretrievable commitment of resources.

The project would add to the cultural and recreational facilities available to the residents of the project and the West Maui area in general. Similarly, the project would add to the tax revenues of the county and state.

3. OFFSETTING CONSIDERATIONS OF GOVERNMENTAL POLICIES

By the very existence of a complex system of land use policies, plans, goals, objectives and controls at both the state and county levels of government, development proposals requiring land reclassification are often faced with inherent contradictions and conflicts within the land use regulatory system. As such, the Lahaina Master Planned Project must be reconciled against those privately and publicly planned elements that may appear to conflict with the proposed project. As indicated in Chapter V, the proposed project is generally consistent with the applicable Hawaii State Plan and various Functional Plans and the County General Plan goals, policies and standards relating to the future growth of the West Maui area. Based on both the housing and agricultural impact analyses conducted for the proposed project it is obvious that a portion of the West Maui agricultural lands and crops will be lost as a result of the proposed project. Just as obvious, however, is the fact that much needed affordable and market-priced housing will be provided in an area that has been identified as needing this housing. The proposed project is not expected to adversely affect the state's or county's overall agricultural economy. The agricultural activity in West Maui will be affected. Economic activity in West Maui is expected to benefit from the proposed project from the standpoint of the number of jobs (595) that will be created on-site as well as those that will be indirectly created off-site (119). The income from these jobs is expected to more than offset the loss of agricultural activity in West Maui. Granting the requested land use boundary amendment would enable the project to meet the primary land use regulatory requirements. The proposed project will result in needed affordable residential units being developed.

4. UNRESOLVED ISSUES

HFDC is aware of many questions and public concerns at this time regarding the proposed project. HFDC has been and will continue to work with the residents and businessmen of the area, as well as administrative and elected officials to assure that the final development plans meet the state's project objectives and satisfactorily address concerns that have been raised to date as well as those that may be raised during public review of this EIS.

Other unresolved issues include the questions of land ownership, ceded lands and the sale of the lands and distribution of the proceeds of that sale. HFDC is discussing these issues with the State Departments of Land and Natural Resources and Hawaiian Home Lands and the Office of Hawaiian Affairs. These questions do not appear to cause a need to stop or delay the proposed project in that they can be resolved as planning and construction proceed to the benefit of all Maui residents.

The issue of the best use of the project lands relative to housing and agriculture has also been raised by the State Department of Agriculture and County Planning Department. Based on the agriculture impact study performed for the proposed project, the project is not expected to adversely affect the state's overall agricultural production and/or economy but could affect West Maui's agricultural picture. However, there are several other factors that also influence West Maui's agricultural picture, not the least of which are pressures of urbanization and the supply of agricultural labor. It is HFDC's position that the proposed project is consonant with the state's goals and objectives for both housing and diversified agriculture. As indicated in Section 3 above, by the very existence of a complex system of land use policies, plans, goals, objectives and controls at both the state and county levels of government, development proposals requiring land reclassification are often faced with inherent contradictions and conflicts within the land use regulatory system. As such, the Lahaina Master Planned Project must be reconciled against those privately and publicly planned elements that may appear to conflict with the proposed project. HFDC's analysis indicates that the proposed project is in the best interests of the West Maui area specifically and the state in general, and that the overriding need for affordable housing in West Maui far outweighs the need to continue agricultural activities on the project lands.

Other unresolved issues at this time include county land use designations and permitting for infrastructural components and the completion of the archaeological site data recovery program. It is believed that these issues can be resolved without undue difficulty with the proposed project continuing to move forward in an expeditious manner.

CHAPTER VII
REFERENCES

CHAPTER VII

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CHAPTER VIII
CONSULTED PARTIES, COMMENTS AND RESPONSES DURING THE CONSULTATION PERIOD

CHAPTER VIII

CONSULTED PARITIES, COMMENTS AND RESPONSES DURING CONSULTATION PERIOD

1. CONSULTED PARTIES

The Environmental Impact Statement Preparation Notice (EISPN) for the proposed Lahaina Master Planned Project was published in the Office of Environmental Quality Control (OEQC) Bulletin on September 8, 1989. The deadline for receipt of comments and/or to request to be a consulted party was October 7, 1989. Comments received during the consultation period are included in this chapter.

465 SOUTH KING STREET, KEKUANAOA BUILDING, #104, HONOLULU, HAWAII

OEQC BULLETIN

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

JOHN WAIHEE
GOVERNOR

MARVIN T. MIURA, PhD
DIRECTOR

Volume VI September 8, 1989 No. 17

REGISTER OF CHAPTER 343, HRS DOCUMENTS

All Chapter 343, HRS documents submitted for publication in the OEQC Bulletin must be addressed to the Office of Environmental Quality Control, 465 South King Street, Room 104, Honolulu, Hawaii 96813. Documents addressed otherwise will not be considered for publication.

NEGATIVE DECLARATIONS

The following are Negative Declarations or determinations made by proposing or approving agencies that certain proposed actions will not have significant effects on the environment and therefore do not require EISs (EIS Rules 11-200-11). Publication in the Bulletin of a Negative Declaration initiates a 60-day period during which litigation measures may be instituted. Copies are available at 25 cents per page upon request to the Office. Parties wishing to comment may submit written comments to the agency responsible for the determination (indicated in project title). The Office would appreciate a copy of your comments.

OAHU

KAHUKU ELEMENTARY SCHOOL SERVICE KITCHEN/DINING ROOM; Koolauloa, Oahu; State Dept. of Accounting and General Services for the Dept. of Education (TMK: 1st Div. 5-6-06 por. 11; 5-6-09 por. 134, 135-146)

This is to construct a 1-story, concrete and masonry kitchen/dining room at Kahuku Elementary School.

The project will provide the school with a much-needed facility to implement its program in accordance with the Educational Specifications.

The estimated cost of the project is $1,416,000.

WAIANAE EXPLORATORY WELL NO.2, WELL NO. 2810-03; Waianae, Oahu; State Dept. of Land & Natural Resources, Div. of Water & Land Development (TMK: 8-5-06:4)

The project involves the drilling, casing and testing of a 12-inch diameter well approximately 670 feet deep on the eastern slope of Kamaileunu Ridge in Waianae Valley on Oahu. This well is next to and is to serve as a back-up source to the existing Waianae Well No. 1 (2810-02).

of the existing kiawe trees will be pruned and shaped and others will be removed.

The walkway will be graded and compacted but not paved. Additional plantings include Kamani trees, coconut palms, Naupaka and Beach Morning Glory.

DEMOLITION OF A TWO CAR GARAGE WITHIN MAUI HISTORICAL DISTRICT NO. 3; Wailuku, Maui; B. Martin Luna/Maui Planning Dept. County of Maui (TMK:3-4-14: por 5)

The applicant proposes to demolish an old two car garage in order to construct a 65 stall parking lot within Maui Historic District No. 3.

STATE CO-HABITATION TELECOMMUNICATION FACILITY; Haleakala, Maui; State Dept. of Budget and Finance/State Dept. of Land and Natural Resources (TMK: 2-2-7:05)

The applicant would:

1. Establish the facility for government/non-commercial co-habitrtion use, including proposed tenants Maui Electric Company (public utility), the University of Hawaii, Institute for Astronomy and the State Dept. of Transportation. Other tenants to be included subject to the approval of the Chairperson.

2. Establish additional antennas on the facility, including:
a. One (1) 10-ft. long, 1-inch diameter UHF radio antenna, and
b. Six (6) additional microwave antennas; four (4) of which will be 12-ft. solid dish and one (1) 4-ft. diameter solid dish.

3. Establish an electricity easement of 6,963 sq. ft. to service the facility.

4. Install an above-ground diesel oil fuel tank, for back-up power.

EIS PREPARATION NOTICES

The following proposed actions have been determined to require an environmental impact statement. Anyone can be consulted in the preparation of the EIS by writing to the listed contacts. 30 days are allowed for requests to be a consulted party.

MAUI

HFDC RESIDENTIAL DEVELOPMENT, MAHIKULI-LAHAINA, MAUI; Lahaina, Maui; Housing Finance & Development Corp./Governor, State of Hawaii (4-5-21:03 por., 4-5-21:04 por., 4-5-21:09, 4-5-21:17, 4-5-10:05, 4-5-21:02 por.)

The proposed HFDC project is to eventually develop about 3,900 residential units with an emphasis on residential product types that fall within the affordable (up to 120 percent of median income) housing range.

It is expected that these units would include single family detached homes and multifamily (townhouses type) dwelling units.

HFDC estimates that at an absorption rate of 360 units per year, it will take 11 years to complete the project.

HFDC's role in the development process will be to obtain the necessary land use designations, provide and/or arrange for possible tax or other economic incentives and contract for the construction of the necessary infrastructure and residential units. Actual development of the homes would be by private interests following the guidelines established by HFDC.

A Master Plan that is being prepared as a companion document to the EIS that will be prepared will define the infrastructure requirements, mix of dwelling units and design guidelines, landscaping requirements, etc.

The proposed project may also include public parks and recreation facilities and a limited amount of commercial property to serve the project.

Contact: Neal Wu
7 Water Front Plaza, Suite 300
Honolulu, Hawaii 96813

Deadline: October 7, 1989

OAHU

KAWAINUI MARSH FLOOD DAMAGE MITIGATION PROJECT; Koolaupoko, Oahu; Dept. of Public Works, City & County/Mayor, City and County of Honolulu; Governor, State of Hawaii (TMK: 4-2-16:1)

The City and County of Honolulu proposes to implement a plan to increase the ability of Kawainui Marsh to distribute and store stormwater runoff in order to reduce the potential for downstream flooding. This action is proposed as an alternative to construction of a channel through the marsh.

There four elements to the plan: 1) open approximately 10 acres of new waterways, 2) protect the levee from overflows, 3) provide for the rapid evacuation of overflow water from Kaelepulu Stream into Oneawa outlet canal, and 4) control the diversion of flood water in Kaelepulu Stream to the south to reduce the severity of flooding along that stream.

Two means are proposed to open the waterways: 1) mechanical removal, and 2) explosives to blow apart the vegetation mat. Mechanical removal would utilize a conventional crane or floating equipment manufactured on the mainland. The other means for removal is the use of small amounts of explosives at closely spaced intervals to shred apart the mat.

To protect the levee, a combination of concrete cap and stone revetment is recommended for approximately 1400 feet of the existing levee where the flow will concentrate plus the excavation of the west bank of Kaelepulu Stream to the level of the existing stream channel bottom at levee station 14+50.

In order to evacuate flood water rapidly from Kaelepulu Stream, a new outlet structure to Oneawa canal at the northern end of the stream will be constructed.

The overflow from the control section of the levee will be prevented from flooding the reaches of Kaelepulu Stream to the south by constructing a new weir and gate structure to replace the dilapidated weir on the south side of Kailua Road at its intersection with Kaelepulu Stream.

DOCUMENTS FOR PUBLICATION IN THE OEQC BULLETIN

DATE: 08 / 28 / 89   PREPARED BY: PBR Hawaii

CHECK THE TYPE OF DOCUMENT THAT IS BEING SUBMITTED:

NEGATIVE DECLARATION	☐	EIS PREPARATION NOTICE	☒
NEPA DOCUMENT	☐	DRAFT EIS	☐
CHAPTER 205A DOCUMENT	☐	FINAL EIS	☐
		SUPPLEMENTAL EIS	☐
		ACCEPTANCE NOTICE	☐

TITLE OF PROPOSED ACTION OR PROJECT: HFDC Residential Development, Wahikuli-Lahaina, Maui

LOCATION: ISLAND Maui   DISTRICT Lahaina

TYPE OF ACTION (CHECK ONE): APPLICANT ☐ AGENCY ☒

NAME OF PROPOSING APPLICANT OR AGENCY: Housing Finance & Development Corp.
NAME OF CONTACT: Neal Wu
ADDRESS: 7 Water Front Plaza, Suite 300
CITY: Honolulu STATE: Hawaii ZIP CODE: 96813
PHONE: (808) 543-2937

NAME OF PREPARER OR CONSULTANT: PBR Hawaii
NAME OF CONTACT: Frank Brandt/Michael Terry
ADDRESS: 1042 Fort Street, Suite 300
CITY: Honolulu STATE: Hawaii ZIP CODE: 96813
PHONE: (808) 521-5631

ACCEPTING AUTHORITY: Governor, State of Hawaii

ESTIMATED PROJECT COST:		DOCUMENT PREPARATION COST:	
FEDERAL FUNDS	$	ASSESSMENT	$
STATE FUNDS	$ 450,000,000.00	DRAFT EIS	$
COUNTY FUNDS	$	FINAL EIS	$
PRIVATE FUNDS	$	SUP EIS	$
TOTAL	$ 450,000,000.00	TOTAL	$

EA TRIGGER (CHECK ALL THAT APPLY):
- ☒ USE OF STATE OR COUNTY LANDS OR FUNDS
- ☐ USE OF CONSERVATION DISTRICT LANDS
- ☐ USE OF SHORELINE SETBACK AREA
- ☐ USE OF HISTORIC SITE OR DISTRICT
- ☐ USE OF LANDS IN THE WAIKIKI SPECIAL DISTRICT

OEQC FORM 89-01 (1/89)
PAGE 1 OF 2

- [X] USE REQUIRING AN AMENDMENT TO A COUNTY GENERAL PLAN
- [ ] USE REQUIRING THE RECLASSIFICATION OF CONSERVATION LANDS
- [ ] CONSTRUCTION OR MODIFICATION OF HELICOPTER FACILITIES
- [ ] OTHER ______

BRIEF DESCRIPTION OF THE PROPOSED ACTION OR PROJECT WHICH WILL BE PUBLISHED IN THE OEQC BULLETIN: ______

(CONTINUE ON ANOTHER SHEET IF NECESSARY)

TAX MAP KEY(S): 4-5-21:03(Por.) 4-5-21:04(Por.) 4-5-21:09 4-5-21:17 4-5-10:05 4-5-21:02 (Por.)

FOR OEQC USE ONLY

DATE OF SUBMISSION:
DATE OF PUBLICATION:
LAST DAY FOR CONSULTED PARTY REQUEST:
COMMENT PERIOD ENDS:
ACCEPTANCE DATE:
PUBLICATION DATE OF ACCEPTANCE:

OEQC #______
PLANNER:

OEQC FORM 89-01 (1/89)
PAGE 2 OF 2

ENVIRONMENTAL ASSESSMENT/DETERMINATION
STATE OF HAWAII
HOUSING FINANCE AND DEVELOPMENT CORPORATION
HFDC RESIDENTIAL DEVELOPMENT
WAHIKULI - LAHAINA, MAUI

TMK 4-5-10:05
4-5-21:02 Portion
4-5-21:03 Portion
4-5-21:04 Portion
4-5-21:09
4-5-21:17

August 1989

I. AUTHORITY

The preparation of the Environmental Assessment/Determination is in accordance with the provisions of Chapter 343, Hawaii Revised Statutes and Title 11, Chapter 200, Environmental Impact Statement Rules, Subchapter 6, Determination of Significance, Section 11-200-9(b) of the State of Hawaii, Department of Health.

II. APPLICANT

State of Hawaii
Housing Finance and Development Corporation
Joseph K. Conant, Executive Director
Seven Waterfront Plaza, Suite 300
Honolulu, Hawaii 96813

Phone: (808) 543-6806

III. ACCEPTING AUTHORITY

Governor, State of Hawaii

IV. PROJECT LOCATION

The proposed project lands are located adjacent to Lahaina town mauka of the Lahaina Civic Center and Wahikuli subdivision area and north of the existing Kelawea subdivision and Lahainaluna High School. The proposed project lands are owned by the State of Hawaii, and are presently leased to Pioneer Mill Company, Ltd., a wholly-owned subsidiary of Amfac/JMB Hawaii, Inc., for sugar cane cultivation and are primarily classified Agriculture by the State Land Use Commission. The project property is identified as Tax Map Keys (TMK) 4-5-10:05, 4-5-21:02 (Portion), 4-5-21:03 (Portion), 4-5-21:04 (Portion), 4-5-21:09, and 4-5-21:17. Lands adjacent to the project site are also owned by the State and various private land owners. Pioneer Mill is located in the immediate vicinity of the proposed project but the mill site would be unaffected by the proposed project. The total land area of the proposed project site is about 1,120 acres. The proposed State Department of Transportation Honoapiilani Highway Bypass Alternative B passes through and dissects the property in a northwesterly-southeasterly direction.

V. PROPOSED ACTION

The proposed HFDC project is to eventually develop about 3,900 residential units with an emphasis on residential product types that fall within the affordable (up to 120 percent of median income) housing range. It is expected that these units would include single family detached homes and multifamily (townhouse type) dwelling units. HFDC estimates that at an absorption rate of 360 units per year, it will take 11 years to complete the project. HFDC's role in the development process will be to obtain the necessary land use designations, provide and/or arrange for possible tax or other economic incentives and contract for the construction of the necessary infrastructure and residential units. Actual development of the homes would be by private interests following the guidelines established by HFDC. The Master Plan that is being prepared as a companion document to the EIS that will be prepared will define the infrastructure requirements, mix of dwelling units and design guidelines, landscaping requirements, etc. The proposed project will also include public parks and recreation facilities and a limited amount of commercial property to serve the project.

VIII-5

VI. EXISTING CONDITIONS

At present, the project lands are partially in sugar cane cultivation and partially vacant/fallow lands. There are 3 cane haul roads traversing the property. The project area is located close to Lahaina Town and the Kaanapali resort area and has been identified as an area that is lacking in affordable and market priced homes.

VII. ESTIMATED PROJECT COST AND PROJECT SCHEDULE

The proposed residential planned community costs are presently estimated to be approximately $450 Million (1989 dollars) inclusive of all planning, engineering, design, infrastructure, land and home construction costs.

Construction of the necessary infrastructure (roads, water, sewer, electrical systems) are estimated to require 12 months, including master planning, environmental impact statement

preparation and acceptance, engineering design and construction of the first increment of homes. Construction of future increments would be performed over an approximately 11-year period, depending on market absorption and need for additional units. Planning and preliminary engineering work are underway. Final design and engineering are presently scheduled to begin in late 1989. Construction of the proposed first phase improvements are expected to begin in mid-1990 and be completed by late 1991.

VIII. NEED FOR THE PROPOSED PROJECT

The primary goal of the proposed project is to create a well-planned residential community with a high level of amenities and services that is available to people of all income levels, including people with special housing needs, and sensitive to potential environmental impacts. The proposed project concept includes developing a mix of detached single family and clustered multifamily residential units that would be priced for gap-group, low- and moderate income groups and market priced homes. The exact percentages of residential product types, based on median income for Maui County, will be developed as part of the Master Plan efforts that are in progress. The primary purpose of the proposed project is to provide the residents of Maui with a residential planned community consisting of affordable single family detached and multifamily townhouse type homes thereby providing greater opportunities for home ownership. The provision of affordable homes will satisfy the present and forecast demand for affordable homes in an area that has been identified as being a primary residential center serving the resort and tourism industry facilities in West Maui as well as businesses and other activities in Central and West Maui.

The need for appropriate housing for all socioeconomic groups is a constant concern of both public and private agencies charged with assisting potential homeowners in finding suitable housing. This issue is especially critical to gap-group and low- and moderate-income groups as housing costs generally tend to be above their borrowing capabilities. Similarly, there is a continual need for housing, especially in those areas that are relatively close to employment centers, such as those in West Maui. The demand for increased residential opportunities on Maui, and especially affordable residential units in the West Maui area, has been identified by HFDC as having reached the critical stage. Present residents of Maui are experiencing extreme difficulty in finding rental and/or for purchase dwelling units, especially units in the affordable range. Forecast growth on Maui indicates that this problem will become even more acute in the near future when presently under construction resort facilities in the Kaanapali and Kihei-Wailea-Makena areas come on line in late 1989 and during 1990. To assist in alleviating this problem, HFDC will be providing the incentives to attract private developers to construct and market residential units.

IX. POTENTIAL IMPACTS

A. Environmental Impacts

The proposed project has the potential to impact the general topography of the project site; the existing, mostly introduced, vegetation of the site; the wildlife inhabiting and frequenting the project site; the air and noise quality of the immediate project site; and the visual character of the project site. None of these potential impact areas are considered to be significant adverse impacts and most will be mitigated and/or short term.

B. Socioeconomic Impacts

The socioeconomic impacts associated with the proposed project are all considered to be positive and beneficial to the residents of Maui in general and specifically the West Maui area. Increased housing opportunities, especially for the gap-group, low- and moderate-income groups, and special housing need groups are needed to improve the well-being of these groups and allow these groups to fully participate in and enjoy the community and social benefits available. In addition, the proposed project will provide short-term construction jobs and long-term housing requirements.

C. Archaeological/Historical Resources Impacts

The proposed project is expected to result in positive impacts to the archaeological/historical resources of the project area. Detailed mapping of these resources is being performed prior to completion of the Master Plan and EIS and those sites and features determined by the State Historic Preservation Officer (SHPO) to be significant will be appropriately preserved per the consulting archaeologist's and SHPO's recommendations.

D. Public Services and Facilities Impacts

The proposed project is being designed to improve the public services and facilities in the Lahaina and West Maui areas. As such, the proposed project is expected to have positive impacts on those services and facilities.

X. DETERMINATION

Although the proposed project is not expected to result in or cause short- or long-term adverse impacts to the project area environmental, socioeconomic, archaeological and historical or public services and facilities characteristics, an environmental impact statement (EIS), prepared in accordance with applicable federal and state rules and regulations, will be prepared. The EIS will be prepared because the proposed project will require that the project lands be redesignated Urban by the State Land Use Commission from their present Agriculture designation and the proposed project may require a County General Plan amendment. Further, the proposed project will require the use of State funds and State-owned lands.

XI. FINDINGS AND REASONS SUPPORTING DETERMINATION

In considering the significance of potential environmental effects, the Housing Finance and Development Corporation, in consultation with other State and County agencies, has considered the sum of effects on the quality of the environment and evaluated the overall cumulative effects of the proposed action. The agency has considered every phase of the proposed action, the expected consequences, both primary and secondary and the cumulative as well as the short- and long-term effects of the proposed action. As a result of these considerations, the agency has determined that:

1. The proposed action is located on State lands and will require State funds;
2. The proposed action could affect air, water quality and ambient noise levels;
3. The proposed action is not located in a coastal water and tsunami zone but could affect coastal water quality;
4. The proposed action does not involve an irrevocable commitment to loss or destruction of any significant natural or cultural resource;
5. The proposed action increases the range of beneficial uses of the environment;
6. The proposed action is in concert with the State and County's long-term environmental policies, goals and guidelines as expressed in Chapter 343 HRS, and any revisions and amendments thereto, court decisions and executive orders;
7. The proposed action would substantially affect the economic or social welfare of the community or state;
8. The proposed action involves substantial secondary impacts, such as population changes or effects on public facilities that are not already contemplated;
9. The proposed action does not substantially affect public health;
10. The proposed action does not involve substantial degradation of environmental quality;
11. The proposed action does not substantially affect rare, threatened or endangered species or habitats; and

12. The proposed action is not individually limited and cumulatively could have a considerable effect upon the environment or involve a larger commitment for larger actions.

Further, although the proposed action is compatible with the locality and surrounding project area and appropriate to the physical conditions and capabilities of the area to be served; and the proposed action will not result in any significant adverse effects to the environment; the proposed action is located on presently Agriculture designated lands and will require State funds and lands. The agency will be responsible for and comply with all applicable statutes, ordinances and rules of the federal, state and county governments.

The above described potential environmental impact areas will be fully discussed and described in the EIS to be prepared for the proposed project. Further, detailed botanical, wildlife and archaeological/historical resources surveys will be conducted, as will noise and air quality studies. The results of those surveys will be included in the EIS.

572FR_1_WPS

STATE OF HAWAII
DEPARTMENT OF BUSINESS
AND ECONOMIC DEVELOPMENT

LAND USE COMMISSION

Suspense 9/23

89: DEV/5178

September 13, 1989

Mr. Neal Wu
7 Water Front Plaza
Suite 300
Honolulu, Hawaii 96813

Dear Mr. Wu:

Subject: HFDC Residential Development, Wahikuli-Lahaina, Maui

This is to request to be a consulted party for the above subject matter.

Sincerely,

ESTHER UEDA
Executive Officer

EU:to

SUSPENSE

September 14, 1989

Neal Wu
7 Water Front Plaza, Suite 300 500 Ala Moana Blvd
Honolulu Hawaii 96813

Dear Sir:

I wish to be a consulted party for the HFDC REsidential Development in Lahaina.

Thank you.

Sincerely yours,
Sally Raisbeck
SALLY RAISBECK

633 Laniloa Way
Haiku Maui HI 96708
808-572-6371

RECEIVED
H.F.D.C.
Oct 2 2 07 AM '89

HFDC [illegible]
Suspense ______

[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	EXECUTIVE DIRECTOR				
	DEP EXECUTIVE DIRECTOR				
	PUBLIC INFORMATION				
	LEGAL				
	FINANCIAL SERVICE OFFICE				
	PROGRAM PLNG & EVAL				
	ADMINISTRATIVE SVC OFC				
	PERSONNEL				
	PURCHASING				
1	HOUSING DEVELOPMENT				
	DEVELOPMENT SUPPORT				
	SALES AND COUNSELING				
	HOUSING FINANCE				
	LAND PROGRAMS				

FILE 89:DEV/5529

DEVELOPMENT COPY

BODDEN & MURAOKA
ATTORNEYS AT LAW – A LAW CORPORATION

200 Wailuku Executive Center
34 North Church Street
Wailuku, Maui, HI 96793-1812
Phone: (808) 244-8222
Facsimile: (808) 242-7621

September 18, 1989

Mr. Neil Wu
Housing Finance and Development Corporation
7 Water Front Plaza, Suite 300
Honolulu, Hawaii 96813

Dear Mr. Wu:

I wish to be a "consulted party" in connection with the preparation of the Environmental Impact Statement for the Wahikuli-Lahaina residential development on Maui, as noticed in the September 8, 1989, OEQC Bulletin.

My mailing address is as indicated above.

Thank you.

Sincerely,

Thomas A. Bodden

TAB:ayw

SUSPENSE

PBR HAWAII

September 25, 1989

Ms. Esther Ueda
Executive Officer
State Land Use Commission
335 Merchant Street, Room 104
Honolulu, Hawaii 96813

SUBJECT: LAHAINA HFDC MASTER PLAN - EIS PREPARATION NOTICE

Dear Ms. Ueda:

In accordance with your request to be a consulted party, enclosed is a copy of the EIS Preparation Notice with respect to the Lahaina HFDC Master Plan project. If you should have any questions or comments, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Jeri Y. Yamaguchi
Jeri Y. Yamaguchi
Planning Coordinator

Enclosure

cc: Mr. Neal Wu/Housing Finance
and Development Corporation,
State of Hawaii

572BL104.WPS

1042 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE [illegible] FAX [illegible]
[illegible]

PBR HAWAII

September 26, 1989

Thomas A. Bodden, Esq.
Bodden & Muraoka
200 Wailuku Executive Center
34 North Church Street
Wailuku, Maui, HI 96793-1612

SUBJECT: LAHAINA HFDC MASTER PLAN - EIS PREPARATION NOTICE

Dear Mr. Bodden:

In accordance with your request to be a consulted party, enclosed is a copy of the EIS Preparation Notice with respect to the Lahaina HFDC Master Plan project. If you should have any questions or comments, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Jeri Y. Yamaguchi
Jeri Y. Yamaguchi
Planning Coordinator

Enclosure

cc: Mr. Neal Wu/Housing Finance
and Development Corporation,
State of Hawaii

572BL106.WPS

[illegible]

PBR HAWAII

October 27, 1989

Ms. Sally Raisbeck
633 Laniloa Way
Haiku, Maui, Hawaii 96708

SUBJECT: LAHAINA MASTER PLANNED PROJECT - EIS PREPARATION NOTICE

Dear Ms. Raisbeck:

In accordance with your request to be a consulted party, enclosed is a copy of the EIS Preparation Notice with respect to the Lahaina Master Planned Project. If you should have any questions or comments, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Jeri Y. Yamaguchi

Jeri Y. Yamaguchi
Planning Coordinator

Enclosure

cc: Mr. Neal Wu/Housing Finance
and Development Corporation,
State of Hawaii

572DL132.WPS

1012 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE (808) 521-5631 FAX (808) 523-1402
[illegible]

PBR HAWAII

November 22, 1989

Mr. Steve Isen
Administrator
Maui Memorial Hospital
221 Mahalani Street
Wailuku, Maui, Hawaii 96793

SUBJECT: LAHAINA MASTER PLANNED PROJECT - EIS PREPARATION NOTICE

Dear Mr. Isen:

In accordance with your request to be a consulted party, enclosed is a copy of the EIS Preparation Notice with respect to the Lahaina Master Planned Project. If you should have any questions or comments, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Jeri Y. Yamaguchi

Jeri Y. Yamaguchi
Planning Coordinator

Enclosure

cc: Mr. Neal Wu/Housing Finance
and Development Corporation,
State of Hawaii

572DL139.WPS

1012 FORT STREET MALL, SUITE 300 HONOLULU, HAWAII 96813 TELEPHONE (808) 521-5631 FAX (808) 523-1402
[illegible]

PBR HAWAII

LANDSCAPE ARCHITECTURE
PLANNING
ENVIRONMENTAL STUDIES

November 22, 1989

Dr. John C. Lewin
Director
Department of Health
State of Hawaii
1250 Punchbowl Street
Honolulu, Hawaii 96813

SUBJECT: LAHAINA MASTER PLANNED PROJECT - EIS PREPARATION NOTICE

Dear Dr. Lewin:

Enclosed, for your information as a consulted party, is a copy of an EIS Preparation Notice with respect to the Lahaina Master Planned Project. If you should have any questions or comments, please do not hesitate to contact me.

Sincerely,

PBR HAWAII

Jeri Y. Yamaguchi

Jeri Y. Yamaguchi
Planning Coordinator

Enclosure

cc: Mr. Neal Wu/Housing Finance and Development Corporation, State of Hawaii

5720L153.WP5

CHAPTER IX

AGENCIES, ORGANIZATIONS AND PERSONS WHO WERE SENT A COPY OF THE DRAFT EIS; WRITTEN COMMENTS RECEIVED DURING THE PUBLIC REVIEW PERIOD; AND RESPONSES

CHAPTER IX

AGENCIES, ORGANIZATIONS AND PERSONS WHO WERE SENT A COPY OF THE DRAFT EIS; WRITTEN COMMENTS RECEIVED DURING THE PUBLIC REVIEW PERIOD AND RESPONSES

The Draft EIS was officially submitted to the Office of Environmental Quality Control (OEQC) on December 8, 1989 and notice of its availability published in the OEQC Bulletin on December 8 and 23, 1989 and January 8, 1990. The deadline for receipt of comments was January 22, 1990. The agencies, organizations and persons listed on the following distribution list received a copy(ies) of the Draft EIS. All comments received as a result of the 45-day public review period, and responses thereto, are included in this chapter.

LAHAINA MASTER PLANNED PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT

TRANSMITTAL CONTROL LOG

DATE FILED WITH OEQC: DECEMBER 5, 1989 — OEQC Contact: Dr. Miura 548-6915

DATE PUBLISHED IN OEQC BULLETIN: DECEMBER 8, 1989 — PBR Contact: Mike Terry 521-5631

END OF 45 DAY REVIEW: JANUARY 22, 1990 — HFDC Contact: Neal Wu 543-2937

DATE FINAL EIS DUE: FEBRUARY 4, 1990

DATE OEQC RECOMMEND: FEBRUARY 24,1990

DATE GOVERNOR ACCEPTS: MARCH 5, 1990

DRAFT EIS DISTRIBUTION LIST

DATE TRANSMTL.	TO WHOM	BY WHOM	COMMENT RECEIVED	RESPONSE TRANSMTD.	BY WHOM
	State				
12-8-89	OEQC Director	OEQC			
12-8-89	Dept. of Agricult	OEQC			
12-8-89	Dept. of Acctg & General Services.	OEQC	No com. 12-11-89		
12-8-89	Dept. of Defense	OEQC	No com. 12-21-89		
12-8-89	Dept. of Education	OEQC			
12-8-89	Dept. of Hawaiian Homes Lands	OEQC			
12-8-89	Dept. of Health	OEQC			
12-8-89	Dept. of Land and Natural Resources	OEQC			
12-8-89	DLNR State Historic Preservatn.Officer	OEQC			
12-8-89	Dept. of Business & Economic Develpt.	OEQC			
12-8-89	DBED Library	OEQC			
12-8-89	HFDC	OEQC			
12-8-89	Dept. of Transportn	OEQC			
12-8-89	State Archives	OEQC			
12-8-89	State Energy Office	OEQC			
12-8-89	Office of State Plg	OEQC			
12-8-89	UH Environmentl Ctr	OEQC			
12-8-89	Water Resources Research Center	OEQC			
12-18-89	Land Use Commission	PBR			

DEIS LOG Continued
Page 2

	Federal				
12-8-89	USEPA Region IX	OEQC			
12-8-89	Army DAFE(Fac.Eng)	OEQC			
12-8-89	Navy	OEQC	No com. 12-12		
12-8-89	Soil Conservation	OEQC			
12-8-89	US Army Corps Eng	OEQC			
12-8-89	US Coast Guard	OEQC			
12-8-89	US Fish & Wildlife	OEQC			
12-8-89	US Geological Surv	OEQC			
	Newspapers				
12-8-89	Honolulu Star Bulln	OEQC			
12-8-89	Honolulu Advertiser	OEQC			
12-8-89	Sun Press	OEQC			
12-8-89	Maui News	OEQC			
	County of Maui				
12-8-89	Planning Dept.	OEQC			
12-8-89	Dept.of Parks & Reco	OEQC			
12-8-89	Dept.of Public Work	OEQC			
12-8-89	Dept.of Water Suppl	OEQC			
12-8-89	Economic Developmt	OEQC			
12-8-89	Maui Comm.Coll.Lib	OEQC			
12-18-89	Dept of Human Concn	PBR	Clarif. Rqd. 12-27		
12-18-89	Fire Department	PBR			
12-18-89	Police Department	PBR			
12-18-89	Maui Memorial Hosp.	PBR			
12-18-89	Bodden and Muraoka	PBR			
12-18-89	Sally Raisbeck	PBR			
12-26-89	Dept.of Finance	HFDC			
12-26-89	County Council	HFDC			
12-26-89	Maui Chamber of Com	HFDC			
12-26-89	Maui Contractors As	HFDC			
12-26-89	Maui ILWU	HFDC			
12-26-89	Pioneer Mill	HFDC			
12-26-89	Amfac-JMB	HFDC			
12-26-89	West Maui Taxpayers	HFDC			
12-26-89	Maui Board of Realt	HFDC			
12-26-89	Maui Hotel Assoc.	HFDC			
1-2-90	Maui Electric Co	HFDC			
1-2-90	Lahaina-Kaanapali Pacific Railroad	HFDC			
	Others				
12-8-89	American Lung Asso	OEQC			
12-8-89	Hawaiian Electric	OEQC			
12-8-89	Office of Hawn Aff	OEQC			
12-26-89	Bishop Estate	HFDC			
12-26-89	Office of Hawn Aff.	HFDC			
1-3-90	Helber Hastert & K	HFDC			

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:
Planning Branch

January 10, 1990

Governor, State of Hawaii
c/o Marvin T. Miura, Director
Office of Environmental
Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Governor:

We have reviewed the Draft Environmental Impact Statement for the proposed Lahaina Master Planned Project, Wahikuli-Lahaina, Maui. The following comments are offered:

a. The Crater Reservoir, Wahikuli Reservoir, and adjacent areas are highly likely to be wetlands. Section 3.2.3 of the DEIS indicates that these areas will be retained as an agricultural preserve. If any fill is to be placed in wetlands or other waters of the U.S., a Department of the Army (DA) permit would be required. For more information regarding DA permit requirements, please contact Operations Branch at 438-9258.

b. The 1981 flood insurance rate map (FIRM) reproduced on page IV-14 of the DEIS is the correct (current) one.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Copy Furnished:

State of Hawaii, Housing Finance
and Development Corporation
Seven Waterfront Plaza, Suite 300
500 Ala Moana Blvd.
Honolulu, Hawaii 96813

Marvin T. Miura, Ph.D.
Director
Office of Environmental
Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-6841

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO:
90:DEV/267

January 19, 1990

Mr. Kisuk Cheung, Chief
Engineering Division
Department of the Army
U. S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Dear Mr. Cheung:

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of January 10, 1990 regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your letter.

1. As noted in the Draft EIS, the areas around the Crater Reservoir will be retained as an agricultural preserve. Should our plans for this area change in the future, HFDC would coordinate those changes with the Department of the Army, U.S. Army Corps of Engineers, Operations Branch.

2. The Flood Insurance Rate Map (FIRM) included in the Draft EIS was provided by your organization. We appreciate the cooperation and assistance provided by your staff.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Director
Office of Environmental Quality Control

U.S. Department of Housing
Honolulu Office, Region IX
300 Ala Moana Blvd., Room 3318
Honolulu, Hawaii 96850-4991

Suspense 2-7-90

January 22, 1990

Mr. Neal Wu
Housing Finance and Development Corp.
State of Hawaii
Seven Waterfront Plaza, Suite 300
500 Ala Moana Boulevard
Honolulu, HI 96813

Dear Mr. Wu:

SUBJECT: Lahaina Master-Planned Project - Draft Environmental Impact Statement (EIS)

We have reviewed the draft EIS that addresses the potential impacts of developing a 1,120-acre site with 4,800 single family and multi-family housing units. Other major land uses include recreational, golf course, commercial, church, school and other supportive land uses.

If HUD assistance is anticipated through its FHA mortgage insurance programs or the Community Development Block Grant program, we have the following concerns:

1. Historic Preservation - Compliance with the Historic Preservation Act of 1966, as amended

2. Noise - Compliance with 24 CFR Part 51, Subpart B; Noise Abatement and Control

3. Soils - Compliance with HUD Data Sheet 79G, Handbook 4140.3, Land Development with Controlled Earthwork

We appreciate the opportunity to comment on the draft EIS. If you have any questions on the above, contact Frank Johnson at 541-1327.

Very sincerely yours,

Calvin Lew
Director
Community Planning
and Development Division

1	EXECUTIVE DIRECTOR
	EXECUTIVE ASST
2	HOUSING DEVELOPMENT
	DEVELOPMENT SUPPORT
	SALES AND COUNSELING
	HOUSING FINANCE
	LAND PROGRAMS

90:DEV/415

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-6841

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO:

90:DEV/503

February 2, 1990

Department of Housing and
Urban Development
Honolulu Area Office, Region IX
300 Ala Moana Boulevard, Room 3318
Honolulu, Hawaii 96813-4991

Attention: Mr. Calvin Lew, Director
Community Planning and
Development Division

Gentlemen:

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of January 22, 1990 regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your letter:

1. Historic Preservation:

A full archaeological inventory survey of the project site has been conducted and full compliance with the State, as well as federal historic preservation requirements under Section 106 of the National Historic Preservation Act, have been accomplished.

2. Noise:

The Housing Finance and Development Corporation (HFDC) is aware of the FHA/HUD/VA noise standards and a noise impact assessment of the proposed project has been completed. Should HFDC utilize FHA mortgage insurance, appropriate noise standards will be met.

3. Soils:

The soils characteristics of the proposed project site are fully described in the Draft EIS, Chapter IV, Section 2.1. Based on the analyses conducted to date, surface and/or

subsurface soil conditions are not expected to adversely affect development of the site or be affected by development of the site. The silty clays are generally in a stiff condition and excessive settlement due to building loads, as well as the placement of fill, is not expected. The soils of the project site generally exhibit low to moderate expansion potentials and will not require replacement by less expansive soils. Appropriate HUD land development and earthwork requirements will be met if federal monies or insurance programs are to be used in the proposed project.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Office of Environmental
Quality Control

DEC 1989

HFDC

Suspense

	EXECUTIVE DIRECTOR		
	DEP EXECUTIVE DIRECTOR		
	PUBLIC INFORMATION		
	LEGAL		
	FINANCIAL SERVICE OFFICE		
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	ADMINISTRATIVE SVC OFC		
	PERSONNEL		
	PURCHASING		
	HOUSING DEVELOPMENT		
	DEVELOPMENT SUPPORT		
	SALES AND COUNSELING		
	HOUSING FINANCE		
	LAND PROGRAMS		
FILE	89:PLNG		

The Honorable John Waihee
Governor, State of Hawaii
c/o Marvin T. Miura, Director
Office of Environmental
Quality Control
465 South King Street, Room 104
Honolulu, Hawaii

Dear Governor Waihee:

Subject: Lahaina Master Planned Project
Draft EIS

Thank you for the opportunity to review the subject document. We have no comments to offer.

Should there be any questions, please contact Mr. Cedric Takamoto of the Public Works Division at 548-7192.

Respectfully,

RUSSEL S. NAGATA
State Comptroller

CT:em
cc: Housing Finance and Development Corporation
Dr. Marvin T. Miura

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-2641

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO

90:DEV/0374

January 26, 1990

The Honorable Russel S. Nagata
State Comptroller
Department of Accounting & General Services
1151 Punchbowl Street, Room 412
Honolulu, Hawaii 96817

Dear Mr. Nagata:

SUBJECT: Lahaina Master Planned Project Draft Environmental Impact Statement

Thank you for your participation in the Draft EIS review process. Your letter and this letter will be appended to the final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

JKC:NW:pv

JOHN WAIHEE
GOVERNOR

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

YUKIO KITAGAWA
CHAIRPERSON

SUZ
DEPUTY

Suspense 2 7-90

January 22, 1990

MEMORANDUM

To: Dr. Marvin T. Miura, Director
Office of Environmental Quality Control

Subject: Draft Environmental Impact Statement (DEIS) for
Lahaina Master Planned Project
Housing Finance and Development Corporation
TMK: 4-5-21: pors. 3, 4, 5 and 9
Lahaina, Maui
Area: approximately 1,120 acres

The Department of Agriculture has reviewed the subject document and offers the following comments.

According to the DEIS, the applicant is seeking to develop about 4,800 residential units on the subject site, which is leased from the State and in sugarcane cultivation.

Impact on Pioneer Mill Company (PHC)

We disagree with the assertion that the subject project is "...not expected to threaten the economic viability of (Pioneer Mill Company)..." for the following reasons:

- The subject project will remove 1,120 acres of sugarcane cultivated lands just to the north of the Mill. The subject project would result in, according to the words of a subconsultant, "...a scattered, and therefore inefficient, plantation rather than a more compact and efficient one" and could "...increase the difficulty of maintaining PMCo's 'break-even" profitability' (Appendix D, page D-3 and -9).

- The subject project will reduce the size of the plantation from 6,627 acres (Hawaiian Sugar Planters' Association, 1988 data) to about 5,507 acres, which would be 500 acres under Amfac's favored 6,000-acre plantation (Appendix D, page D-3). If, as suggested in the DEIS, other projects resurface and receive approval (Appendix, page D-3) then PMC could find itself with only about 4,700 acres. These

SUSPENSE
DEVELOPMENT COPY

reductions would gravely threaten the economic viability of PMC.

- The removal of 1,120 acres of sugarcane fields will result in a situation where there is little or no leeway to alter the total area available for sugarcane cultivation. This is especially critical if high-yield lands are removed from production. The DEIS contains no sugar yield information on the fields affected by the proposal as well as those fields comprising the two other alternative sites discussed (DEIS, Chapter III). Therefore, as the DEIS indicates, "Actual impacts, however, could deviate (from the indicated impacts)."

- It appears that the analysis of the other two alternative sites (Honokowai and Olowalu) did not include an investigation of their respective impacts on the economic viability of PMC (DEIS, Chapter III). Is this to say that the economic viability of PMC was not a priority concern in the methodology used to locate the subject project? Is it possible that location of the subject project on the alternative sites would result in less adverse impact on PMC?

- Should the project be approved, will the development be phased so as not to force premature harvesting of sugarcane from the affected fields?

To summarize, we are not convinced that PMC will not be adversely affected by the proposed development. Therefore, using the project site for housing would be inconsistent with applicable objectives, policies, priority guidelines, and implementing actions of the Hawaii State Plan (as amended) and the adopted State Agriculture Functional Plan (1985) as they relate to the continued viability of the sugar industry.

Impact on Diversified Agriculture

We disagree with the assertion that the subject project is "...not expected to threaten...the growth of diversified agriculture on Maui" for the following reasons:

- While there may be a reduction in sugarcane acreage, the fallowed lands do not necessarily become available for other agricultural uses. This is especially true if landowners wish to pursue other activities that promise higher returns, or hold their lands off the market.

- A measure of the demand for land for diversified agricultural use is the applicant list for lots within the State Agricultural Park system. Although no total number of applicants are available for Maui, there were more applicants than lots in the Kula Agricultural Park. On Oahu, our records show more than 370 applicants have applied for State Agricultural Park lots. Accommodation of all these applicants would require development of at least 3,000 acres of new agricultural parks. The Final EIS should specifically identify "freed" sugarcane and pineapple land in terms of location, their availability for profitable replacement crops, and their sale or lease prices and terms.

- The DEIS states that the subject site is agronomically suited to many crops, however "...none require locational characteristics unique to West Maui." The DEIS does not mention one characteristic that should make the project site ideal for an agricultural park for diversified farming - that it is entirely State-owned. If the project site could be improved and made available to farmers by the State, the lease terms and rents would reflect agricultural rather than urban value of the property. Lease terms and rents found within the State Agricultural Park system reflect this practice. Making the site even more attractive for farming is the availability of inexpensive irrigation water from the Wahikuli Ditch which runs midway through the project site.

- The DEIS states that "...high prices for urban land indicate that at least some land in low-value agricultural uses should be reallocated to high-value urban uses, such as housing. Furthermore, any marginal amount of West Maui land which may be freed from sugar production is too valuable to place in a low value use such as most (but not all) diversified agriculture crops. Thus the conversion of a small amount of sugarcane land to diversified agriculture would be justified only if the new crop were of high value and could be grown only in West Maui" (emphases added) (Appendix D, page D-10). This seems to suggest that laissez-faire free-market economics should take precedence over established State land use policy to protect agricultural land. We cannot agree with such an approach.

- The above brings up the issue of what is a scarce resource. The findings of Appendix D are based largely on "...an extensive amount of agricultural land and water in the State...freed from sugar and pineapple production due to

past plantation closings and reductions in operations" and that "...a very small amount of land and water is required to grow proven and promising diversified agricultural crops in order to achieve a realistic level of Statewide food and animal feed self-sufficiency, and to increase exports" (pages D-3 and -4). Furthermore, Appendix D states that the acreage needed for crops in the near future is "surprisingly modest" (page D-4) as compared to the agricultural production goals of the Land Evaluation and Site Assessment (LESA) Commission. The LESA Commission purposefully took a more optimistic and broad view of the future of diversified agriculture in Hawaii than does the DEIS. In the determination and protection of "important agricultural lands", it is the State's duty to assure the availability of agriculturally suitable lands. Therefore, it is appropriate that the State take a conservative, long range view and maintain what appears to be a surplus of productive lands as compared to the DEIS's findings. Incremental losses of a resource like arable lands, if left uncontrolled, will have a devastating and irreversible cumulative effect on the viability of agriculture, and in particular, Pioneer Mill Company. Once agricultural lands are urbanized there is no return. This cannot be overemphasized.

To summarize, we are convinced that agriculture will be adversely affected by the proposed development. Therefore, using the project site for housing would be inconsistent with applicable objectives, policies, priority guidelines, and implementing actions of the Hawaii State Plan (as amended) and the adopted State Agriculture Functional Plan (1985) as they relate to sugarcane and diversified agriculture.

Thank you for the opportunity to comment. We hereby request a copy of the Final EIS as soon as it is available.

Yukio Kitagawa

YUKIO KITAGAWA
Chairperson, Board of Agriculture

cc: Housing Finance and Development Corporation /
Office of State Planning (attention: Land Use Division)
Land Use Commission
Maui County Planning Department

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
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FAX (808) 543-6841

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO:

90:DEV/507

February 2, 1990

MEMORANDUM

TO: The Honorable Yukio Kitagawa, Chairperson
Board of Agriculture

FROM: Joseph K. Conant, Executive Director

SUBJECT: Lahaina Master Planned Project - Draft Environmental Impact Statement

Thank you for your memorandum of January 22, 1990 to Dr. Marvin Miura, Director, Office of Environmental Quality Control, regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your memorandum.

1. Impact on Pioneer Mill:

The information contained in the Draft EIS and Appendix D, Lahaina Master Plan: Impact on Agriculture, was developed from interviews and meetings with Pioneer Mill Company and Amfac-JMB personnel regarding the future of the mill and sugar operations in West Maui. While we understand your position that the loss of any sugar lands, for whatever purpose, is not necessarily in the best interests of continued agricultural activities in the state, we must rely on the individual growers and producers for specific information regarding specific parcels under cultivation. In this instance, Amfac/Pioneer Mill Company indicates a willingness to reduce their sugar acreage while maintaining that the mill will continue to operate at its present or under better economic status. As noted in our consultant's report, "In the longer term, the future of PMCo becomes increasingly uncertain given the outlook for flat or declining sugar prices and costs for labor, materials and supplies which characteristically increase with inflation." Providing that labor contracts and applicable state laws, rules and regulations are followed, we believe that

Amfac/JMB Hawaii and Pioneer Mill Company must be allowed to make their own business decisions regarding their operations and that such decisions are outside the purview of the government. We note that the proposed Lahaina Master Planned project will, at build out, create about 600 jobs on-site and that the average annual income from these jobs will be about $10 million. The project would also create about 120 offsite, indirect, induced jobs. As noted in the Draft EIS and Appendix D, it is unlikely that any of the workers affected by the reduction of acreage by Pioneer Mill Company would lose their jobs; they would be transferred to other Pioneer Mill Company activities and lands. As such, we see the proposed project as not only providing much needed affordable housing in the West Maui area, but one that also creates a substantial number of jobs and personal income without causing the loss of present economic activities.

Our initial evaluations of alternative sites concentrated on up-front development costs, i.e., infrastructural components. Following selection of the Lahaina site as the least costly in terms of onsite and offsite development costs that would be borne by HFDC, consultations with Pioneer Mill Company and Amfac/JMB Hawaii personnel were held. The decision by Pioneer Mill Company and Amfac/JMB Hawaii to reduce their sugar acreage in Lahaina was theirs, not HFDC's. All parties were aware of the three sites under consideration at the time of our meetings with Pioneer Mill Company and Amfac/JMB Hawaii personnel.

The proposed Lahaina Master Planned Project would be phased in so as not to force premature harvesting of sugarcane from the affected fields.

As noted above, we understand your reluctance to support any project that would reduce the amount of acreage under sugar cultivation. However, by the very existence of a complex system of land use policies, plans, goals, objectives and controls at both the state and county levels of government, development proposals must be reconciled against those privately and publicly planned elements that may appear to conflict with the proposed project. HFDC has evaluated these various factors, met with numerous private and public agencies and conducted public informational meetings regarding the proposed Lahaina Master Planned Project. As a result of these evaluations and meetings, we have determined that the proposed site would best meet the objectives of the proposed project and the State's objectives of providing affordable housing where it is needed while maintaining viable agricultural activities within the State. The proposed project's relationship to land use plans, policies and controls for the affected area is described in Chapter V of the Draft EIS. We note that State land use policy does allow for the retention of agricultural land if there is an overriding public benefit and if market signals indicate such a need. In this particular instance, we believe that the overriding public benefit would result from the development of much needed affordable housing in West Maui and the resultant onsite and offsite jobs that the proposed project would generate.

2. Impact on Diversified Agriculture:

As indicated in the Draft EIS and Appendix D, "The development of the Lahaina HFDC Master Plan on sugarcane acreage would not change the amount of land *currently* available for diversified agriculture; but it would preclude the *future* use of the affected lands for diversified agriculture. However, it is extremely doubtful that the project would adversely affect the *Statewide* growth of diversified agriculture. ..."... the limiting factor is not the *land supply*, but rather the *market demand* for those crops that can be *grown profitably* in Hawaii." Further, Appendix D notes that "Although the HFDC project would not adversely affect the Statewide growth of diversified agriculture, it could affect the growth of diversified agriculture in West Maui if the lands were made available for diversified agriculture." We fully agree that diversified agriculture is an important part of the State's overall economic picture. Based on the information in your memorandum regarding your experiences at the Kula Agricultural Park, it would appear the Department of Agriculture might develop additional agricultural park space in that rather than suggesting that type of development in a resort/residential area such as the proposed project site. Our analysis of your suggestion regarding additional information be included in the Final EIS identifying the availability of agricultural lands throughout the State, indicates that such an undertaking would be very costly; should probably be part of an overall statewide agricultural master plan; would probably be lacking in key information because of a reluctance by land owners to state their position on selling or leasing lands for such purposes; and is not properly part of an EIS for a housing project. Should the Department of Agriculture undertake such a project, we would be interested

in the results of your studies and would include those results in our analysis of future projects.

It is true that the Draft EIS does not provide an extensive analysis of just what it would take to convert the project lands into an entirely state-owned agricultural park. That we believe is outside the bounds of the project Draft EIS. However, we do question the suitability and compatibility of the project lands for an agricultural park site, given the surrounding land uses, i.e., resort/residential, and most likely future intensification of those uses regardless of the proposed project.

With regard to your comment regarding the use of the project lands for high- or low-value agricultural crops, we note again that State Land Use policy does allow for the retention of agricultural land if there is an overriding public benefit and if market signals indicate such a need. In this particular instance, we believe that the overriding public benefit is the development of much needed affordable housing in West Maui and the resultant onsite and offsite jobs that the proposed project would generate. The key here, we believe, are the market signals and the overall land use planning in the West Maui area.

We note that the Draft EIS, Appendix D, states that according to the LESA Commission estimates, the projected increased requirements for prime agricultural land for diversified agriculture... "are surprisingly small. Nevertheless, the projected requirements, as small as they are, are high in that diversified agriculture is growing more slowly than the LESA Commission projected." We agree that it is the "State's duty to assure the availability of agriculturally suitable lands" and your projects on all islands reflect that policy. Based on the analysis our consultant has performed, we believe that the proposed Lahaina Master Planned Project is consonant with that policy. Further, we are convinced that the proposed project will provide the much needed affordable housing required in the West Maui region without adversely affecting the agricultural component of our State's economy. It is likely that diversified agriculture would benefit from the project through the sale of increased quantities of vegetable, dairy products, etc., which we believe are best cultivated in an agricultural setting, not a resort/ residential setting.

Thank you for your comments and participation in the Draft EIS review process. Your memorandum and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Office of Environmental Quality Control

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

ENERGY DIVISION 335 MERCHANT ST., RM 110 HONOLULU, HAWAII 96813

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January 22, 1990

Dr. Marvin T. Miura, Director
Office of Environmental Quality Control
465 South King Street, #104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement for Lahaina Master Planned Project

The Energy Division has received the subject Draft Environmental Impact Statement (DEIS) and has the following comments:

There are several references in the DEIS that address our energy-related concerns. In Chapter V, section 6.8.2 (page IV-109), dealing with electrical power and communication, the DEIS states: ". . . in keeping with State energy policies, energy efficient lighting, water heating and cooling would be encouraged in the design of the residential units."

In Chapter V, Section 1.4.3 (page V-19), dealing with Hawaii State Plan Priority Guidelines, the DEIS states: "The proposed project would also aid in the attainment of the energy related guidelines through the energy conservation measures that would be suggested to new homeowners."

In Chapter V, Section 1.5.6 (page V-24), dealing with the State Energy Functional Plan, the DEIS states: "While specific building designs have not been completed, the proposed project will adhere to energy conservation standards whenever possible. Elements of energy conservation that may be incorporated into the project include the use of solar energy for water and air conditioning purposes and the use of heat recovery pumps."

We note, in addition, that the DEIS does not contain an estimate of total electricity consumption within the project.

The above-quoted references indicate an intent to consider energy conservation issues in the design and construction of the project, but they do not signal a commitment to designing and constructing an energy-efficient subdivision. In the place of the tentative language used in the DEIS, we would like to see language that commits the developers to the use of energy conservation design and technologies to help meet the project's energy requirements. We would like to recommend that the developer commit to adopting "energy efficiency design guidelines" for this project. In that regard we are enclosing guidelines which the Energy Division prepared for the Housing Finance and Development Corporation and were included in HFDC's recent request for proposals for increments two and three of the Villages of Kapolei.

Thank you for this opportunity to comment; I hope these comments will be useful to you.

Sincerely,

Maurice H. Kaya
Energy Program Administrator

MHK/PE:dki
Enclosure

cc: Housing Finance and
Development Corporation

DESIGN GUIDELINES - ADDENDUM NO. 1

ENERGY EFFICIENCY DESIGN GUIDELINES

To minimize the life cycle energy use and life cycle cost of the project while maintaining the project development objectives of cost effectiveness, health, safety, security and aesthetics, the following guidelines should be considered and, where applicable, incorporated into the project plans.

1.0 Site Planning and Landscaping

1.1 Orient streets to provide an east/west orientation for the long dimension of the houses to minimize heat gains in the morning and afternoon.

1.2 Incorporate pedestrian walkways and bikeways to encourage walking and bicycling between home, school, parks and commercial areas.

1.3 Select and place landscape materials on the site to provide shading to minimize heat gains in the morning and afternoon.

1.4 Minimize exterior paved surfaces that are not shaded by trees, awnings, trellises, roofing or house.

1.5 Provide for enclosed yard areas where clotheslines could be utilized.

1.6 Incorporate drip irrigation where appropriate, and automate irrigation system to conserve water.

1.7 Select drought-tolerant landscape materials where appropriate to reduce the need for water and energy consumption associated with landscape maintenance.

2.0 Building Design

2.1 Use operable windows to allow cross ventilation in every room, and orient openings toward prevailing winds.

2.2 Utilize eaves (minimum 30"), louvers, trellises, or shade screen to shade windows, especially on west, south and east sides.

2.3 Ventilate attic with devices such as louvers at or near the roof ridge to reduce attic heat buildup and resultant heat transfer to living areas.

2.4 Install a radiant barrier (reflective foil-faced kraft paper material or similar product) in the attic to reduce heat gain into the house attic. Typically installed at the underside of the roof rafters or the top side of the ceiling joists per manufacturer's recommendations.

2.5 Use light colored finishes on roof and wall to reflect sunlight.

3.0 Mechanical Equipment and Systems

3.1 Consider use of heat pump waterheaters.

3.2 Consider use of solar waterheater or provide for future installation by pre-plumbing and running power and control wiring.

3.3 Utilize the most efficient refrigerators, clothes dryers, and dishwashers.

3.4 Install ceiling fans or provide for future installation.

3.5 Use time switches to cut off electricity when not needed to high-usage applications or equipment such as electric waterheater.

3.6 Install fluorescent lights with high efficiency ballasts.

3.7 Use low water consumption waterclosets.

3.8 Install flow restrictors on showers and other water uses which can have high flow rates.

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
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FAX (808) 543-6841

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO

90:DEV/524

February 5, 1990

MEMORANDUM

TO: Mr. Maurice Kaya, Energy Program Administrator
Energy Division
Department of Business and Economic Development

FROM: Joseph K. Conant, Executive Director

SUBJECT: Lahaina Master Planned Project - Draft Environmental Impact Statement

Thank you for your letter of January 22, 1990 to Dr. Marvin Miura regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your letter.

As indicated in our meeting with you and your staff regarding energy conservation, we agree that energy conservation is an important element of the State's overall energy policy and support that policy.

Please be assured that if the installation of energy efficient systems does not adversely affect the income qualification of the potential buyer, we will include the various energy saving system.

Mr. Maurice Kaya, Energy Program Administrator
Page 2
February 2, 1990

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Executive Director

cc: Dr. Marvin Miura, Office of Environmental Quality Control

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104
HONOLULU, HAWAII 96813

MARVIN T. MIURA, Ph.D.
DIRECTOR

TELEPHONE NO.
548-6915

January 22, 1990

MEMORANDUM

TO: Mr. Joseph K. Conant
Executive Director
Housing Finance and Development Corporation

FROM: Marvin T. Miura, Ph.D., Director
Office of Environmental Quality Control

SUBJECT: Draft Environmental Impact Statement
Lahaina Master Planned Project

We have reviewed the draft and offer the following comments.

The "No-Action" Alternative on page III-2 should be reworded. The paragraph gives the impression that there is no other place that the Housing Finance and Development Corporation could develop affordable housing on the island. Also, while this alternative might be contrary to the objectives of the State Housing Functional Plan it would not necessarily be contrary to the objectives of the State Plan since the State Plan includes objectives which also promote agriculture.

The availability of potable water for the project needs to be researched and coordinated with the County of Maui Department of Water Supply before the Final Environmental Impact Statement is submitted.

We question building a package treatment plant at a cost of 3.4 million dollars only to abandon it after expansion of the municipal collection and treatment facilities (pages IV - 106-107). The life expectancy of the package treatment plant should be given as well as any possible uses for it after it has been abandoned.

An estimate of solid waste which will be generated should be possible by calculating 3 1/2 pounds per person per day which is a national average. With the rapid filling of landfill sites, solid wastes will become a greater problem. The proposed project could implement a coordinated recycling effort at the beginning which would require recycling rather than encouraging it.

Thank you for the opportunity to comment.

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
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JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO

90:DEV/504

February 2, 1990

MEMORANDUM

TO: Dr. Marvin Miura, Director
Office of Environmental Quality Control

FROM: Joseph K. Conant, Executive Director

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of January 22, 1990 regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response t· your letter.

1. "No-Action" Alternative:

As indicated in Chapter III, Alternatives Considered, of the Draft EIS, three state-owned areas were investigated as possible sites for the West Maui affordable housing project. All three sites present some of the same and some different limitations and cost factors as the selected Lahaina site. By the very existence of a complex system of land use policies, plans, goals, objectives and controls at both the state and county levels of government, development proposals must be reconciled against those privately and publicly planned elements that may appear to conflict with the proposed project. The Housing Finance and Development Corporation (HFDC) has evaluated these various factors, met with numerous private and public agencies and conducted public informational meetings regarding the proposed Lahaina Master Planned Project. As a result of these evaluations and meetings, we have determined that the proposed site would best meet the objectives of the proposed project and the State's objectives of providing affordable housing where it is needed while maintaining viable agricultural activities within the State. The proposed project's relationship to land use plans, policies and controls for the affected area is described in Chapter V of the Draft EIS.

2. Availability of Potable Water:

HFDC has been and will continue to work with the Maui County Department of Water Supply as well as major private land owners, to assure that the proposed project does not adversely affect potable water supplies in West Maui. Correspondence between HFDC and the Department of Water Supply will be included in the Final EIS.

3. Temporary Wastewater Treatment Plant:

The package treatment plant would only be used until such time as the Lahaina Wastewater Treatment Plant has been expanded to meet the needs of the proposed, as well as other projects. Although the package treatment plant life expectancy may be much longer than the time that it will be used to serve the proposed project, in keeping with Department of Health policy guidelines, the plant will be dismantled and abandoned. At present we do not have any plans for the temporary plant and are not prepared to speculate on its use following abandonment.

4. Solid Waste:

An estimate of solid waste to be generated following build-out of the project will be included in the Final EIS. The estimate will be based on the national average included in your letter. We would hope that recycling would be the adopted mode of solid waste collection and disposal. As indicated in the Draft EIS, recycling will be encouraged through the community association(s). However, we are not in a position at this time to require recycling as a policy for HFDC projects. We will continue to work with the County Department of Public Works on this matter and we are aware of the need to reduce the quantities of solid waste that require landfill disposal.

Thank you for your comments and participation in the Draft EIS. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
1600 KAPIOLANI BLVD., SUITE 1500
HONOLULU, HAWAII 96814

January 18, 1990

Mr. Neal Wu
Project Coordinator
State of Hawaii
Department of Budget and Finance
Housing Finance and Develop]ment Corporation
Seven Waterfront Plaza, Suite 300
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Re: Lahaina Master Planned Project Draft EIS - October 31, 1989

Dear Mr. Wu

Thank you for the opportunity to comment of the above-referenced draft environmental impact statement. We have the following comments and concerns.

The Office of Hawaiian Affairs is aware that there is a need for affordable housing projects. Our major concern about this project however, is the propossed sale of ceded land. Ceded land carries with it heavy responsibilities to both the general public and the native Hawaiian community. While a proposal such as the Lahaina Master Planned Project serves a portion of the public, namely those needing affordable housing, the sale of ceded land is nonetheless a detriment to other recipients of ceded land trust benefits.

Unfortunately, there is no discussion in the draft EIS of the responsibilities of the ceded land trust or how this project will affect those responsibilities. While ceded land concerns are one of the issues that continue to be discussed between this office and Governor Waihee, the loss of land to the ceded land trust is still of great concern to this office. It is the position of this office that until issues concering ceded lands are resolved that there be a moritorium on all sales, transfers or exchanges of all ceded land, irrespective of the appropriatness of the project.

We also are concerned about the lack of a comprehensive archaeology plan for the project. Vague references to "Preservation 'as is', with minimal further work (and possible inclusion into landscaping), or appropriate data recovery/disinterments" is not adequate. Indeed, the legislature, in establishing the state Historic Preservation Program found in Chapter 6E of the Hawaii Revised Statutes declared that:

> "[T]he historic and cultural heritage of the State is among its most important assets ... the rapid social and economic development of contemporary society threaten to destroy the remaining vestiges of this heritage. The legislature further declares that it is in the public interest to engage in a comprehensive program of historic preservation at all levels of government to promote the use and conservation of such property for the education, inspiration, pleasure, and enrichment of its citizens."

In order to follow the mandate of the state legislature the final EIS must be more specific as to what archaeological resources are actually found on the property and exactly how they will be treated. It should include information on which sites will be data recovered, which sites will be preserved "as is", whether interpretation will be done, whether preserved sites will be incorporated into park settings or marked in any way and what efforts will be made to see that sites are protected as well as preserved. Again, because this is ceded land there is an even greater responsibility of the state to insure that those attributes, in this case the archaeological resources, that are contained on public land are preserved for the present and future public.

We also urge that archaeological monitoring continue throughout the construction process. If any additional sites are found during construction that all interested parties be notified and a thorough analysis of the new sites be done. Further, that if any burials are found during construction that all work cease immediately and the Historic Sites Section of the Department of Land and Natural Resources be notified in accordance with HRS section 6E.

Again, thank you for this opportunity to comment on this project.

Sincerely,

Richard K. Paglinawan

Richard K. Paglinawan
Administrator

LJL
cc: Office of Environmental Quality Control

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
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HONOLULU, HAWAII 96813
FAX (808) 543-2641

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO

90:DEV/509

February 2, 1990

Mr. Richard Paglinawan, Administrator
Office of Hawaiian Affairs
1600 Kapiolani Boulevard, Suite 1500
Honolulu, Hawaii 96814

Dear Mr. Paglinawan:

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of January 18, 1990 regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your letter:

1. Ceded Land Issue:

We agree that the ceded land issue is of utmost importance and will continue to meet with your office as well as the Departments of Land and Natural Resources and Hawaiian Home Lands to determine the best disposition of this issue. The Draft EIS notes that the proposed project lands are ceded lands and that discussions with the preceding agencies have been and will continue to be conducted until the issue has been resolved. We believe that the Draft EIS has, as an environmental disclosure document, adequately discussed the ceded lands issue. As additional information becomes available, it will be included in the Final EIS. Final resolution of the ceded lands issue is outside the purview of the environmental impact statement process and is best handled as an issue between HFDC, OHA, DLNR and DHHL. The ceded lands issue will be noted as an "Unresolved Issue" in the Final EIS.

2. Historic Preservation:

A full archaeological inventory survey of the project site has been conducted and is included as Appendix H to the Draft EIS. As indicated in the text of the Draft EIS (see Chapter IV, Sections 4.2 and 4.3), preservation treatment of significant sites, in compliance with applicable state and

federal rules and regulations would be accomplished. Since publication of the Draft EIS, in consultation with the Department of Land and Natural Resources, Historic Sites Section and State Historic Preservation Office, the preservation treatments recommended by the consulting archaeologist has been performed. No further archaeological treatment of previously identified sites is required. Should presently unidentified subsurface sites be revealed during construction of the proposed project, work would cease and appropriate state and county agencies contacted. Work would not proceed until such time as agreed to by the appropriate agencies.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Office of Environmental
Quality Control

University of Hawaii at Manoa

Environmental Center
Crawford 317 - 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

January 19, 1990
RE:0546

Marvin T. Miura, Director
Office of Environmental Quality Control
465 S. King St., #104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Draft Environmental Impact Statement
Lahaina Master Planned Project
Lahaina Maui

This project proposes development of rental and market single family and clustered multifamily residential units adjacent to Lahaina town, mauka of the Lahaina Civic Center and Wahikuli subdivision and north of Kelawea subdivision and Lahainaluna High School. Included are public parks and recreation facilities, a public golf course and a limited amount of commercial property. The land parcels targeted for this development are primarily designated Agriculture by the State Land Use Commission.

The Environmental Center has conducted a review of this project with the assistance of Anders Daniels, Meterology; Leonard Freed, Zoology; and Carolyn Cook, Environmental Center. Although many issues in this document warrant further consideration, we applaud the Housing Finance and Development Corporation for appropriately providing opportunity for public review at the master planning stage. Our reviewers have expressed concerns in the following areas.

<u>Housing Needs</u>
Reviewers concur with the market study in the DEIS regarding the present housing demands in Maui. However, the assumption of a steady state growth in tourism is probably not warranted.

Specifications on the proportion of affordable to market value units to be constructed within the initial phase of the project are not discussed. If present needs for affordable housing are as acute as indicated, construction of the higher priced market units might appropriately be deferred until this demand is met. Given the extended

time frame of the full development, keying construction to specific housing demands seems economically feasible and socially responsible.

<u>Air Quality</u>
Our reviewers felt that the DEIS was thorough in its discussion of air quality. However, one aspect which might have received more emphasis was the consideration of smoke from agricultural burning. As sugar land is converted into residential areas, the potential for air quality problems increases because of new housing adjacent to cane fields. It is our understanding that many of the air quality complaints on Maui come from Kihei residents suffering from smoke inhalation during field burning and from drifting pesticide sprays. The proposed development is similar to that in Kihei. Because State Air Quality Standards (AQS) employ a method of measuring particulates that requires a minimum period of 24 hours, contributions from agricultural field burns, lasting from a half to one hour, do not generally exceed the Standards, though concentrations are very high during the burn period.

<u>Golf Course</u>
It is commendable that the golf course is included in the DEIS for the project's master plan, and much of the ground work regarding soils, water availability, and drainage appears to have been covered. However, a detailed discussion of golf course water requirements and pesticide use and resulting impacts is lacking. Although it is stated that brackish water will be used for irrigation, neither maps nor descriptions provide specific information as to the locations of wells, irrigation plans, fertilizer and pesticide use, and other environmentally significant information.

We thank you for the opportunity to comment on this DEIS.

Yours truly

John Harrison
Environmental Coordinator

cc: OEQC
L. Stephen Lau
Anders Daniels
Leonard Freed
Carolyn D. Cook
Housing Finance & Development Corp. ✓

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
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HONOLULU, HAWAII 96813
FAX (808) 543-6841

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO
90:DEV/506

February 2, 1990

University of Hawaii
Environmental Center
Crawford Hall 317
2550 Campus Road
Honolulu, Hawaii 96822

Attention: Dr. John Harrison
Environmental Coordinator

Gentlemen:

SUBJECT: Lahaina Master Planned Project
Draaft Environmental Impact Statement

Thank you for your letter of January 19, 1990 to Dr. Marvin T. Miura, Director, Office of Environmental Quality Control, regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your memorandum:

1. Housing Needs:

The assumptions regarding the growth of tourism and population contained in the Draft EIS are based on the State Department of Business and Economic Development and Hawaii Visitors Bureau projections. Where necessary, these projections have been adjusted for Maui County in general and specifically the West Maui area.

As indicated in the Draft EIS, private developers will be selected to design and construct the residential units. The phasing of the construction is such that the first increment (Village 1) will consist of affordable and market units for sale and rental units. The mix of subsequent villages will include both affordable and market priced units. The market units and other amenities planned for the project are necessary to recapture some of the public monies expended on infrastructural components required for the entire project. Our first objective is to satisfy the demand for affordable homes to the extent possile given the high costs of

developing affordable housing. The following information regarding the residential units will be included in the Final EIS:

The residential portion of the project would be approximately 500 acres, or 45 percent of the site. The average residential density would be about 9.6 units per acre (U/A). As indicated previously, 60 percent of the project would be within the affordable range with the remaining 40 percent at market prices.

Affordable Housing Unit (780 - 1,200 sq.ft.): Rental and "for-sale" housing will both be priced at rates affordable for families that earn between 80 and 120 percent of the median family income for the County of Maui. These units are comprised of apartments, condominiums, duplexes and single-family dwellings. The single-family units will have lots of approximately 4,000 square feet and be priced between $123,000 and $168,000. Condominiums and townhouses are priced at approximately $105,000. Approximately 216 to 319 acres of the project site will be necessary to accommodate the affordable units.

Market Units (1,300 - 1,800 sq.ft.): Market housing units are all single-family with minimum building lots (usable area) ranging between 4,700 and 5,500 square feet. Pricing for the units on smaller 4,500 square foot lots will range from $234,000 to $315,000. Larger lot products will be priced between $345,000 and $414,000. Unit density will range from 5.2 to 7.0 units per acre, requiring approximately 285 total acres for market priced units.

2. Air Quality:

We understand your concerns regarding cane burning on Maui and have similar problems with our Kapolei/Ewa projects. Fortunately cane burning only occurs occasionally and residents are advised well in advance of such burning. In consideration of Hawaii's Right-to-Farm law and the occasional nature of the cane burning, residential unit sales docments will include information regarding the frequency of cane burning in the Lahaina area and measures residents can take to minimize potential adverse impacts.

3. Golf Course:

The final design and operational characteristics of the golf course have not been determined at this time. As indicated in the Draft EIS, we believe that the non-potable water wells that would provide irrigation water will be located onsite. We are continuing to work with the County Department of Water Supply to ensure that the wells do not cause adverse impacts to the area's potable or non-potable water supplies. Further, a golf course maintenance plan and program, similar to those required by the Department of Health for golf courses on Oahu will be developed by the private party selected to design, construct and operate the golf course. Based on research performed on Oahu, the Big island and Maui, we do not anticipate any adverse impacts to groundwater supplies and/or residents as a result of fertilizer and biocide applications to the golf course or other public park and landscape areas within the project.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Office of Environmental Quality Control

HANNIBAL TAVARES
Mayor
TELEPHONE 244-1955

OFFICE OF THE MAYOR
COUNTY OF MAUI
WAILUKU, MAUI, HAWAII 96793

sa

January 8, 1990

Mr. Neal Wu
Housing Finance and Development
Corporation, State of Hawaii
Seven Waterfront Plaza, Suite 300
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Wu:

My staff has thoroughly reviewed the Lahaina Master Planned Project - Draft Environmental Impact Statement, and the following are our comments:

1. The following projects should be listed on page IV-54 of the EIS:

   a. Maui Palisades (Kihei) - 1050 units

   b. Piilani Residential Community (Kihei) - 785 units

2. If possible, the EIS should include a map showing each increment or phase of the project.

3. The recommended absorption table on page II-9, shows 240 units being developed in 1991, and 860 units in 1992. We request that a larger area and more units be provided in the first increment of the project.

We really appreciate HFDC's efforts to coordinate the development of this project with the County, and look forward to your continuing to do so in the future.

Very truly yours,

Hannibal Tavares

HANNIBAL TAVARES
Mayor, County of Maui

cc: Housing Administrator
W. S. Haines, Executive Assistant

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
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FAX (808) 543-2641

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO:
90:DEV/268

January 19, 1990

The Honorable Hannibal Tavares, Mayor
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Dear Mayor Tavares:

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of January 8, 1990 regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your letter.

1. The Final EIS will include the Maui Palisades and Piilani Residential Community projects as Maui County projects that include affordable housing components.
2. The Final EIS will include a drawing showing each phase of the proposed Lahaina Master Planned project.
3. We also would like the first increment to be larger, however, it is limited to the planned 240 units because of limited capacity of the present wastewater transmission, treatment and disposal system.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Director
Office of Environmental Quality Control

Council Chairperson
Goro Hokama

Council Vice-Chairperson
Howard S. Kihune

Council Members
Linda Crockett Lingle
Pat S. Kawano
Alice L. Lee
Rick Medina
Wayne K. Nishiki
Vevra M. Santos
Joe S. Tanaka

COUNTY COUNCIL
COUNTY OF MAUI
200 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

January 24, 1990

Mr. Neal Wu, Project Coordinator
State of Hawaii
Department of Budget and Finance
Housing Finance and Development Corporation
Seven Waterfront Plaza, Suite 300
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Wu:

SUBJECT: LAHAINA MASTER PLANNED PROJECT DRAFT EIS

Thank you for allowing me to comment on the draft environmental impact statement pertaining to HFDC's Lahaina Master Planned Project.

Although the foregoing will provide much needed housing units for residents of the County, I have offered comments as it pertains to specific sections of the report. These are attached for your review.

Should you have any questions or concerns, please feel free to contact me at 243-7838.

Very truly yours,

GORO HOKAMA
Council Chair

Attachment

GH89343:PAP:rh

January 22, 1990

LAHAINA MASTER PLANNED PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT
OCTOBER 31, 1989

Page I-7 (7.2), Adverse Impacts

LOSS OF AGRICULTURAL LAND - The project area ......on Maui.

COMMENT: In large scale operations, economies of scale has a major impact on the viability of the operation, up to the point of diminishing marginal returns. It should be noted that according to the report of Decision Analysts Hawaii, Inc 1989, Pioneer Mill is currently breaking even.

It would seem that the loss of the 1,120 acres from the operation which accounts for 16.2% of PMCo's sugar lands, would adversely impact the mill's operations. As noted in Appendix D, pg D-3, with the loss of the proposed acreage, export earnings would drop by about $3 million.

In addition, the project site includes Prime Agricultural Land and Other Important Agricultural Land as defined under the Agricultural Lands of Importance to the State of Hawaii (ALISH).

Page I-8, (7-2), Adverse Impacts

SERVICES - The proposed project......public services.

COMMENT: The section states that rather than being growth inducing, the project has been designed to accommodate existing Maui residents, presumably who are already receiving public services. In contrast, Section 5.4.3.3 on page IV-79 states that indirect regional impacts of the project include a larger voting population.

If the project is not growth inducing, where would this larger voting population come from?

Page II-12 (3.2.3), Golf Course, Regional Park, ...Park

The golf course would be open to the public and local residents .....fees.

COMMENT: It is not specified as to exactly what constitutes "priority status" with regard to starting times and fees. Would local residents be guaranteed a maximum cap on kamaiana rates? It would seem that the residents in the area should be informed as to the fee structure currently under consideration by the appropriate entities involved, i.e., the specific fee a "kamaiana" golfer would be charged.

Also, it should be kept in mind that in recent times, foreign investors have shown a marked interest in procuring property and/or business interests in Hawaii. Should the foregoing scenario be accomplished through the use of "straw buyers", would the provisions agreed to by these "straw buyers" be binding on any subsequent purchaser(s)?

In addition, based on the fact that HPDC intends to lease the development rights of the golf course for 55 years for a lump sum of $5 million and 5% of gross revenues per year thereafter, it would seem that a private entity would be in favor of adjusting the fees upward as soon as they are allowed to do so, in order that they may obtain a more expeditious return on their investment.

Page IV - 32 (3.3.3), Probable Impacts

As indicated in the Project Description.....runoff streams.

COMMENT: As noted in Section 2.1.1.2 of the report, the soils in the project area will consist primarily of Lahaina silty clay with a slope ranging from 3% to 25%. While sections of the site has been designated rocky terrain, the entire area fronting the ocean consists of silty clay soil.

It would seem that with the elimination of the sugarcane fields, the volume of runoff water would increase dramatically. The way the fields are currently constructed, the crops are encircled by a 2 to 4 foot earth berm. Together with the fact that the fields were basically uncovered, it would appear that rainfall would not be absorbed as readily as it used to be.

Also, with silty clay soil flowing downhill, it is debatable as to the volume of water runoff that could be accommodated by the proposed retention basins and drainage channels. It would seem that the amount of dirt and debris flowing into the ocean would be greatly increased.

A final factor is that silty clay soil would be among the worst type of soil which would affect living reefs as these soils are very fine in nature and would tend to suffocate growing reef organisms more effectively than coarser types of soil.

Page IV-58 (5.3.1), Existing Economic Base and Employment

The median family income in West Maui was above the county average in 1970 and remained well above the average in 1980. Lahaina's families were not so affluent, Lahaina resident's family income fell below the county average in 1980.

COMMENT: This paragraph is not clear. Does this section imply that the outlying areas of Honokowai and Kapalua raised the median family income for West Maui substantially?

Page IV-88 (6.1.1.2), Probable Impacts

According to a sensitivity analysis conducted by the traffic engineers......HPDC project.

COMMENT: According to Table IV-3, annual growth rate from 1980-1988 is 3.8%. Based on this figure, using the 14,000 persons in Lahaina in 1988, the estimated population would be approximately 18,000 persons by the year 1995.

Does this infer that these traffic engineers are under the impression that Honoapiilani Highway will be able to accommodate this projected increase of motorists traversing the roadway?

Page IV-13 (2.2.1.2), Probable Impacts

Based on preliminary engineering analyses, average potable water for the completed Lahaina Master Planned Project is estimated to be about 4.3 mgd, equivalent to about 900 gpd/unit.

Page IV-102 (6.5.2), Probable Impacts

Water Demand: Preliminary estimates indicate that the 4,800 residential unit project is expected to require an average daily demand of 2.88 million gallons per day.....based on an average daily demand of 560 gpud for multifamily low rise project and 600 gpud for single family or duplex units.

COMMENT: Conflicting data. Even if section 6.5.2 did not include water demand of the proposed golf course and other amenities, the paragraph following 6.5.2 notes that 4.8 mgd are needed.

Page IV-112 (6.11.2), Probable Impacts

The proposed project is expected to have a population of about 15,000......the community.

COMMENT: In section 6.11.3, it is noted that HPDC will continue to coordinate the project development with the DOE to assure that the educational needs of the community are met in a timely manner.

Persons residing in outlying areas have previously requested that a school be located outside the immediate vicinity of Lahaina Town. With a 12 acre elementary school site included in the preferred alternative drawing, it is hoped that plans for construction of the school is already in progress.

Although mention was made regarding health care facilities, it is becoming imminently evident that a more comprehensive medical facility be located in West Maui or that a more expeditious transportation means be in place before completion of the project. Residents of West Maui have already expressed concern as to the length of time that is needed to transport victims to the Maui Memorial Hospital facility. As stated in section 5.4.3.1, the project "will encourage people to move from other areas of Maui to West Maui. As a result, the West Maui population is likely to change".

It follows that with more residents in the area, including an increased number of young families, health care will continue to be needed and the length of time it takes to commute to Wailuku will increase.

0122HPDC:REPORTS:rh

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
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FAX (808) 543-4841

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO

90:DEV/508

February 2, 1990

The Honorable Goro Hokama
Council Chair
Maui County Council
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Councilman Hokama:

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of January 24, 1990 regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your letter.

1. Loss of Agricultural Land:

The information presented in the Draft EIS regarding the economic viability of Pioneer Mill and the loss of the project lands was derived directly from Pioneer Mill. That is, Pioneer Mill believes that its mill operations will continue to at least break even with the loss of the project lands. Our consultant, Decision Analysts Hawaii, Inc. has reviewed this position and believes that it is a true statement of the facts as they are known at this time.

2. Services - Adverse Impacts:

The project in and of itself is not expected to require the immigration of workers or others to service the project as would be the case, for example, with a new resort project. Rather, the proposed project is expected to provide homes for residents in West Maui who are either living in homes owned by others, i.e., renters, those who may be living with their parents or other relatives or family friends and those who may be living in other parts of Maui but employed in West Maui. As such, although the population of project area may increase due to the project, the overall population of the island is not expect to increase due solely to the proposed project. Certainly there will be an increase in

the Maui population due to natural growth and immigration caused by factors other than the proposed project.

3. Golf Course, Regional Park and Parks:

The operational characteristics of the golf course would be determined following selection of a developer. Any provisions HFDC places on the original developer of either the residential units and/or recreational facilities will be binding on all subsequent owners. The term, costs and conditions for the golf course development rights have not been finalized at this time. However, it is our intent that the golf course primarily serve the general public and the development rights conditions will reflect this intent.

4. Stream Runoff Probable Impacts:

As indicated in Chapter IV, Section 2.2, appropriate mitigation measures will be taken to ensure that surface water runoff is controlled such that siltation of nearshore marine waters and or other areas does not occur. These mitigation measures include the use of portions of the golf course for retention basins and the controlled flow of surface water runoff into existing and future drainage channels and structures. Other measures to reduce and minimize surface water runoff will include planting appropriate ground cover and the landscaping of private and public areas. The design guidelines that are included in the Master Plan prepared for the proposed project identifies several species of plants that, among other things, are excellent erosion control plant materials. It is likely that the vegetative cover of the area at build out will be similar to that which exists at present.

5. Existing Economic Base and Employment:

The paragraph in question (Chapter IV, Section 5.3, page IV-61, paragraph 5) is intended only to state the facts of the median family income for Maui County and the Lahaina area. No interpretation of those facts was intended. However, a reasonable interpretation would be that the outlying areas of Honokowai and Kapalua did raise the West Maui median family income.

6. Traffic - Probable Impacts:

The traffic analysis is performed for the proposed project concluded that the existing Honoapiilani Highway could serve the project area until between 2,100 and 2,400 residential units are constructed. After that time, the Lahaina Bypass Highway would be required to maintain efficient traffic flow in the project area. The traffic analysis did consider and include forecast population increases without the proposed project.

7. Potable Water - Probable Impacts:

We apologize for the inconsistency in information on pages IV-13 and IV-102. Those inconsistencies will be corrected in the Final EIS. More detailed engineering analyses have indicated that the proposed project will result in a maximum daily potable water demand of 4.2 million gallons per day. This does not include water demand for schools and commercial zoned areas. Non-potable water would be used for the golf course, parks and public landscaped areas. The final EIS has been revised to include the latest engineering information. In addition, HFDC has been and will continue to meet with the County Department of Water Supply to assure the water requirements of the proposed project do not adversely affect existing uses or other planned or potential West Maui projects.

8. Schools - Probable Impacts:

Based on the latest mix of residential product types planned for the Lahaina Project, the resident population would be about 12,000 rather than the originally estimated 15,000 persons. HFDC is continuing to meet with the State Department of Education regarding facility requirements. At present, two school sites would be included in the project and improvements made to Lahaina Intermediate and Lahainaluna High Schools. The Department of Education will be contracting for the design and construction of the schools. HFDC will provide the land on which the schools would be located.

9. Health Care Facilities:

As indicated in the Draft EIS, HFDC has been consulting with Maui Memorial Hospital personnel regarding their present and forecast service capabilities in Wailuku as well as those of West Hawaii. HFDC will continue to encourage the establishment of increased public health service facilities in West Maui. As noted in the Draft EIS, it is likely that health care facilities and services in the West Maui area would improve in the future as a result of natural

population increases, regardless of the proposed project.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Office of Environmental Quality Control

HANNIBAL TAVARES
Mayor

CHRISTOPHER L. HART
Planning Director
RALPH N. MASUDA
Deputy Planning Director

COUNTY OF MAUI
PLANNING DEPARTMENT
200 S. HIGH STREET
WAILUKU, MAUI, HAWAII 96793

January 26, 1990

Dr. Marvin Miura, Director
Office of Environmental Quality Control
465 South King Street, Rm 104
Honolulu, Hawai'i 96813

Dear Dr. Miura,

Re: Draft Environmental Impact Statement (DEIS) for Lahaina Master Planned Project.

The Maui County Department of Planning has reviewed the subject document and offers the following comments.

Civic Center Expansion and Recreational Facilities (Section 6.12)

We do not concur that the plan provides for adequate recreational facilities or for the continued use of existing facilities at the Civic Center.

While the DEIS asserts that "an abundance of coastal recreational areas" exist in West Maui, this perception is not shared by residents of the area. Furthermore a regional park serves other needs besides coastal recreation. The project's projected population increase will contribute significantly to the need for a substantial regional park facility. Sixteen (16) acres does not comprise a regional park, sixty (60) acres would be more appropriate.

The existing Civic Center amphitheater produces high levels of noise that may be incompatible with nearby residential uses. A large regional park between the center and residences would provide a buffer. Is HFDC prepared to pay for noise reduction measures at the amphitheater, when complaints arise from abutting residences?

The County of Maui requests that the entire approximately 60 acre parcel (including the existing civic center) between the lower cane haul road and Honoapi'ilani Highway, be set aside for civic and recreational purposes. We believe this would result in a better planned project, and will contribute an attractive and useful civic/recreational center to the region as whole, as well as the project. Is this proposal feasible within the preferred alternative? Why or why not?

Traffic (Section 6.1)

The DEIS assumes completion of the Lahaina Bypass by 1994 as a mitigation measure to traffic produced by the project. Recent statements by State officials indicate that the completion date has been postponed indefinitely.

What impact will the proposed project have on Lahaina traffic without the bypass in place? What alternatives are proposed? Has HFDC considered deferring development until the bypass is completed?

Waste Management (Section 6.7)

The DEIS states that "Estimated quantities of solid waste to be generated by the proposed project cannot be determined at this time." Why not? Do adequate models for projecting waste generation not exist? We would request a more in-depth treatment in the Final EIS.

Has HFDC considered setting aside an area within the project to allow for a community recycling center? Can the houses be designed to facilitate home sorting of solid wastes for pick up by the county or delivery to a community recycling center? We would request that both a community recycling center, and household sorting facilities be required of the project developer.

Impact on Agriculture (Section 2.1)

We are uncomfortable with the DEIS assessment of the project's impact on agriculture. We believe the threat to the viability of Pioneer Mill is understated. Implementation of the project may well push the current plantation operations below profitable economies of scale. Has Pioneer Mill Company, Ltd. been consulted as to their assessment of the project's impact on the plantation?

Notwithstanding the project's positive impact on the critical Maui/West Maui housing crisis, perhaps the issue of agricultural impacts, per the State policy on its preservation, should be recognized in Chapter IX, Unresolved Issues, and in Chapter IV, Section 5, Socioeconomic Environment.

Dr. Marvin Miura, Director
January 26, 1990
Page 3

The Maui County Planning Department supports the mission of the Housing Finance and Development Corporation and the concept of the Lahaina Master Planned Project. The project's importance toward alleviating the critical housing crisis cannot be overstated. We would request however, that our concerns be addressed, in order to minimize negative impacts and planning oversights.

Thank you for this opportunity to comment. We look forward to receiving the Final Environmental Impact Statement.

Very Truly Yours,

Christopher L. Hart
Director

cc: Mayor Hannibal Tavares
Department of Public Works
Department of Parks and Recreation
Housing and Finance Development Corporation
Land Use Commission
Department of Agriculture

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-6841

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO:

90:DEV/505

February 2, 1990

Mr. Christopher Hart, Director
Planning Department
County of Maui
200 South High Street
Wailuku, Maui, Hawaii 96793

Dear Mr. Hart:

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of January 26, 1990 to Dr. Marvin Miura, Director, Office of Environmental Quality Control, regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your memorandum.

1. Civic Center Expansion and Recreational Facilities (Section 6.12):

Included in the proposed project are a regional park, a golf course, five community parks, two elementary school sites and civic center expansion lands. Based on our master plan analysis of park space requirements for the population that would exist in the Lahaina area following completion of the proposed project (utilizing recreation standards of the City and County of Honolulu as none for Maui County exist), our planners have determined that at build out, six (6) new baseball fields, one (1) new softball field, one (1) new pool, one (1) new gym/recreation center, two (2) recreation buildings, and two (2) new child play areas will be required to service the proposed project and surrounding Lahaina area. Based on the preceding, it appears that more than ample park space and facilities would be provided for the community. Other facilities for each community park would probably include comfort stations and areas for passive recreation. The recreation/open space plan proposed for the project is characterized by selected improvement of the existing drainageways and steep slope areas as recreational and scenic amenities.

In recognition that certain activities at the civic center amphitheater produce high sound levels, we have performed a noise analysis study and find that homes closest to the amphitheater could be adversely affected by those events if appropriate mitigation measures are not taken. We have suggested that appropriate mitigation measures would include the installation and use of a distributed outdoor speaker system; the construction of sound attenuating walls along the boundary of the amphitheater; and the use of sound attenuating building materials for those homes that might be impacted by amphitheater activities. Please note that because of our mutual concern regarding potential noise conflicts, our plan has been revised such that two (2) golf holes are now located directly mauka of the amphitheater. This places the closest mauka residential units about 1,200 feet east of the amphitheater, generally outside the measured noise sensitive area. It is possible that the Department of Health could extend Oahu noise standards to the remainder of the state, which could, in effect, preclude loud rock concerts and/or other activities at the amphitheater. We understand that the County does not encourage rock concerts at the amphitheater and that they only occur about six times per year. We support the County's policy and would encourage that it be tightened by requiring concert promoters to use directed speaker systems in place of omnidirectional, non-selective systems.

We understand your request to have approximately 60 acres of land around the present Civic Center reserved for regional park space. However, we believe that the need for affordable housing outweighs the need for regional park space at this time, especially given the critical nature of the affordable housing situation in West Maui, the need to begin to alleviate that problem as soon as possible and the amount of park land that will be included in the project. The area makai of the industrial road is best suited for the initial development, given the need for HFDC to develop and improve sewer and water lines to serve the proposed project. We believe your request for additional regional park land would not be feasible within the preferred alternative, given the existing topographic, drainage, et., limitations of the site.

2. Traffic:

The traffic assessment conducted for the proposed project indicates that the Lahaina Bypass Highway will be required by the time between 2,100 and 2,400 residential units are

completed. Based on our present scheduling, assuming infrastructural components are completed on time, as well as other outside market factors, this would occur in the 1994 time period. HFDC and the State Department of Transportation have been discussing the Bypass Highway and our preliminary determinations are that the portion of the highway that passes through the Lahaina Master Planned Project site would be funded by HFDC; the highway would be designed and constructed in compliance with County standards; and that access to the highway would be limited to two to three points to assure the smooth and safe flow of traffic. Further, design and construction of the Bypass Highway would begin well in advance of the time that it would be required solely for the proposed project purposes.

3. Waste Management:

The Final EIS will include an estimate of solid waste to be generated following completion of the proposed project. The estimate will be based on national averages. As indicated in the Draft EIS, the community association(s) established within the project will be encouraged to support recycling programs. However, HFDC is not in a position to require recycling until such time as appropriate mechanisms are established on Maui to accept recycled solid waste products.

4. Impact on Agriculture:

The assessment of the impact of the proposed project on present and forecast agricultural activities on Maui was developed by a recognized expert consultant. We note that our consultant's report (Draft EIS, Appendix D) indicates that the proposed project is not expected to adversely affect the statewide agricultural economic situation, but that the project could affect the West Maui agricultural economic situation. We further note that, at build out, the proposed project is expected to result in the creation of about 600 on-site jobs, in various fields, and about 120 indirect, induced jobs. The average annual income from the on-site jobs would be about $10 million. The choice of the project site has been discussed with Amfac/JMB Hawaii and Pioneer Mill Company personnel and it is their belief that the economic viability of the mill will not be adversely affected solely by the proposed project. As noted in our consultant's report, "In the longer term, the future of PMCo becomes increasingly uncertain given the outlook for flat or declining sugar prices and costs for labor, materials and supplies which characteristically increase with inflation."

Providing that labor contracts and applicable state laws, rules and regulations are followed, we believe that Amfac/JMB Hawaii and Pioneer Mill Company must be allowed to make their own business decisions regarding their operations and that such decisions are outside the purview of the government. As noted in the Draft EIS and Appendix D, it is unlikely that any of the workers affected by the reduction of acreage by Pioneer Mill Company would lose their jobs; they would be transferred to other Pioneer Mill Company activities and lands. As such, we see the proposed project as not only providing much needed affordable housing in the West Maui area, but one that also creates a substantial number of jobs and personal income without causing the loss of present economic activities.

By the very existence of a complex system of land use policies, plans, goals, objectives and controls at both the state and county levels of government, development proposals must be reconciled against those privately and publicly planned elements that may appear to conflict with the proposed project. HFDC has evaluated these various factors, met with numerous private and public agencies and conducted public informational meetings regarding the proposed Lahaina Master Planned Project. As a result of these evaluations and meetings, we have determined that the proposed site would best meet the objectives of the proposed project and the State's objectives of providing affordable housing where it is needed while maintaining viable agricultural activities within the State. The proposed project's relationship to land use plans, policies and controls for the affected area is described in Chapter V of the Draft EIS. We note State Land Use policy does allow for the retention of agricultural land if there is an overriding public benefit and if market signals indicate such a need. In this particular instance, we believe that the overriding public benefit would result from the development of much needed affordable housing in West Maui and the resultant onsite and offsite jobs that the proposed project would generate.

Thank you for your comments and participation in the Draft EIS review process. Your memorandum and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Office of Environmental Quality Control

DEPARTMENT OF
HUMAN CONCERNS
COUNTY OF MAUI

200 SOUTH HIGH STREET, WAILUKU, HAWAII 96793

December 27, 1989

Honorable John Waihee, Governor
State of Hawaii
c/o Marvin T. Miura, Director
Office of Environmental Quality Control
465 South King Street, #104
Honolulu, Hawaii 96813

Dear Governor Waihee:

Subject: Environmental Impact Statement prepared for the Lahaina Master Planned Project.

The Office of Economic Development have reviewed the subject Environmental Impact Statement and find that, in general it has adequately identified and addressed the major environmental impacts which can be anticipated to result from the proposed project. However, we feel that there is a need to address whether the gulches will be used for a drainage basin, and what measures will be taken to prevent erosion. Also what type of poles will be used for the street lights.

On page 1 - 6, it states that the site is also absent of flood and natural hazards. This contradicts page iv-20 section 2-3.1 existing conditions. It states that the primary potential natural hazards to which the property could be subjected include flooding.

We have no other comments to offer at this time; however, we thank you for the opportunity to review and express our comments on the Environmental Impact Statement.

Very truly yours,

Fred Matsumoto

FRED MATSUMOTO
Economic Development Coordinator

EDWIN OKUBO Housing Division Administrator | ROBIN TANAKA | MICHAEL LUXTON | FRED MATSUMOTO Office of Economic Development | ARNOLD BAXA | JAN DAPITAN | ROY FUSATO

Honorable John Waihee, Governor
December 27, 1989
Page -2-

cc: Marvin T. Miura, Director
Office of Environmental Quality Control
465 South King Street, #104
Honolulu, HI 96813

State of Hawaii
Housing Finance & Development Corp.
Seven Waterfront Plaza, Suite 300
500 Ala Moana Boulevard
Honolulu, HI 96813

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-6841

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO

90:DEV/165

January 11, 1990

Mr. Fred Matsumoto
Economic Development Coordinator
Department of Human Concerns
County of Maui
200 South High Street
Wailuku, Hawaii 96793

Gentlemen:

Subject: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of December 27, 1989 regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your letter:

1. The gulches will continue to serve as part of the overall project area drainage system. As noted in the Draft EIS (see Chapter IV, Section 2.2.2.3, page IV-19), "...the onsite drainage from the project will be channelized into culverts and retention basins as recommended in the preliminary project engineering report. The final engineering drawings and specifications will be reviewed and approved by the County Engineering Department". In general, the gulches will not serve as "retention basins" but will receive runoff from areas mauka of the project as well as from portions of the project. Retention basins will be designed into the golf course and the lower portions of Kahoma Stream.

2. Erosion control will be in compliance with state and county standards. In general, erosion control will be accomplished by planting graded areas with appropriate ground cover as soon as practicable and the use of earthen berms during the construction phase to assure that surface water runoff is directed to existing

drainage channels in quantities that minimize the potential for siltation of ocean waters. Erosion control measures will be subject to the review and approval of the County Department of Public Works.

3. Although the type of street lights has not been selected, the infrastructural components of the proposed project will be designed and constructed in compliance with dedicable standards.

4. The Final EIS will be clarified regarding the potential for natural hazards (flooding and volcanic eruptions) affecting the project site. We note that, although the site <u>might</u> be subjected to either flooding and/or volcanic hazards, it is not because of a variety of factors, including location and topography.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Director
Office of Environmental Quality Control

RECEIVED

DEPARTMENT OF WATER SUPPLY '89 DEC 27 P1:32
COUNTY OF MAUI
P.O. BOX 1109
WAILUKU, MAUI, HAWAII 96793
OFC. OF ENVIRO. QUALITY CONT.

December 26, 1989

Dr. Marvin T. Miura, Director
Office of Environmental Quality Control
State of Hawaii
465 S. King Street, Room 104
Honolulu, Hi 96813

Dr. Miura:

Subject: Environmental Impact Statement
Lahaina Master Planned Project
TMKS: 4-5-21:por. of 3,4, 5 and 9
Lahaina, Maui, Hawaii

Per your request for comments relative to the subject matter, we wish to offer the following for your consideration:

1. The report states that "on occasion, water from the Kanaha Wells is more saline than desirable, partially because of an over-sized pump (900 gpm) in one well and an unusual depth of penetration (95 feet below seal level) of the other well." The latter part of this statement is not true. The pump capacities in each well is 350 gpm and only one pump operates at a time. Further, one well was drilled deeper than originally intended, but the hole was backfilled to its desired depth. Water supply from Kanaha Well may occasionally be more saline than desirable, but this may be attributed to a thin domestic water lens (4 feet to 5 feet) and long periods of pumping.

   Based on the above conditions, the proposed wells for this project may adversely impact the Kanaha wells. It is suggested that a single producing well be first drilled and tested (over a long period than normally tested) to determine the impact it may have on the surrounding wells. The applicant should also be aware that Amfac's existing wells and its proposed wells are within the same aquifer with HFDC's proposed wells.

2. The report states that, at least six, and possibly more, wells rated at 400 gpm to 450 gpm will be required. For your information, as required by the State Water Commission, pursuant to the State Water Code, the technical report of Maui's Water Use and Development Plan, the capacity of the wells in that area are likely to be low, at about 0.3 mgd. Based on the above, it appears that 15 or more wells will be needed to satisfy the water demand of the project. Can that many wells of potable water be developed in the planned area without impacting the existing wells?

3. The report states that "brackish groundwater will be developed on site for its golf course irrigation, parks and street landscaping." Because the aquifer lens in the area is very thin, drawing brackish water from that lens may affect the available potable water. The geologist for the Housing and Finance and Development Corporation must ascertain the affect on non-potable withdrawal on the potable sustainable yield.

4. The report states that the project will construct a total of 3.5 mg storage to compensate an existing 1.5 mg tank. The capacity of the existing tank is already assigned to the existing service areas of Lahaina and though the project may use it to service the area between Honoapiilani Highway and being at elevation of 100 feet, the project would need to provide full storage capacity for its total project in accordance with the Maui County Code. Additionally, it is strongly suggested that the applicant should meet with us so that we can assist them in the proper design of the required transmission, distribution and storage system.

The phasing of the water development for the planned project and the project construction must be carefully matched to avoid unnecessary delays. The applicant must be advised that sufficient water supply be developed before the increment development of the project is initiated.

If you have any questions or if we can be of further assistance to you, please do not hesitate to call on us.

Sincerely,

Vince G. Bagoyo, Jr., Director

VGB/ao

cc: DWS Engr.
Chris Hart, Planning Director

"By Water All Things Find Life"

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-4641

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO
90:DEV/502

February 2, 1990

Mr. Vince G. Bagoyo, Jr., Director
Department of Water Supply
County of Maui
P. O. Box 1109
Wailuku, Maui, Hawaii 96793-7109

Dear Mr. Bagoyo:

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of December 26, 1989 regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your letter:

1. The information in the Draft EIS regarding the sizes of pumps and water table levels will be corrected in the Final EIS to reflect the information provided in your letter. As you are aware, the Housing Finance and Development Corporation (HFDC) and our engineers have met with the representatives of your department and will continue to do so to ensure that the water needs of West Maui are not adversely affected by the proposed project. It is our intent to test a single well before proceeding with the development of additional wells to serve the proposed project.

According to our consultant, Mr. John Mink:

"Originally one of the Kanaha wells was fitted with a larger pump, and a record at either the US Geological Survey or DOWALD listed it as 900 gpm. If the record was corrected, I missed it. Also, when a well is backfilled the official record often is not kept current. Neither of these errors invalidates the arguments below.

It is certain that the lens is thin at Kanaha and Waipuka, less than 4 feet if the originally

reported heads are correct. The initials heads were as follows (DOWALD records).

Kanaha 1 .... 2.5 ft.
Kanaha 2 .... 3.2 ft.
Waipuka 1 .... 2.6 ft.
Waipuka 2 .... 1.8 ft.

The variation among these heads suggests that the original measurements were not exact, yet it seems clear that the head in Kanaha Valley at a distance of 2 miles inland is less than 4 feet. Under this constraint the pump capacity should be 300 to 350 gpm. The geology of Kanaha Valley where the wells are located is very different from the region to the north. Rift zone conditions may prevail in Kanaha as implied by the occurrence nearby of an extrusion of Honolua andesite, Lahaina series eruptives and dikes of the Wailuku rift zone.

North of Kahoma-Kanaha Stream the head-distance relationship appears to be more favorable. At 2 miles inland the expected head falls between 4 and 5 feet. The allowable pump capacity per well therefore is between 400 and 450 gpm.

It would be an unexpected phenomenon were the proposed HFDC wells to affect the Kanaha wells. The distance between the nearest HFDC well and the Kanaha wells is at least half a mile. Using a conservative set of parameters for aquifer characteristics and high draft at the HFDC wells, the drawdown affecting Kanaha would be less than 1 foot. Very likely a drawdown would not be detectable.

The first well to be drilled for HFDC will indeed be exploratory in the sense that accurate water level measurements will be made and a long pump test performed. A 4 or 5 day test is more than sufficient to establish the initial groundwater conditions. The marginal value of information obtained with longer testing will be small --- the big changes, if any, will have taken place by the end of the fourth day. Also, there is no need to pump the well for a long period at a rate higher than the design capacity. Why perturb the fresh-salt water equilibrium by submitting it to unnecessary stress?"

2. The number and capacities of the wells that will be required for the proposed project will be determined during on-going hydrogeological studies and investigations. The information included in the Draft EIS was the best available information at the time and according to Mr. John Mink the expected allowable yield of the wells is 400-450 gpm well. If test results show a lower than expected yield, yes, we will evaluate the impact of additional wells on the existing wells. As noted above, we will continue to work with your department regarding the number and locations of potable and non-potable water wells to serve the proposed project.

3. Our preliminary hydrogeological investigations and reports indicate that non-potable water can be developed on-site to serve the golf course and parks and public landscape areas. Additional information regarding this matter will be provided to your department as it is developed.

According to our consultant, Mr. John Mink:

> "Pumping brackish water for golf course irrigation will not affect the up-gradient HFDC potable water wells. The reverse is true, but the quality of the brackish water controls the quantity extracted from each golf course well. Grass can't tolerate much more than 1000 mg/l chloride. The brackish wells will capture groundwater that by-passes the potable wells; more than half the groundwater flux will travel past the potable wells."

4. As a result of our discussions, in compliance with the Maui County Code, water storage tanks providing full storage capacity for the proposed project, will be constructed as part of the proposed project.

We agree that phasing of the water supply requirements for the proposed project must be carefully matched to avoid unnecessary delays. As noted above, we will continue to meet with representatives of your department to assured that the proposed project does not adversely affect the water supply needs of West Maui.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

cc: Dr. Marvin Miura, Office of Environmental Quality Control

HANNIBAL M. TAVARES
Mayor

COUNTY OF MAUI
DEPARTMENT OF FINANCE
200 SOUTH HIGH STREET
WAILUKU, MAUI, HAWAII 96793

January 11, 1990

Mr. Neal Wu, Project Coordinator
Housing Finance and Development Corporation
Department of Budget and Finance
State of Hawaii
Seven Waterfront Plaza, Suite 300
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Wu:

Thank you for allowing me to review the draft Environmental Impact Statement dated October 31, 1989. The report was comprehensive and informative. I do not have constructive comments to offer at this time.

Very truly yours,

HENRY T. S. LAU
Director of Finance

HTSL:rt

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-6441

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO

90:DEV/0375

January 26, 1990

Mr. Henry T.S. Lau
Director of Finance
County of Maui
200 S. High Street
Wailuku, Hawaii 96793

Dear Mr. Lau:

SUBJECT: Lahaina Master Planned Project Draft Environmental Impact Statement

Thank you for your participation and comments in the Draft EIS review process. Your letter and this letter will be appended to the final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

JKC:NW:pv

KAWAIAHAO PLAZA
567 South King Street
Suite 200
PO Box 3466
Honolulu, Hawaii 96801
Telephone 523 6200

KAMEHAMEHA SCHOOLS / BERNICE PAUAHI BISHOP ESTATE

January 23, 1990

Mr. Neal Wu
State of Hawai'i
Department of Budget and Finance
500 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Wu:

Lahaina Master Planned Project - Environmental Impact Statement

We received your Lahaina Master Planned Project Draft Environmental Impact Statement with request for our review and comment. The proposal is a solution for the housing shortage in the Lahaina area, especially since 67% of the homes are earmarked as affordable.

The relocation of the 18 families was not addressed in this EIS. Is that a separate issue? We previously discussed the possibility of an exchange between the State's Civic Center land for Kamehameha Schools/Bishop Estate's 12 mauka acres. Are you still pursuing this exchange? Please advise us on the status of these subjects.

Very truly yours,

Lurline Salvador

Lurline Salvador
Land Manager
Neighbor Island Division

LS/kmk

JOHN WAIHEE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813
FAX (808) 543-6441

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO

90:DEV/501

February 2, 1990

Kamehameha Schools
Bernice Pauahi Bishop Estate
567 South King Street
Honolulu, Hawaii 96813

Attention: Ms. Lurline Salvador
Land Manager, Neighbor Island Division

Gentlemen:

SUBJECT: Lahaina Master Planned Project
Draft Environmental Impact Statement

Thank you for your letter of January 23, 1990 to Mr. Neal Wu regarding the subject project and Draft Environmental Impact Statement (EIS). The following is provided in response to your memorandum.

1. Relocation of Families:

The proposed project will not require the relocation of any families. The families to which you refer, will require relocation as a result of the Department of Transportation's proposed Lahaina Bypass Highway. This is a completely separate project and we would suggest you communicate with the Department of Transportation regarding this matter.

2. Land Exchange:

At this time, we are not considering a land exchange with respect to the first village next to the civic center. However, we would like to keep a land exchange possibility open for future villages in this project.

Thank you for your comments and participation in the Draft EIS review process. Your letter and this response will be appended to the Final EIS.

Sincerely,

JOSEPH K. CONANT
Executive Director

JKC:NW:jk

cc: Dr. Marvin Miura, Office of Environmental Quality Control

APPENDICES

APPENDIX A
MARKET FEASIBILITY STUDY

LOCATIONS
Real Estate Sales & Research

FINAL DRAFT

MARKET FEASIBILITY STUDY

FOR

STATE OF HAWAII'S
LAHAINA MASTER PLANNED PROJECT

PREPARED BY

LOCATIONS INCORPORATED RESEARCH DEPARTMENT

NOVEMBER 7, 1989

Locations Inc Main Office 1339 Hunakai Street Honolulu Hawaii 96816 Telephone (808) 735 4200 Cable Locations Telex RCA7238336

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

BACKGROUND

The Locations Inc. Research Department was retained by the Housing Finance Development Corporation (HFDC) and PBR Hawaii to analyze the feasibility of the proposed Lahaina Master Planned Project. In particular, we analyzed economic trends, population and household trends, income trends, housing market trends, housing supply and demand trends, and a housing needs survey (performed by SMS Research & Marketing Services). The report which follows contains detailed analysis, findings, recommendations and conclusions.

The proposed HFDC project is to eventually develop about 3,900 residential housing units with an emphasis on residential product types that fall within the "affordable" housing range. It is expected that the project would include single family detached homes and multi-family dwellings. The proposed project lands are located adjacent to Lahaina town mauka of the Lahaina Civic Center and Wahikuli subdivision area north of the existing Kelawea subdivision and Lahainaluna High School. The proposed project lands are owned by the State of Hawaii and the total land area is about 1,120 acres. The proposed project is expected to be completed over a 10 year period.

STUDY OBJECTIVES

The objectives of our study were as follows: (1) to analyze the major residential market trends on Maui, and specifically on West Maui, that would potentially impact the Lahaina Master Planned Project, (2) assess the market support for the project given the potential supply and demand in the project's market area, and (3) determination of units types, sizes, other uses, and absorption by low to moderate and above moderate income categories.

CONCLUSIONS

The West Maui residential resale and rental markets are mirroring the extremely tight conditions which exist for all of Maui. New construction in recent years has fallen far short of the demands of a rapidly growing population. In fact, household growth has been even more rapid as household sizes continue to decline. This has caused both home prices and rents to rise much faster than income levels in recent years, resulting in an "affordability" gap. This structural problem will only be solved by building a substantial number of new moderately priced housing units in the years ahead. Our estimates suggest that this island wide shortfall is accruing at the rate of 800 to 900 housing units per year.

There appears to be some relief in the near term as several thousand units may be built over the next two years. However, the longer term housing shortfall will not change materially since a large excess demand will continue to persist. We estimate current total unmet housing needs to be approximately 7,500 units for Maui island and 2,900 units for West Maui. Preliminary results from the SMS housing survey confirm the strong pent-up demand -- the survey found that 8,665 Maui households and 4,345 West Maui households wish to move over the next several years. Assuming that approximately 10 percent of all households typically move in a given year, this suggests a pent-up demand for approximately 6,000 units for Maui and 3,700 units for West Maui. Also, a remarkable 13.2 percent of the Maui and 23.5 percent of the West Maui households surveyed reported having two or more families living under the same roof. Finally, the Locations Inc. model projects that, even with all the new units planned, total unmet housing needs will only decline to 4,412 units for Maui island and 502 units for West Maui by the year 2000 (approximate date of project completion).

Our analysis of both renter and total household income distributions has resulted in a recommended unit mix for "affordable" and "market" priced units. We recommended that two-thirds of the units be targeted toward the "affordable" market, with the remaining one-third being market priced. Of the total units, 9 percent should be rental units allocated to elderly and special need groups, 18 percent should be rental units priced between $430 and $689 per month, 9 percent for sale units priced between $96,000 and $105,000, 14 percent for sale units priced between $105,000 and $123,000, 11 percent for sale units priced between $123,000 and $143,000, 6 percent for sale units priced between $143,000 and $168,000, and 33 percent for sale units priced near the prevailing market rate or about $180,000 to $230,000. These percentages turned out to be quite close to the mix suggested by the SMS survey. That data would suggest building 31.9 percent of the project as rental units (rent to rent households), 43.2 percent of the units as affordable priced for sale (rent to own households), and 24.9 percent as market priced for sale (own to own households). Because of the tremendous demand which exists for affordable homes and rentals, the Lahaina Master Planned Project construction of 240 and 860 units, respectively, for the first two years and approximately 463 units per year, thereafter, should be readily absorbed, assuming the same proportions of "affordable" and "market" priced units mentioned above.

The amount of living area for the rental units should range from 650 to 700 square feet, 850 to 950 square feet, and 1,000 to 1,100 square feet for a one, two, and three bedroom units respectively. Single family homes should have approximately 1,400 to 1,500 square feet of interior area and 7,000 to 8,000 square feet of land. In particular, the market priced homes should conform to the recommended sizes in order to remain competitive. However, we feel both living and land areas can be reduced somewhat in order to accommodate "affordable" units. One way to decrease land areas is the zero lot line concept. Two homes are built with an abutting wall on what would be a single lot of 7,000 to 8,000 square feet. However, the abutting wall serves as a property line between two separate lots. Another idea is a cluster type development whereby homes are independently situated on smaller lots, thus creating higher density.

We were asked to look at the viability of a golf course as a possible amenity to the Lahaina Master Planned Project. Considering the current population and corresponding golf participation rate, we estimate that, at the current time, there is an excess demand of 300 rounds per day; this translates into another 1.0 golf courses needed if we assume a rate of 300 rounds per day. If no new public courses are built on Maui, this will grow

to 1.5 new golf courses needed by 1995 and 1.8 courses by 2000. The inclusion of a new golf course in the Lahaina Master Planned Project will serve the demands of many West Maui resident golfers, who must commute to other areas to play, as well as enhance the over quality of the project.

Finally, there is the possibility of including commercial and light industrial space in the Lahaina Master Planned Project. The need for light industrial space in West Maui appears to be quite acute. However, the potential Hawaii Omori development may satisfy the market's existing needs. Therefore, close monitoring on the status of this project is recommended. The inclusion of retail/commercial space appears to be a viable one. However, any such development should not be large scale. In particular, existing neighborhood centers on Maui generally average between 50,000 and 60,000 square feet of gross leasable area.

II. PROJECT DESCRIPTION

SITE LOCATION

The proposed project lands are located adjacent to Lahaina town mauka of the Lahaina Civic Center and Wahikuli subdivision area and north of the existing Kelawea subdivision and Lahainaluna School (see Appendix II). The proposed project lands are owned by the State of Hawaii, and are presently leased to Pioneer Mill Company, Ltd., a wholly owned subsidiary of Amfac/JMB Hawaii, Inc., for sugar cane cultivation and are primarily classified Agriculture by the State Land Use Commission. The project property is identified as Tax Map Keys (TMK) 4-5-10:05, 4-5-21:02 (Portion), 4-5-21:03 (Portion), 4-5-21:04 (Portion), 4-5-21:09, and 4-5-21:17. Lands adjacent to the project site are also owned by the State of Hawaii and various private land owners. Pioneer Mill is located in the immediate vicinity of the proposed project but the mill site would be unaffected by the proposed project. The total land area of the proposed project site is about 1,120 acres. It is located in the U.S. Census Tract 314. That tract and tract 315 together comprise a larger district recognized for planning and census purposes. This area is vicariously termed Lahaina Judicial District (State of Hawaii), and the Lahaina Division (U.S. Census).

In this report, the Lahaina Community Plan area or District will also be termed "West Maui." West Maui can be defined as beginning north of the tunnel on Honoapiilani Highway to Kapalua. In this report, the Lahaina District will be considered the primary study area. Special attention will be paid to the town of Lahaina and to specific neighborhoods, in connection with potential impacts and competition to the Lahaina Master Planned Project.

MASTER PLAN LAND USES AND THEME

The Housing Finance Development Corporation, State of Hawaii (HFDC) is proposing the development of a master planned residential community in Lahaina, Maui. The project will occupy much of a 1,120 acre parcel owned by the State of Hawaii. The community will include:

- Approximately 4,800 residential units;
- An elementary school;
- Parks;
- Commercial areas, providing space for a neighborhood shopping center complex; and
- An area set aside for expansion of community facilities at the Lahaina Civic Center.

The Lahaina Master Planned Project is being developed to help meet the need for "affordable" housing on Maui. Most of the units will be priced at rates "affordable" for families making 140 percent of the median household income or less. Most units will be single family homes on separate lots. Some townhouses, for sale or for rent, will be included in the project. Many lots will be smaller than 6,000 square feet in area. Lots adjoining existing subdivisions, will be larger than the average, so that these lots and houses on them will be relatively compatible with existing homes in the area. Currently, there are four alternative land use plans which are shown in Figures II-1 through II-4.

Construction is scheduled to begin in August 1990. Completion of the development is projected to take about 10 years. A first increment of about 240 homes will be built near the Lahaina Civic Center while infrastructural work for the larger community is under way.

Access to the project from Honoapiilani Highway will be provided at the Lahaina Civic Center Road and Kapunakea Street. Eventually, the Lahaina Bypass of Honoapiilani Highway will pass through the project site, affording additional access to the project. The Bypass is not, however, part of the project.

Prospective buyers of units in the project will register with HFDC. A lottery will be held to select persons who can apply for homes in early increments. Buyers of "affordable homes" will have to qualify on the basis of income. They also must not own a majority interest in any real property suitable for residential living. Buyers of market priced units will not be subject to the same restrictions.

A community association will be empowered to enforce covenants limiting on-street parking, barring commercial uses of homes, and limiting resales. Parks will be dedicated to the County of Maui.

OTHER RELEVANT FACTORS

Adjacent Developments

The general Lahaina area has a number of distinct single family neighborhoods. However, only a few of these neighborhoods, which represent potential competition or could be impacted, are actually relevant. We have identified the following neighborhoods as potential competition: Wahikuli, Kelawea Mauka, and Kapunakea subdivisions. A brief description is provided for each of these subdivisions.

Wahikuli is adjacent to the Lahaina Master Planned Project and makes up part of the makai border (see Appendix II). Homes in this area are generally of modest design. Kelawea Mauka is a relatively new neighborhood located near Lahainaluna High School (see Appendix II). Many homes in this area possess good ocean and mountain views. Kapunakea is located on both the makai and mauka sides of Honoapiilani Highway. Homes in this neighborhood are generally very spacious.

West Maui residents interviewed for this study were unanimously in support of increased housing for low to moderate income families. They viewed such housing as meeting the needs of area residents and the regional economy. Additional concerns largely involved perceived impacts on Lahaina and adjacent neighborhoods, questions of equity for potential project occupants, and project design and construction. In particular,

Robert Colley of Tom Soeten Realty in Lahaina said "we don't want to see poor quality homes stacked against one another, rather we want a good quality neighborhood which would enhance the area."

The potential impact of the Lahaina Master Planned Project on existing adjacent neighborhoods should be mostly positive. There are a number of factors which must be considered. First, in light of the expected concept and master planned design of the Lahaina Master Planned Project, we envision that the project will upgrade the existing Lahaina housing stock. Furthermore, the amount of open space, such as neighborhood parks, recreation areas, and the possibility of a golf course, should be a welcomed change from the existing agricultural use. Second, the increased housing supply generated by the project will help provide longer term economic growth and prosperity for the general West Maui area. Finally and most importantly, is the effect on housing prices and rents. The quantification of the actual impact in dollar terms is very difficult since similar examples of building a mixed use development near established neighborhoods do not exist. However, from a supply and demand standpoint, the shorter term impact will be neutral on both housing prices and rents. Turnover of housing units for sale in the Lahaina area has historically been quite small. Thus, the availability of existing units for sale (or potential supply) will remain quite limited in the near term. On a longer term basis, property values should increase, however, at a more moderate pace than in recent years. This can be perceived as both positive and negative, depending on one's point of view. On the positive side, current home owners may experience increased property values and equity, however, to some, this also can mean higher taxes. With regard to rental units, the longer term impact on rents will be toward more stability. Thus, rental rates should also increase at a more moderate pace. The positive side is increased availabilities and more stable rental rates for renters. On the negative side, home owners who currently rent their properties may not see increasing yields.

Thus, we feel that the Lahaina Master Planned Project's overall impact on the West Maui housing market and economy will be positive. If unchanged, the current situation will only lead to increased economic and housing problems. Macro economic theory tells us that any excessive increase in supply will lead toward lower prices. However, this theory does not consider that severely constricted supply can also lead to the erosion of a particular market. For example, if housing prices and rents continue to increase because of the lack of available supply, existing and potential residents and businesses may leave the area or not come at all. Instead, they would look for an alternative area which offers more favorable housing market conditions. Longer term, this can be a serious problem as witnessed by the situation in New York City. Consequently, the Lahaina Master Planned Project will not only benefit area residents, but also future economic growth in West Maui.

Planned Projects Near Site

There are currently four known projects being constructed or planned in the general West Maui area. The projects are listed and described below:

The Poinciana Place is a new project currently under construction in Honokowai, which is scheduled to be completed in January 1990. Poinciana Place will be an apartment building for long-term rentals at market rental rates. The project will consist of 159 units - - 42 studio, 108 one bedroom, and 9 two bedroom units. Monthly rents will average $662, $795, and $1060 for studio, one bedroom, and two bedroom units respectively. However, the lack of two and especially three bedroom units in this development appears to indicate that the growing demand for larger units is not going to be satisfied by this project.

Komohana Hale, a Maui County project, will be located in Lahaina, consisting of 42 affordable two bedroom duplex homes for sale and 20 affordable one bedroom apartments for rent (see Appendix II). All units will be for low to moderate income families and construction is expected to commence in 1991.

The State of Hawaii's Honokowai Rental Project will consist of 184 units. The unit mix calls for mostly two bedroom units with a lesser

percentage of one and three bedroom units. The state plans to rent 60 percent of the units to residents meeting the low income requirements with a maximum $175 per month rental subsidy per unit. The remaining 40 percent will be available at slightly below market rates.

Maui Land & Pineapple has plans for an agricultural lot subdivision which will provide "affordable" vacant lots to their employees. It is estimated to contain 50 lots in total, which is to be spread out over 5 years beginning in 1990.

Major Transportation Arteries

Since there is no public transportation in West Maui, the need for major transportation arteries has increased dramatically with the continued development of West Maui as the State of Hawaii's second largest resort destination. The Honoapiilani Highway, which is the main thoroughfare in West Maui is being widen to four lanes in the Lahaina area. There are also plans for a Lahaina Bypass Road, developed by the State Department of Transportation, which should also help to alleviate traffic congestion. The preferred alternative has been announced by Ed Hirata of the State Department of Transportation as Alternative B, the Ikena Street alternative.

A new terminal at Kahului Airport is scheduled to be completed in mid-1990. Proposals to lengthen the airport's runway have been much discussed on Maui, but no definite plans have been announced. The potential impact is for additional traffic through Kahului Airport and, consequently, in West Maui.

Public Facilities Near Site

The major public facility in West Maui is the Lahaina Civic Center. The Civic Center contains a Police Station, Post Office, Fire Station, Health Center, gym, District Courts, meeting rooms, and tennis courts. Other public facilities in the area include the Wahikuli Beach Park and a number of smaller regional centers.

The Lahaina Master Planned Project will probably increase the use of the Lahaina Civic Center and retail centers on Honoapiilani Highway, contributing to an ongoing trend for the Civic Center, rather than Front Street in Lahaina, to be seen as the region's center. There will also be increased demand for facilities such as beach parks, medical and other services.

Development Plan and Timetable

As mentioned above, the Lahaina Master Planned Project development plan was originally proposed to include the following elements: approximately 4,800 residential units, an elementary school, parks, commercial areas, providing space for a neighborhood shopping center complex, and an area set aside for expansion of community facilities at the Lahaina Civic Center.

Considering the large pent-up demand and the expected growth of approximately 250 households per year in West Maui, we have constructed a suggested development timetable which considers the extensive infrastructural work that must be completed. The development timetable is show in the table below:

PERCENT OF MEDIAN HOUSEHOLD INCOME & CORRESPONDING HOME PRICE

Year	Total Units	Elderly/ Spec Need	50-80% ($430-$689)	80-88% ($96-$105k)	88-103 ($105-$123k)	103-120% ($123-$143k)	120-140% ($143-$168)	>140% (>$168k)
1991	240	21	44	22	34	26	11	79
1992	860	77	155	77	120	91	52	285
1993	463	42	83	42	65	51	28	152
1994	463	42	83	42	65	51	28	152
1995	463	42	83	42	65	51	28	152
1996	463	42	83	42	65	51	28	152
1997	463	42	83	42	65	51	28	152
1998	463	42	83	42	65	51	28	152
1999	463	42	83	42	65	51	28	152
2000	459	41	83	42	64	50	28	151

As seen, the timetable has been broken down by the number of units demanded per income bracket and corresponding suggested price ranges. In particular, elderly/special need housing needs were determined by an estimate of households with the primary wage earner being aged 65 years and above in the 50 to 80 percent income bracket (using SMS housing survey data). With the current pent-up demand of 2,938 units in West Maui, which will grow to 3,179 units by the end of 1989, we suggest a large number of units to be built over the first two years. Afterward, a slightly slower absorption rate is expected.

III. ECONOMIC TRENDS OF MAUI COUNTY & LAHAINA AREA

VISITOR INDUSTRY

In the 1950's, Amfac withdrew about 500 acres of land from sugar and grazing, the first major step toward the development of Maui's visitor industry, to create the Kaanapali resort. After Kaanapali proved successful, the Kapalua resort was developed and visitor units were built at Honokowai, Kahana, and Napili in West Maui. As of early 1988, West Maui had 4,427 hotels rooms and approximately 5,100 resort condominium units. Figure III-1 shows the total hotel room inventory for Maui County to have reached 16,028 units by mid-1989.

Maui County's westbound visitor count declined for the second consecutive year in 1988, to 1,897,000 visitors (Figure III-2). However, according to the Hawaii Visitors Bureau estimates, the Japanese visitor count rose by 42 percent to 242,000 overnight and longer visitors. Total westbound visitor expenditures rose by 16 percent to $1.5 billion.

The visitor industry appears to be stronger in 1989. Through mid-year, the westbound visitor counts increased by approximately 9 percent to 834,840 visitors. However, the average length of stay has decreased. Maui County's hotel occupancy rate was marginally changed from 1988's 73.2 percent (Figure II-3). As of mid-year, the hotel occupancy rate stood at 73.7 percent. West Maui's hotels were 75 percent occupied, reflecting a 4 percent decline. Hotels at Kaanapali were 83 percent occupied through April, 1989.

Future growth potential for the visitor industry appears to be quite good. Three hotels will be completed at the Wailea resort in 1990 -- the Four Seasons (378 rooms), the Grand Hyatt (812 rooms), and the Diamond Resorts (72 rooms). Later, a 450 room all-suite hotel will be constructed on the remaining ocean frontage in Wailea. After completion of the major hotels, improvements around the resort will begin. The two existing golf courses will be upgraded and a third will be built. Maui Land & Pineapple's Ritz-Carlton hotel (550 rooms) is awaiting county approval; afterward construction will commence. Maui Land & Pineapple has begun initial grading on its Plantation golf course which is scheduled to be ready for play in 18 months.

The Maui visitor industry should continue to grow in the years ahead since a number of hotels and resorts are being added to the existing visitor room inventory. However, the current labor shortage, tight housing market, and infrastructural limitations could constrain longer term growth if nothing is done to offset these trends.

AGRICULTURE

Sugar production in West Maui began in the 1840's. Pioneer Mill Company was founded in Lahaina in 1860. In 1885, Pioneer Mill was acquired by the company that is now Amfac/JMB Hawaii, one of the two largest Hawaii conglomerates. Pioneer Mill is now the smallest sugar operation in the state, with 6,922 acres in use in 1987, according to Decision Analyst Hawaii, Inc. Overall, Maui's sugar production declined by 2 percent to 293,000 tons in 1988. Of which, approximately 47,500 tons were produced by Pioneer Mill. Production for 1989 is expected to be mixed. Pioneer Mill expects total production to be down, however, total yield will be up. As for HC&S, production is expected to increase even though poor weather will cause a delay in harvesting.

Pineapple production is expanding on Maui. Wailuku Agribusiness harvested its first crop of pineapples last year. Maui Land & Pineapple is encountering increased foreign competition since importation quotas are not imposed upon pineapple. In a diversification move, Maui Land & Pineapple has entered the fresh fruit market by air-shipping pineapple to the mainland. At present, the biggest concern is the labor shortage since agriculture is perceived to be less desirable than than hotel or other service employment.

Maui County has achieved record production levels in diversified agriculture in the past year. Total production for melons and vegetables increased by 11 percent to 47 million pounds. Molokai's watermelon production led the way in the surge. Grape production has also increased and is projected to be 120 tons at Tedeschi Vineyards. The production surge is being driven by increased demand for Maui wines. The tropical flower industry looks promising as well.

OTHER ECONOMIC ACTIVITY

The Maui County economy rebounded after a mild slowdown in 1987. Gross business receipts, a measure of overall economic activity, increased by 16 percent to $2.1 billion. Business receipts have increased in the first part of 1989, which indicates continued growth in Maui's economy.

Maui's construction industry experienced substantial growth in 1988. Construction activity through mid-year has increased by 19 percent over the same period a year ago. Retail sales for 1988 increased by 11 percent to $814 million, reversing the slowdown of the prior year. In particular, the Lahaina Cannery Shopping Center is doing quite well overall. However, business has been slow for some of the tourist oriented shops. Store catering to local residents have been doing well, possibly indicating a increased need for these types of businesses within the Lahaina Master Planned Project.

Again, the labor shortage will continue to plague economic growth. After a slight increase in 1988 (3.6%), the unemployment rate has decreased sharply in the current year. The unemployment rate in April 1989 stood at 1.7 percent. Thus, Maui County appears to be fully employed. Nevertheless, near term economic growth should continue.

IV. POPULATION TRENDS OF MAUI AND WEST MAUI

OVERVIEW

Maui County is comprised of four islands; these islands are Maui, Molokai, Lanai, and Kahoolawe. However, the vast majority of the County's population resides on the island of Maui, with Kahoolawe being uninhabited. For the purpose of identification of specific population growth patterns, the island of Maui was focused upon. The island of Maui was further broken down into the general areas of West Maui, Kihei, Central Maui, Up Country, and East Maui.

RESIDENT POPULATION/HOUSEHOLD GROWTH & PROJECTIONS

Maui County

Maui County population growth has continued at a brisk pace since the mid-1970's. Figure IV-1 shows the historical trend of Maui County's resident population. As seen, the population has risen sharply since the mid-1970's, averaging approximately 2,600 additional residents per year since 1980. Figure IV-2 shows that this trend of rapid population growth is likely to continue in the foreseeable future. Furthermore, Figure IV-3 shows Maui as the fastest growing county in the State of Hawaii when comparing 1980 to 1988 population levels. The net result has been strong housing demand caused by a rapidly growing population. This combined with sharply curtailed supply (discussed later), has resulted in substantial pressures on both housing prices and rents.

Island of Maui

The island of Maui has, of course, shown similar population growth patterns when compared to Maui County. The surge in resident population growth occurred in the mid-1970's, averaging approximately 2,500 additional residents per year since 1980 (Figure IV-4). This number is very similar to overall Maui County population growth, indicating very little growth on the islands of Molokai and Lanai. A closer look at current and projected population growth trends by age bracket (Figure IV-5) reveals that approximately 47 percent (39,634 persons) of the Maui island population is aged over 34 years, the prime candidates for home ownership. This will grow to approximately 49 percent (47,801 persons) by 1994, indicating continued housing demand in the future. The rapid population growth of the 1970's and 1980's is projected to slow slightly in the 1990's as Maui County attempts to brake growth, thus, allowing existing infrastructure and housing inventory to catch up with ever growing needs.

The number of existing and projected households in any particular area is one of the most basic indicators of housing demand. Figure IV-6 shows Maui island households to have grown at a similar, but slightly faster pace than the overall population in recent years. This more rapid growth rate can be attributed to the continued decrease in household sizes. Figure IV-7 shows a historical estimate of the Maui island median household size. As seen, the household size decreased sharply in the 1970's, followed by a more gradual decline throughout the 1980's. A detailed household size distribution for 1989 (according to SMS's 1989 Housing Survey) shows 36.8 percent of the Maui island households having 2 or less persons. The 1988 estimated median household size is 2.52 persons. We expect the current household size to be little changed over the next several years.

West Maui

The population base in West Maui has historically represented approximately 14 to 18 percent of the island of Maui. The early 1970's saw extremely rapid population growth with the development of many resort destinations (Figure IV-9). Growth in the 1980's has declined by more than half of the torrid 1970's pace. However, Figure IV-10 shows West Maui population growth to be the most rapid on the island of Maui when comparing 1980 to 1989 levels. Currently, West Maui represents approximately 18 percent of the Maui island population base. Figure IV-11 shows the West Maui historical and projected population to 1994. As seen, the growth rate will continue to slow, however, it will remain at a brisk pace of over 3 percent per year. In fact, according to Maui County's 1983 Lahaina Community Plan, Maui County intends to adopt a policy of slow population growth. In particular, a resident population of 20,000 persons by 2003 should be used to coordinate planning of facilities, programs, and supporting services for the region. A closer look at current and projected population by age bracket reveals that approximately 49 percent (7,600 persons) are aged over 34 years (Figure IV-12). The percentage of persons aged over 34 years is expected to rise dramatically to 54 percent (9,843 persons) by 1994, which may translate into greater home ownership demand.

Household growth in West Maui has continued to move up sharply since the mid-1970's. Figure IV-13 shows West Maui households from 1970 to 1989, including a projection to 1994. The 1980's has seen a combination of rapid household formation trends and relatively slow housing inventory growth. The rapid household growth is shown in Figures IV-14 and IV-15. Of particular note is the sharp increases in the West Maui (60.7%), Kihei (47.8%), and Up Country (46.2%) areas of Maui. However, household growth is projected to slow somewhat in the years ahead, as household sizes begin to stabilize. Figure IV-16 shows a historical estimate of the West Maui median household size. As seen, the household size decreased sharply in the 1970's, followed by a more gradual decline throughout the 1980's. A detailed household size distribution for 1989 (according to SMS's 1989 Housing Survey) shows 40.9 percent of the West Maui households having 2 or less persons. The 1988 estimated median household size is 2.33 persons. We expect the current household size to be little changed over the next several years.

A-11

TOTAL JOBS BY INDUSTRY

The visitor industry has provided the greatest amount of employment on the island of Maui, like most of the islands in the State of Hawaii. The major portion of the tourism related employment consists of service, retail, and construction jobs above all. Figure IV-18 shows more than one-third of all employment in 1988 to be in services; these numbers do not include the related and highly dependent eating and drinking businesses, which would boost the percentage of tourism related employment. Most of the service jobs mentioned above are dependent upon the tourism industry in one way or another. The proportion of West Maui residents involved in the tourism industry is higher than any other area in the state, according to the 1988 Tourism Impact Management Study (Hawaii State Department of Business and Economic Development, Tourism Branch, 1989) (see Figure IV-18). Furthermore, the hotel jobs, other services and those in the trade categories are anticipated to be the largest areas of employment growth in the years ahead (Figure IV-19).

This survey also showed that West Maui workers put in long hours -- over 44 a week, on average -- and most work weekend and/or evening hours, not just a five-day work week.

Most West Maui residents surveyed (63 percent) thought that the quality of life in their area had become worse over the last five years, and only a few (16 percent) saw improvement (Figure IV-20). West Maui respondents reported a higher level of dissatisfaction than people from any other area in the state. Nearly all West Maui residents identified traffic congestion and the cost of housing as problems in their community.

West Maui residents express, in interviews as well as this survey, strong concern that rapid growth in their area has created problems of infrastructure and housing. Many question whether new developments, including retail centers, are of value to area residents. As a result the buoyant economic trends could be severely constrained if the development of supporting facilities and infrastructure does not keep pace with growing visitor industry needs.

V. INCOME TRENDS OF MAUI AND WEST MAUI

OVERVIEW

Our economic well being can be measured in either of two ways. First, we are concerned with how much we can earn from our jobs and whatever other sources of income, such as interest, dividends, rents, and so on. Second we can evaluate our income in terms of what we can do with it and what kind of goods and services can be obtained by spending the money. Based upon this approach, charting one's economic progress and understanding one's relation to the economic forces affecting day-to-day life consists of comparing the amount of income received and the type of expenditures that can be made. Thus, one can see the overwhelming importance of income in relation to potential home ownership.

The Locations Inc. Research Department has developed a computer model which enables us to separate owner occupant and renter households using the 1980 U.S. Census income distribution and owner occupancy rates as a point of reference. Our model provides very useful insight in this regard. We have also received historical and projected household income data from Donnelley Marketing Information Services. Since this data is not separated into owner occupant and renter households we feel that the Locations Inc. Research Department's model is more useful for our purposes. However, we have included the Donnelley data in the report and labeled it Appendix I.

ISLAND OF MAUI

Median household income levels on the island of Maui are the second highest in the State of Hawaii. The Maui island median income has grown at a fairly constant rate since the 1970's (Figure V-1). In fact, growth has averaged approximately 5 to 6 percent annually in the 1980's -- this growth rate is projected to continue in the years ahead. However, for the purpose of determining "affordable" home prices we must separate the renter households from the owner occupant households, since the latter cannot qualify for "affordably" priced homes under the current arrangement.

Furthermore, we must consider the number of renter households whose income falls in the 50 to 80 percent, 80 to 120 percent, and 120 to 140 percent bracket of 1989 median income ($34,000, established by HUD). The 50 to 80 percent of median income households represent potential renters. The remaining two income brackets are potential "affordable" home buyers. The final category includes all households whose income level exceeds 140 percent of the median income -- these households represent potential market priced home buyers.

Figure V-2 shows the estimated 1989 Maui island household income distribution by income bracket. As seen, incomes are distributed in the expected or gaussian shape with most of the households being in the $20,000 to $50,000 income bracket. As for the above 140 percent of median income or potential market priced home buyers, we estimate there to be 6,986 households. Figure V-3 shows the Maui island projected 1994 income distribution to be relatively similar, however, with incomes growing at approximately 5 to 6 percent the distribution has shifted upward by one bracket. The majority of 1994 households have an income ranging from $25,000 to $55,000.

In contrast, the estimated 1989 Maui island renter household income distribution is shifted toward the left, as expected. Figure V-4 shows the majority of Maui island renter households to have incomes ranging from $15,000 to $34,000. This represents over 70 percent of the renter households. In particular, the estimated number of renter households in the 50 to 80 percent, 80 to 120 percent and 120 to 140 percent of median income brackets are 2,622 households, 4,665 households, and 487 households respectively. The larger proportion of renter households in the 80 to 120 percent of median income bracket suggests greater potential demand for the most moderately priced homes. Again, renter incomes can be expected to grow by approximately 5 to 6 percent annually, like overall household incomes.

WEST MAUI

Separating the Maui island median incomes into 5 general areas (Wailuku, Up Country, Kihei, Central Maui, and West Maui) reveals some very interesting results. Figure V-5 shows all of the areas having very similar income levels in 1970, which grew at approximately the same rate up to 1980 (with the exception of East Maui). Afterward, West Maui median incomes rose sharply when compared to other Maui areas. Figure V-6 shows West Maui household income growth to be 67.8 percent when comparing 1980 to 1989 levels -- this is 15.3 percent higher than Central Maui's 52.5 percent. This trend of rapid growth is projected to continue. In fact, the estimated median income for a West Maui household in 1994 is $46,528.

West Maui 1989 estimated household incomes are also aligned in the expected shape with the majority of incomes being in the $20,000 to $50,000 range (Figure V-7). Concerning the number of households whose income is above 140 percent of the median income, we estimate that approximately 1642 households can be considered potential market priced home buyers. Figure V-8 shows the projected 1994 West Maui household income distribution. Again, household incomes have shifted higher, moving with the projected 5 to 6 percent growth rate. In fact, the majority of the West Maui households are in the $25,000 to $50,000 income range.

West Maui has historically been an area where renters generally outnumber owner occupants. Figure V-9 shows the majority of West Maui renter households being in the $20,000 to $40,000 income range. The overall higher level of incomes in West Maui should provide a generous pool of qualified first time home buyers. The only potential problem we foresee is the ability of these households to make down payments. In this regard, the estimated number of renter households in the 50 to 80 percent, 80 to 120 percent and 120 to 140 percent of median income brackets are 1,305 households, 1,698 households and 306 households respectively. Again, the greatest potential demand is for moderately priced homes.

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VI. ANALYSIS OF MAUI AND WEST MAUI HOUSING NEEDS

HOUSING UNIT NEEDS

By Category

The TIMS survey conducted by the Department of Business & Economic Development had a number of interesting results. The survey included data on income and housing conditions. The results of this survey are summarized in Tables VI-A and VI-B. The basic conclusions derived from these tables include:

•Tourism workers' household incomes were almost as high on average as other worker's household incomes.

•However, due to larger household sizes, per capita income in tourism worker households would be lower. Also, the much higher number of workers in these homes tends to suggest lower per-worker wages.

Table VI-B shows that tourism worker households usually require more wage earners to boost the home into a particular income category than do other households. Within any given income category, the average number of wage earners was 20 to 30 percent higher in tourism worker households than in worker households with no tourism employees.

•Perhaps as a strategy for dealing with lower incomes, tourism workers live in somewhat cheaper housing; are more likely to rent rather than own; and appear to have more crowded housing conditions. Not only are their total households larger, but they are more likely to share with non-relatives. And the lower percentage of children who are the respondents' "own" children suggests a greater incidence of extended families.

•An important result for housing planners is that <u>some conclusions differ</u> within Table VI-A when comparing tourism area **residents** with residents of other areas, as opposed to comparing tourism **worker** households with other households. (This is because tourism workers do not all live in resort areas.)

For example, high density resort area residents have smaller households and fewer workers than other people (hence possibly higher per capita incomes), while the opposite is true for tourism worker households. Resort area residents are more likely to be apartments dwellers (suggesting a higher per-square-foot housing cost) -- something not true of tourism workers in general.

These differences point out critical distinctions which must be taken into account when doing studies of <u>visitor industry employee housing needs</u> vs. studies of <u>general housing demand in expanding resort areas</u>. The assumptions used for one purpose would be wrong for the other.

•Housing for visitor industry employees now typically accommodates larger households, while overall housing in high density resort areas is oriented to smaller households.

The TIMS survey also estimates that 48 percent of all household workers in high density resort areas, such as West Maui, are "visitor industry" workers. With this in mind and the data and conclusions presented above, we feel that the greatest need is and will continue to be for visitor industry households who, as previously mentioned, have larger household sizes and lower per capita incomes. Consequently, the majority of housing units should be of reasonable size to the typical local visitor industry household.

Transient Worker Versus Local Resident

With the visitor industry being the single largest employer in West Maui, it logically follows that the operators should have some insight into the type of housing West Maui employees desire. We conducted a number of phone interviews with the larger hotel personnel directors in West Maui. It appears that transient employees make a meaningful proportion of their total labor force, with the proportion being highest in the winter months. These transient employees will usually require rental housing.

Transient hotel employees tend to live closer to their places of employment than other workers, most staying within 4 to 6 miles. This can be attributed to the fact that most transient hotel employees do not invest in an automobile when they come to Hawaii, according to Tom Mailhiot, the Hyatt Regency Maui Personnel Director. Mailhiot says, "they instead depend upon mopeds, bicycles, or a shuttle system." According to the TIMS survey, workers in high density resort areas, like West Maui, commute shorter distances to work. In particular, 68 percent of those employees working in high density resort areas travel under 20 minutes to work. The personnel directors that we interviewed indicated that their transient employees tended to rent units in the Lahaina and Honokowai areas. Fred Perry, Director of Administration at the Kapalua Bay Hotel said, "these locations offer the accommodations that a number of transient employees come to Hawaii for, in particular, good beaches and an enjoyable atmosphere in addition to being near to work."

The typical transient hotel employee stays in Maui only 3 to 6 months, with few staying as long as three years. Because of the short term nature of their stay, a problem arises with the length of leases that must be signed. Most transient hotel employees would not be willing to sign a lease if it were for more than three to six months, according to Lindsey Geyer, Human Resources Director at the Westin Maui. Geyer says, "in fact, when the rental market loosens up in April and May, many transient hotel employees can be found hopping from vacation rental to vacation rental to avoid signing a long term lease."

Almost all of the transient employees that come to Hawaii are young and single. Upon their arrival, they usually bring very few personal possessions, which indicates the need for a furnished apartment. The furnishing would include: major appliances, a bed, a dinette set, and a dresser, according to Fred Perry. A large number of transient hotel employees are forced to hold two jobs to pay for the high cost of living in West Maui. Consequently, they do not spend much time in their apartments, which implies that they do not require large living areas or deluxe amenities. The current average rent for a one bedroom apartment in West Maui is much too high for many of these transient hotel employees, so they have to settle for a studio or sharing a two bedroom apartment with another transient hotel employee, according to Lindsey Geyer. However, Fred Perry says, "many transient hotel employees prefer to live together since they have few friends."

With the rental market being so tight in West Maui, many potential transient hotel employees have been scared away from coming to Hawaii. This has created a lack of available temporary employees, which appears to have hurt the visitor industry in the past few years. For example -- Lindsey Geyer says, "the Westin Maui hotel has plans to open more rooms in the near future; they are trying to recruit mainland employees by making accommodations such as temporary housing in the hotel until they find their own apartment and a shuttle service to and from work once they relocate." Furthermore, with a large percentage of West Maui visitor industry employees living in the Kihei area, a number of major hotels feel that these employees may be lost to the growing resort area in Wailea, when the new hotels come on-line in the next 2 to 3 years, according to Lynn Britten of the Maui Hotel Association. Britten adds, "this, of course, could be partially offset if housing inventory in West Maui was increased and, consequently, rental rates reduced."

The local employees that work at these hotels tend to live in the Kihei and Wailuku/Kahului areas. Mari Olson of the Human Resources Department at the Maui Marriot says, "most the local employees have families and they prefer larger living areas, which are of limited supply of in West Maui." For this reason, many local residents have been forced to

stay on the far side of the island where larger housing is both more available and affordable. These local employees appear to be segmented into two groups -- local residents who have previously lived in or have family members living in West Maui and local residents who have lived in a particular area (outside of West Maui) for an extended period of time. The first group would be willing to move to West Maui if availabilities and rental rates were favorable. The second group, for the most part, would not be willing to move to West Maui. According to Fred Perry, a Wailuku resident himself, the primary reasons for this reluctance to relocate is the fact that one or more of their family members already work in their present area, their children attend school in the area, and the area has a sense of community unlike the fast pace of a resort area.

RESIDENTIAL CONSTRUCTION AUTHORIZATIONS

Overview

The number of construction authorizations is the most basic indicator of future building activity. In this regard, the number of single family or multi-family authorizations should, in theory, be representative of anticipated housing supply. However, an authorized residential unit may never materialize into a home and may actually be authorized a number of times if not built before the building permit expires. Nonetheless, the number of residential construction authorizations is a key factor in determining current and future housing supply.

Single Family

The number of single family housing authorizations remained relatively stable throughout the 1960's -- this was followed by a surge in the early to late 1970's (Figure VI-1). After a sharp decline in the early 1980's, single family housing authorizations has moved up sharply, surpassing the record levels set in the late 1970's. There were 1,453 single family units authorized in 1988.

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Multi-Family

Construction of new multi-family units in Maui experienced tremendous growth in the early to mid-1970's, after an extended period of little change (Figure VI-2). There was a lesser surge in the late 1970's which was followed by very low construction activity for most of the 1980's. With single family home construction remaining relatively stable between the early 1970's and mid-1980's, the surges in multi-family activity between 1973-74 and 1979-80 were a logical response to strong second home and investor demand caused by a rapidly growing visitor industry. As seen in Figure VI-2, the 1973 to 74 period marked the secular peak for Maui multi-family construction. There were 958 multi-family units authorized in 1988.

RESIDENT VERSUS TRANSIENT/RESORT HOUSING UNITS

The island of Maui, much like Oahu but on a smaller scale, has a significant stock of condominium units. The largest number of the Maui island condominium units are located in the resort areas of West Maui and Kihei. If all of these units were available to local residents, we feel the current Maui housing shortage would be partially offset. The problem is that a large percentage of the existing and planned condominium units are targeting the ever growing visitor industry or resort rental market. This appears to be the most profitable market from a development standpoint, which attracts a number of mainland as well as foreign buyers.

In order to quantify the actual housing inventory, or inventory available to local residents, on the island of Maui and West Maui in particular, we assumed all single family homes to be part of the existing resident housing stock. All of the condominium projects listed in the Hawaiian Condominium Guide, published by Hawaii TMK Service, were identified noting the year built and total number of units. With the assistance of the Hawaii Business Resort Condominium Guide, we classified condominiums into one of two categories; that is resort or resident units. Resort units are those used for either hotel rentals, resort/vacation rentals, or timesharing. Resident units are those used for long term rentals or by owner occupants.

Figure VI-3 shows the estimated proportion of Maui island resort and resident units since 1970. As seen, the number of resort units has increased sharply from just over 1,200 in 1970 to more than 12,000 by 1988. In particular, since 1980 the stock of resident units has grown at an anemic pace even though the population has grown rapidly during this time period. The net result of this clash between a rapidly growing population and subdued resident housing inventory growth has been a severe housing shortage. The situation in West Maui appears to be even more acute. Figure VI-4 shows West Maui resident housing inventory to have remained relatively unchanged since 1980. In fact, the chronic problem during this time period was the conversion of resident units to resort units. This put additional pressures on an already strained existing housing stock. Consequently, the need for housing units in Maui and, in particular, West Maui is quite apparent.

RESIDENTIAL SALES ACTIVITY

OVERVIEW

The Maui residential market is not meeting the needs of a rapidly growing population and visitor industry. According to Michael Spalding of Michael Spalding Realty, there is great demand for single family homes in West Maui. Spalding adds, "single family housing allowing for both privacy and some private yard use remains a clear preference for home owners. Yet, the scarcity of available land in Maui has created a situation whereby single family home prices are out of reach of most young households, newer Maui residents, and most renters. Condominiums, with their intensive land use, should continue to increase in market share." However, condominium housing units have not gained rapid acceptance within the local Maui community, since these units are generally associated with the visitor industry. Recent trends appear to be indicating a growing acceptance to condominium living as a viable alternative to single family homes. In particular, Chris Hart, Maui County's Director of Planning said, "a number of Maui residents would welcome any affordable multi-family development which could provide garden style living." Hart also provided an example of this type of development -- Kihei Villages, a fee simple residential community consisting of two story eight and 12 unit garden style townhouses. All of the Phase IV units will have 2 bedrooms and 1 1/2 or 2 baths and 742 or 750 square feet of interior area, with prices ranging from approximately $97,000 to $107,000 (see Appendix II).

SINGLE FAMILY

The number of homes listed for sale is a good indication of real estate market conditions. This "counter-cyclical" indicator is typically lower in strong markets and higher in weaker ones. As shown in Figure VI-5, mid-year Maui single family homes listed for sale by the Multiple Listing Service increased sharply in the late 1970's to early 1980's. After a peak in 1983, listings declined for 5 consecutive years, until 1989's upward movement. Currently there are 418 single family homes listed for sale, which is indicative of strong single family market conditions. Another useful "counter-cyclical" indicator of real estate market conditions is the average sold market time. This indicator is also low in strong markets and high in weak ones. Low market times reflect a situation where homes sell quickly because buyers are forced to bid against one another for limited available inventory; high market times reflect just the opposite. Figure VI-6 shows the relatively high market times of the recessionary early 1980's and the gradually declining market times of the past several years (indicative of the improving single family market conditions). The 1989 year-to-date Maui single family average market time is 118 days.

The number of units sold is the most basic indicator of market activity and is useful in helping estimate the number of new units which a specific market segment may be capable of absorbing. Figure VI-7 shows Maui single family resale activity to have averaged approximately 150 to 200 per year between 1977 and 1984. This period of relative stability was followed by sharp increases in activity over the next several years, with 1988 recording nearly 550 resales. If resales continue at their current pace, 1989 should nearly equal the record levels set in the past year. If past history is any indication of the future, we expect prices to continue their rise in the near term since increases in sales activity usually lead price increases by

approximately 1 year. As seen in Figure VI-8, the prices increases beginning in 1984 were preceded by sales activity increases of the prior year. The 1989 year-to-date Maui single family average price is $259,280.

In order to provide more specific information on single family home price trends, we have segmented the island of Maui into 6 geographic regions: Kihei, Kahului, Wailuku, Napili, Kaanapali, and Lahaina. Figures VI-9 through VI-15 show average sales prices and sales activity by month since 1978 for the island of Maui as well as the geographic areas described above. Figure VI-9 shows Maui sales prices peaking in the 1980 to 1981 period; this was followed by 4 years of relatively stable to slightly lower prices, until 1986 when prices began to move up sharply. Recent average single family home prices are averaging $250,000 to $275,000 and current sales activity remains quite strong. The trend shows continued upward pressure on single family home prices as inventory remains low.

Over the past few years, the Kihei single family market has shown relatively good performance. Figure VI-10 shows prices remaining relatively stable for an extended period of time; this was followed by sharp upward movement over the past 2 years, corresponding to significant sales activity increases. Current average sales prices are ranging from $250,000 to $275,000. The Kahului and Wailuku markets have shown similar price movements. Like Kihei, prices have risen in 1987 after years of little change. Current average prices are in the $160,000 to $180,000 range and $200,000 to $225,000 range for Kahului and Wailuku respectively.

Prices and sales activity in West Maui remain quite strong. However, the Napili and Kaanapali average single family prices are quite erratic since the mix of homes selling in these areas differ substantially. Consequently, average prices are not exceptionally meaningful. As for Lahaina, home prices have increased gradually over the past 3 years. In particular, average prices have increased by approximately 20 percent when comparing 1986 to 1988. The current year appears to be continuing this trend of gradual upward movement as the number of available homes for sale remains quite low. Current average sold prices are ranging from $180,000 to $230,000.

Statistical Market Analysis

Sales Activity: The number of units sold is the most basic indicator of market activity and is useful in helping estimate the number of new units which a specific market segment may be capable of absorbing. For overall Maui island and selected Maui single family areas (Kihei, Central Maui, East Maui, Up Country, and West Maui), the number of MLS resales between 8/88 and 8/89 are shown in Figures VI-16 through VI-27 by price range. Figure VI-16 shows the majority of Maui island single family resales to be in the $125,000 to $249,000 price range. Few sales occurred below this level, however, a substantial number of homes sold above $250,000. This illustrates the overwhelming need for homes in the lower price ranges. There were a total of 612 single family sales over the past 12 months.

The general Kihei area, which includes Kihei and Wailea, has shown good sales activity in the past twelve months. In particular, the majority of the home sales occurred between $150,000 and $224,000 for Kihei and over $325,000 for Wailea (Figures VI-17 and VI-18). Figures VI-19 through VI-20 show most of the Central Maui (Kahului and Wailuku) sales occurring in the $150,000 to $199,000 and $125,000 to $224,000 price ranges for Kahului and Wailuku respectively. Since sales activity in East Maui is very limited, the only area with sufficient data was Haiku. Figure VI-20 shows most of the Haiku sales occurring in the $150,000 to $274,000 price range. Up Country Maui (Pukalani, Makawao, and Kula) sales for the most part have been in the $150,000 to $274,000, $125,000 to $199,000, and $125,000 to $274,000 price ranges for Pukalani, Makawao, and Kula respectively (Figures VI-22 through VI-24).

West Maui's (Napili, Kaanapali, and Lahaina) relatively small single family market shows the majority of sales occurring above $224,000. In particular, 60 percent of the sales in Napili were over $424,000 (Figure VI-25), while over 65 percent of the Kaanapali sales were over $249,000 (Figure VI-26). The only West Maui area with well distributed sales activity was Lahaina. Figure VI-27 shows, 14 sales below $174,000, 13 sales between $200,000 and $324,000, and 6 sales above $349,000.

Sold Price and Sold Price Per Square Foot: Home buyers tend to shop the existing market, which serves as a good benchmark for pricing a competitive new product. In this regard, the median sold price per unit and per square foot is a useful indicator of the existing market.

Figure VI-28 shows the past 12 months (8/88 to 8/89) median single family sales prices for selected Maui areas ranging from a low of $180,000 (Makawao) to a high of $446,000 (Napili). In particular, median home prices in Napili, Kaanapali, and Lahaina were $446,000, $277,500, and $220,000 respectively. These numbers indicate that homes prices in West Maui are among the highest on the island of Maui. On an island wide basis, the current median sale price is $207,000.

Figure VI-29 shows the past 12 months median sold price per square foot of interior area for selected Maui single family areas. Current median sold prices per square foot range from a low of $117 (Kahului) to a high of $319 (Napili). As might be expected, Napili possesses the highest average sold price per square foot of interior area at $319, since it also has the highest median sale price. The current median sold price per square foot of interior area for Lahaina is $147. The overall Maui island single family median sold price per square foot of interior area is $145.

List Price: Multiple Listing Service list price distributions constructed for Maui island and selected Maui areas are shown in Figures VI-30 through VI-35. The list prices for the island of Maui appear to be well distributed among the corresponding price ranges. In fact, a large number of homes are listing in the $175,000 to $299,000 price ranges. However, even more striking is the number of homes listed for sale above $500,000. As of September, approximately 121 or 31 percent of all Maui island MLS listings are for over $500,000. As for "affordably" priced homes, there are only 11 homes listed for sale below $150,000 (3 in Kihei, 3 in East Maui, and 5 in Up Country Maui).

Segregating the Maui island single family list price distribution into distinct areas provides some very useful insight. In particular, Kihei, Central Maui, East Maui, and Up Country Maui have 34 homes, 14 homes, 15 homes, and 45 homes listed below $250,000 (representing potentially competitive market priced homes) respectively (Figures VI-31 through VI-34). All of these areas have a substantial number of homes listed above $500,000. The number of homes listed for sale in West Maui is of particular interest, since they represent potential competition. Figure VI-35 shows a general lack of available inventory below $250,000 in West Maui. In fact, there are only 3 homes listed for sale below $250,000. In sharp contrast is the number of homes listed above $500,000; currently 45 or approximately 63 percent of all homes listed for sale in West Maui are priced above $500,000. Consequently, one can see why a number of West Maui residents have been frustrated in their quest for home ownership. Thus, the current market appears to be unable to fill the void for "affordably" priced homes in West Maui, which increases our belief that the Lahaina Master Planned Project will be well received by many Maui residents.

Land and Living Areas: The size of a particular single family home is a very important determinant of market acceptance. In this regard, the square footage of land and living (interior) area are two of the most basic factors potential home buyers use when comparing competitive products. Figure VI-36 shows the median square footage of land area by geographic region. As seen, median land areas range from a low of 7,364 square feet (Wailuku) to a high of 33,410 square feet (Haiku). In particular, land areas in Napili, Kaanapali, and Lahaina are 7,501 square feet, 10,162 square feet, and 7,550 square feet respectively. Figure VI-37 shows the median square footage of living area ranging from a low of 1,150 square feet (Haiku) to a high of 2,839 square feet (Kaanapali). In particular, living areas for Napili, Kaanapali, and Lahaina are 1,396 square feet, 2,830 square feet, and 1,500 square feet respectively. Therefore, land and living areas should be approximately in line with existing competition, especially for the market priced homes.

Analysis of Existing Single Family Competition

The general Lahaina area has a number of distinct single family neighborhoods. However, only a few of these neighborhoods which represent potential competition are actually relevant. We have identified the following neighborhoods as potential competition to the Lahaina Master Planned Project market priced units; these neighborhoods are Wahikuli, Kelawea Mauka, and Kapunakea. A general description and statistical market analysis is provided for each of these neighborhoods.

Wahikuli is adjacent to the Lahaina Master Planned Community and makes up part of the makai border (see Appendix II). Homes in this area are generally of modest design, with living areas averaging 1,562 square feet for homes currently listed for sale. Figure VI-38 shows average homes prices to have increased sharply in recent years, with current prices nearing $250,000.

Kelawea Mauka is a relatively new neighborhood located near Lahainaluna High School (see Appendix II). Many homes in this area possess good ocean and mountain views. However, the average living area of homes currently listed for sale in this neighborhood is only 1,136 square feet. Average home prices in Kelawea Mauka have moved up gradually in the past 2 years, with current prices nearing $200,000 (Figure VI-39).

Kapunakea is located on both the makai and mauka sides of Honoapiilani Highway. Homes in this neighborhood are generally very spacious, with the average living area of homes currently listed for sale being 1,905 square feet. Since there is a mix of both makai and mauka homes in Kapunakea, average prices appear to be quite erratic. Nonetheless, there appears to be a clear upward pattern. Figure VI-40 illustrates this pattern and shows prices to be averaging approximately $240,000.

Figures VI-41 and VI-42 provide a comparative analysis of the three above mentioned neighborhoods. Figure VI-41 compares average sold prices over the past 12 months with current average list prices. Figure VI-

42 does the same on a per square foot of interior area basis. As seen in both charts, the average list prices and list prices per square foot are substantially higher than the average sold prices in all cases but one. The lone exception is Kapunakea's average list price per square foot of interior area, which is $14 lower than the average sold price. However, this difference can be attributed to one home having over 3,000 square feet of living area. Current average list prices are $323,500 or $207 per square foot for Wahikuli, $267,000 or $235 per square foot for Kelawea Mauka, and $346,800 or $182 per square foot for Kapunakea. The above average list prices indicate a further escalation of home prices in West Maui. Therefore, the Lahaina Master Planned Project market priced homes should be competitively priced below average sold prices per square foot of interior area of the existing single family neighborhoods in order to attract potential home buyers into this new project.

VACANT LOTS

Vacant residential lots can be considered a potential addition to the existing housing stock. The period between initial purchase and actual home construction can vary tremendously depending upon the buyer's motivation and financial conditions.

Vacant lot sales in Maui have represented a relatively small portion of total residential sales. Over the past twelve months (8/88 to 8/89) there were 167 residentially zoned MLS vacant land sales on Maui (Figure VI-43). Of that, 47 or approximately 28 percent were in West Maui -- there were 27 sales in Kaanapali, 16 sales in Kapalua, 2 sales in Lahaina, and 2 sales in Napili. The corresponding lot prices are shown in Figure VI-44. As seen, lot prices in West Maui are considerably higher than any other region of Maui. Specifically, Kapalua and Napili average sales prices were in excess of $400,000, with Kaanapali and Lahaina being approximately half at $199,222 and $155,000 respectively. The above prices illustrate the extremely tight market conditions in West Maui which has led to the current problems many home buyers face. On a price per square foot basis, the picture does not change dramatically. Figure VI-45 shows vacant residential land in West Maui, again, to be the most highly priced in Maui.

In particular, Kahului's $16.56 per square foot is the nearest to Lahaina's (the lowest price in West Maui) $17.34. The most reasonably priced land, as might be expected, is located in East and Up Country Maui -- median prices for residential vacant land in Makawao and Kula are $5.67 per square foot and $6.07 per square foot respectively. The average size of the residential vacant lots sold ranged from a low of 7,750 (Kahului) to a high of 73,089 (Makawao) (Figure VI-46). In particular, residential vacant lot sizes in Kapalua, Napili, Kaanapali, and Lahaina were 12,465 square feet, 13,198 square feet, 11,008 square feet, and 9,120 square feet respectively.

CONDOMINIUM

The number of homes listed for sale, as mentioned above, is a good indication of real estate market conditions. Mid-year Maui condominiums listed for sale by the Multiple Listing Service increased sharply in the late 1970's; this was followed by 5 years of little change (Figure VI-47). However, since 1985 listings began to move downward rapidly, thus, depleting the number of available condominium units for sale. Currently there are 741 condominiums listed for sale, which is indicative of very tight condominium market conditions. Another useful "counter-cyclical" indicator of real estate market conditions is the average sold market time. Figure VI-48 shows the relatively high market times of 1981 and 1982; this was followed by a sharp decline and a sudden rise which peaked in 1986. Since 1986, when listings began to fall off sharply, lower market times have confirmed the continued strength of Maui's condominium market. The 1989 year-to-date Maui condominium average market time is 139 days.

The number of units sold is the most basic indicator of market activity and is useful in helping estimate the number of new units which a specific market segment may be capable of absorbing. In this regard, Figure VI-49 shows Maui condominium resale activity to have grown dramatically from the almost nonexistent levels of the early 1970's. After the mid-1970's surge, the recessionary early 1980's experienced depressed sales activity levels up to 1986. Since that period sales activity has rocketed high above previous record levels set in the late 1970's. In fact, 1988's 1,121 sales was nearly double 1979's 625 sales. The current year appears to be no different and we expect 1989 sales activity levels to be similar to slightly higher than the past year. Consequently, prices can be expected to continue their rise in the near term since increases in sales activity usually lead price increases by approximately 1 year (Figure VI-50). The 1989 year-to-date Maui condominium average price is $192,043.

In order to provide more specific information on condominium prices, we have segmented the island of Maui into 5 geographic regions: Kihei, Kapalua, Napili, Kaanapali, and Lahaina. Figures VI-51 through VI-74 show average sales prices and sales activity by month and bedroom type since 1978 for the island of Maui as well as the geographic areas described above. Figure VI-51 shows Maui condominium sales prices peaking in 1980; this was followed by 5 years of gradual decline, until 1986 when prices began to move up sharply. Recent condominium prices are averaging $180,000 to $220,000 and current sales activity levels continue to increase. The overall trend points to continued upward pressure on condominium prices as inventory remains low and single family prices move further out of reach of many potential home buyers. Maui studio, one bedroom, two bedroom, and three bedroom prices have exhibited somewhat sporadic price movements over the years. This can be attributed to the mix of resort and "resident" condominiums being sold. However, we feel the direction of price movement is representative of overall market conditions. Figures VI-52 through VI-55 show current Maui average prices ranging from $90,000 to $110,000 for studio units, $140,000 to $160,000 for one bedroom units, $225,000 to $275,000 for two bedroom units, and $250,000 to $350,000 for three bedroom units.

With the exception of West Maui, Kihei is the only other major condominium market in Maui. In the early to mid-1980's, the Kihei condominium market, like many resort markets, was hit especially hard by the period's unfavorable economic conditions which caused a number of investors to dump their properties as negative cash flows developed. However, the complexion of the current market appears to have changed -- according to the Locations Inc. proprietary client survey database, the number of investor buyers has decreased in the past few years. Thus, the current market may be in much stronger hands. Figures VI-56 through

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VI-59 shows current Kihei average prices ranging from $65,000 to $75,000 for studio units, $100,000 to $120,000 for one bedroom units, $140,000 to $160,000 for two bedroom units, and $175,000 to $225,000 for three bedroom units.

Prices and sales activity in West Maui remain quite strong. This resort oriented condominium market probably exhibits prices that are not representative of existing competition to a resident oriented project like the Lahaina Master Planned Project. However, these prices can be used for comparative analysis if a golf course (discussed later) is included along with a number of golf course frontage condominium units. Current average sold prices for West Maui studios range from $85,000 to $95,000 for Napili, $125,000 to $150,000 for Kaanapali, and $80,000 to $100,000 for Lahaina (Figures VI-60 through VI-62). Prices for one bedroom units range from $280,000 to $320,000 for Kapalua, $110,000 to $120,000 for Napili, $175,000 to $200,000 for Kaanapali, and $95,000 to $115,000 for Lahaina (Figures VI-63 through VI-66). Prices for two bedroom units range from $500,000 to $700,000 for Kapalua, $175,000 to $225,000 for Napili, $280,000 to $330,000 for Kaanapali, and $150,000 to $180,000 for Lahaina (Figures VI-67 through VI-70). Since there are few three bedroom units in West Maui, average sales prices are not exceptionally meaningful. However, average sales prices are provided for the four above areas in Figures VI-71 through VI-74.

Statistical Market Analysis

Sales Activity: The number of units sold is the most basic indicator of market activity and is useful in helping estimate the number of new units which a specific market segment may be capable of absorbing. For the overall Maui island and selected Maui condominium regions (Wailea, Kihei, Kahului, Kapalua, Napili, Kaanapali, and Lahaina), the number of MLS resales between 8/88 and 8/89 are shown in Figures VI-75 through VI-92 by price range and bedroom type. Figure VI-75 shows the majority of Maui condominium resales to be in the $50,000 to $174,000 price range. The total number of resales over the past twelve months was 1,399. A closer look reveals the majority of sales being in the $50,000 to $149,000 range for studio units, $50,000 to $199,000 range for one bedroom units, $75,000 to $199,000 range for two bedroom units, and $125,000 to $274,000 range for three bedroom units (Figures VI-76 through VI-79).

The Wailea and Kihei areas have shown the majority of the condominiums selling between $200,000 and $349,000 and $50,000 and $174,000 respectively (Figures VI-80 and VI-81). The availability of sufficient data allowed us to plot a distribution for Kihei one and two bedroom units. Figures VI-82 and VI-83 show most of the one and two bedroom sales occurring in the $50,000 to $174,000 range and $75,000 to $199,000 range respectively. As for Kahului, all of the condominium sales were below $74,000 (Figure VI-84). However, most of the sales occurred in the Harbor Lights condominium project.

West Maui's (Kapalua, Napili, Kaanapali, and Lahaina) large condominium market shows the majority of sales occurring in the $225,000 to $374,000 range for Kapalua, $50,000 to $199,000 range for Napili, $100,000 to $324,000 range for Kaanapali, and $50,000 to $174,000 range for Lahaina (Figures VI-85 through VI-88). The availability of sufficient data allowed us to plot a distribution for Napili and Kaanapali one and two bedroom units. Figures VI-89 and VI-90 show most of the one bedroom sales occurring in the $75,000 to $149,000 range for Napili and $100,000 to $199,000 range for Kaanapali. Figures VI-91 and VI-92 show most of the two bedroom sales occurring in the $75,000 to $199,000 range for Napili and $150,000 to $324,000 range for Kaanapali. Thus, since approximately 83 percent of all West Maui MLS condominium resales occurred above $100,000, with the price level needed for lower income (80 to 100 percent of median income) households being $96,000 to $120,000, one can see the overwhelming need for units priced near or below this level.

Sold Price and Sold Price Per Square Foot: Home buyers tend to shop the existing market, which serves as a good benchmark for pricing a competitive new product. In this regard, the median sold price per unit and per square foot is a useful indicator of the existing market.

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Figures VI-93 through VI-96 show the past 12 months (8/88 to 8/89) median sales prices for selected Maui studio, one, two, and three bedroom units ranging from $64,000 (Kihei) to $152,000 (Wailea), $36,000 (Kahului) to $285,000 (Kapalua), $45,000 (Kahului) to $460,000 (Kapalua), and $205,000 (Kihei) to $1,112,500 (Wailea) respectively. In particular, current the overall Maui median sales prices for studio, one, two, and three bedroom units are $100,000, $120,500, $165,000, and $260,000 respectively.

Figures VI-97 through VI-100 show the past 12 months median sold prices per square foot of interior area for selected Maui condominium markets. Current median sold prices per square foot range from a low of $144 (Kihei) to a high of $314 (Wailea) for studio units, $59 (Kahului) to $286 (Kapalua) for one bedroom units, $57 (Kahului) to $329 (Wailea) for two bedroom units, and $134 (Kaanapali) to $415 (Wailea) for three bedroom units. In particular, current the overall Maui median sales prices per square foot for studio, one, two, and three bedroom units are $211, $187, $167, and $173 respectively.

List Price: A Multiple Listing Service list price distribution constructed for Maui island condominiums is shown in Figure VI-101. The list prices for the island of Maui appear to be well distributed among the corresponding price ranges. In particular, a large number of units are listing in the $50,000 to $199,000 price ranges. However, even more striking is the number of units listed for sale above $200,000. As of September, approximately 327 or 44 percent of all Maui island MLS condominium listings are above $200,000. Currently, there are only 138 condominiums listed for sale below $100,000, many of which are studio and one bedroom units.

Segregating the Maui island condominium list price distribution by bedroom type provides some very useful insight. In particular, most of the units are listed between $50,000 and $99,000 for studios, $75,000 to $199,000 for one bedrooms, and $100,000 and $299,000 for two bedrooms (Figure VI-102 through VI-104). Figure VI-105 shows the most three bedrooms listing above $400,000. Thus, with the most preferred unit types among Maui residents being two and three bedrooms, one can see the potential demand for moderately priced two and three bedroom units being quite substantial.

Living Areas: The size of a particular condominium unit is a very important determinant of market acceptance. In this regard, the square footage of living (interior) area is one of the most basic factors potential home buyers use when comparing competitive products. Figures VI-106 through VI-109 show the median square footages of living area for selected areas by bedroom type. As seen, the median square footage of living area ranges from a low of 431 square feet (Napili) to a high of 507 square feet (Kaanapali) for studio units, from a low of 510 square feet (Wailuku) to a high of 995 square feet (Kapalua) for one bedroom units, from a low of 787 square feet (Kahului) to a high of 1,750 square feet (Kapalua) for two bedroom units, and from a low of 1,392 square feet (Kihei) to a high of 2,678 square feet (Wailea) for three bedroom units. In particular, living areas for Maui island and Lahaina are 493 and 473 square feet, 642 and 643 square feet, 807 and 988 square feet, and 1,413 and 1,499 square feet respectively for studio, one, two, and three bedroom units. Therefore, living areas should be approximately in line with existing competition, especially for the market priced condominium units.

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Maui Resident Condominiums

As discussed earlier, all of the condominium units listed in the Hawaiian Condominium Guide, published by Hawaii TMK Service, were identified noting the year built and total number of units. With the assistance of the Hawaii Business Resort Condominium Guide, we classified condominiums into one of two categories; that is resort or resident units. Resort units are those used for either hotel rentals, resort/vacation rentals, or timesharing. Resident units are those used for long term rentals or by owner occupants.

After classifying the condominiums into resort or resident, we constructed a statistical market analysis for the resident condominium units separately. We feel that the resident units are more representative of local market demands as far as sales activity, sales prices, and unit sizes

are concerned. Figure VI-110 shows the total number of Maui MLS resales in the past twelve months (8/88 to 8/89) by bedroom type. As seen, the overwhelming majority of the sales were for one and two bedroom units. Again, the low number of three bedroom sales can be attributed to the general lack of this type of unit. The availability of sufficient data has enabled us to plot a price distribution for one and two bedroom units separately. Figures VI-111 and VI-112 show most of the Maui one and two bedroom condominium sales occurring in the $50,000 to $89,999 range and $40,000 to $89,999 range respectively. An interesting point in the slim difference between the prices for one and two bedroom units. Figure VI-113 illustrates this difference and shows both the average and median sales prices by for one and two bedroom units to be $73,754 and $86,477 and $70,500 and $83,500 respectively. Of particular note is the large price gap one and two bedroom units exhibit with three bedroom units, as might be expected. On a price per square foot of interior area basis, both average and median price for two bedroom units are substantially lower than one bedroom units. The current median sales prices for a one and two bedroom units are $125 and $106 per square foot respectively (Figure VI-114).

The supply of resident condominium units appears to be quite limited. Figures VI-115 and VI-116 show 35 one bedroom and 46 two bedroom units currently listed for sale. In particular, most of the one bedroom units are listed in the $80,000 to $119,999 range, while most of the two bedroom units are listed in the $60,000 to $149,999 range. However, the vast majority of the above units listed for sale are located in the Central Maui area. Based upon the past twelve months sales, the median square footage of living area is 564 square feet for a one bedroom unit and 787 square feet for a two bedroom unit (Figure VI-117). Median lanai areas range from 53 to 81 square feet (Figure VI-118).

MAUI RENTAL MARKET

OVERVIEW

Apartment living has been an important part of Maui's housing market since the late 1960's. With developable land both limited and expensive, multi-family units are generally the most efficient way to provide affordable housing to a significant percentage of Maui residents. Unfortunately, most of the multi-family additions to inventory since that time have been in the form of resort condominiums. Virtually no new apartment rental projects have been built in the past 15 years. To make matters worse, a number of condominium and apartment rentals have since been converted to resort rentals, thus depleting the existing stock of residential housing units.

AVERAGE RENTS

The average rents in the section below were computed from classified ads appearing in the Maui News. A limited time series analysis was performed to establish trends in both the single family and condominium/apartment rental markets. Figures VI-119 through VI-137 show average rents for Maui single family homes and condominiums/apartments.

SINGLE FAMILY

Single family homes, as mentioned, have been the most preferred living accommodations for local families, since they provide large living areas and more privacy. As seen in Figure VI-119, Maui single family rents have steadily increased throughout the years. In particular, July 1989 rents have increased by 31.6 percent over July 1986 levels. Figures VI-120 through VI-123 show average single family rents for selected areas. Of particular note is the seasonality exhibited in many of the charts. Typically, the rental market tightens up in the winter months, along with the rise in visitor counts, and loosens in the summer months. This explains the reason for rents being lower in the summer months, or in this

case July. The current monthly average single family rents for Central Maui, South Maui, Up Country Maui, and West Maui are $1,153, $1,361, $1,289, and $1,750 respectively. The most striking figure is the $1,750 average West Maui rent. This rent level would require an annual household income of $70,000, assuming 30 percent was allocated to housing expense. Considering the current incomes of renter households, discussed in Section V, very few households could afford such a rent.

CONDOMINIUM/APARTMENT

Since single family homes are both limited and highly priced, condominiums have become a very important substitute in Maui's rental market. Figures VI-124 through VI-127 show rental rates for Maui studio, one bedroom, two bedroom, and three bedroom units. Apartment rental rates have moved up gradually over the years with the past 6 months average monthly rent being $613, $728, $1,120, and $1,604 for studio, one bedroom, two bedroom, and three bedroom units, respectively.

Taking a closer look at rental rates, we have separated Maui apartment rents into three geographic regions; Central (Wailuku/Kahului), South (Kihei), and West Maui. The historical rental rates for these regions are shown in Figures VI-128 through VI-136 with a past 6 month summary shown in the table below:

	Studio	1-Bdrm	2-Bdrm
CENTRAL MAUI RENTS:	$475	$588	$767
SOUTH MAUI RENTS:	$754	$761	$1,291
WEST MAUI RENTS:	$613	$817	$1,256

As seen in the above table, rental rates in South and West Maui are very similar. This can be attributed to both regions being resort oriented. However, rental rates in Central Maui are substantially lower. In particular, rental rates are approximately 44 percent, 34 percent, and 66 percent lower for studio, one bedroom, and two bedroom units. The above apartment rental rates will likely continue to rise if a significant number of new rental housing is not built in the near future.

ANALYSIS OF WEST MAUI RENTAL MARKET

OVERVIEW

West Maui has historically been an agricultural area with preservation of rural land being a major concern. West Maui has also been the primary destination of Maui's visitors for a number of years. Consequently, the majority of visitor related employment is centered here. With this in mind, the need to provide adequate housing for these people is obvious. According to Chris Hart of the Maui County Planning Department, "approximately 4,000 to 5,000 people commute to West Maui to work; many of these young commuters would like to live in West Maui." Consequently, it is not surprising that West Maui has been experiencing a housing and parking shortage for many years. In particular, "this shortage has been magnified since 1986, when many long-term rentals were converted into short-term resort rentals," says Grace West of Realty West. West also receives about 10 calls a day for long-term rentals, which she says, "simply are not available." Furthermore, Chaney, Brooks & Co. and Sullivan & Conlan, the two largest rental management companies, currently have few if any vacancies -- with both having long waiting lists. Therefore, it appears that a large pent-up demand exist for rental housing in West Maui.

The West Maui residential rental market appears to be very important to the tourism industry because of the great need to house visitor industry employees. Tight supply and strong demand have combined to limit availabilities and pressure rents. Furthermore, West Maui has

steadily emerged as an attractive area for a certain group of residents. These individuals tend to work in the general West Maui area and prefer to live in close proximity to their jobs.

COMPETITIVE PROJECTS

In general, there are very few long-term rentals available in West Maui. According to Erin Whattam of Sullivan & Conlan, "there are only four apartment buildings in West Maui that rent strictly long-term." Whattam adds, "these four buildings consist of only approximately 200 units." Since few truly comparable apartment buildings exist, in terms of a long-term rental objective, we will concentrate on selected newly built or planned apartment buildings that may compete with the Lahaina Master Planned Project rental units.

The **Honokowai Villa Apartments** is a Federal project for low to moderate income households, financed by the Farmers Home Administration. The project consists of 56 units, 28 one bedrooms and 28 two bedrooms. Rental rates are based upon administrative and maintenance expenses associated with the project. However, this project is subsidized by the Federal Government and annual rents are approximately 30 percent of adjusted family income. This project has been recently completed and fully rented out, according to Dennis Duarte of Finance Investment.

Poinciana Place is a new project currently under construction in Honokowai, which is scheduled to be completed in January 1990. Poinciana Place will be an apartment building for long-term rentals at market rental rates. The project will consist of 159 units - - 42 studio, 108 one bedroom, and 9 two bedroom units. Monthly rents will average $662, $795, and $1060 for studio, one bedroom, and two bedroom units respectively. However, the lack of two and especially three bedroom units in this development appears to indicate that the growing demand for larger units is not going to be satisfied here.

Komohana Hale, a Maui County project, will be located in Lahaina, consisting of 42 affordable two bedroom duplex homes for sale and 20 affordable one bedroom apartments for rent. All units will be for low to moderate income families. Construction is expected to commence in 1991.

The State of Hawaii's **Honokowai Rental Project** will consist of 184 units. The unit mix calls for mostly two bedroom units with a lesser percentage on one and three bedroom units. The state plans to rent 60 percent of the units to residents meeting the low income requirements with a maximum $175 per month rental subsidy per unit. The remaining 40 percent will be available at slightly below market rates.

Therefore, the only potential competition for "affordable" rental units will come from the state as well. However, with pent-up and future rental demand be so large, we expect full absorption of "affordable" rental units included in the Lahaina Master Planned Project.

VACANCY RATES

Residential vacancy rates in general are very difficult data to obtain for specific neighbor islands. We have located a combined neighbor island residential vacancy rate from the Hawaii State Department of Health, Health Surveillance Survey. Figure VI-137 shows residential vacancy rates from 1970 to 1987, with 1987 being 6.1 percent. However, after interviewing a number of real estate professionals who specialize in the West Maui rental market, we have concluded that rental vacancy rates in West Maui are almost nonexistent at the current time.

RECENTLY COMPLETED, ONGOING, OR PLANNED PROJECTS

There appears to be a large number of new projects currently in the planning stages. Figure VI-138 lists all proposed projects which we are aware of at this time. We have listed the project name, project type, location, developer name or source of funds, land area, total units, unit type, price range, and development timetable when data were available. As seen, not all projects have a current timetable and some contain only

general or vague information. The projects with an available timetable and detailed information was obtained through discussions with Maui County officials, the developer, or related parties.

For all of the above projects, we have made an estimate of the total number of new housing units which may be built each year out to 2005. Concerning the projects without a timetable, we assumed the same number of units built per year over 15 years. This list has been further segregated by "affordable" units, a combination of "affordable" and market units, market units, resort units, rental units, and unknown units. At the moment, this list probably overstates the number of new resident units (and understates the number of resort units) which may be built, particularly beyond the next several years. Figure VI-139 summarizes the total potential new housing supply per year out to 2005 by "affordable" and market priced categories. As seen, the potential new housing supply is further broken down by the total new units in Maui with and without the Lahaina Master Planned Project. The latter is shown on the last few lines of Figure VI-139. There appears to be a potential for 9,511 other new units, excluding Lahaina Master Planned Project, being built by 1995 (1,885 in 1990, 2,279 in 1991, 1,653 in 1992, 1,594 in 1993, 1,055 in 1994, and 1,045 in 1995). However, to the best of our knowledge, less than 600 units will be built in West Maui. Furthermore, the likelihood of all of these units being built is not very high.

ESTIMATED EXISTING HOUSING INVENTORY

As discussed earlier, in an effort to quantify the actual housing inventory, or existing inventory available to local residents, on the island of Maui and West Maui, we assumed all single family homes to be part of the existing resident housing stock. All of the condominium projects listed in the Hawaiian Condominium Guide, published by Hawaii TMK Service, were identified noting the year built and number of units.

Figures VI-140 and VI-141 show the estimated number of existing housing units for Maui and West Maui. As seen, the Maui island housing inventory has grown at a steady pace throughout the 1980's while West

Maui growth has been anemic at best. As of 1988, we estimate there to be 26,730 housing units on Maui. Of which only 3,423 are located in West Maui. The existing housing stock has fallen far short of a rapidly growing population and, consequently, has resulted into a severe housing shortage. In fact, we estimate there to be a current excess demand for 7,574 units and 2,939 units in Maui and West Maui respectively. Therefore, the need for a large number of new housing units in Maui, and particularly in West Maui, is quite apparent.

HOUSING SUPPLY AND DEMAND ANALYSIS

OVERVIEW

One of the more difficult factors in determining the success of a proposed project is estimating future absorption rates. There are two components to this: First is the design and pricing of the proposed project. This is, of course, well within the developer's control. Second is the overall market environment at the time of pre-sale and, of course, market completion. This is obviously more difficult to define because it involves forecasting such variables as interest rates, overall economic conditions, and general and specific sector real estate market conditions. The added complication with most projects are the time frames and time lags involved. Since most multi-family developments take several years between conception and completion, market and interest rate conditions can change significantly. Thus, a project may commence in a favorable environment and be completed in an unfavorable one (or vice versa). Furthermore, real estate is a cyclical industry and sales activity tends to move in spurts. It is not unusual for a new project to sell half its units in the first month of marketing and require 12 to 24 months (or longer) to sell the remaining half. Thus, the notion of a linear sales rate (a constant number of sales per month) may be convenient for planning purposes, but is unrealistic in terms of actual market behavior.

Housing demand is analyzed from two perspectives. First, "demographic" demand, the number of units needed to house the

population of a given area or employment base, is determined. Second, "effective" demand, the financial side of the demand equation which involves looking at the number of households who would be both qualified and interested in purchasing new units is determined.

DEMOGRAPHIC DEMAND

Using anticipated population and employment growth and household formation trends, the number of units needed to house the population in a given area at the time of project completion is estimated. This is compared to the anticipated supply or inventory of housing which will exist at that time. The difference between the two is the projected excess supply or demand.

ESTIMATED NUMBER OF HOUSEHOLD FORMATION BASED ON POPULATION PROJECTIONS

Based upon historical and projected population and household size trends, the number of households in Maui and West Maui were estimated. In order to determine current excess housing demand, a current population estimate of 83,053 and 14,819 and a household size of 2.52 and 2.33 persons, were used for Maui and West Maui respectively. Thus, at the end of 1988 we estimate there to be 32,968 Maui island households and 6,361 West Maui households. Combining the household numbers with the existing housing inventory numbers will result in an estimate of excess demand in Maui and West Maui. Graphic representations of historical excess housing demand for Maui and West Maui are shown in Figures VI-142 through VI-144. As seen in Figure VI-142, the total number of households (demand) has outpaced housing inventory (supply) for an extended period of time. The gap appears to have widened during the 1980's as home construction remained relatively stable. Figures VI-143 and VI-144 show the annual change in the number of households and housing inventory for Maui and West Maui. Of particular note is the compounding effect of continual household growth and slow housing inventory growth.

Figure VI-145 provides a very detailed analysis of housing demand and supply for both Maui and West Maui. As seen, housing demand and supply is estimated from 1989 through 2005. The housing demand was developed from population and household size projections. The housing supply data was developed from the recently completed, ongoing, and planned housing projects list provided earlier. Considering the number of projects in this list without a estimated timetable and the nature of real estate development, we have assumed that only 75 percent of all the known new housing units (excluding the Lahaina Master Planned Project) will in fact be built after 1989. The estimated annual new housing supply by category is provided in Figures VI-146 through VI-148, assuming 75 percent of the units are built. Furthermore, we have assumed a five percent housing vacancy rate for Maui. Concerning West Maui, we have assumed all of the planned units will in fact be built and a zero percent vacancy rate. In both cases, the Lahaina Master Planned Project development timetable was assumed to occur. The net result is total 1991 (the approximate date of first marketing for the Lahaina Master Planned Project) excess housing demand of 6,577 units for Maui and 2,862 units for West Maui (Figure VI-149). These numbers will decline to 4,412 units for Maui and 502 units for West Maui by the year 2000, or the expected date of completion for the Lahaina Master Planned Project. However, these numbers may overstate potential excess demand since it is contingent upon the projected housing supply, which is probably understated in the more distant future. Nevertheless, there should be ample demand for the Lahaina Master Planned Project even if 100 percent of the known new housing units are built.

ESTIMATED NUMBER OF HOUSEHOLD FORMATION BASED ON EMPLOYMENT PROJECTIONS

Historical and future household formation trends were also estimated by employment figures. Maui County experienced sharp employment growth since the early 1970's after more than 10 years of little change (Figure VI-150). Although growth appears to have plateaued in the past few years, expected economic activity in the years ahead will lead to substantial growth in employment. In fact, employment is expected to rise to 54,740 jobs by 1995.

In order to quantify household formation trends we used 1980 as a point of reference. In 1980, according to U.S. Census data, 92 percent of all the Maui County jobs were located on the island of Maui and there was an estimated 1.5 jobs per household. We assumed the proportion of jobs on Maui would continue into the foreseeable future because of its greater degree of urbanization and economic growth. The ratio of jobs per household is projected to decline over the years along with the trend toward smaller household sizes. In this regard, Figure VI-151 shows a comparative analysis of households and excess housing demand based upon both population and employment growth trends. As seen, the excess demand numbers are larger for the estimate based upon population growth. However, both estimates indicate a substantial number of unmet housing unit needs. An average of the two results in an excess demand of 7,096 units in 1988, 6,336 units in 1990, 3,961 units in 1995, and 4,066 units in 2000. It is our feeling that the estimates based upon population growth projections are more reasonable because it better represents the total number of existing and potential households -- we feel many households represented as having only one may actually contain more than one, thus the employment approach would underestimate the total number of households and, consequently, excess demand.

EFFECTIVE DEMAND

The major obstacle confronting developers in the 1980's has been qualifying buyers for purchase. Although there is a housing shortage on Maui, and specifically in West Maui, many prospective buyers lack the incomes or down payments required of home ownership. However, with approximately 60 percent of the Lahaina Master Planned Project housing units being "affordable" we do not foresee a problem of income requirements since the incomes developed below will determine home prices. The only concern is if potential home buyers will have the necessary down payments. Therefore, the second and critical phase of the demand analysis focuses on estimating the number of potential buyers who will be both able to qualify and interested in the project. The Locations Inc. supply/demand model estimates the total number of households who would be qualified to purchase such units, based upon various assumptions.

In the case of the Lahaina Master Planned Project, the parameter ranges are:

1. 3.3 to 1 monthly income-to-monthly-payment qualifying ratio
2. 8, 8.5, 9, 9.5, 10, and 10.5 percent mortgage rates
3. 80, 90, and 95 percent loan-to-value ratios
4. 10% of total demand = number who would be intending to purchase a residence.

A-29

Using derived distributions of renter and total household incomes, the model estimates the total number of qualified buyers, or the number of households in the market area, whose incomes would enable them to purchase the Lahaina Master Planned Project homes. Of these totals, only the renter households can qualify for the purchase of an "affordable" home since potential home buyers may not own or have previously owned real property. Only a small percentage of the total population will actually be looking to move and can be considered genuine potential buyers. Past data suggests that at any point in time, approximately 4 to 10 percent of all qualified households would be in the market with the intent of purchasing another residence. With pent-up demand being quite large, we felt 10

percent would be more likely. For example, if we assume a 9 percent mortgage rate, 3.3 to 1 qualifying ratio, 90 percent loan-to-value ratio, and a $96,000 to $105,000 price (based upon a household income of $27,200 to $29,999), the model suggests that there are approximately 1,267 capable renter households in Maui to buy, but only 10% or 127 actually intending to buy in a given year.

Using the most likely parameters, 3.3 to 1 monthly income-to-monthly payment qualifying ratio, 9 percent mortgage rate and a 90 percent loan-to-value ratio, and the renter household income distribution, we derived "affordable" price ranges for potential home buyers. Figure VI-152 summarizes the results, with income levels corresponding to percentages of the current Maui island median income of $34,000 (established by HUD). As shown, a household earning $27,200 to $29,999 could afford a home priced between $96,000 and $105,000 and a household earning $40,800 to $47,600 could afford a home priced between $144,000 and $168,000. Figure VI-153 uses the "affordable" price ranges and estimates the total number of renter households with an annual income between 50 to 140 percent of median income. The 50 to 80 percent of median income are considered to be potential renters and the 80 to 140 percent are considered to be potential home buyers. Above 140 percent of median income, all households were included since they would only qualify for the market priced homes. Demand was then estimated, again assuming a 10 percent capture rate, by category for Maui and West Maui. Total housing demand based upon the above parameters is 1,476 housing units for Maui island and 495 units for West Maui. In particular, we estimate there to be 131 qualified and interested renter households in the 50 to 80 percent income bracket, 46 in the 80 to 88 percent income bracket, 69 in the 88 to 103 percent income bracket, 55 in the 103 to 120 percent income bracket, and 31 in the 120 to 140 percent income bracket for West Maui. In addition, there are 164 qualified and interested total households with incomes above 140 percent of median income.

Therefore, the West Maui market appears to be capable of absorbing approximately 500 units per year. However, any particular new project will not attract all qualified and interested buyers since it must compete with neighboring projects and the resale market. Considering existing pent-up demand and future demand, we feel the Lahaina Master Planned Project housing units will be fully absorbed under the recommended development timetable.

VII. ANALYSIS OF INCOME PRODUCING PROPERTIES

GOLF COURSE FEASIBILITY

One of the possible amenities to the Lahaina Master Planned Project is a new golf course. We have performed a simple analysis of the potential demand for such a facility. The focus is on residents of Maui, although there certainly will be some demand from visitors.

According to the National Golf Foundation (NGF), there were 20.2 million golfers in the U.S in 1986. This corresponded to 9.1 percent of the population. The NGF also estimated that the typical U.S. golfer will play an average of 20.2 rounds per year or 5.5 percent of the days in a year. Thus, on any particular day, 0.5 percent of the population will play a round of golf. However, we feel that these numbers may substantially understate Hawaii's golf participation rate for the following reasons: (1) age is strongly related to frequency of play since the majority of frequent players are over the age of forty -- approximately 40 percent of the Maui island population is over forty years old, (2) increased leisure time and early retirement tends to boost demand -- Hawaii is known to be an area possessing a large number of retirees, (3) regionally, frequent golfers are more likely to come from the Southern regions since these players can take advantage of four season golf to play more rounds -- this is very much, if not more the case in Hawaii and, (4) resort regions tend to possess a large proportion of frequent golfers -- much like West Maui. All of these factors add up to a substantially higher golf participation rate in Hawaii in general and Maui in particular. Consequently, we feel that a participation rate of 10 to 15 percent and an

average of 25 to 30 rounds played per year would be more appropriate. Thus, if we assume the middle of these two ranges, 0.94 percent of the population will play a round of golf on any given day. Maui's resident population of 85,052 in 1989 corresponds to 800 rounds demanded each day. As Maui's population increases, this demand will grow to 941 rounds per day by 1995 and 1,048 rounds per day by 2000. This analysis is very conservative since it assumes no growth in golf participation rates when these rates are expected to grow into the foreseeable future.

On the supply side, Maui presently has one municipal course, Waiehu Golf Course and one daily fee private course, Silversword, which is affordable to residents. The municipal course has reported that it can accommodate approximately 300 rounds per day. If we assume that Silversword and all other Maui courses combined accommodates 200 rounds per day, the supply is approximately 500 rounds per day. This leaves a present excess demand of 300 rounds per day, or another 1.0 golf courses if we assume a rate of 300 rounds per day. If no new public courses are built on Maui, this will grow to 1.5 new golf courses needed by 1995 and 1.8 courses by 2000.

This analysis has only considered existing resident demand. However, the availability of golf courses has a substantial impact on golf participation rates. Areas with more golf courses generally have higher participation rates since many people interested in golf become players when new facilities are constructed in their area. In addition, it is likely that a new course in West Maui would also appeal to visitors. In this regard, we could envision some of the Kaanapali hotels purchasing memberships for their guests to use. Consequently, we feel that there is great potential for golf in West Maui since no "public" or relatively inexpensive facilities currently exist.

As demand for golf rises, but the supply of golf facilities does not rise adequately, golf will become increasingly expensive, driving the game back into the richer classes, reversing a trend of egalitarianism that is so important if golf is to grow in popularity.

LIGHT INDUSTRIAL

A growing demand for industrial space throughout Maui has created low vacancies in Kahului and Wailuku and "no vacancy" in Lahaina. Wailuku rents are currently at $.55 to $.65 per square foot, approaching the Kahului rates of $.65 to $.85, up substantially over December 1988, and near parity with Oahu rates. The existing buildings in Wailuku's Millyard Industrial Area are substantially leased with new buildings under construction at land values of approximately $13 to $15 per square foot. C. Brewer's 29 acre Wailuku Industrial Park II will consist of 55 fee simple lots averaging 12,000 to 13,000 square feet (photos of Wailuku Industrial Park are provided in Appendix II). Steel Tech has an approximately 15 acre industrial project in Kihei with Phase I in the planning stages. Also in Kihei, Blackfield's 11 fee simple industrial lots have been totally committed, and the Maui Economic Development Board is establishing a local investment group to develop and the Maui Research and Development Park. One project of particular interest is the Hawaii Omori light industrial/commercial development located adjacent to Kahomo Stream in Lahaina. This project's overall size and concept is somewhat speculative at this point, but the 34 acre site could potentially bring 1 million square feet of space onto the market over a number of years. Four alternatives are currently under consideration. The first two involve the improvement of the site and subsequent lease or sale of these lots to others to develop and rent out, the third would include the improvement and development of leasable space by Hawaii Omori, and the last would be a combination of all of these. Hawaii Omori firmly expects initial development to occur within 12 to 18 months.

Although there appears to be a great need for light industrial space in West Maui, the depth of the market is unknown. Harold Mizomi of Hawaii Omori feels the market in West Maui is oriented toward the smaller user who generally cannot afford to build a structure or lease large amounts of space, according to private surveys they conducted. Grant Howell of Monroe & Friedlander sees the light industrial market as a quasi business/service park. Consequently, he feels there is sufficient demand to support a new project. David Blane of C. Brewer also feels that there is a

great need for light industrial or mixed use space in West Maui. Blane said, "store owners in Lahaina and Whaler's Village do not have room for storage or office work, since display space is much too valuable." There appears to be no doubt concerning the need for this type of space, however, the actual amount needed remains a question since the lack of available data makes quantification of demand very difficult. Consequently, the inclusion of some light industrial space in the Lahaina Master Planned Project appears to be viable. However, the Hawaii Omori development must be monitored very closely.

RETAIL

Retail activity on Maui continues strong in spite of infrastructure delays from 1988. Overall island vacancy has decreased from 3.1 percent to 2.7 percent. Construction on at least three new centers is underway and slated for completion before year's end. These three centers are currently leasing very well. One additional center, the Kahana Gateway is slated for 1990 completion.

In particular, resident oriented merchants at the Lahaina Cannery have done very well (see Appendix II). However, stores located deep inside have not fared as well. Currently there is approximately 11,000 square feet vacant, which corresponds to a 7.9 percent vacancy rate. Overall, West Maui's vacancy rate is approximately 5.5 percent. Base rental rates as of June 1989 for neighborhood shopping centers on Maui range from a low of $1.38 to a high of $2.33 per square foot, with the average common area maintenance fee being $.35 per square foot. The currently under construction Lahaina Shopping Center will consist of approximately 190,000 square feet, which will bring a substantial amount of retail space on the market. Thus, the retail market may loosen in the near term.

A regional or mini town center to serve the needs of the local community will probably be necessary since existing facilities appear to be nearing capacity. Such a center should include a few anchor type tenants, financial services, hardware, food, and other related services. We have compiled a short list of possible tenant types (which is not to be considered all inclusive): convenience stores, drug store, fast food and other restaurants, dry cleaners, laundry mat, copy service, insurance office, real estate office, bank branch, medical offices, beauty salon, auto parts, hardware/home improvement, movie theater, specialty retail shops, etc... Such a neighborhood centers on Maui generally average between 50,000 and 60,000 square feet of gross leasable area.

VIII. HOUSING NEEDS SURVEY BY SMS RESEARCH & MARKETING

The results of the SMS Research & Marketing Services Housing Needs Survey confirm the strong pent-up demand which exists for housing on Maui in general and West Maui in particular. Of 26,858 total households on Maui, the survey found that 8,665 are interested in moving in the near future. Assuming that approximately 10 percent of all households typically move in a given year, this suggests a pent-up demand for approximately 6,000 units. This is supported by the crowded living conditions which presently exist for many households. The survey found that 13.2 and 23.5 percent of the housing units have two or more families (or households) living under the same roof for Maui and West Maui respectively. With regard to the 8,665 Maui households looking to move, the greatest percentage are renters who would like to purchase a home -- they comprise 40.5 percent of the households in this category. The total number of households looking to move is quite close to the current pent-up demand of approximately 7,500 housing units which presently exists on Maui, according to the Locations Inc. supply/demand model.

Of the total Maui households looking to move, 4,345 are willing to move into a mixed income development in West Maui. Again, assuming that approximately 10 percent of all households typically move in a given year, this suggests a pent-up demand for approximately 3,700 units. This is more than half of the households looking to move. The Locations Inc. model also projected that approximately 39 percent of the present pent-up demand is for West Maui housing units. These households looking to move to West Maui should provide more than enough demand for the Lahaina

Master Planned Project's 4,800 housing units, particularly since it will be built over a ten year period.

As far as type of product is concerned, the SMS survey would suggest building 31.9 percent of the project as rental units (rent to rent households), 43.2 percent of the units as affordable priced for sale (rent to own households), and 24.9 percent as market priced for sale (own to own households). The Locations Inc. model projected building 27 percent rental units, 40 percent affordable for sale units, and 33 percent market priced for sale units.

Potential demand must be taken a step further to estimate effective or financially based demand. In this regard, the SMS survey asked the interested households if they had a sufficient incomes and savings to purchase and make a down payment for a new home. Figures VIII-1 and VIII-2 show renter household income distributions for both Maui island and West Maui. As seen, most of the Maui island and West Maui renter household incomes range from $10,000 to $40,000 and $10,000 to $50,000 respectively. In the case of the affordable units for sale, the estimate is that 1,059 of the 1,817 renter households willing to move to a West Maui development have at least $5,000 in savings for a down payment, while 780 of the 920 present homeowners willing to purchase a market priced home have at least $20,000 in savings. In particular, Figures VIII-3 and VIII-4 show the distribution of expected down payments for both Maui island and West Maui renter households. As seen, 33.8 and 38.3 percent of the Maui and West Maui renter households, respectively, expect to make a down payment between $5,000 and $20,000, with 40.6 and 42.6 percent of the Maui and West Maui renter households, respectively, expecting to make a down payment above $20,000. These potential effective demand numbers should more than cover the suggested initial phase of construction, whereby approximately 300 affordable units and 150 market units will be built each of the first several years. Finally, the survey estimates that of the 1,304 renter households looking to rent and willing to move to a West Maui development, 1,104 are willing to pay at least $500 per month, or currently are doing so.

An important component of potential demand is the willingness and timing of a buyers future move. In this regard, a particular population's mobility is very important. According to the SMS survey, 29.4 percent of the Maui island renter households are planning to move within the next year, 56.4 percent within the next 5 years, and 59.5 percent within the next 10 years (Figure VIII-5). In particular, 34.4 percent of the West Maui renter households are planning to move within the next year, 59.7 percent within the next 5 years, and 60.8 percent within the next 10 years (Figure VIII-6). Thus, the overwhelming majority of both Maui island and West Maui renter households plan to move before or during the phasing of the Lahaina Master Planned Project. Considering the relatively large numbers of mobile households, one would like to know their choice of future housing areas. Figures VIII-7 and VIII-8 show the distribution of Maui island and West Maui renter households first choice of housing area. As seen, the most preferred housing area is West Maui, Central Maui, and Up Country Maui for Maui island renter households, with West Maui being the overwhelming choice for West Maui renter households. However, we feel that these choices may reflect the actual distribution of Maui island renter households since most would select their present area as being most preferable. Nonetheless, the above first choices should reflect housing preferences quite well. Concerning West Maui, Figure VIII-9 shows the percentage of households whose first choice was West Maui by their present area of residence. As might be expected, the vast majority of households with West Maui as their first choice of housing area currently live in this area. Of particular note is the small number of households willing to move to West Maui from other areas. However, this small percentage can potentially result in a significant number of home buyers.

The SMS survey also provided detailed information on employment characteristics of a household's primary wage earner by industry. Figures VIII-10 and VIII-11 show the majority of both Maui and West Maui primary wage earners being employed in the visitor, service, and construction industries. The service and construction industries are usually highly dependent upon the visitor industry in one way or another. In particular, the visitor industry in itself employed approximately 38 percent of all primary wage earners in West Maui, with service (10.9%) and

construction (8.3%) employment being quite significant. Thus, the need for additional infrastructure to accommodate current and future economic growth cannot be underestimated.

In conclusion, initial results from the SMS survey are quite close to the demand projections derived from the Locations Inc. model. Both project a strong current pent-up demand for housing on West Maui and a sufficient number of willing and qualified buyers and renters for the mix of single and multi-family units to be built in the Lahaina Master Planned Project.

IX. FINAL RECOMMENDATIONS

- This section contains recommendations and conclusions of the entire market study. We have also included some brief remarks on various aspects of the project in order to address areas that are not quantifiable by our statistical analysis.

- The Maui County economy rebounded after a mild slowdown in 1987. Gross business receipts, a measure of overall economic activity, increased by 16 percent to $2.1 billion. Business receipts have increased in the first part of 1989, which indicates continued growth in Maui's economy. However, the current and projected labor shortage will continue to plague economic growth. The unemployment rate has increased slightly in 1988 to 3.6 percent from 1987's 3.2 percent. However, Maui County remains nearly fully employed. Nevertheless, near term economic growth should continue.

- The West Maui residential resale and rental markets are mirroring the extremely tight conditions which exist for all of Maui. New construction in recent years has fallen far short of the demands of a rapidly growing population. In fact, household growth has been even more rapid as household sizes continue to decline. This has caused both home prices and rents to rise much faster than income levels in recent years, resulting in an "affordability" gap. This structural problem will only be solved by building a substantial number of new moderately priced housing units in the years ahead. Our estimates suggest that this island wide shortfall is accruing at the rate of 800 to 900 housing units per year. There appears to be some relief in the near term as several thousand housing units may be built over the next 2 years. However, the longer term housing shortfall will not change materially since a large excess demand will continue to persist.

- The Lahaina Master Planned Project will contain a total of 4,800 housing units to be built over a 10 year period. Our analysis of both renter and total household income distributions has resulted in a recommended unit mix for "affordable" and market priced units. Under the development timetable provided earlier, we suggest two-thirds of the units be targeted toward the "affordable" market, with the remaining one-third being market

priced. Of the total units, 9 percent should be rental units allocated to elderly and special need groups, 18 percent should be rental units priced between $430 and $689 per month, 9 percent for sale units priced between $96,000 and $105,000, 14 percent for sale units priced between $105,000 and $123,000, 11 percent for sale units priced between $123,000 and $143,000, 6 percent for sale units priced between $143,000 and $168,000, and 33 percent for sale units priced near the prevailing market rate or about $180,000 to $230,000. The expected absorption rate for the first 2 years is 240 and 860 units respectively -- thereafter, approximately 463 units can be absorbed annually, assuming the same proportions of "affordable" and market priced units mentioned above. The amount of living area for the rental units should range from 650 to 700 square feet, 850 to 950 square feet, and 1,000 to 1,100 square feet for a one, two, and three bedroom units respectively. Single family homes should have approximately 1,400 to 1,500 square feet of interior area and 7,000 to 8,000 square feet of land. In particular, the market priced homes should conform to the recommended sizes in order to remain competitive. However, we feel both living and land areas can be reduced somewhat in order to accommodate "affordable" units. One way to decrease land areas is the zero lot line concept. Two homes are built with an abutting wall on what would be a single lot of 7,000 to 8,000 square feet. However, the abutting wall serves as a property line between two separate lots. Another idea is a cluster type development whereby homes are independently situated on smaller lots, thus creating higher density.

- We we asked to look at upper price limits for higher-end market priced homes. After identifying nearby single family areas, like single family subdivisions, and golf course resort condominiums, we prepared a detailed statistical market analysis. Figures IX-1 and IX-2 show average prices per unit and per square foot of interior area for selected Maui single family areas and Wailuku Heights, in particular. Considering the potentially competitive single family prices, we feel higher-end homes can be priced between $350,000 to $450,000 or $180 to $220 per square foot of interior area. Figures IX-3 and IX-4 show average prices per unit and per square foot of interior area for selected golf course resort condominium by bedroom type. Considering the potentially competitive condominium projects, we feel golf course resort units can be priced between $175,000 to $225,000 or approximately $230 to $250 per square foot of interior area for one bedroom units and $225,000 to $300,000 or approximately $240 to $260 per square foot of interior area for two and three bedroom units. The recommended price ranges for higher-end units assumes that the products will be of competitive design and overall quality.

- We were also asked to look at the viability of a golf course as a possible amenity to the Lahaina Master Planned Project. Considering the current population and corresponding golf participation rate, we estimate there to be an excess demand of 300 rounds per day, or another 1.0 golf courses if we assume a rate of 300 rounds per day. If no new public courses are built on Maui, this will grow to 1.5 new golf courses needed by 1995 and 1.8 courses by 2000. The inclusion of a new golf course in the Lahaina Master Planned Project will serve the demands of many West Maui resident golfers, who must commute to other areas, as well as enhance the over quality of the project. In addition, market priced homes with golf course frontage will command a premium of approximately 25 to 35 percent over other similar homes, based upon past Locations Inc. studies.

- There is the possibility of including some commercial and light industrial space in the Lahaina Master Planned Community. The need for light industrial space in West Maui appears to be quite acute. However, the potential Hawaii Omori development may satisfy the markets existing needs. Therefore, close monitoring on the status of this project is recommended. The inclusion of retail/commercial space appears to be a viable one. However, any such development should not be large scale. In particular, existing neighborhood centers on Maui generally average between 50,000 and 60,000 square feet of gross leasable area.

- Preliminary results from SMS Research & Marketing Services confirm the strong pent-up demand which exists for housing on Maui in general and West Maui in particular. Of 26,858 total households on Maui, the survey found that 8,665 are interested in moving in the near future, of which 4,345 are willing to move into a mixed income development in West Maui. Assuming that approximately 10 percent of all households typically

move in a given year, this suggests an excess demand for approximately 6,000 units. Also, a remarkable 12.7 percent of the households surveyed reported having two or more families living under the same roof. The excess demand number suggested by the SMS survey is quite close to the current pent-up demand of approximately 7,500 housing units for Maui and 2,900 housing units for West Maui, predicted by the Locations Inc. supply/demand model. As far as type of product is concerned, the SMS survey would suggest building 31.9 percent of the project as rental units (rent to rent households), 43.2 percent of the units as affordable priced for sale (rent to own households), and 24.9 percent as market priced for sale (own to own households). The Locations Inc. model projected building 26.5 percent rental units, 40.6 percent affordable for sale units, and 33.1 percent market priced for sale units. In conclusion, initial results from the SMS survey are quite close to the demand projections derived from the Locations Inc. model. Both project a strong current pent-up demand for housing on West Maui and a sufficient number of willing and qualified buyers and renters for the mix of single and multi-family units to be built in the Lahaina Master Planned Project.

The above recommendations and conclusions are based upon the Lahaina Master Planned Project being both a well planned and designed community. Thus, it is our opinion that there will be sufficient demand to support this project, which should be favorably received by Maui residents, in general, and West Maui residents, in particular.

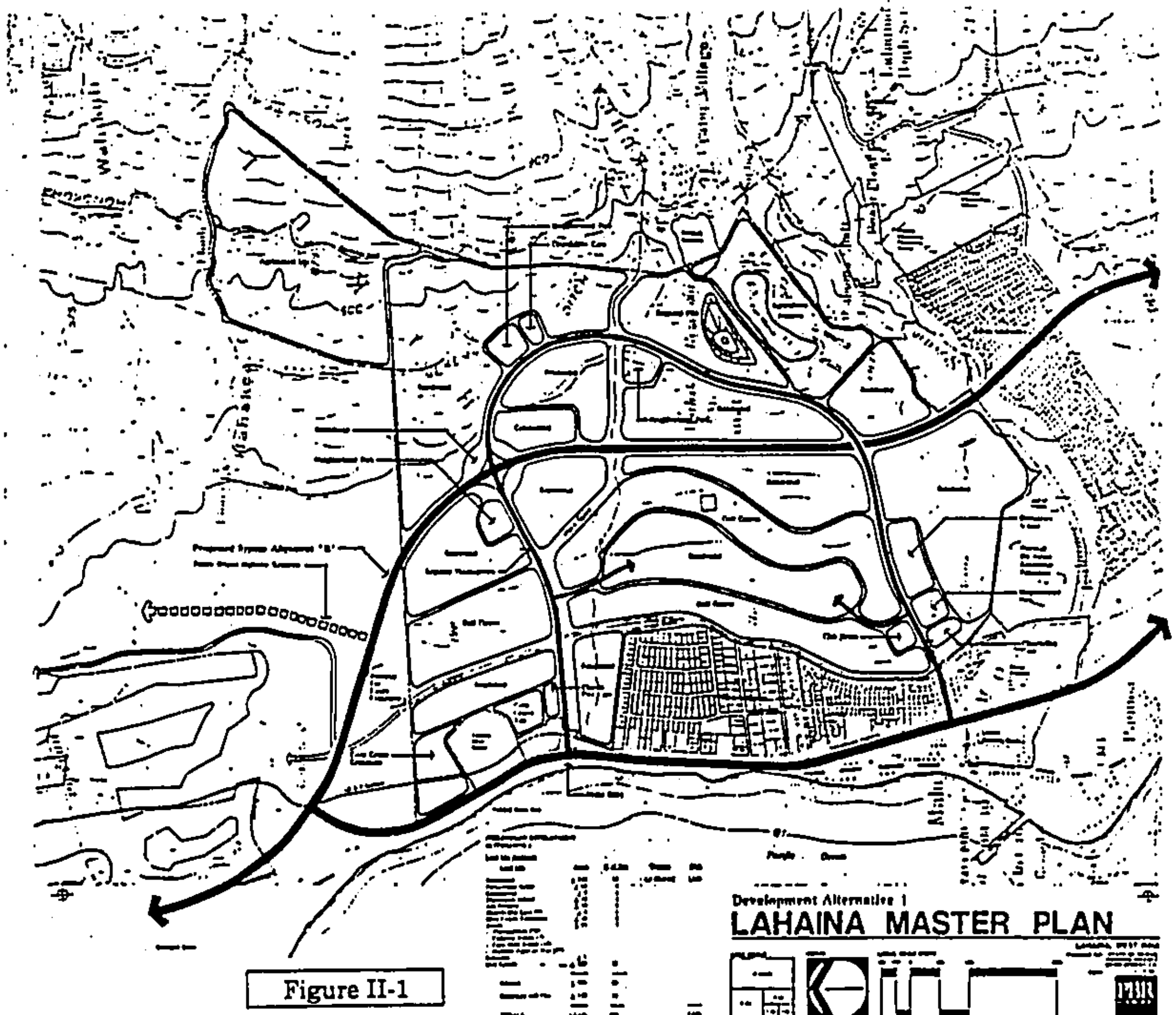


Figure II-1

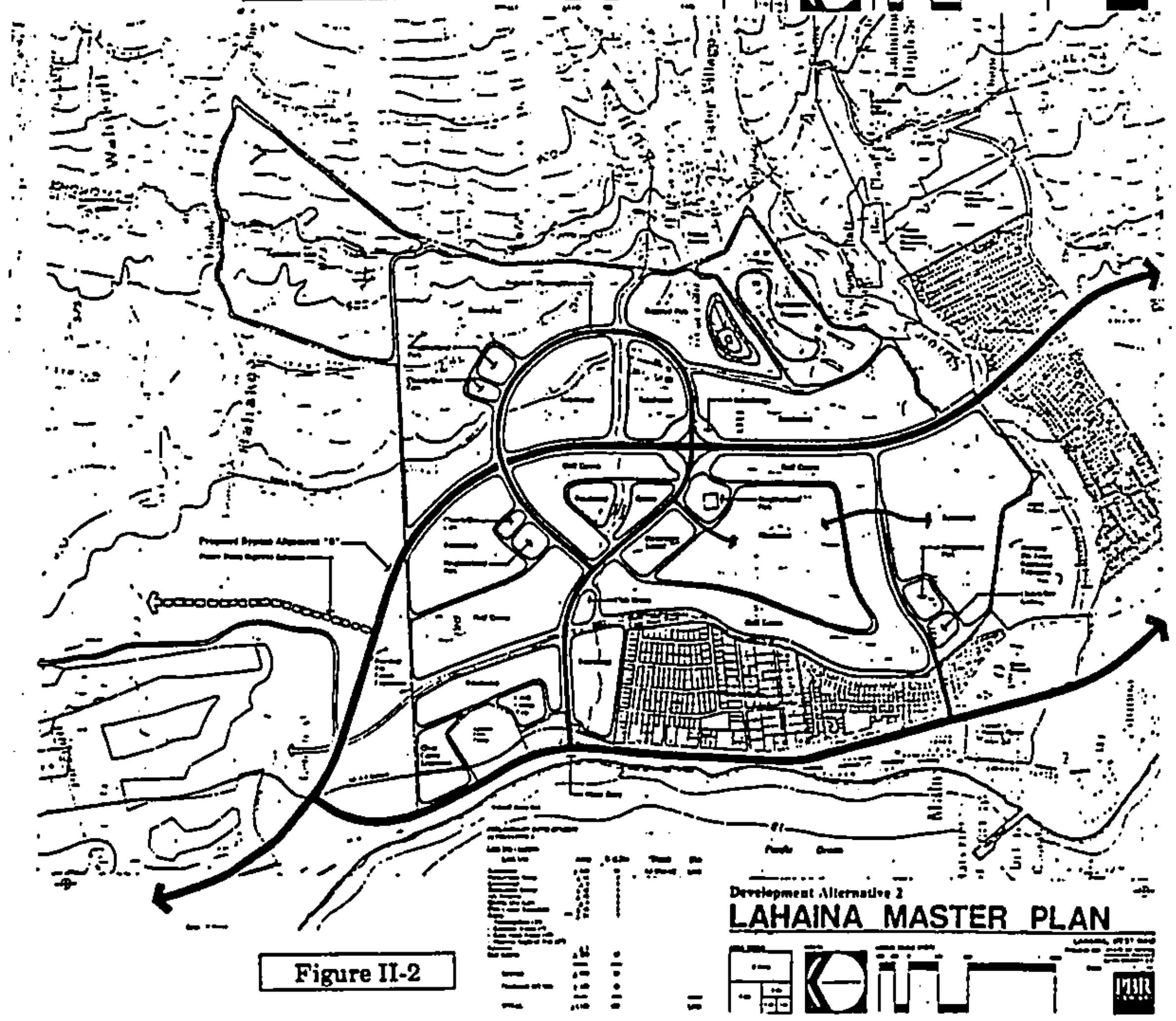


Figure II-2

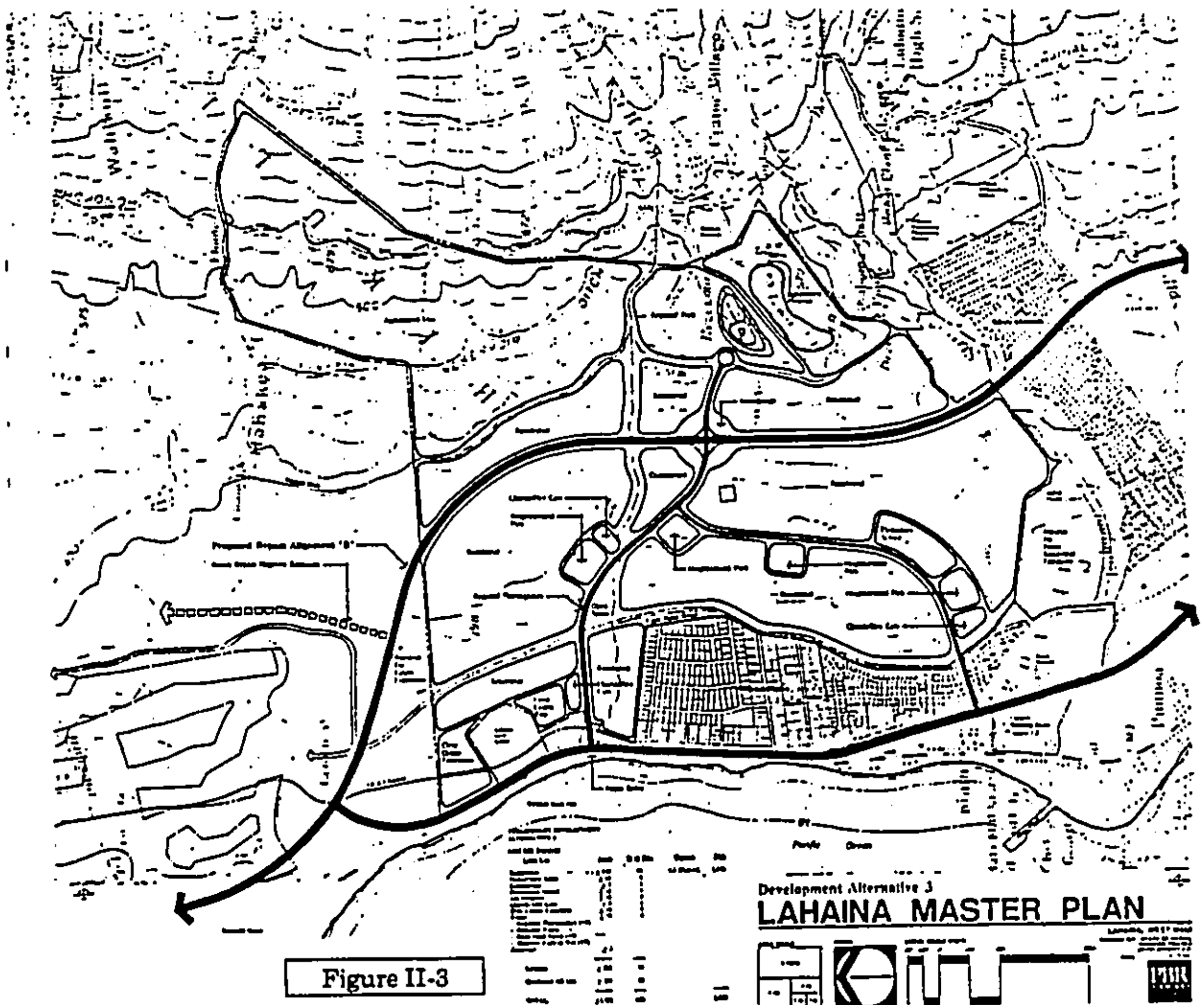
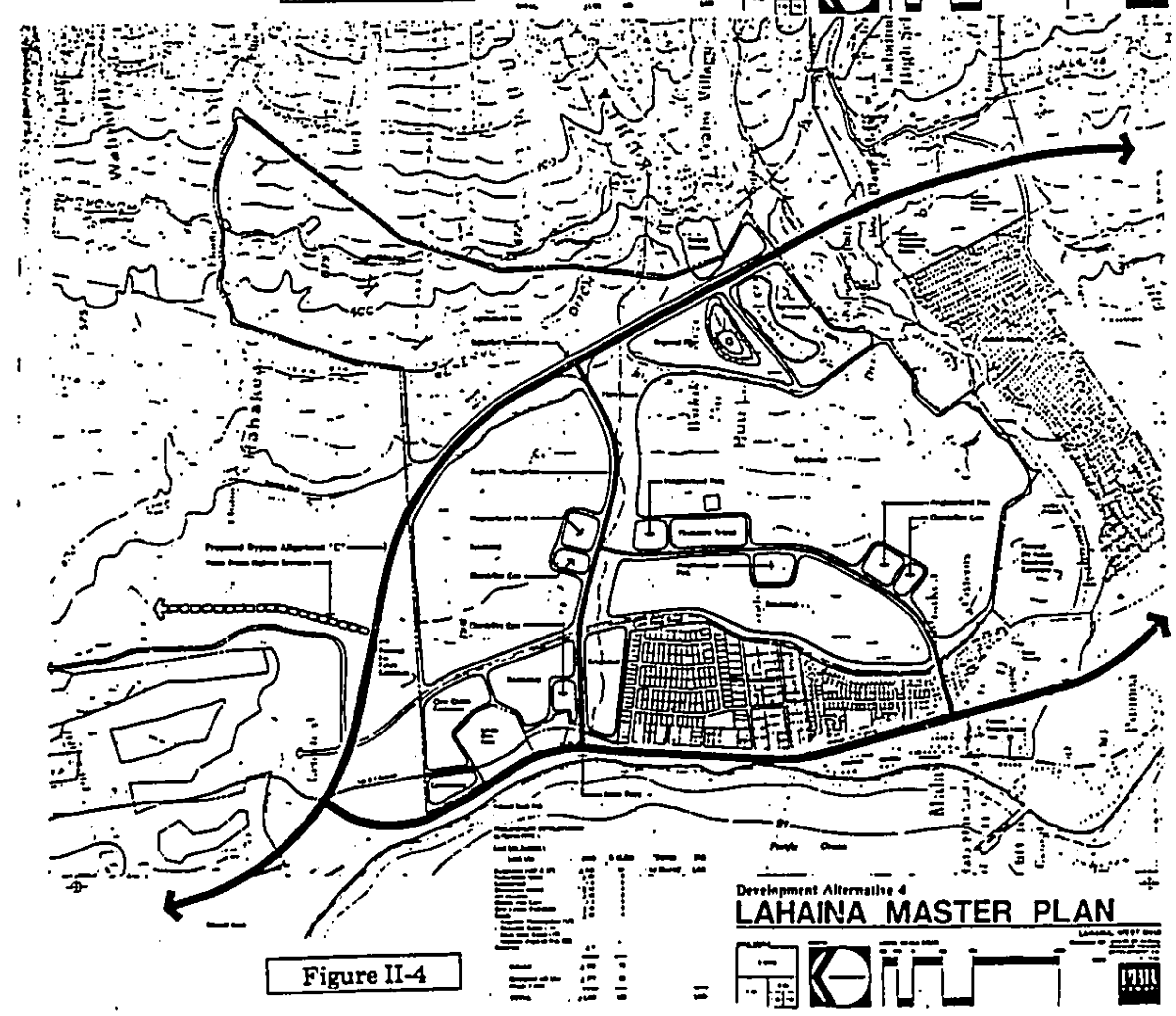


Figure II-3



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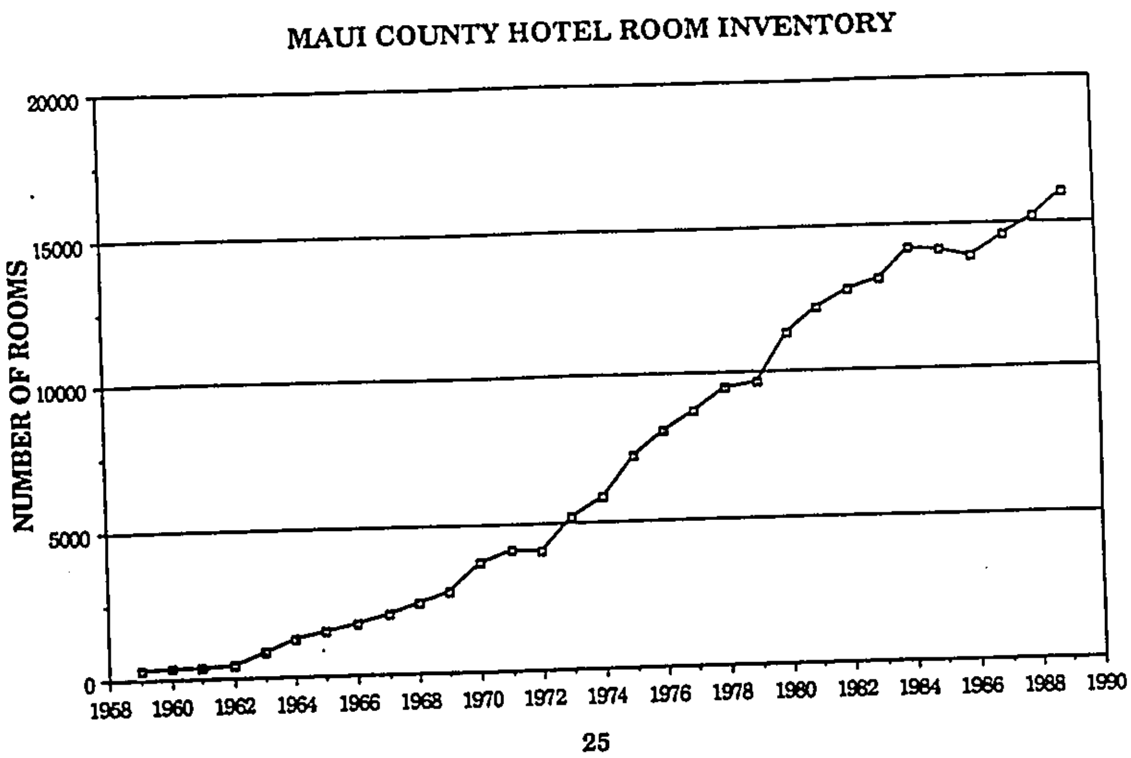


Figure III-1

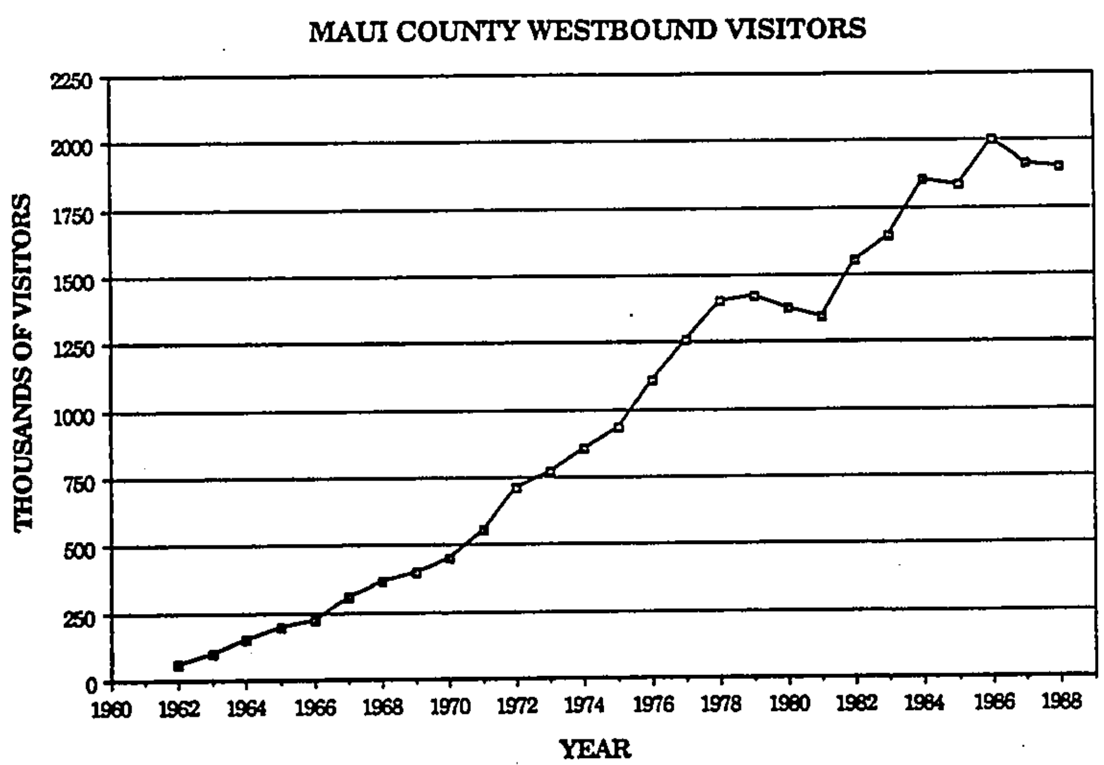


Figure III-2

MAUI COUNTY HOTEL OCCUPANCY RATE

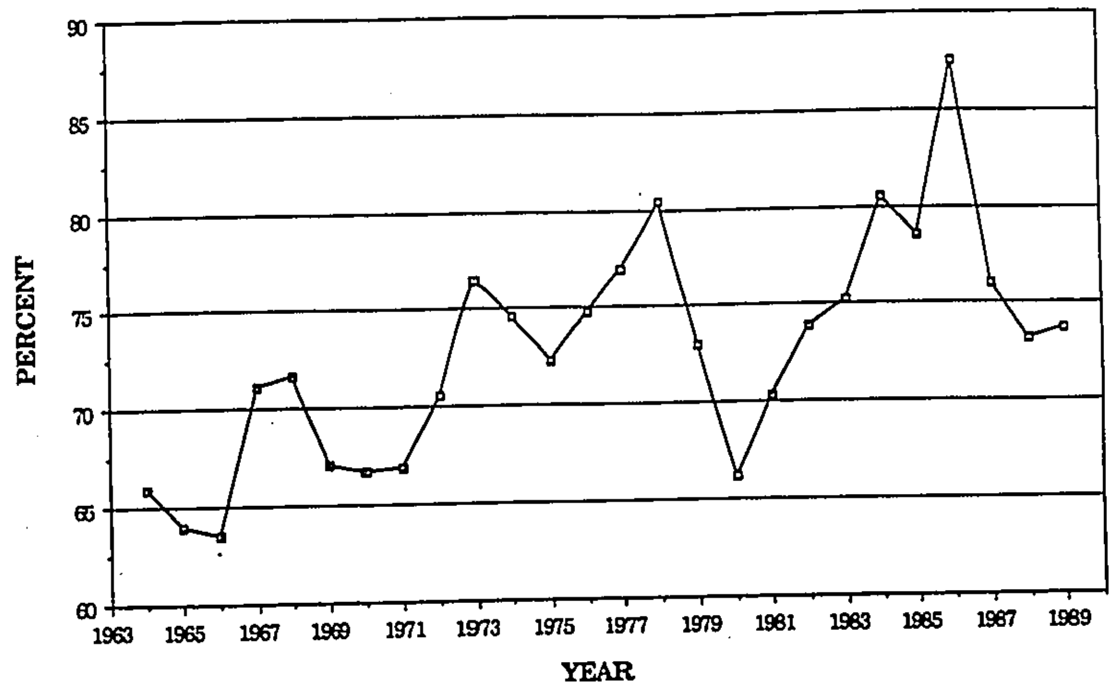


Figure III-3

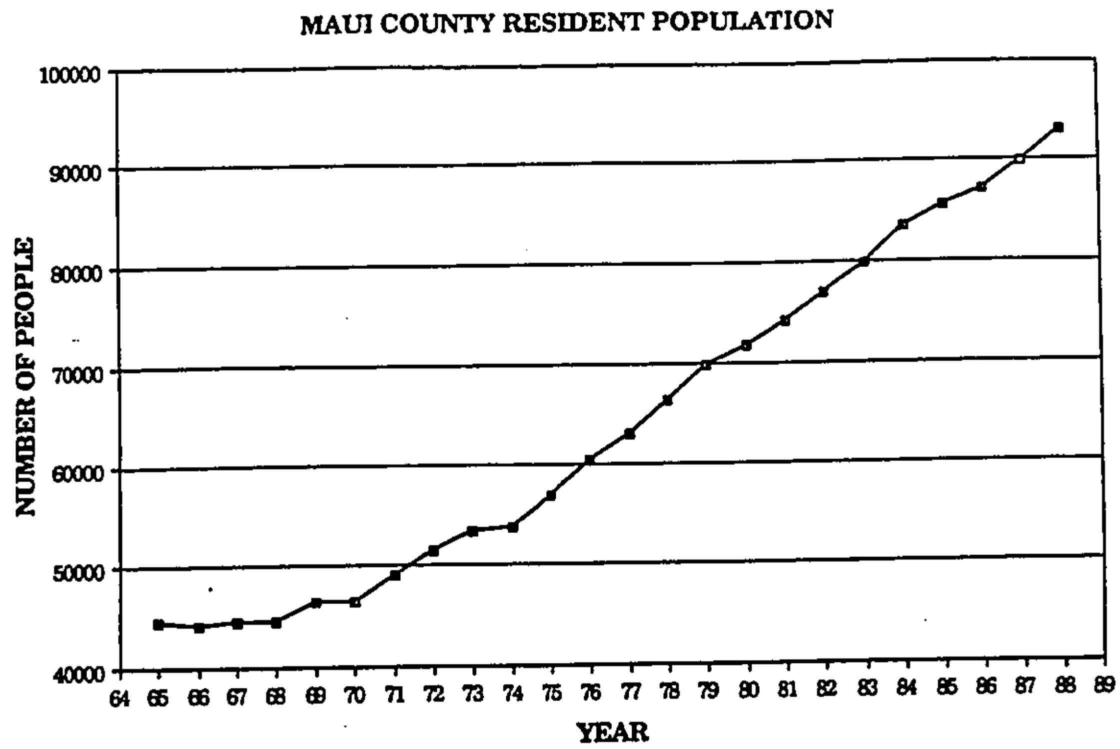


Figure IV-1

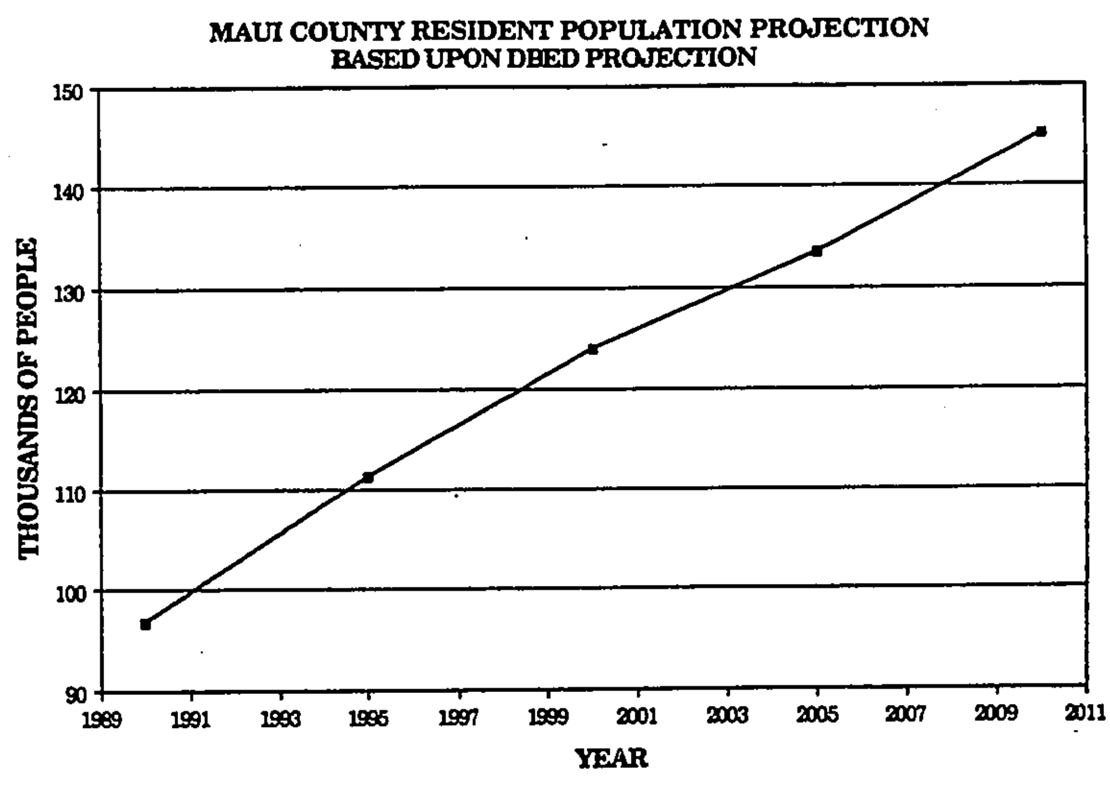
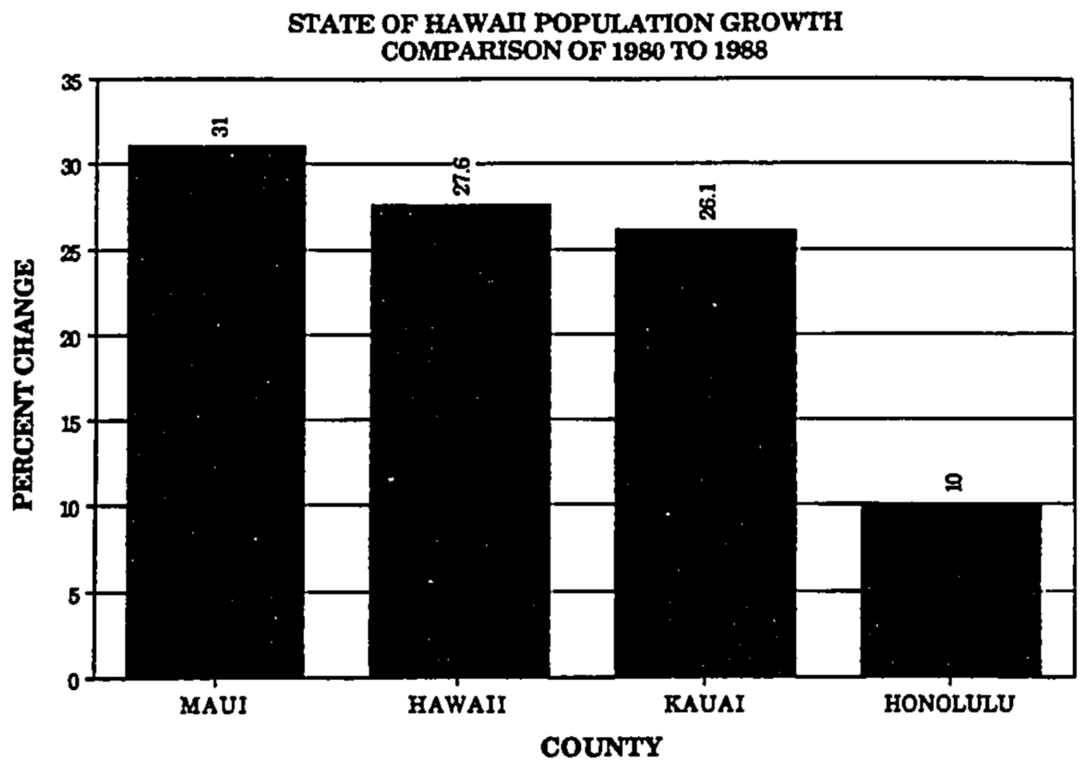


Figure IV-2



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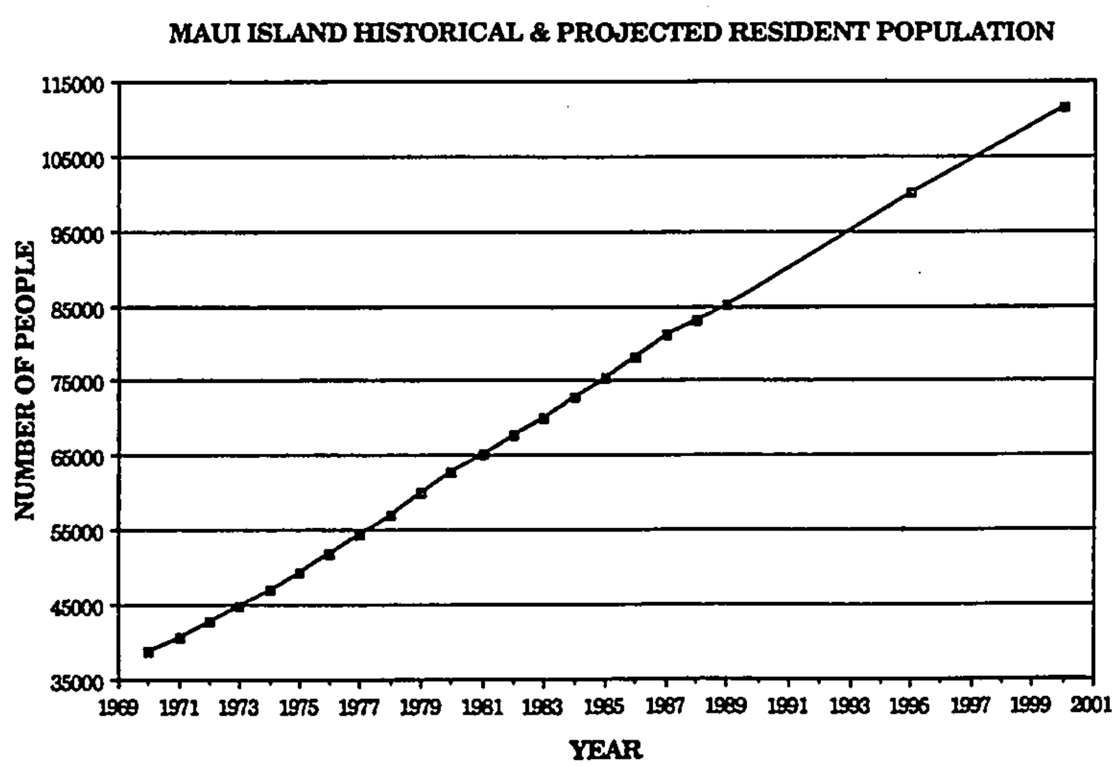

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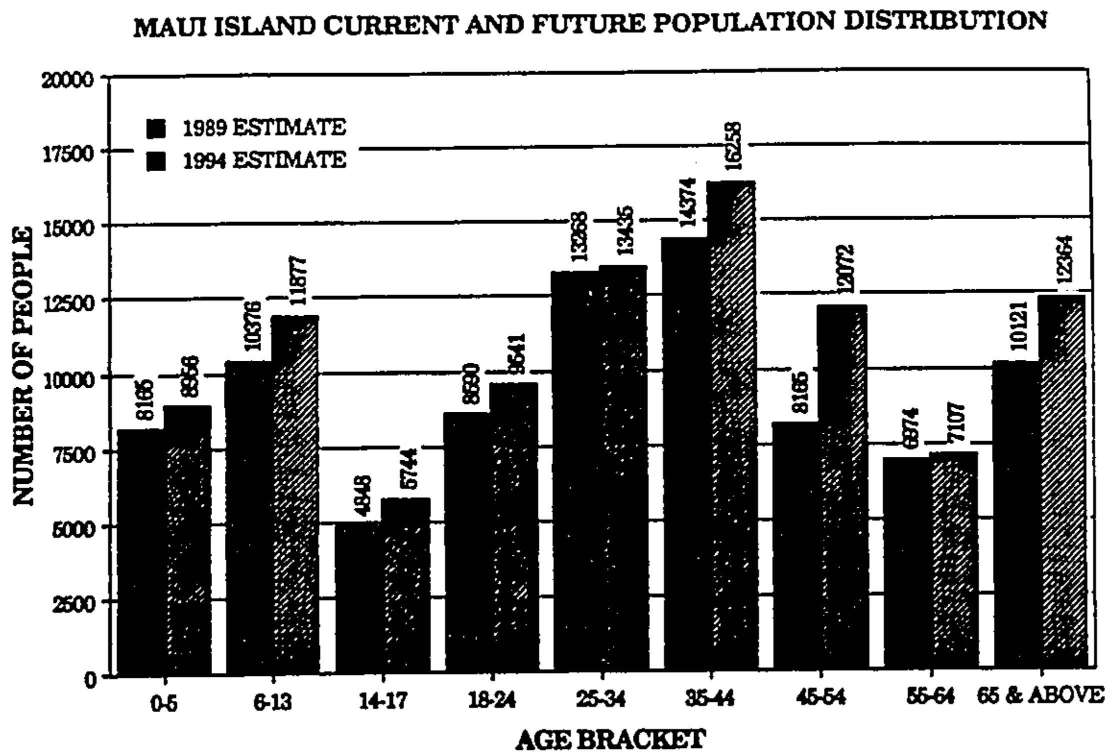

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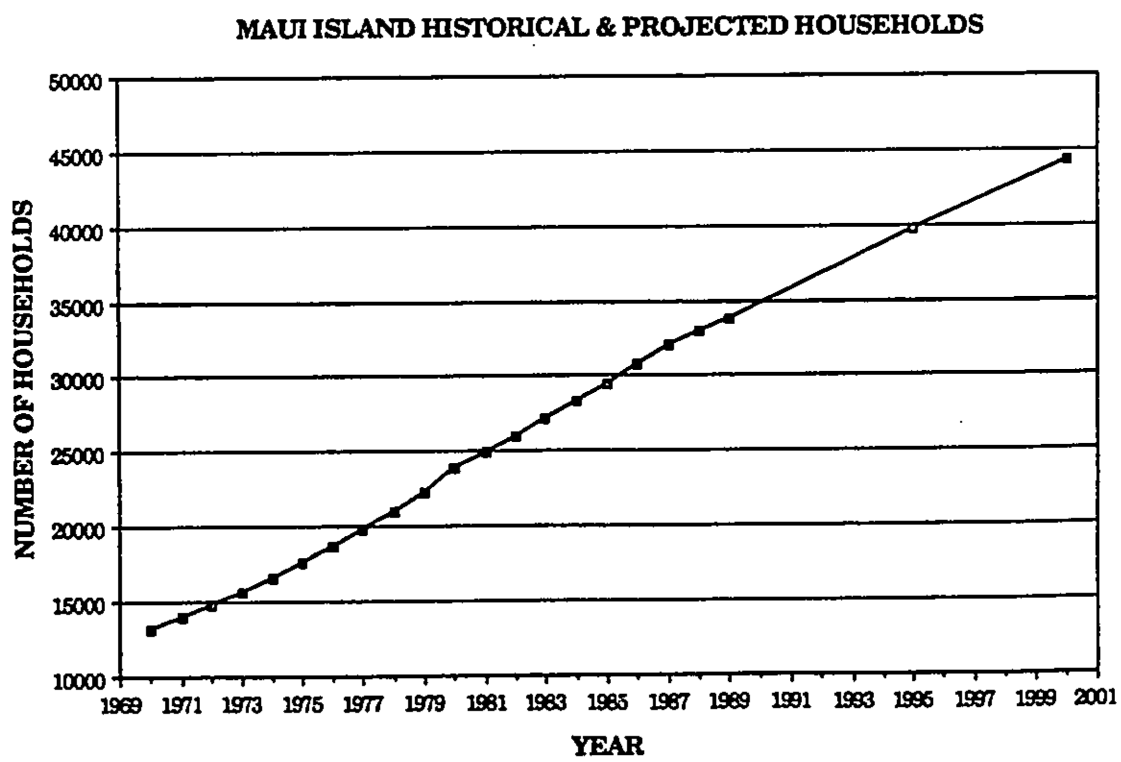

Figure IV-6

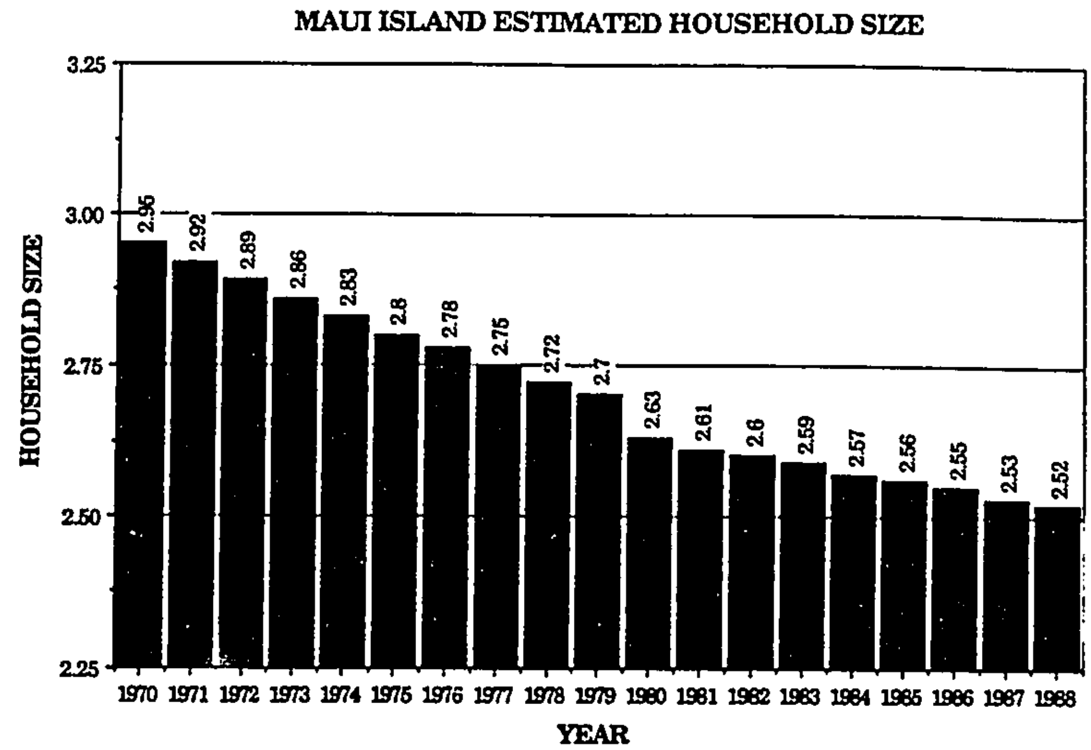

Figure IV-7

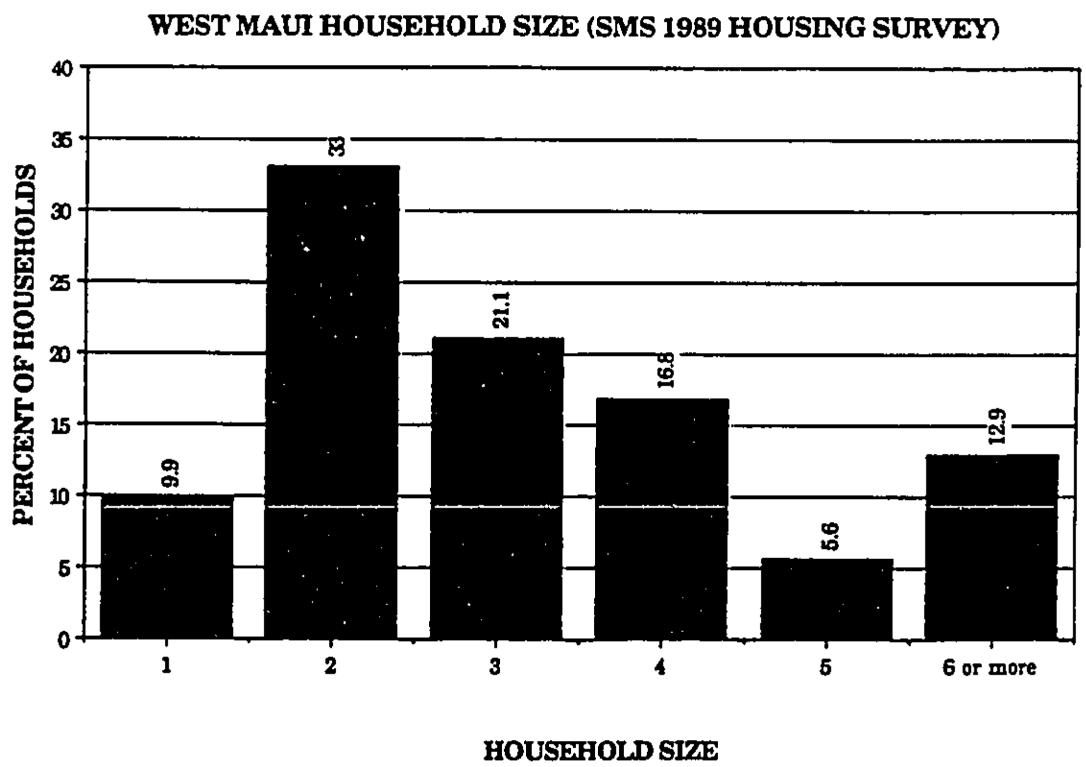

Figure IV-8

WEST MAUI HISTORICAL & PROJECTED POPULATION

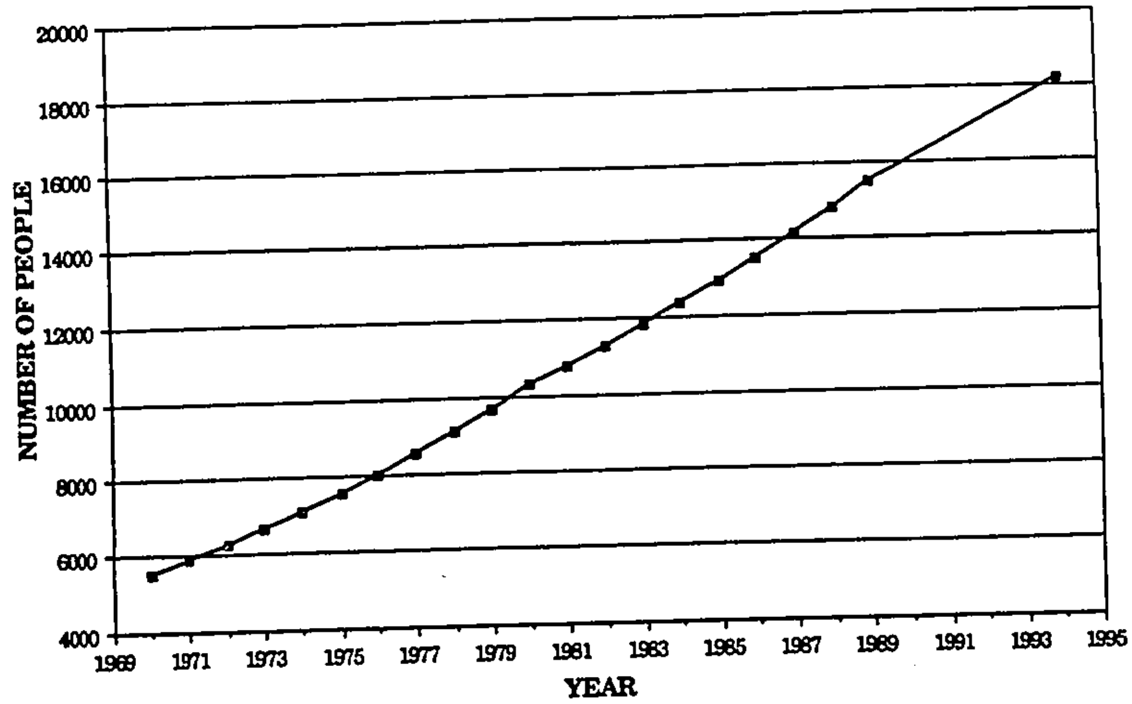

Figure IV-9

MAUI 1980 TO 1989 POPULATION GROWTH

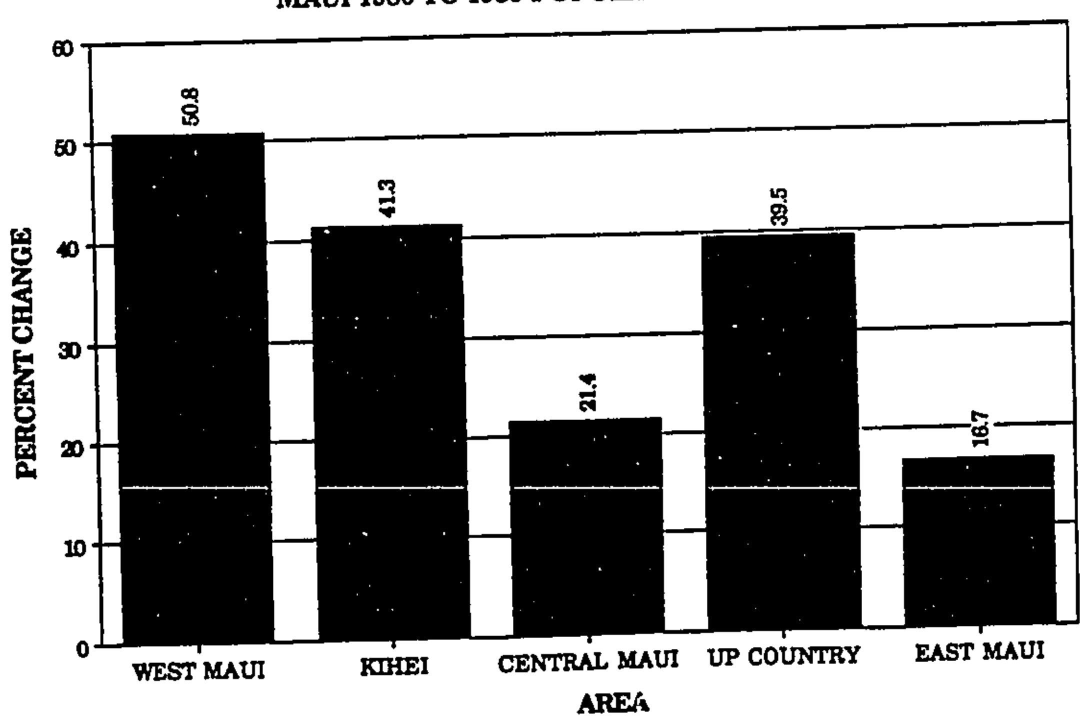

Figure IV-10

MAUI HISTORICAL & PROJECTED POPULATION

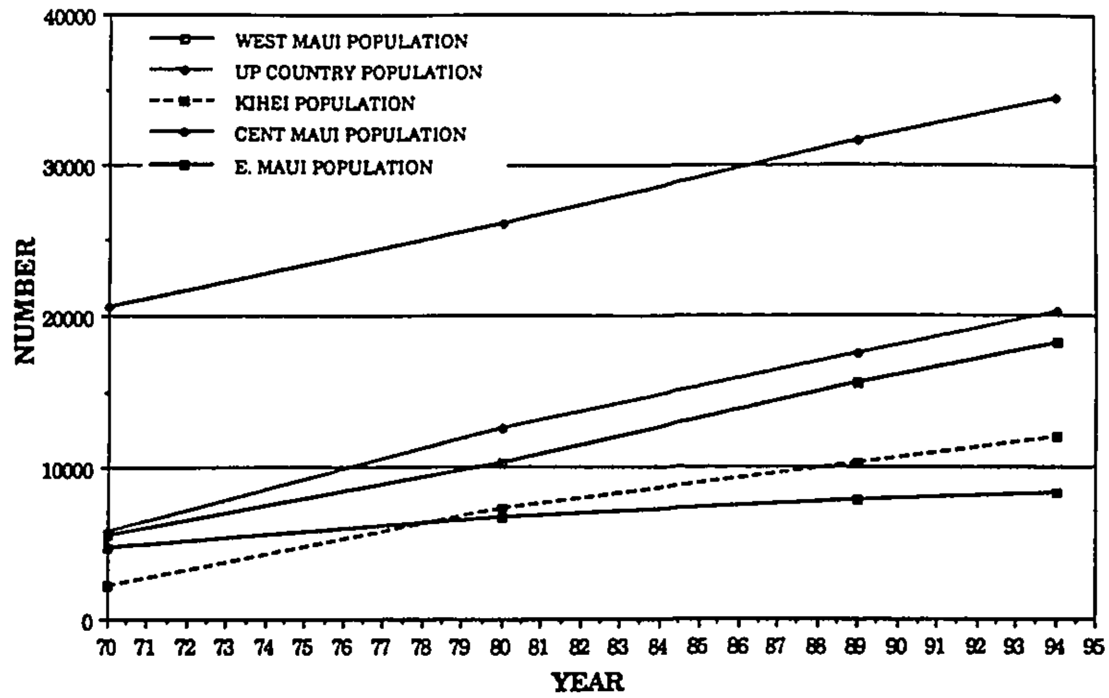

Figure IV-11

WEST MAUI CURRENT AND FUTURE POPULATION DISTRIBUTION

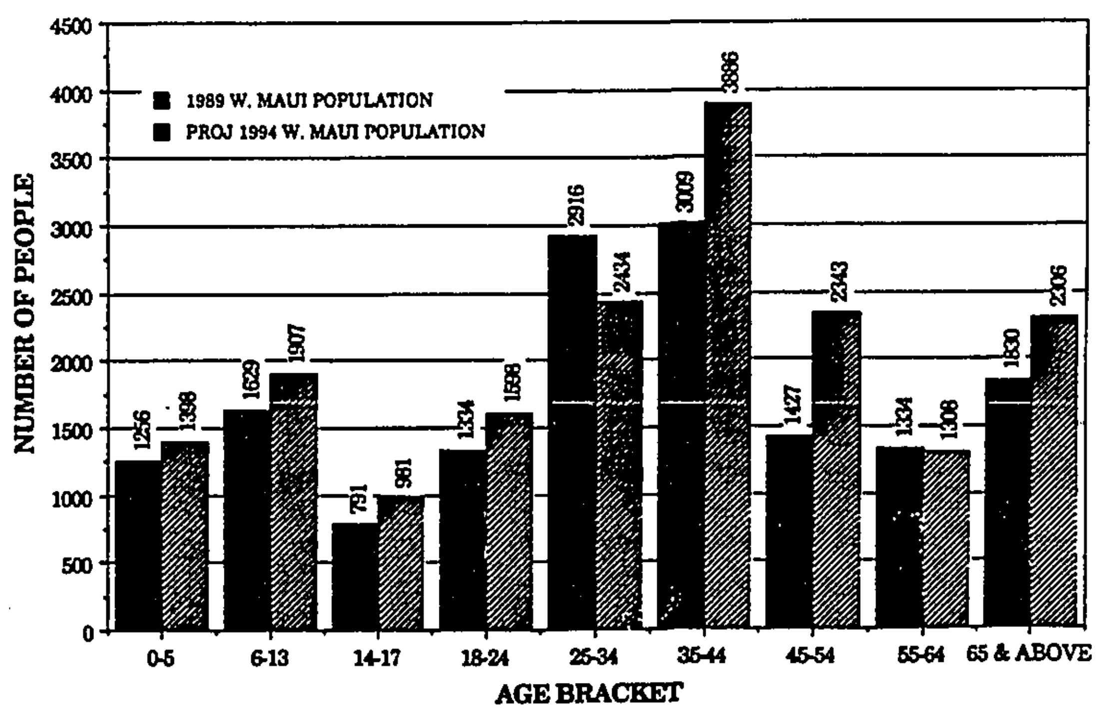

Figure IV-12

WEST MAUI HISTORICAL AND PROJECTED HOUSEHOLDS

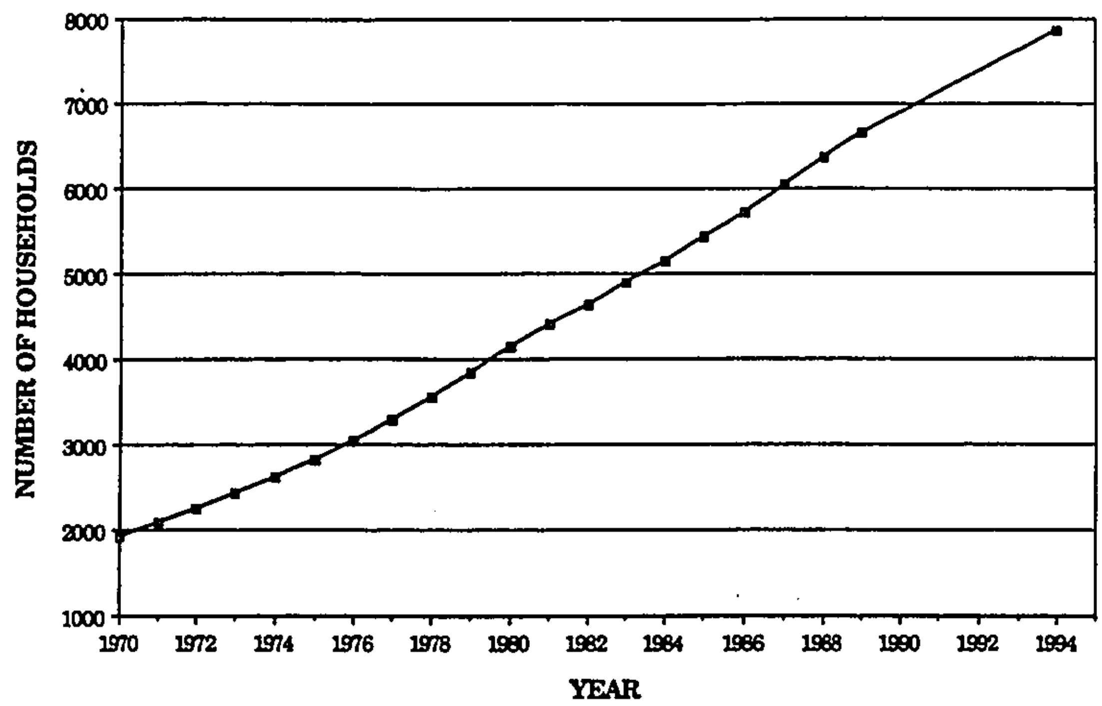

Figure IV-13

MAUI HISTORICAL AND PROJECTED HOUSEHOLDS

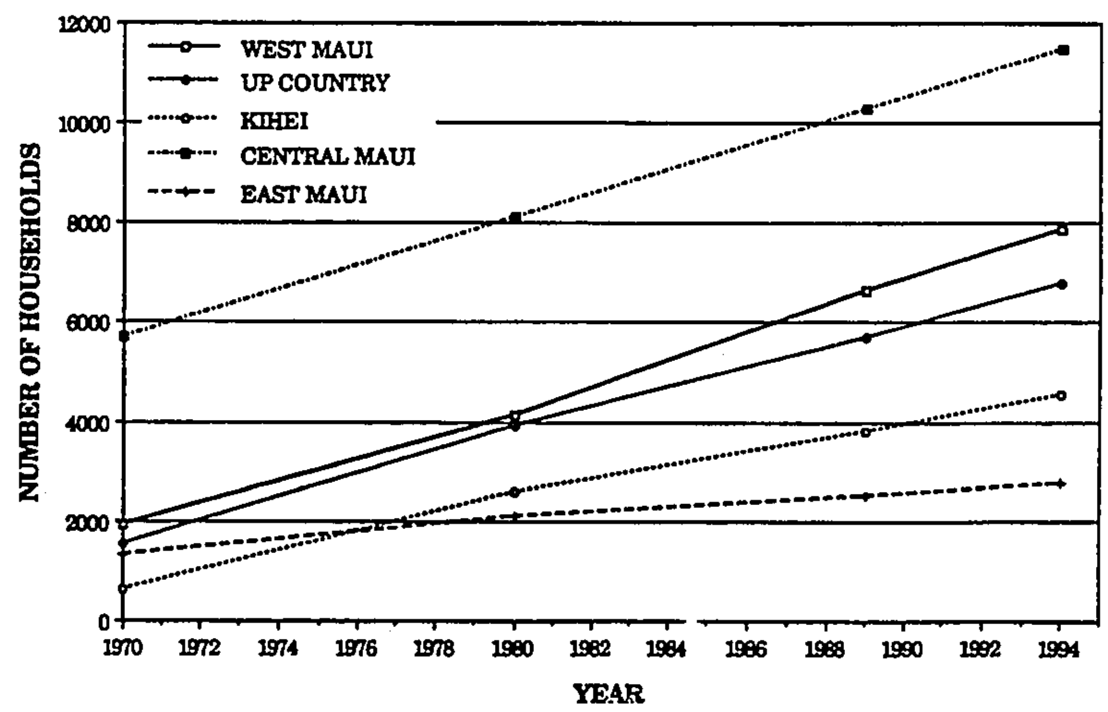

Figure IV-14

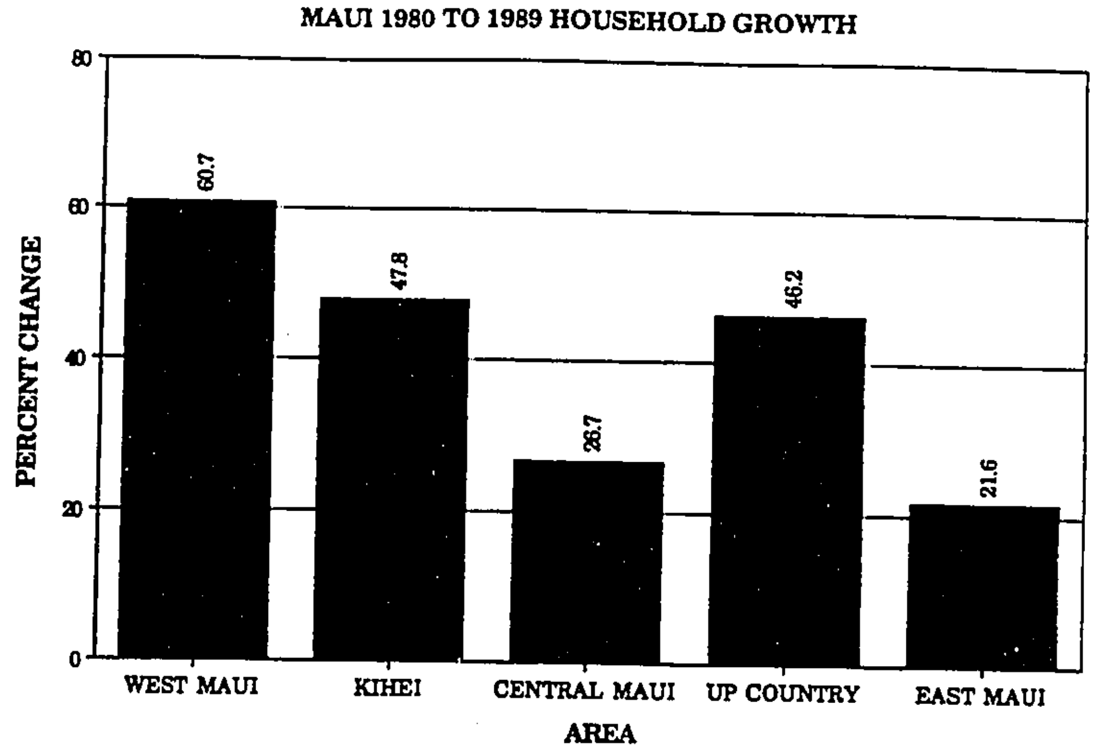

Figure IV-15

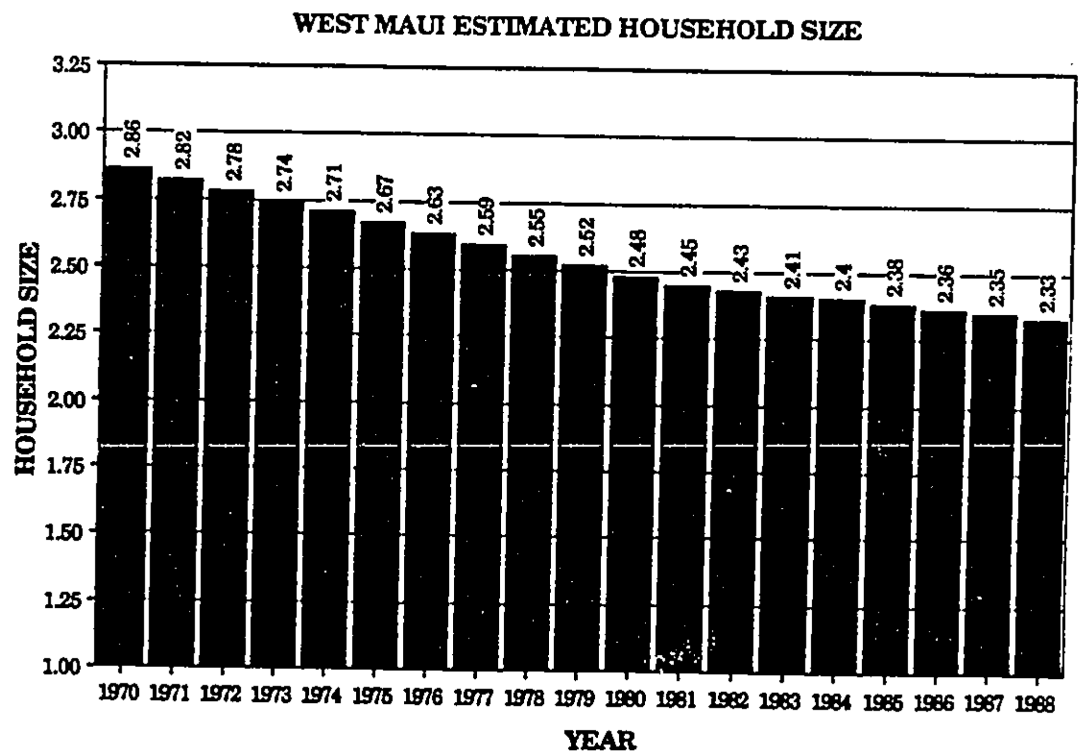

Figure IV-16

MAUI ISLAND HOUSEHOLD SIZE (SMS 1989 HOUSING SURVEY)

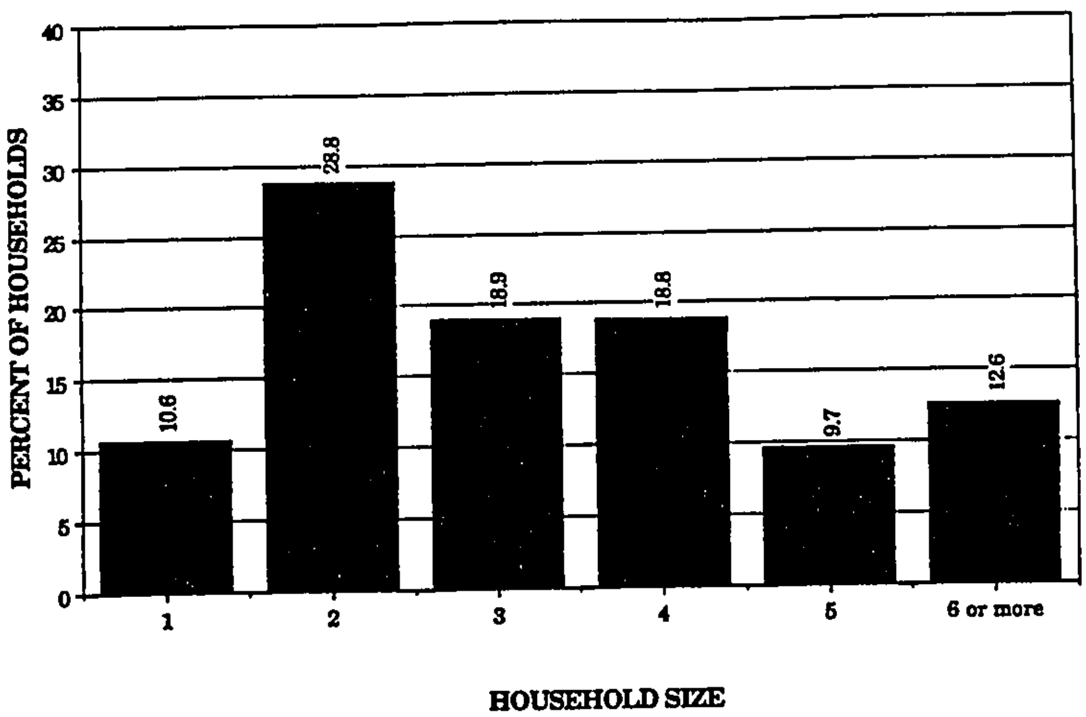

Figure IV-17

TABLE 2: EMPLOYMENT INDICATIONS FROM THE 1988 HAWAII STATE TOURISM IMPACT MANAGEMENT SURVEY

	STATE-WIDE	MAUI COUNTY	WEST MAUI
Civilian labor force (CLF) participation rate	69%	72%	83%
Female CLF participation rate	60%	67%	80%
Average number of hours worked weekly	41.5	42.3	44.4
% of respondents working over 48 hours weekly	22%	25%	35%
% working weekends and/or evenings			
Usually	47%	49%	63%
Sometimes	19%	18%	14%
Percent commuting over 40 minutes	13%	10%	5%
Job satisfaction			
% Very satisfied	57%	61%	60%
% Dissatisfied	11%	8%	5%
Average household size (1)	3.47	3.42	3.12
Average number of members employed	1.87	1.86	2.08
Average number employed in visitor industry	0.43	0.71	1.37
% Respondent households with member in visitor industry	26%	44%	71%
BASE	(3,904)	(1,057)	(158)

NOTE:
(1) Larger households are probably overrepresented in the survey. Estimates of household size can be used for comparative purposes.

SOURCE: Hawaii State Department of Business and Economic Development, Tourism Branch, 1989.

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 Figure IV-18

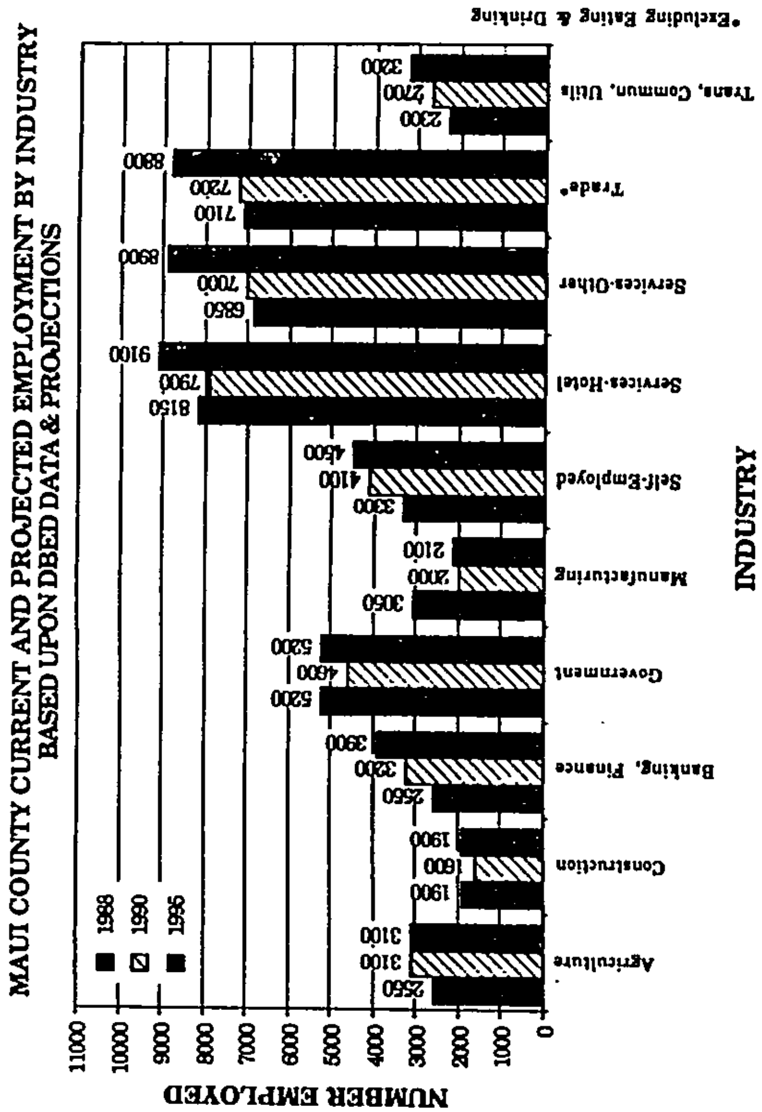

Figure IV-19

TABLE 3: VIEWS OF COMMUNITY LIFE FROM THE 1988 HAWAII STATE TOURISM IMPACT MANAGEMENT SURVEY

	STATE-WIDE	MAUI COUNTY	WEST MAUI
Quality of life, compared to 5 years ago			
BETTER	29%	32%	16%
WORSE	24%	31%	63%
% Thinking that item is a "Big Problem"			
Housing cost	64%	71%	83%
Traffic	56%	51%	87%
Cost food, clothing	43%	52%	66%
Population growth	38%	40%	49%
Crime	30%	22%	28%
New developments hurt natural beauty	25%	30%	44%
Crowded beach parks	23%	24%	19%
Not enough sports, rec. facilities	22%	25%	28%
Not enough stores, restaurants	14%	16%	13%
Problems, people with different backgrounds	9%	7%	9%
Too many tourists	7%	13%	21%
Reason for living in community			
Convenience	35%	33%	44%
Family, roots	23%	21%	23%
Uncrowded, little traffic	19%	20%	9%
Affordability	14%	11%	6%
Afraid to walk at night near home -- YES	30%	29%	26%
Are children nearby abused or neglected? -- YES	16%	12%	14%
BASE	(3,904)	(1,057)	(158)

SOURCE: Hawaii State Department of Business and Economic Development, Tourism Branch, 1989.

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Figure IV-20

MAUI ISLAND HISTORICAL & PROJECTED MEDIAN HOUSEHOLD INCOME

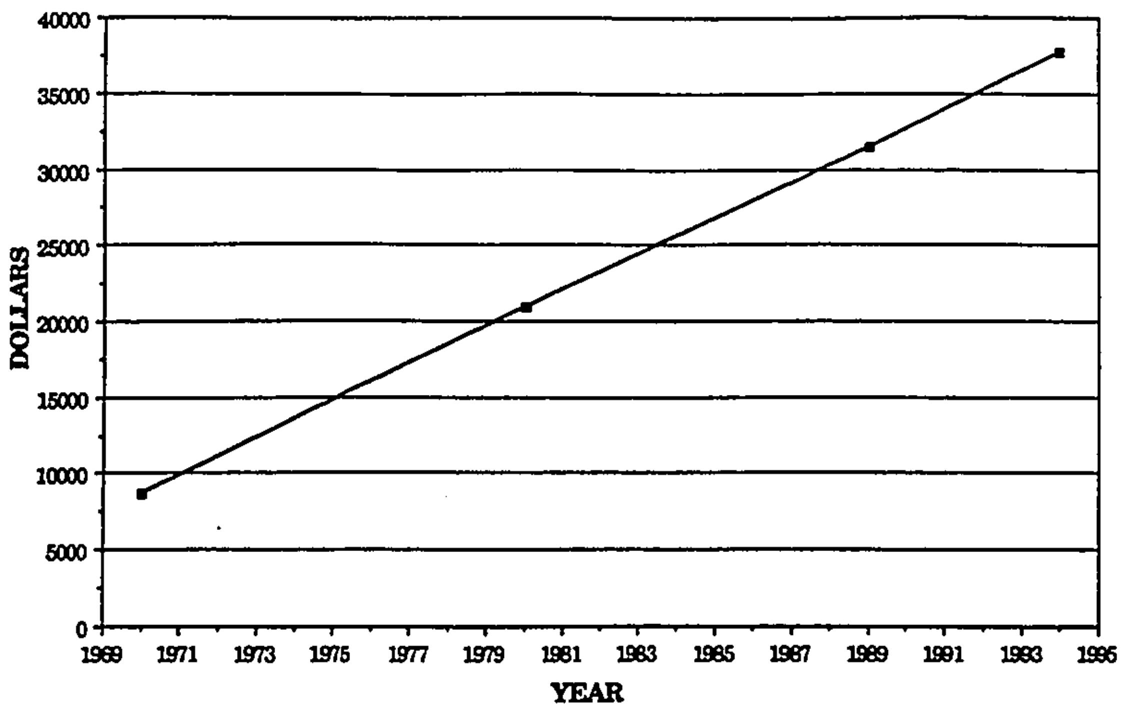


Figure V-1

MAUI HOUSEHOLD INCOME DISTRIBUTION BASED UPON 9/1989 ESTIMATE

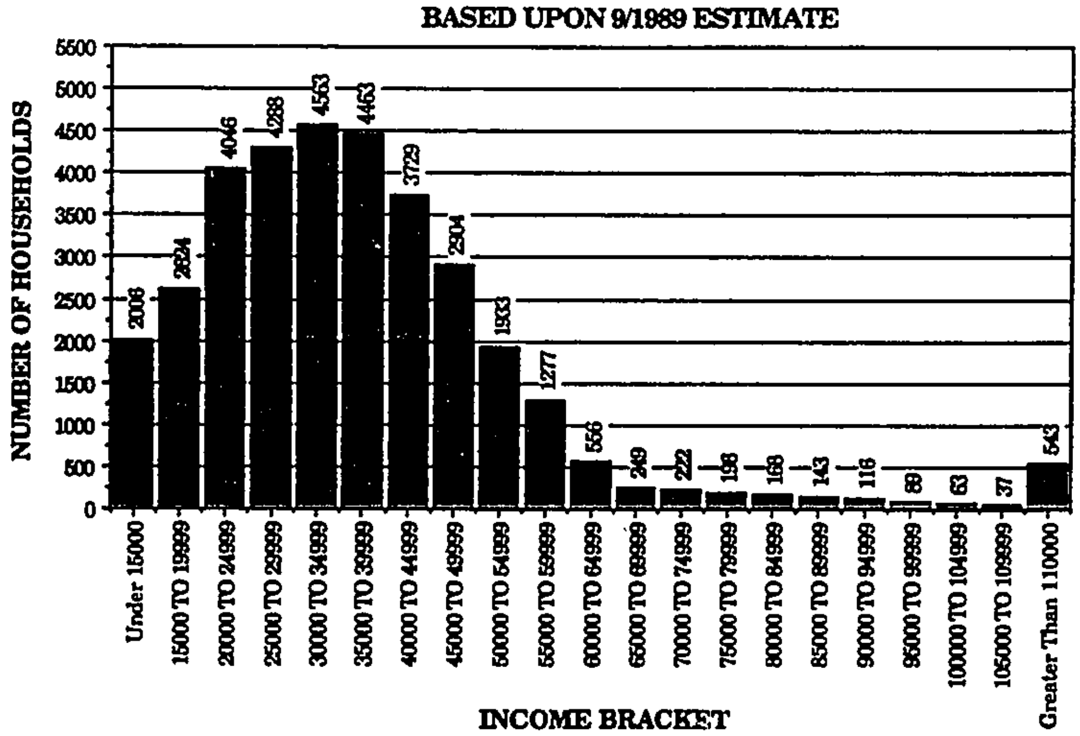


Figure V-2

MAUI HOUSEHOLD INCOME 1994 PROJECTED DISTRIBUTION

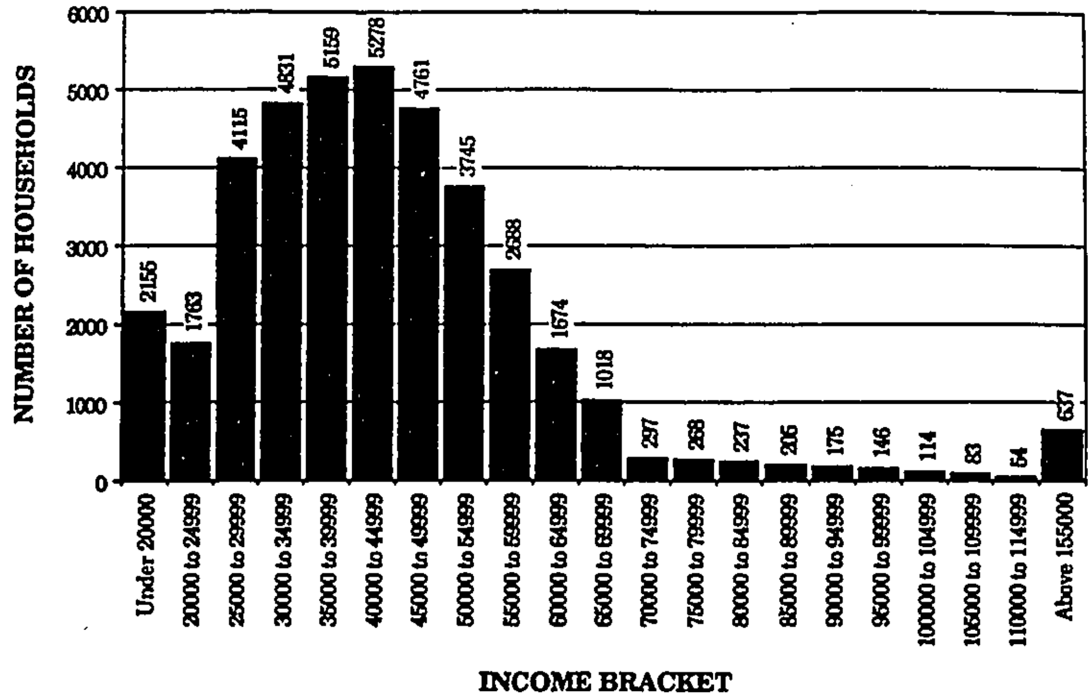


Figure V-3

MAUI RENTER HOUSEHOLD INCOME DISTRIBUTION
BASED UPON 9/1989 ESTIMATE

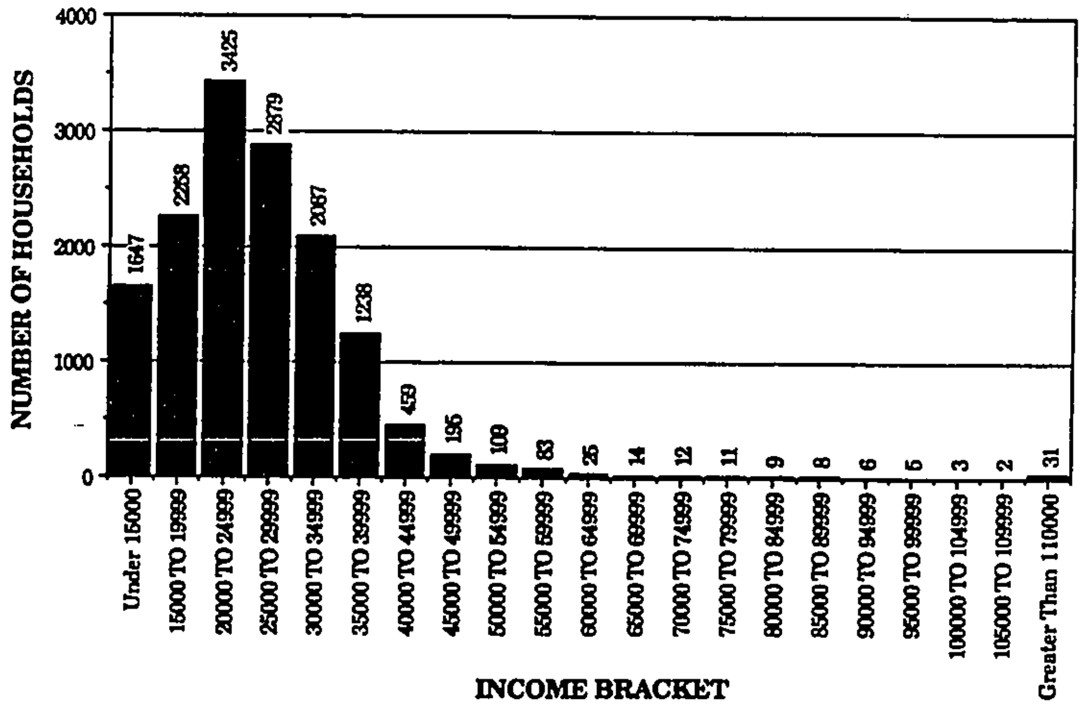


Figure V-4

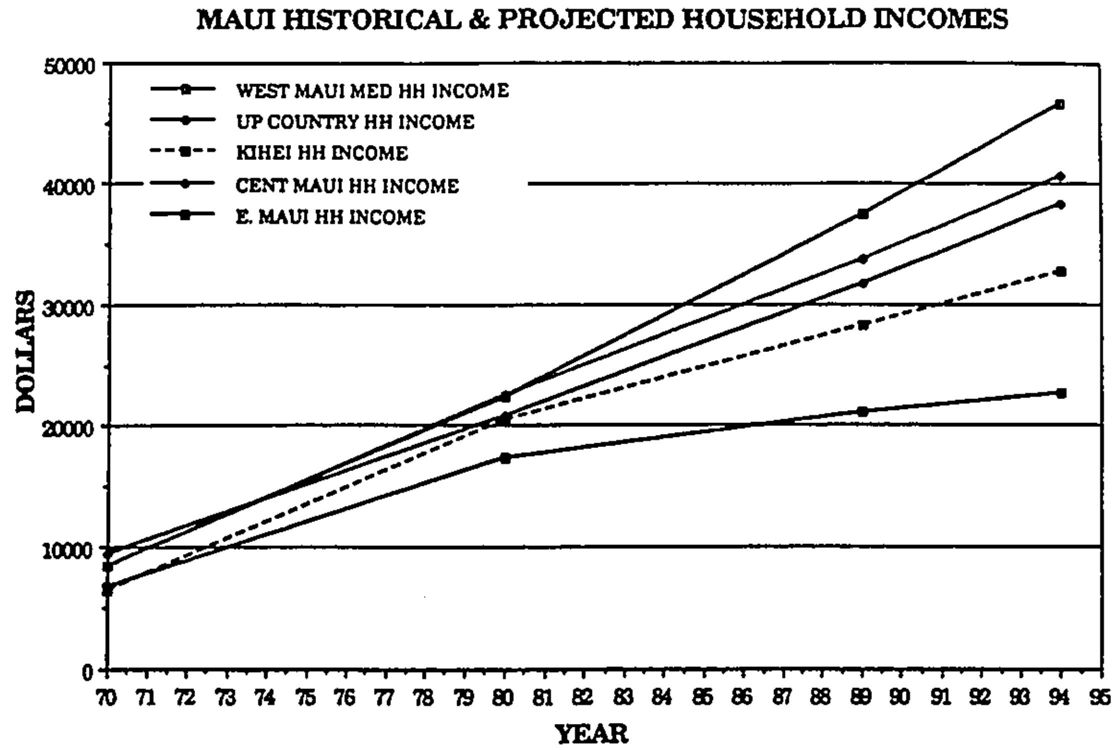


Figure V-5

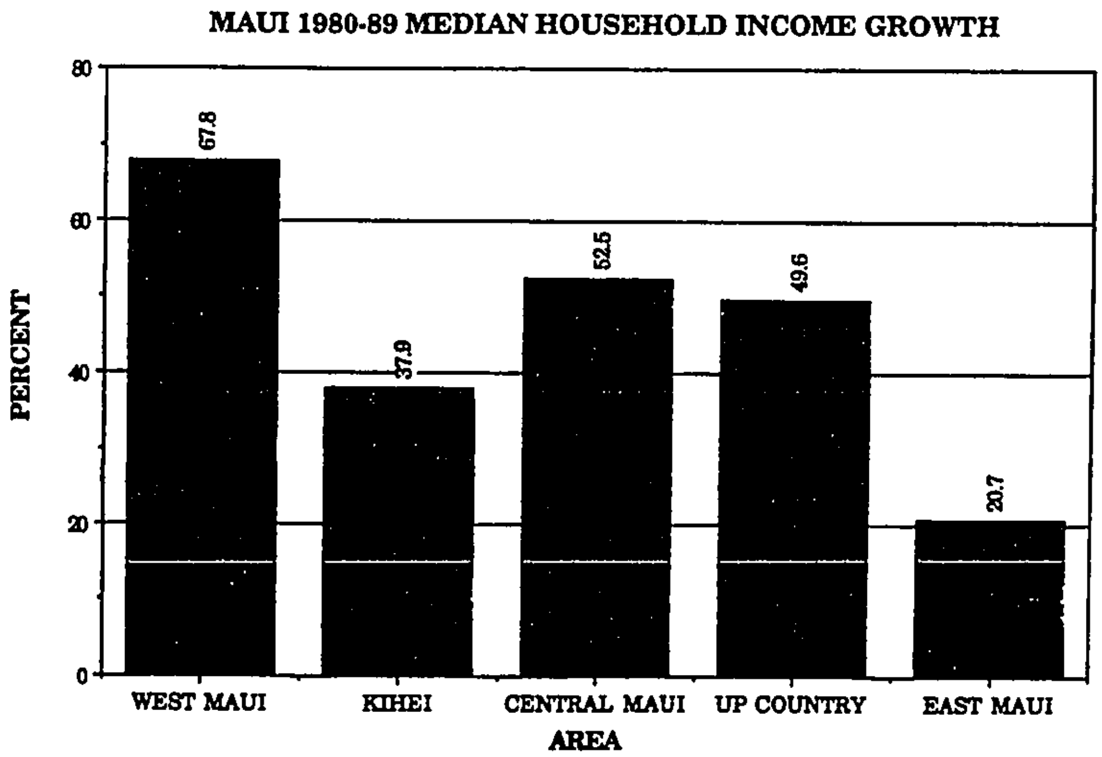


Figure V-6

WEST MAUI HOUSEHOLD INCOME DISTRIBUTION BASED UPON 9/1989 ESTIMATE

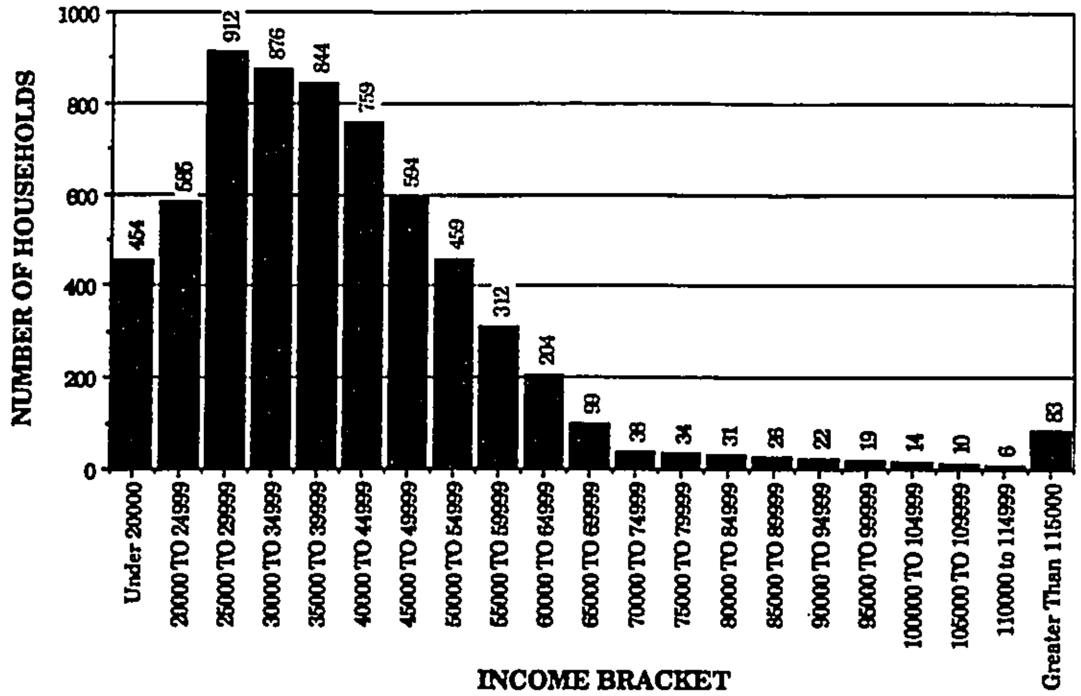


Figure V-7

WEST MAUI HOUSEHOLD INCOME 1994 PROJECTED DISTRIBUTION

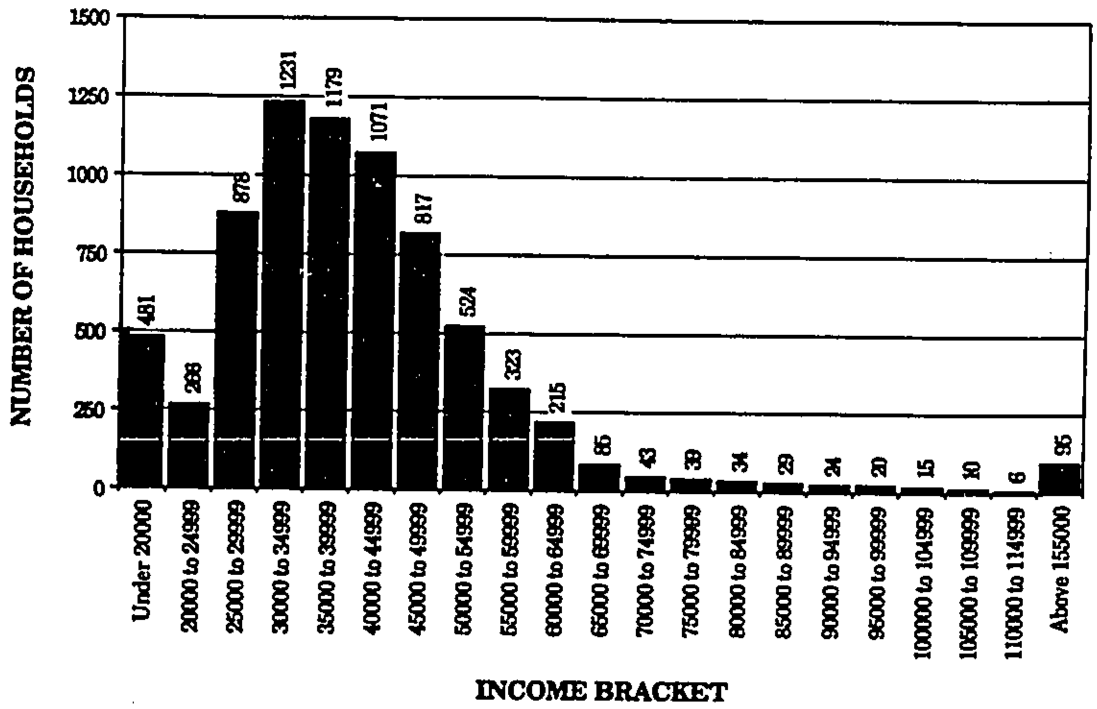


Figure V-8

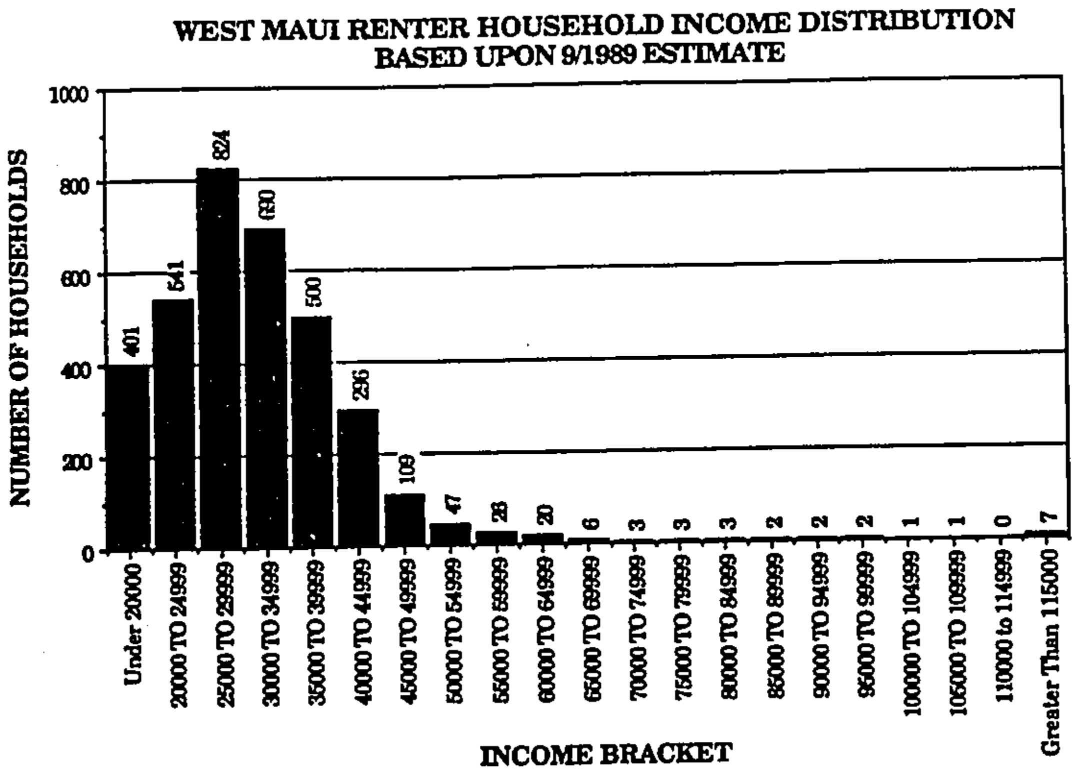

WEST MAUI RENTER HOUSEHOLD INCOME DISTRIBUTION
BASED UPON 9/1989 ESTIMATE
NUMBER OF HOUSEHOLDS
1000
800
600
400
200
0
401
541
824
690
500
296
109
47
28
20
6
3
3
3
2
2
2
1
1
0
7
Under 20000
20000 TO 24999
25000 TO 29999
30000 TO 34999
35000 TO 39999
40000 TO 44999
45000 TO 49999
50000 TO 54999
55000 TO 59999
60000 TO 64999
65000 TO 69999
70000 TO 74999
75000 TO 79999
80000 TO 84999
85000 TO 89999
90000 TO 94999
95000 TO 99999
100000 TO 104999
105000 TO 109999
110000 to 114999
Greater Than 115000
INCOME BRACKET

Figure V-9

Table 1: Income Housing Data Comparisons

	Tourism "Density" (Ratio of Visitor Units To Adult Pop)			Workers in Household		
	Low	Medium	High	No Workers At All	Workers, But Not Tourism	1+ Tourism Workers
1987 Median Income	$32,400	$29,000	$29,500	$21,000	$33,100	$32,000
% of Income:						
Under $20,000*	25%	33%	29%	48%	25%	24%
Over $50,000*	23%	19%	17%	6%	25%	22%
Avg. No. Workers Per Household**	1.92	1.82	1.67	N/A	1.91	2.6
Avg. HH Size**	3.64	3.33	2.83	2.06	3.49	4.07
Avg. No. Children	0.98	0.89	0.68	0.32	0.97	1.08
% of HH's With at Least 1 Child	49%	41%	32%	14%	49%	52%
% Children Who Are Respondents Own	78%	79%	79%	94%	81%	70%
% of HH's With at Least 1 Non-Relative	10%	11%	22%	4%	10%	18%
% Saying Someone Would Move Out if Housing Cheaper	30%	27%	26%	8%	28%	39%
% Living Apartment	15%	39%	41%	32%	23%	25%
% Townhouse	12%	3%	4%	4%	11%	6%
% Single Family	73%	58%	54%	63%	67%	69%
% Owning Unit	59%	49%	49%	63%	55%	51%
% Renting	35%	49%	47%	35%	39%	45%
% Occupying Without Cash Rent	6%	2%	2%	1%	6%	3%
Median Monthly Housing Cost:						
Including People Who Pay $0	$480	$430	$500	$125	$510	$480
Excluding People Who Pay $0	$600	$490	$590	$415	$590	$540

* Percentages adjusted to exclude those who refused or were unsure

** Household surveys tend to overestimate average household size, since small households are less likely to have someone at home to be interviewed. The statewide average HH size for this survey was 3.47, compared to typical planner estimates of 3.0. One solution could be to apply and 86.5% adjustment factor to the survey figures.

Table VI-A

Table 2: Average Number of Employed Household Members by Household Income and Type of Worker in Household

1987 Household Income	Workers but not Tourism	1 or More Tourism Workers
Under $10,000	1.46	2.12
$10,000 to $20,000	1.52	1.8
$20,000 to $30,000	1.74	2.09
$30,000 to $40,000	1.81	2.38
$40,000 plus	2.07	2.7

Table VI-B

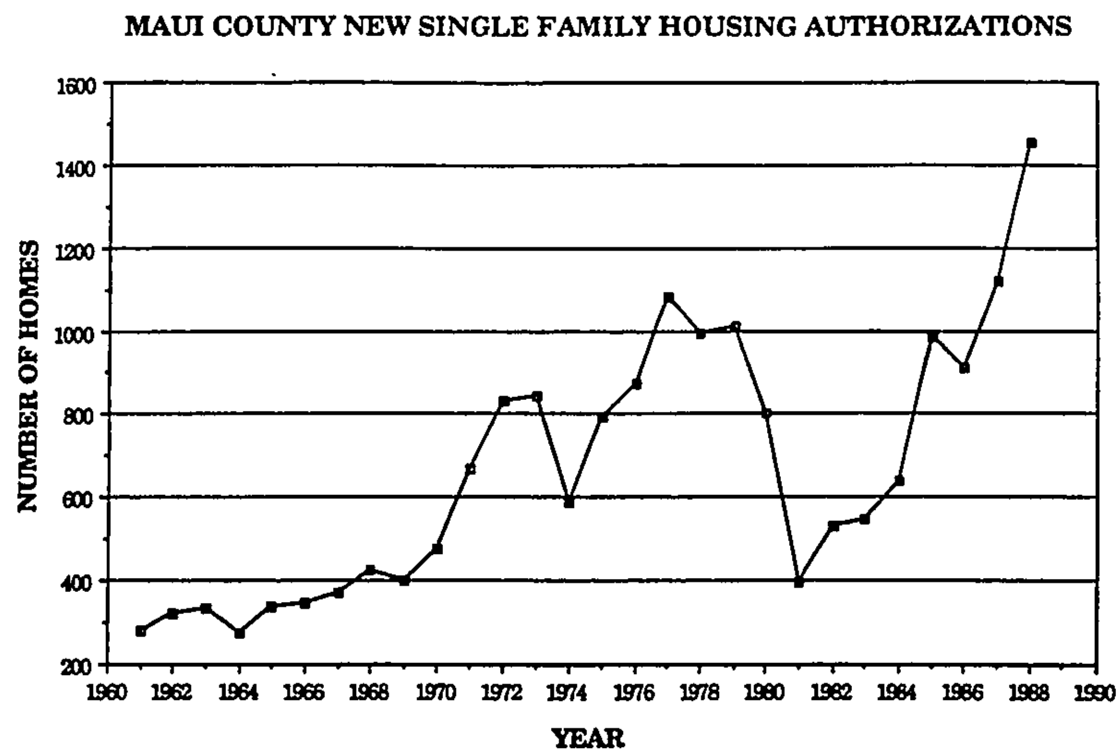


Figure VI-1

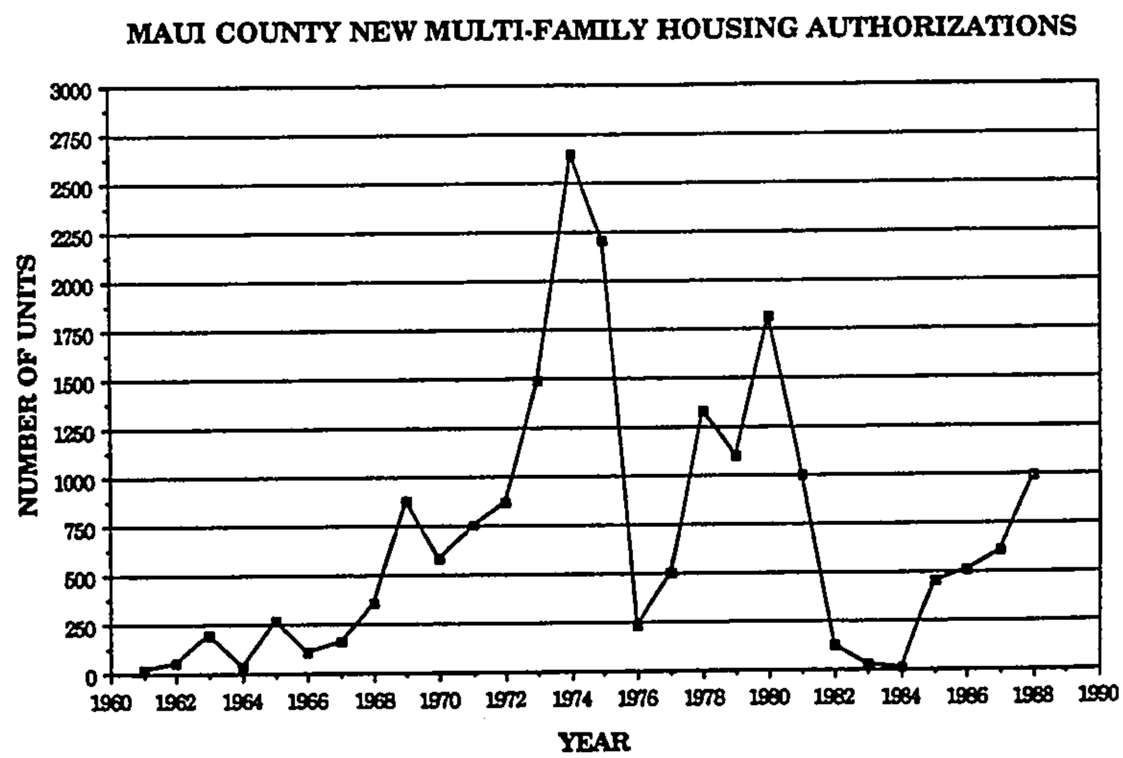


Figure VI-2

MAUI RESIDENT & RESORT HOUSINGS UNITS
BASED UPON TMK CONDO GUIDE

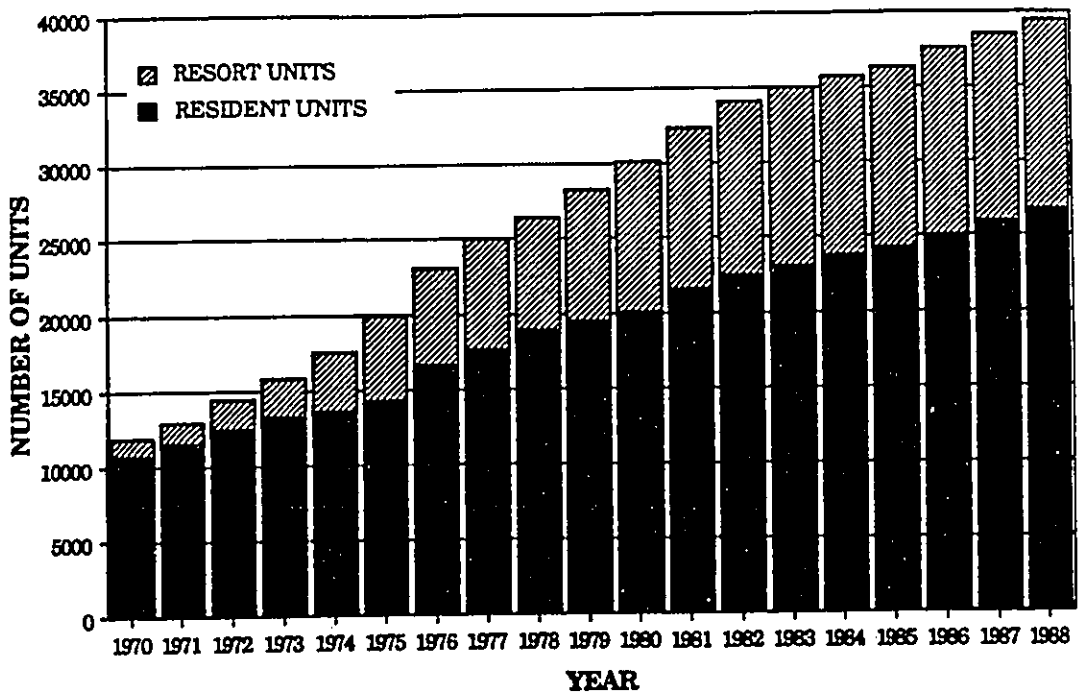


Figure VI-3

WEST MAUI RESIDENT & RESORT HOUSING UNITS
BASED UPON TMK CONDO GUIDE

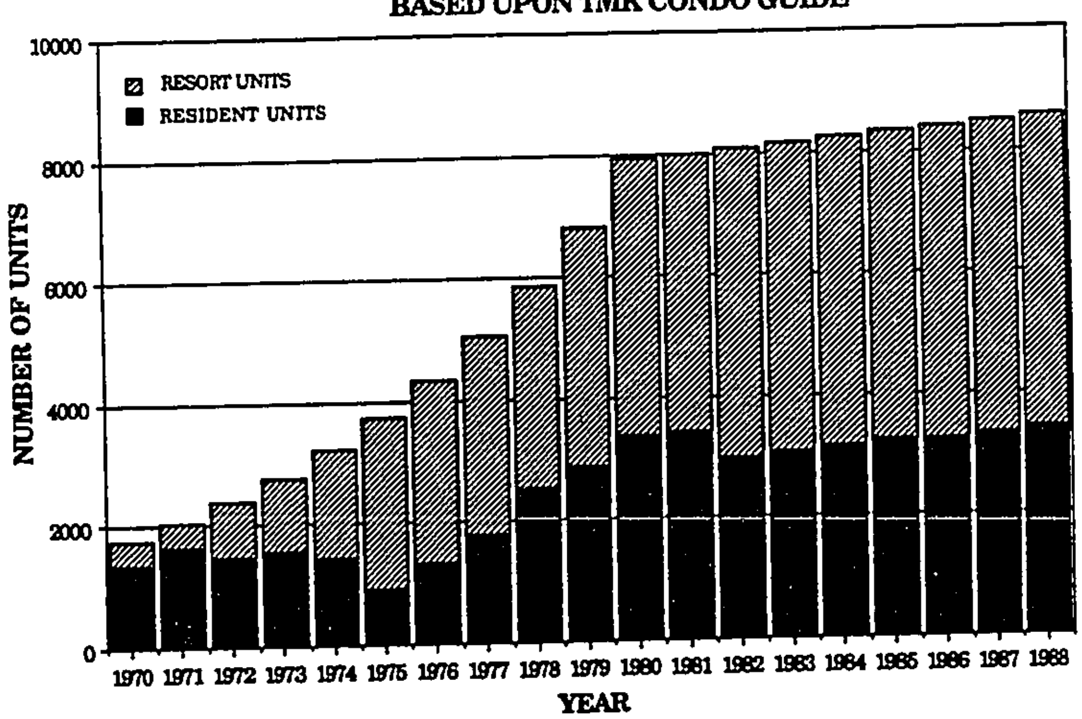


Figure VI-4

MAUI SINGLE FAMILY MLS LISTINGS AS OF MID-YEAR

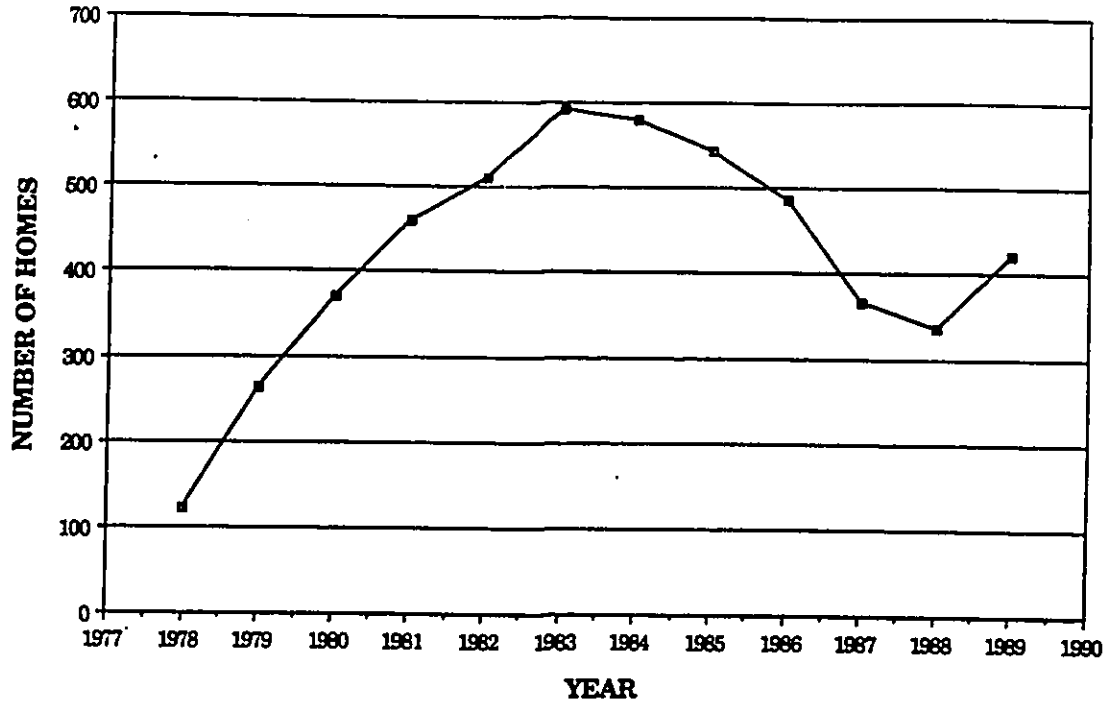


Figure VI-5

MAUI SINGLE FAMILY AVERAGE SOLD MARKET TIME BASED UPON MLS RESALES

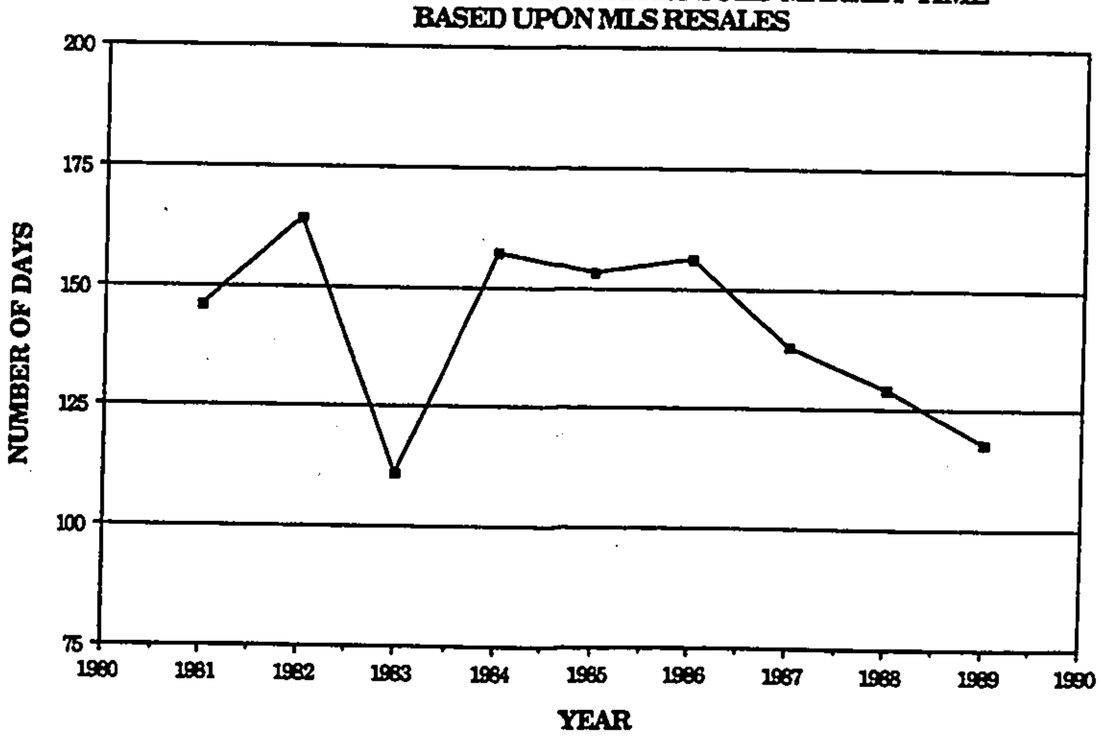


Figure VI-6

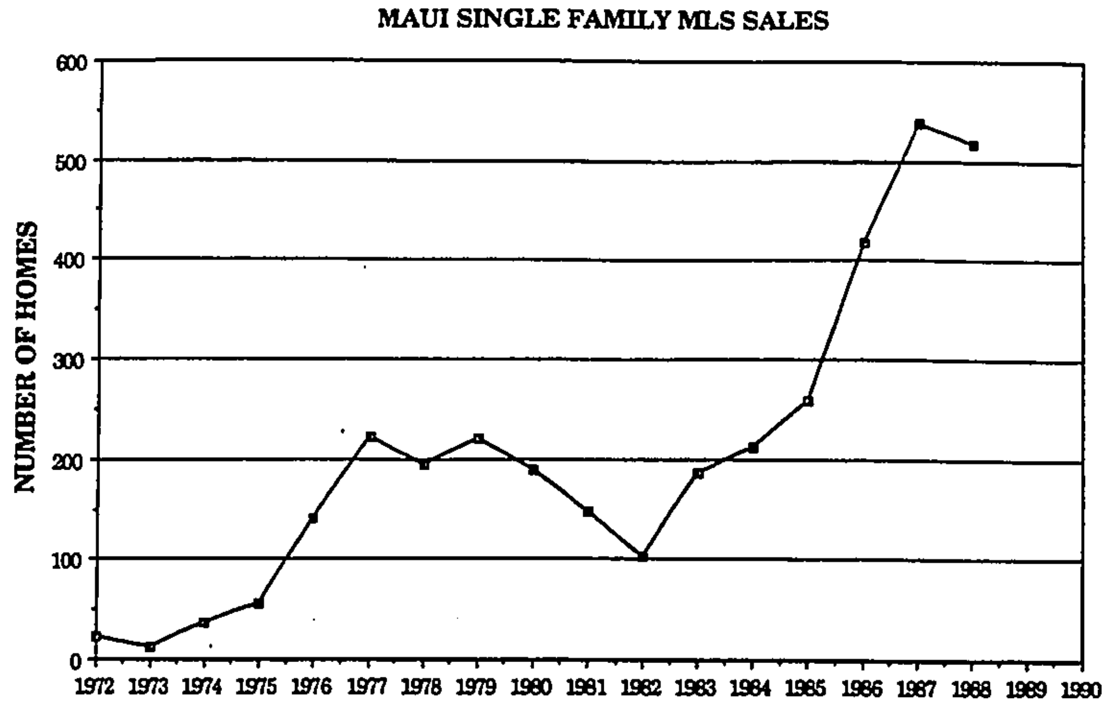


Figure VI-7

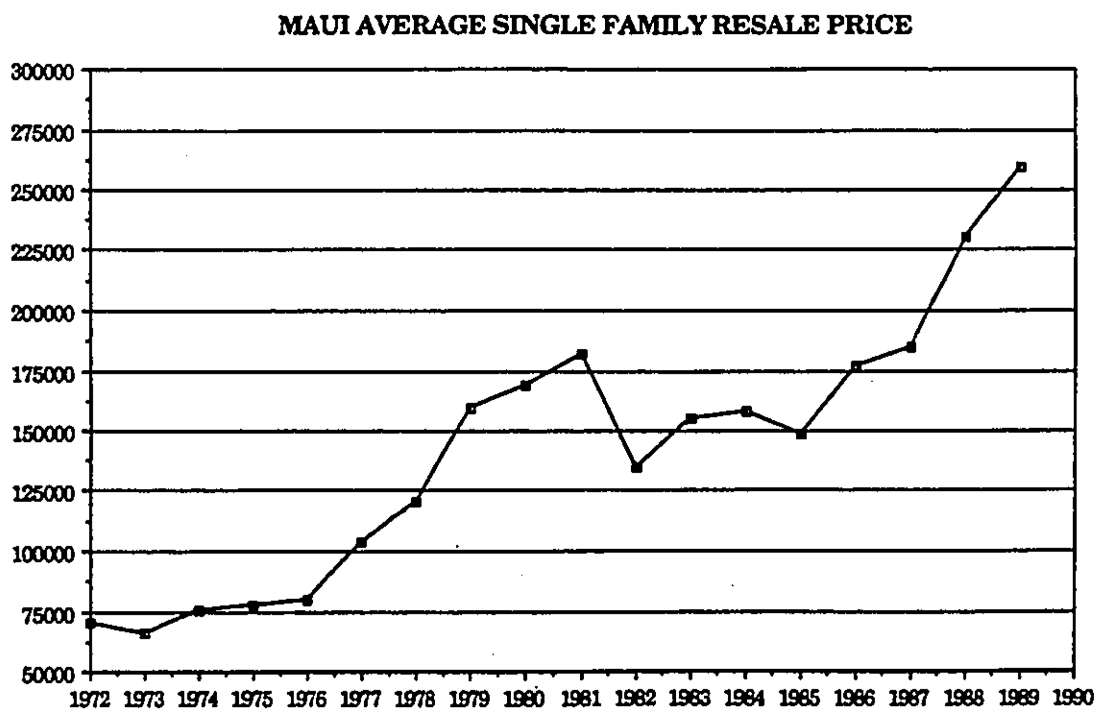


Figure VI-8

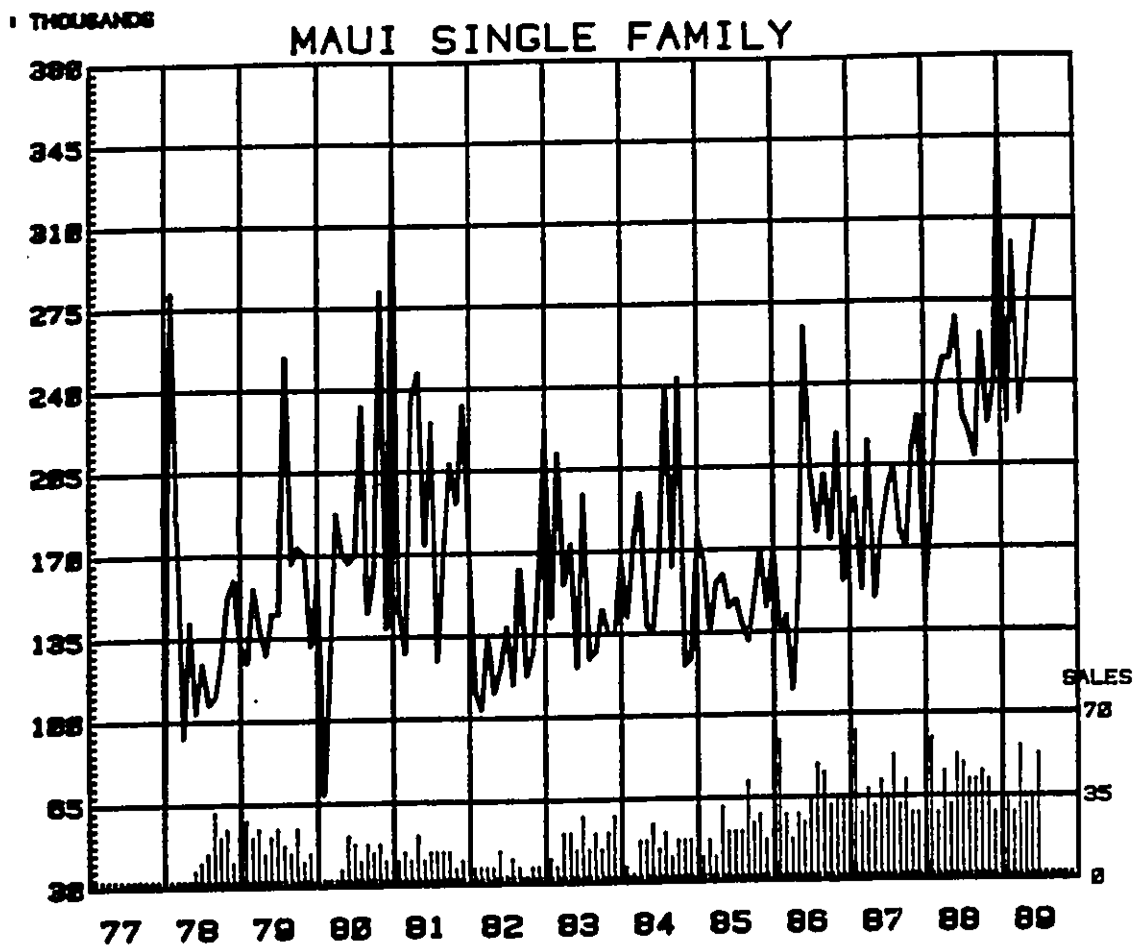


Figure VI-9

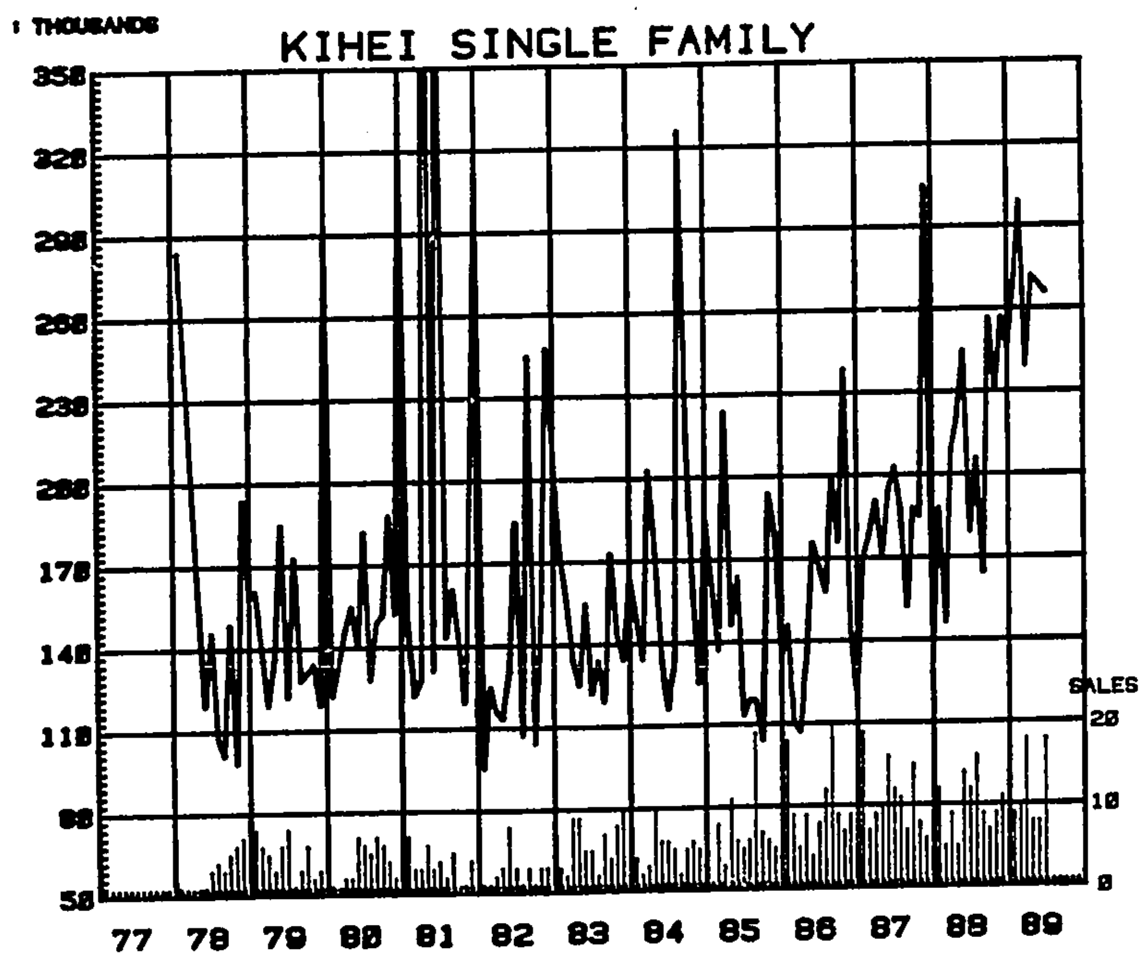


Figure VI-10

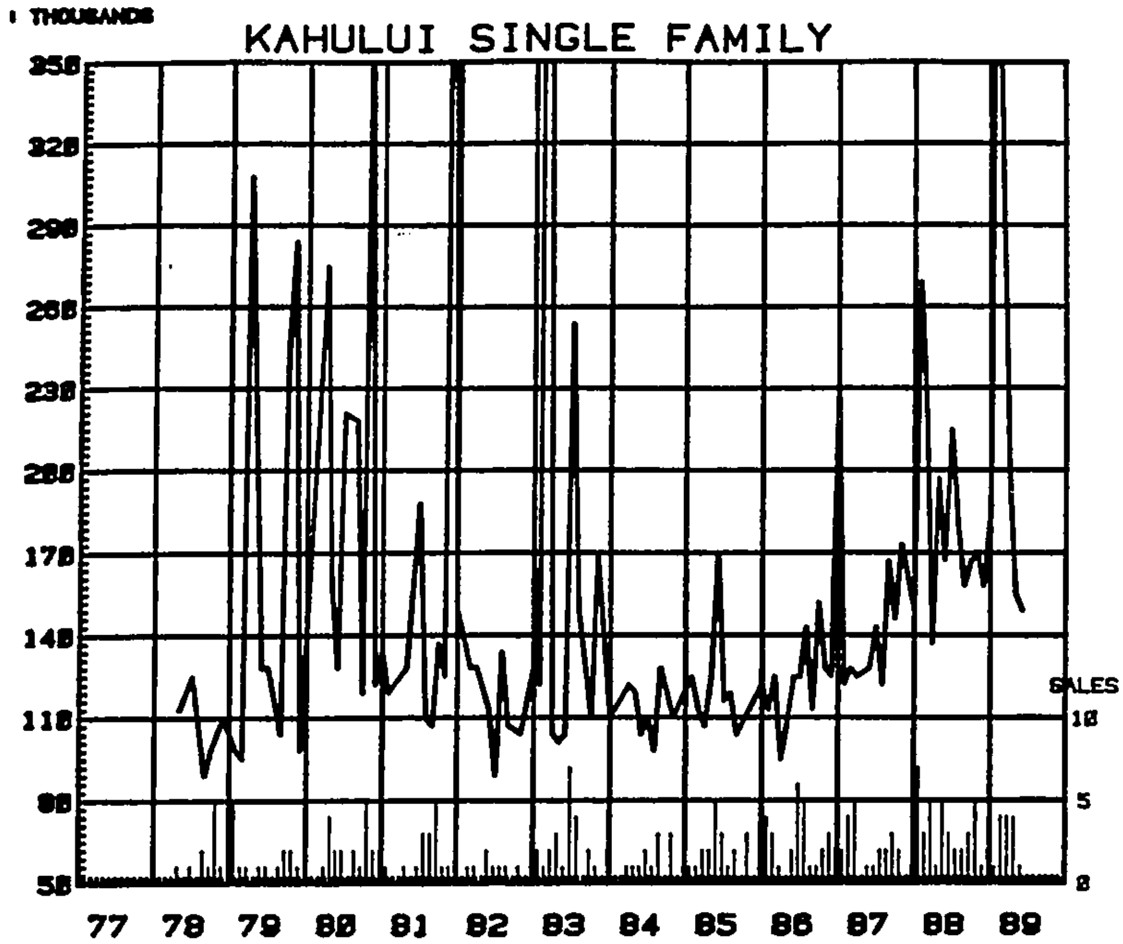


Figure VI-11

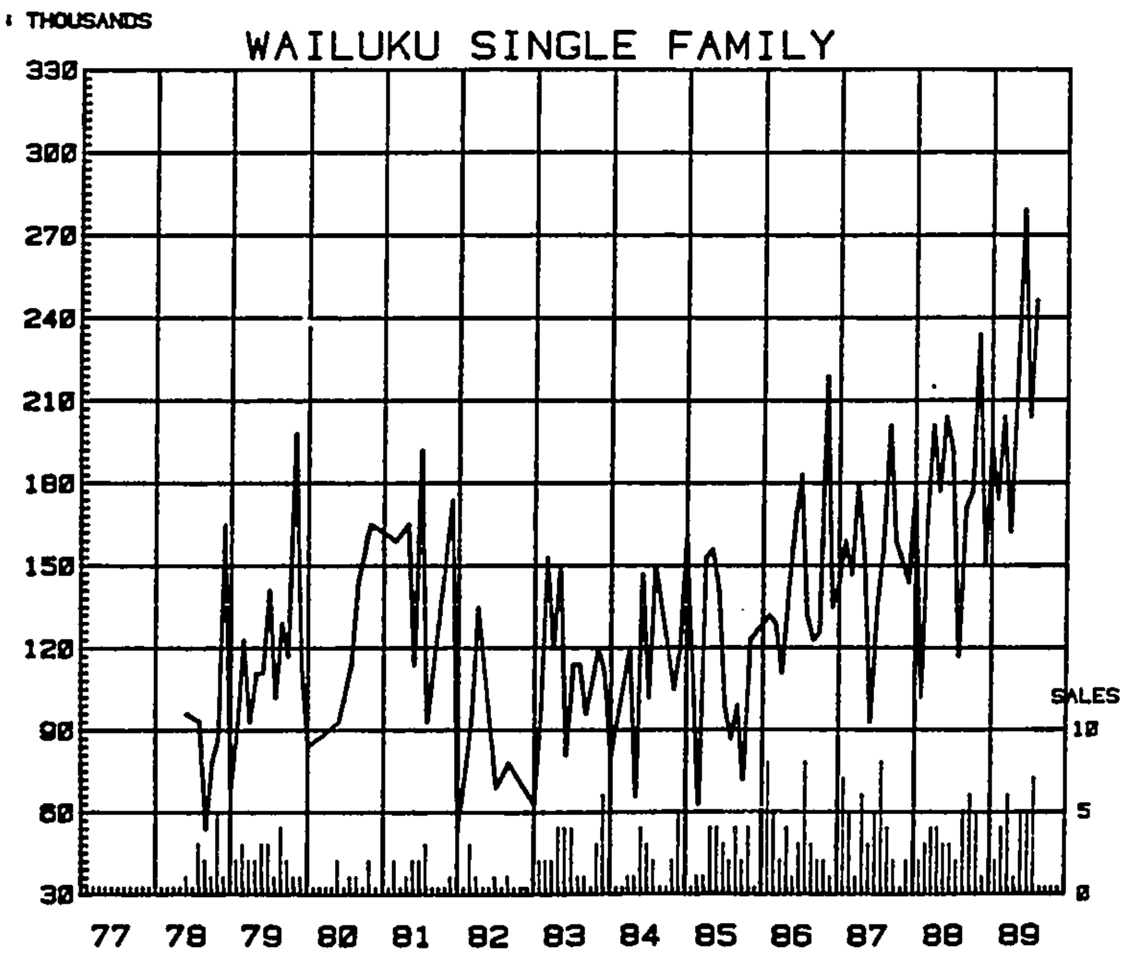


Figure VI-12

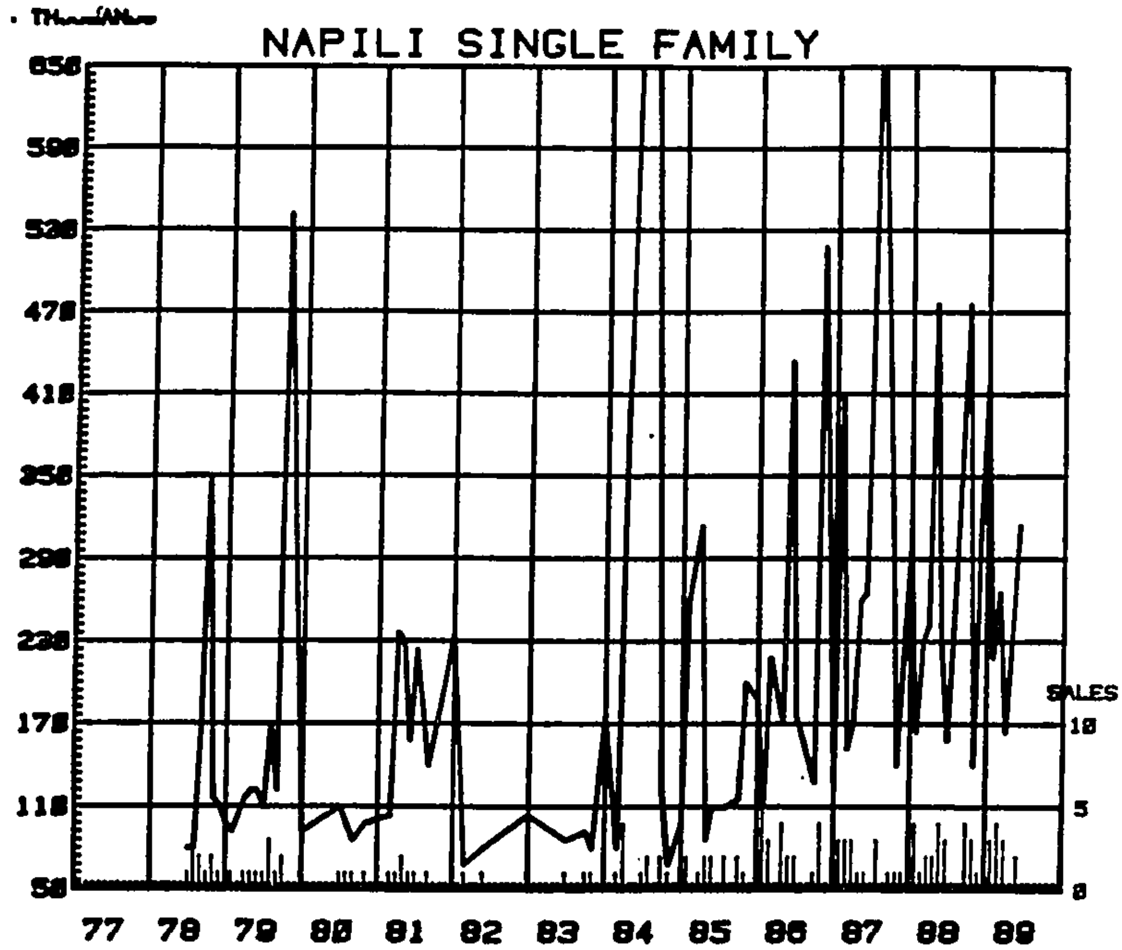


Figure VI-13

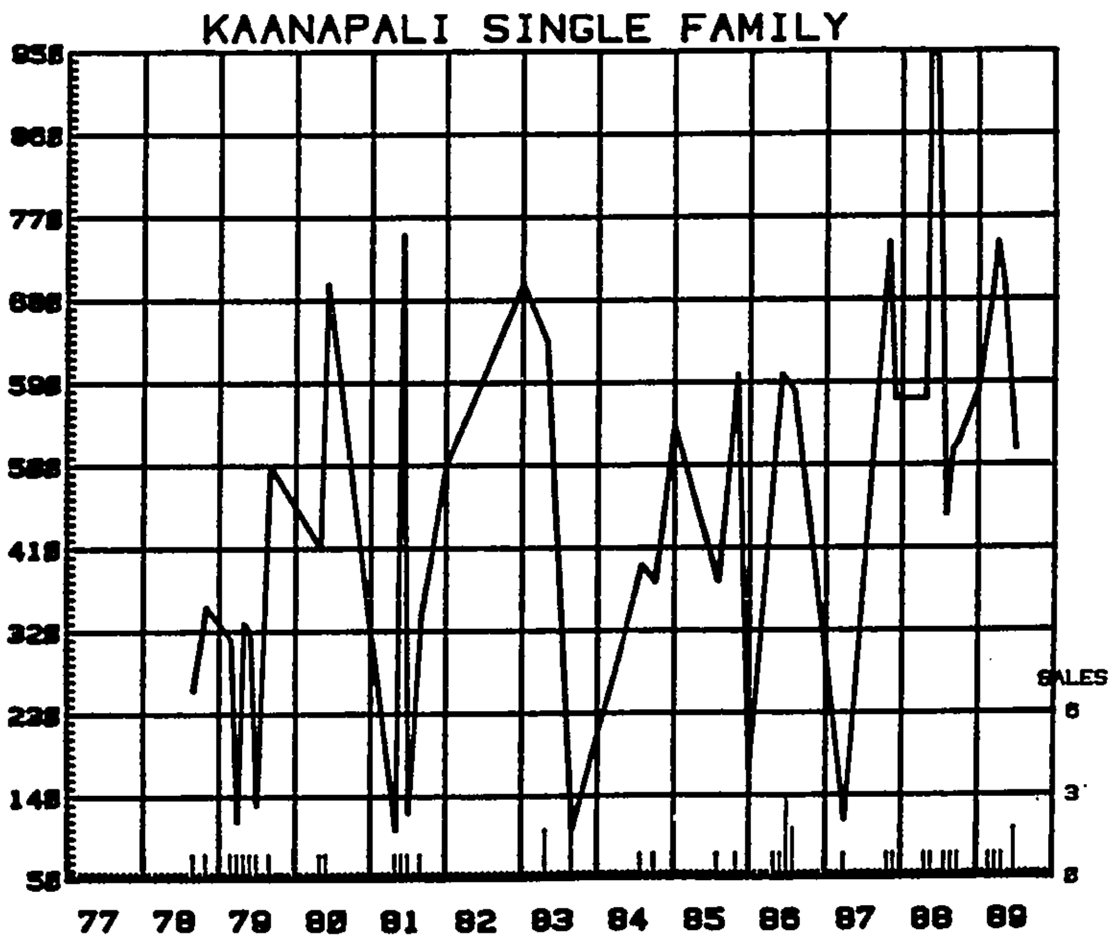


Figure VI-14

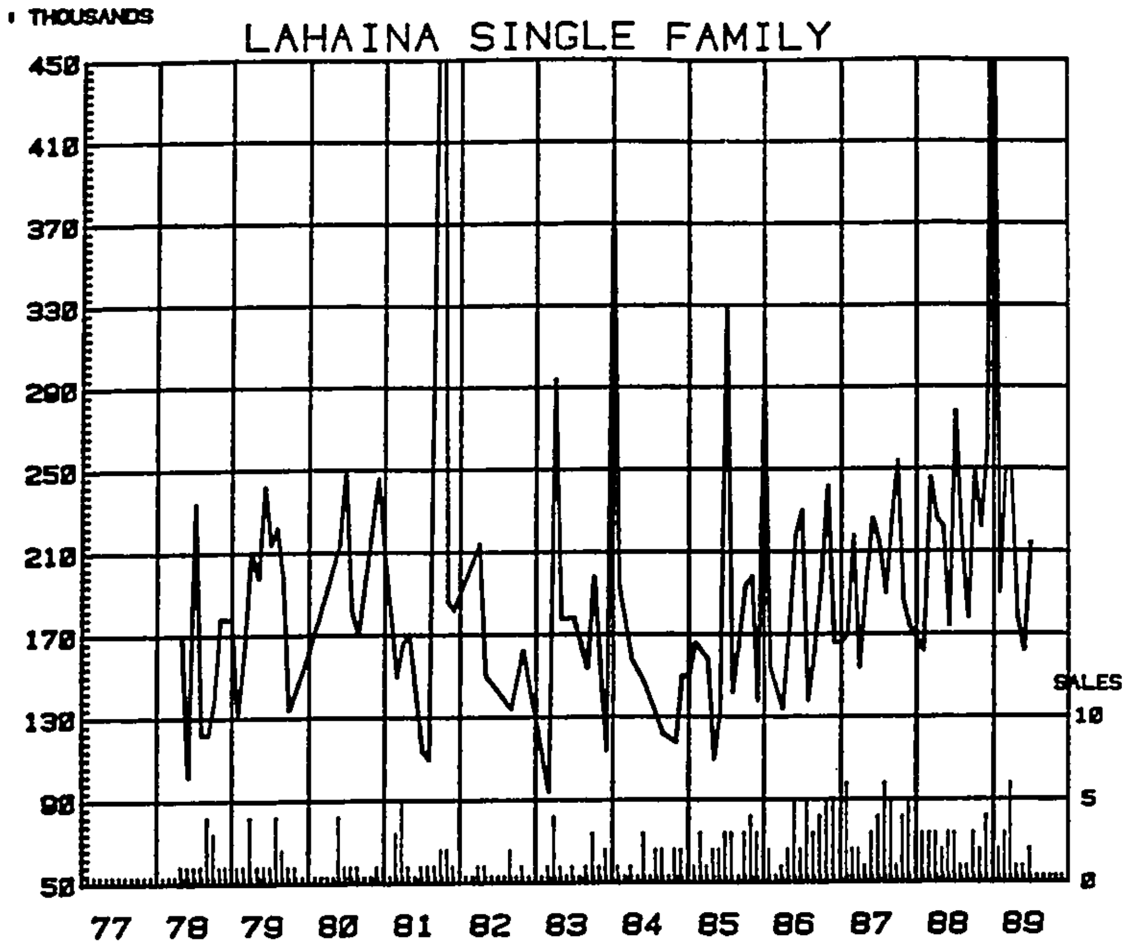


Figure VI-15

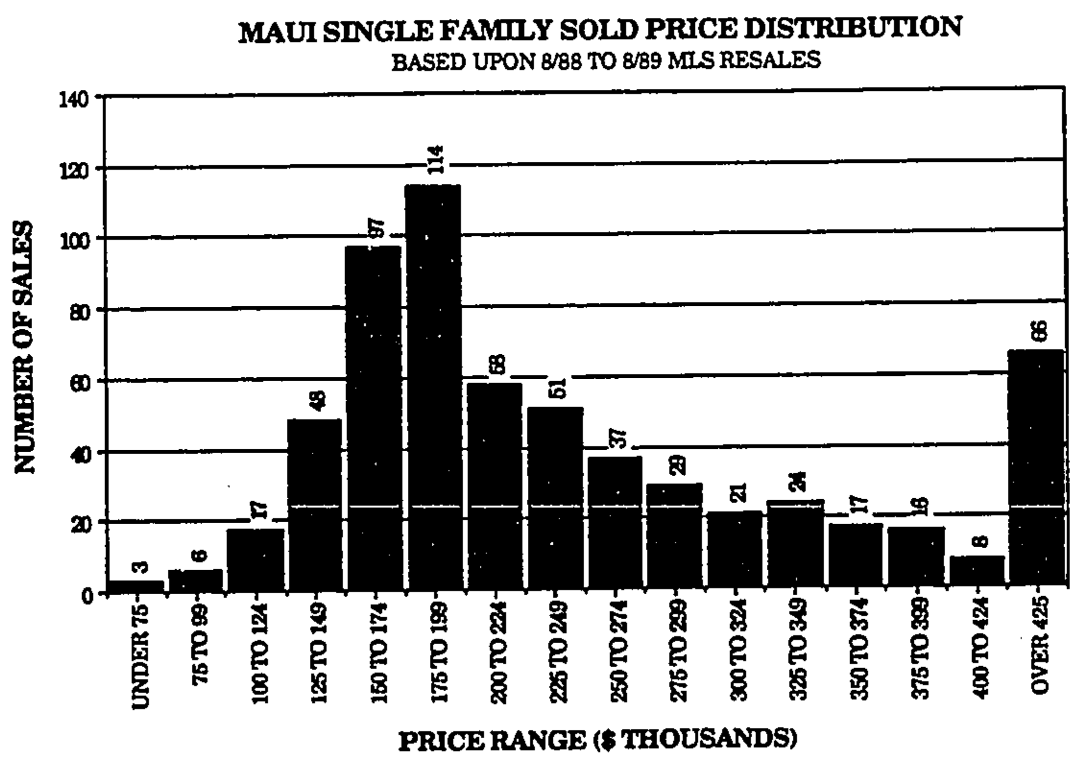


Figure VI-16

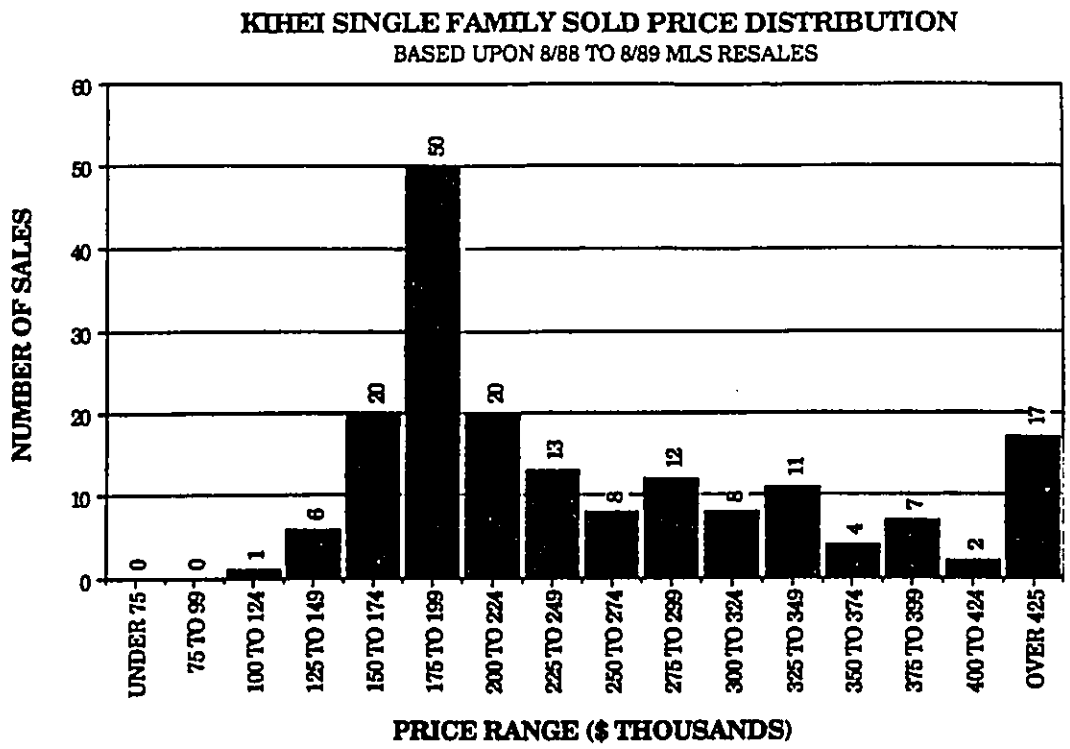


Figure VI-17

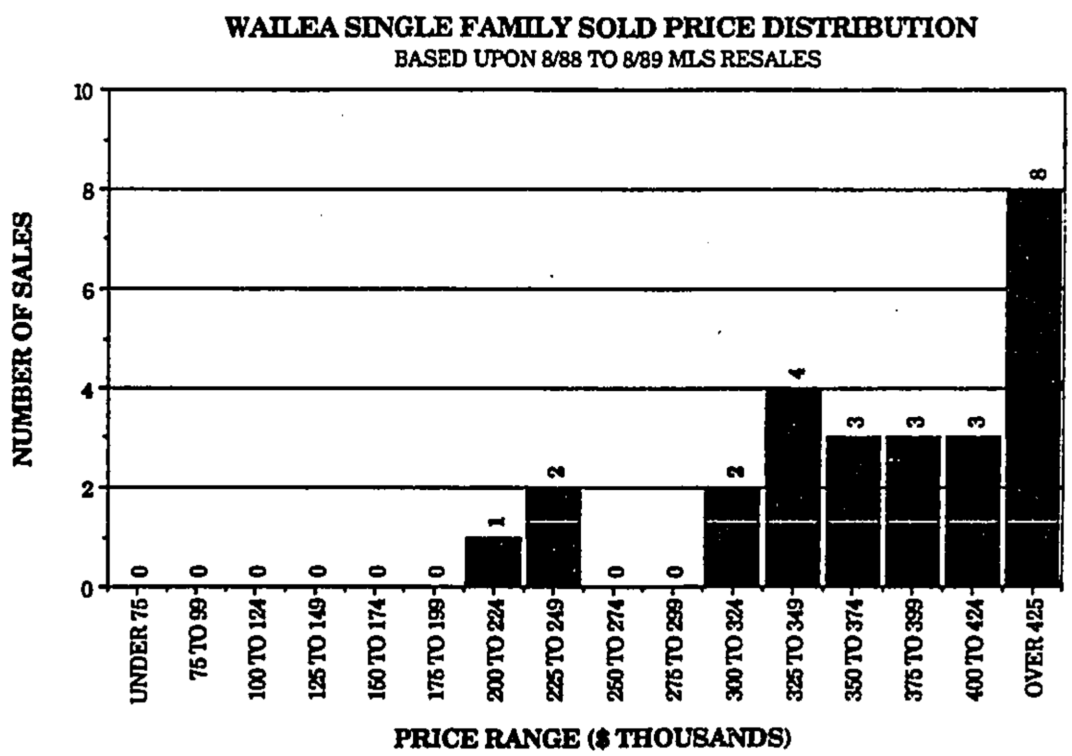


Figure VI-18

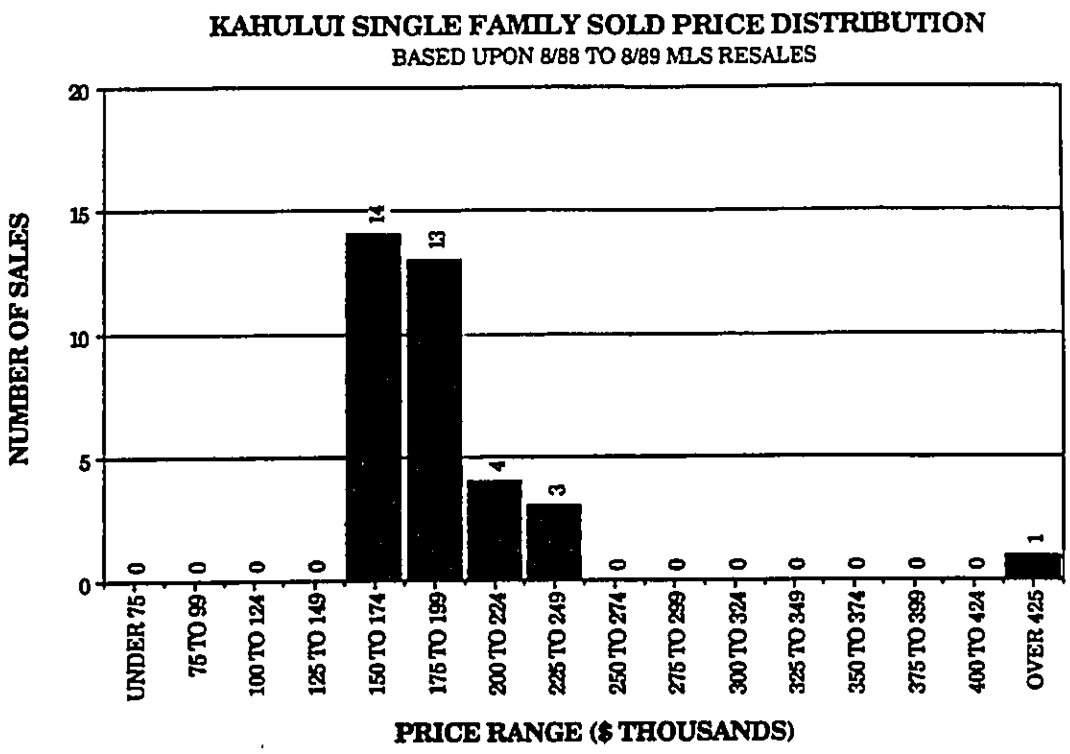


Figure VI-19

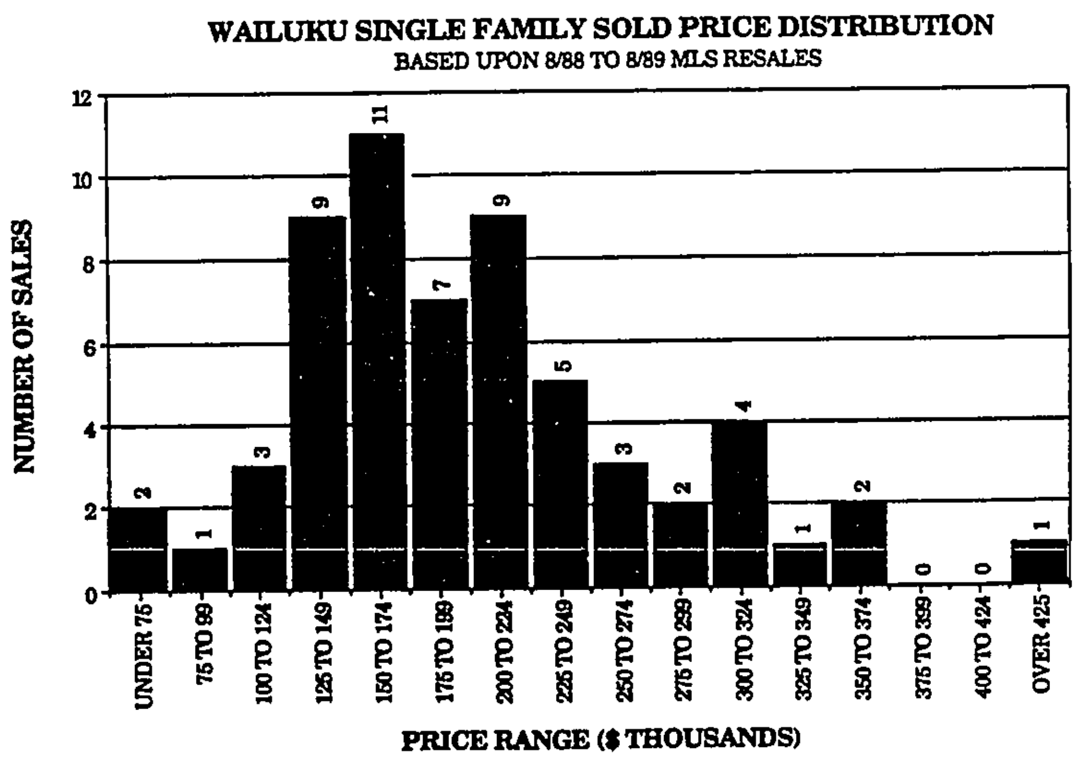


Figure VI-20

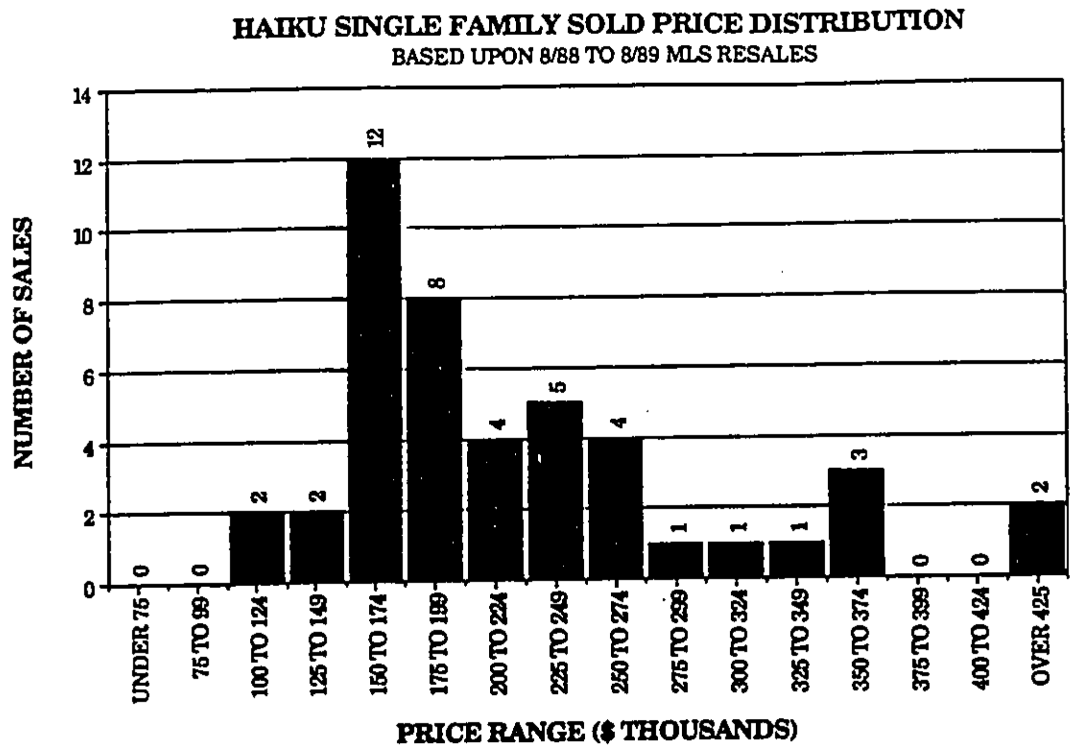


Figure VI-21

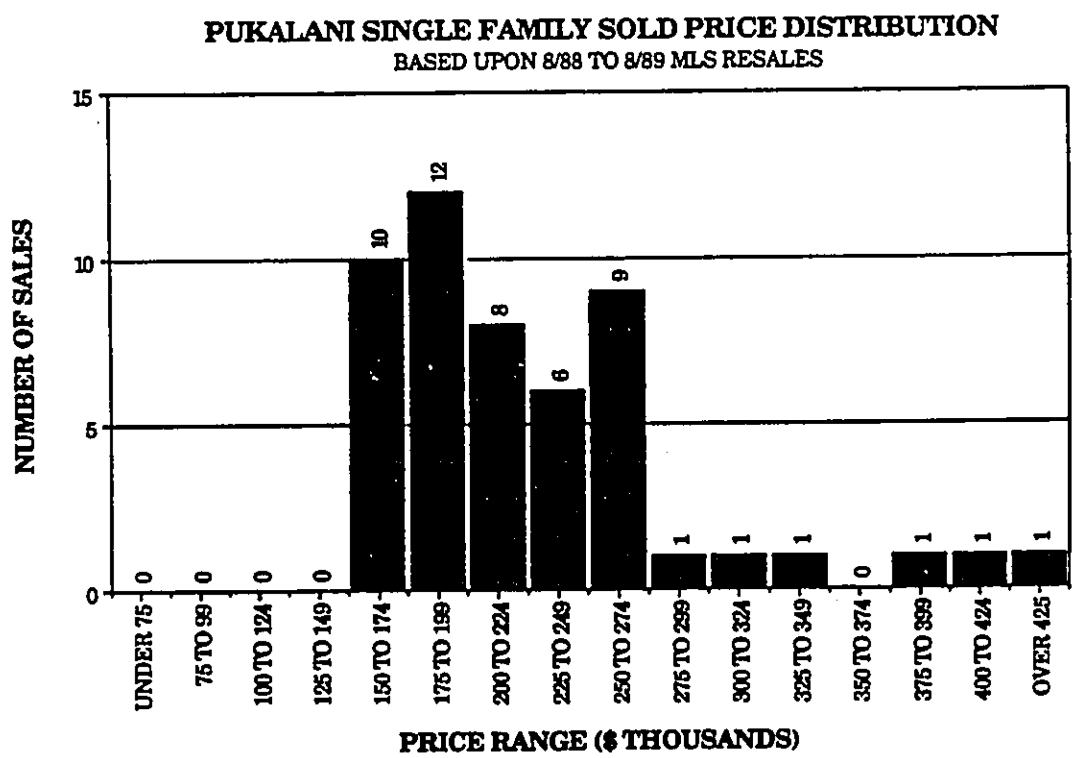


Figure VI-22

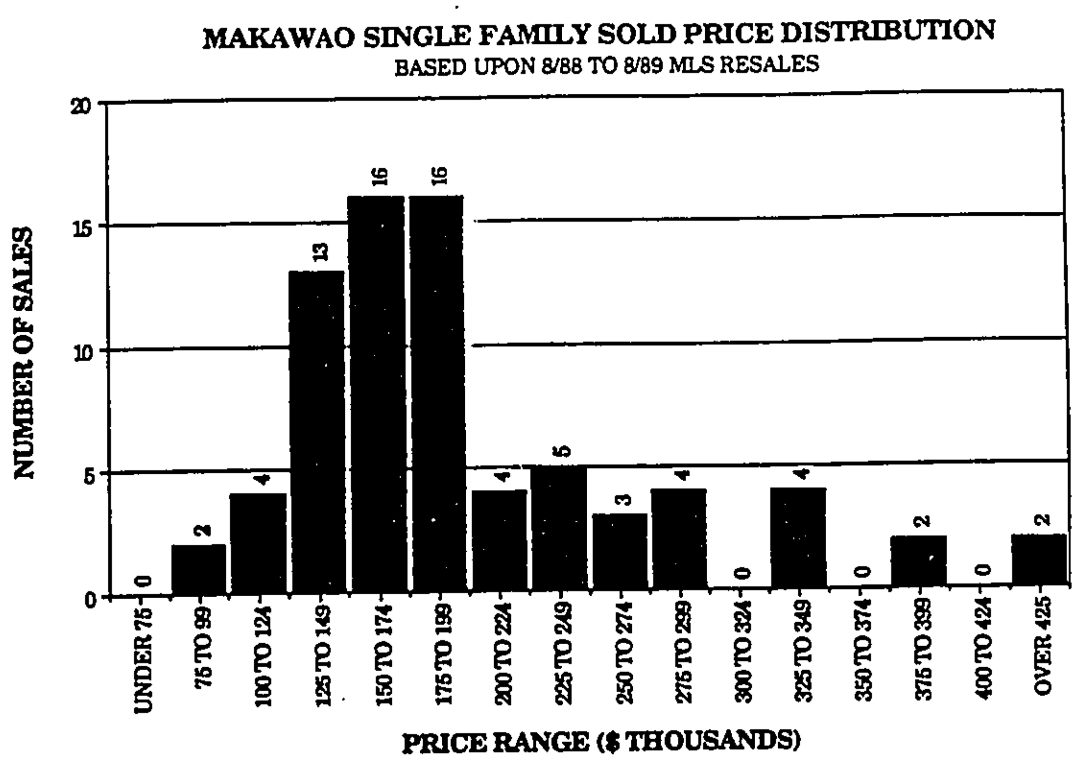


Figure VI-23

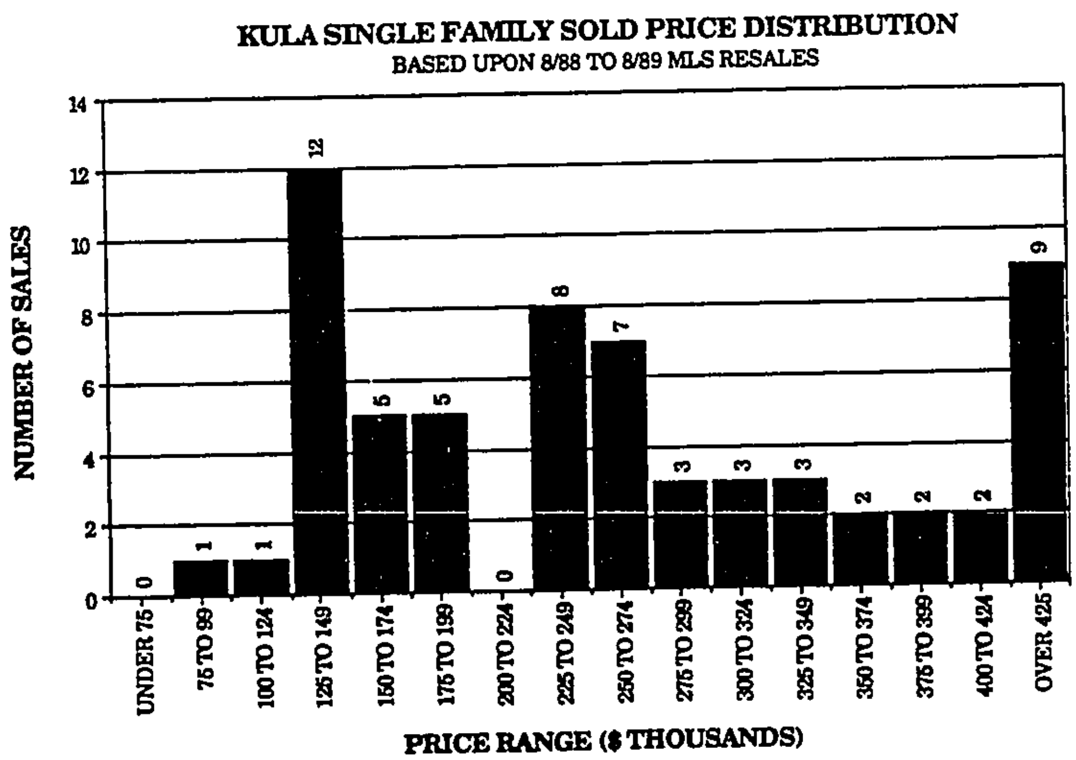


Figure VI-24

NAPILI SINGLE FAMILY SOLD PRICE DISTRIBUTION
BASED UPON 8/88 TO 8/89 MLS RESALES

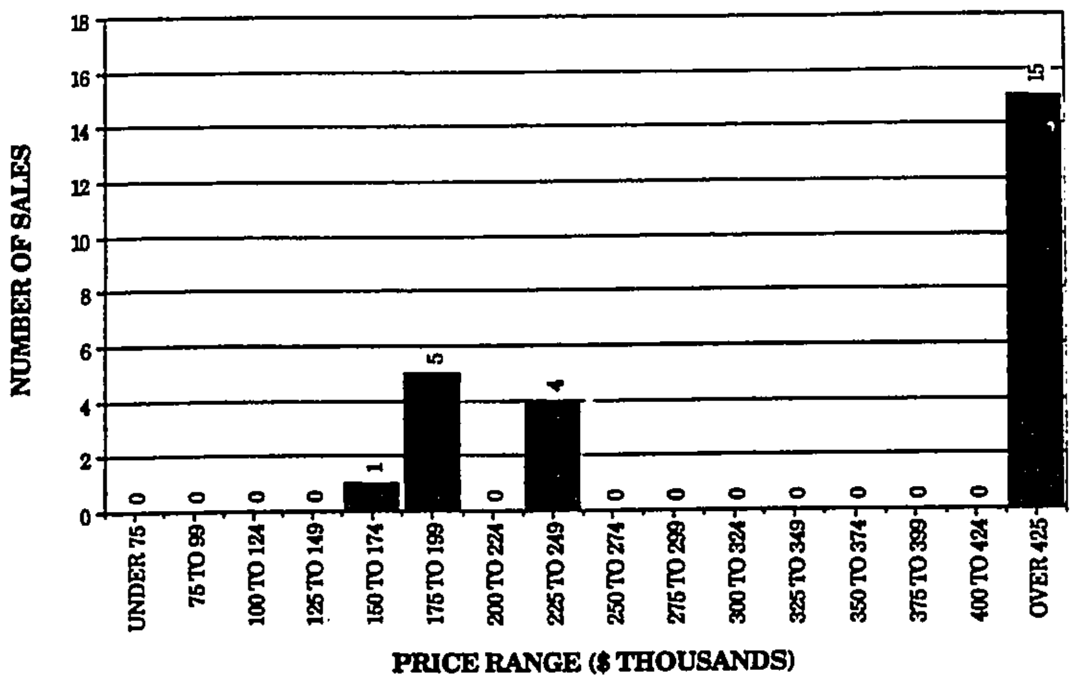


Figure VI-25

KAANAPALI SINGLE FAMILY SOLD PRICE DISTRIBUTION
BASED UPON 8/88 TO 8/89 MLS RESALES

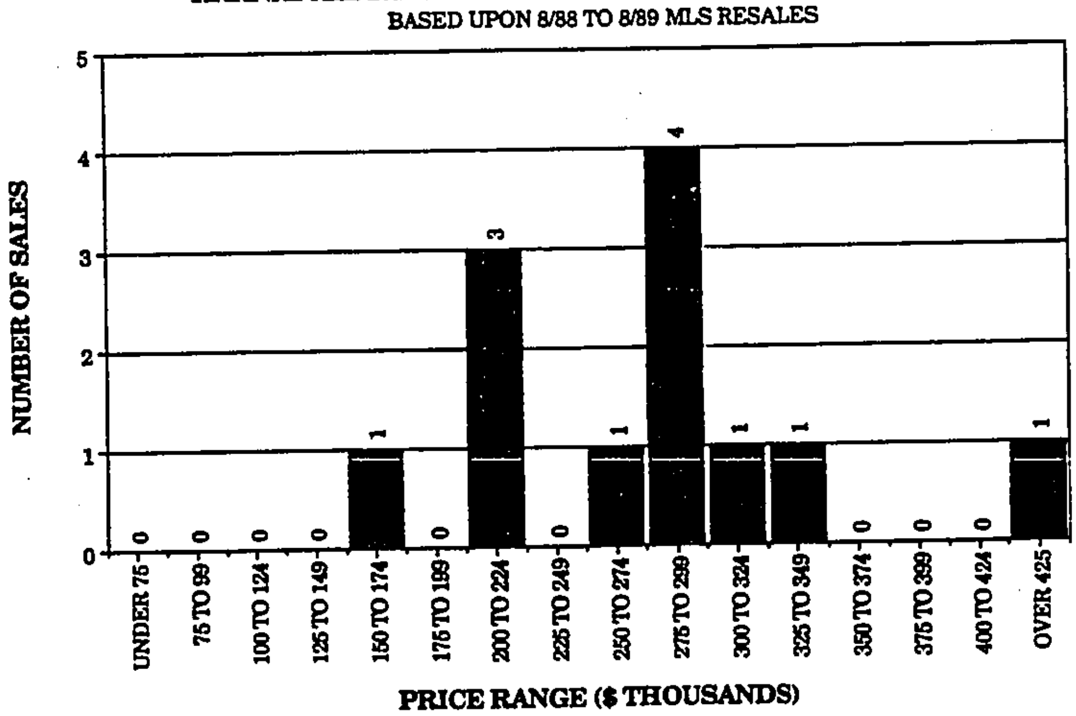


Figure VI-26

LAHAINA SINGLE FAMILY SOLD PRICE DISTRIBUTION
BASED UPON 8/88 TO 8/89 MLS RESALES

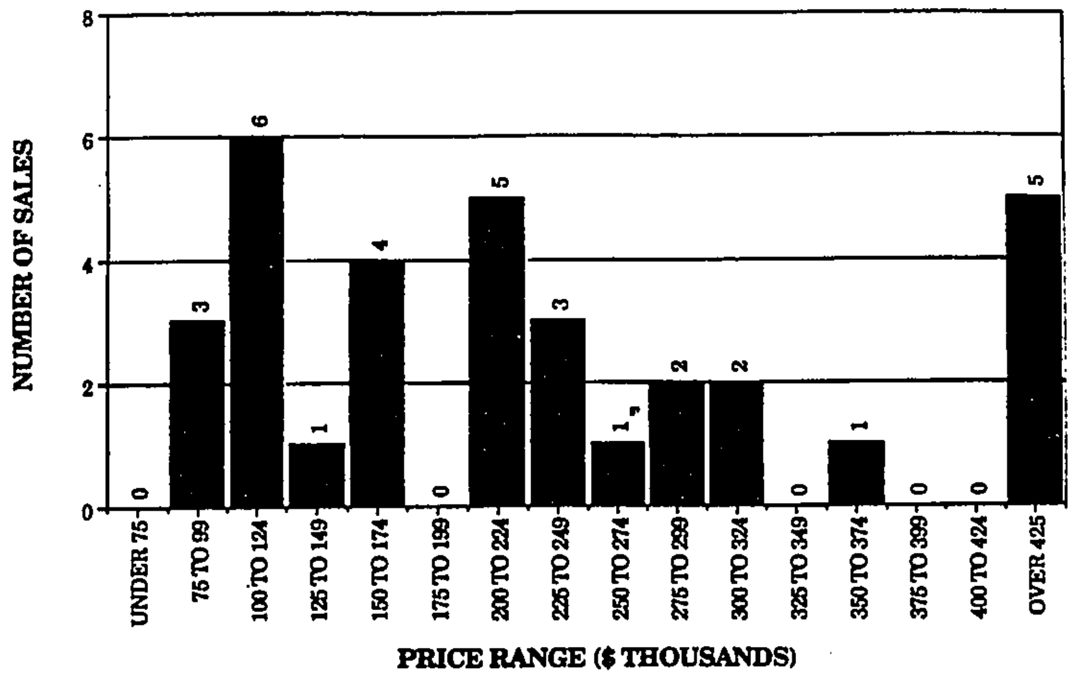


Figure VI-27

SELECTED MAUI SINGLE FAMILY MEDIAN SALES PRICES
BASED UPON 8/88 TO 8/89 MLS RESALES

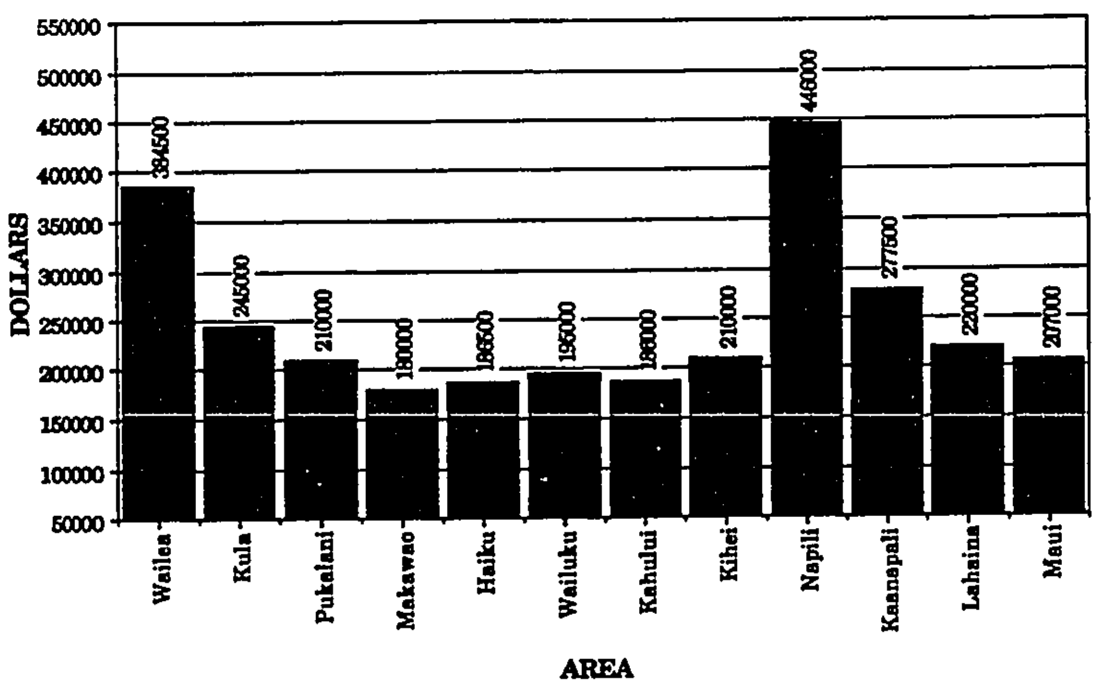


Figure VI-28

SELECTED MAUI SINGLE FAMILY MEDIAN PRICE PER SQUARE FOOT OF INTERIOR AREA
BASED UPON 8/88 TO 8/89 MLS RESALES

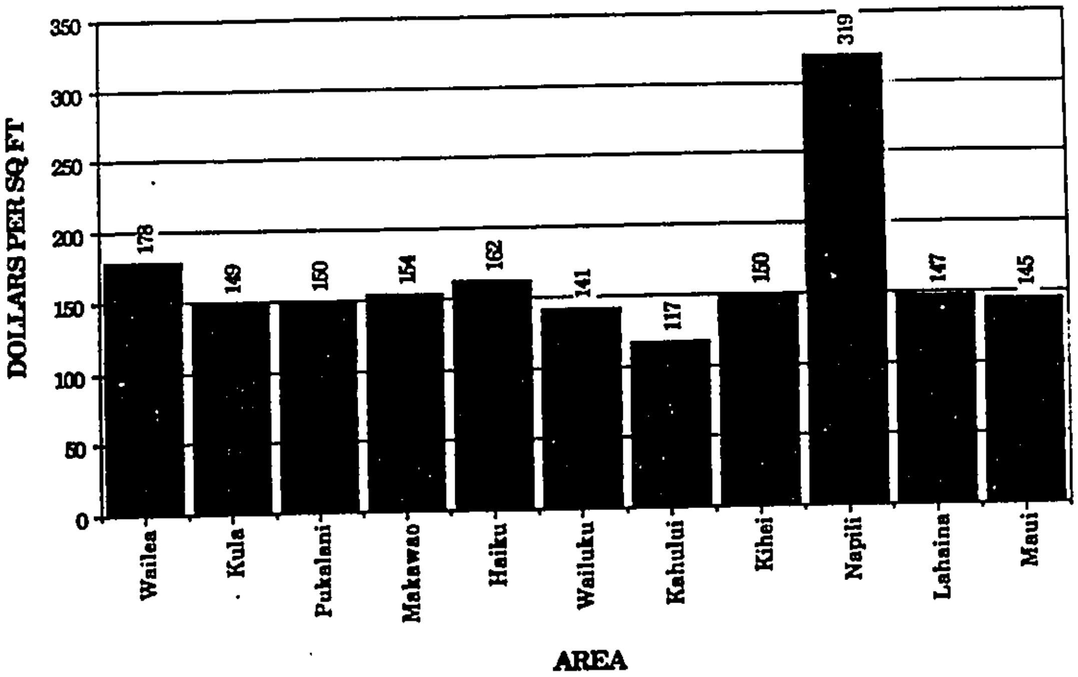


Figure VI-29

MAUI SINGLE FAMILY MLS LISTINGS AS OF 9/1989

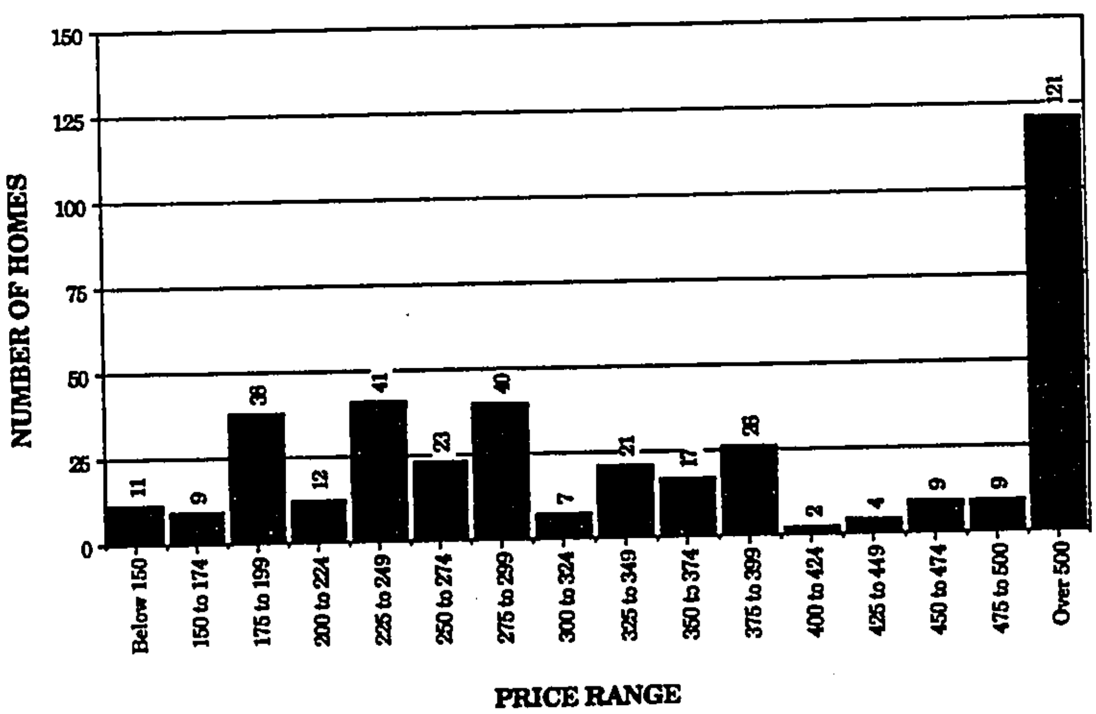


Figure VI-30

KIHEI SINGLE FAMILY MLS LISTINGS AS OF 9/1989

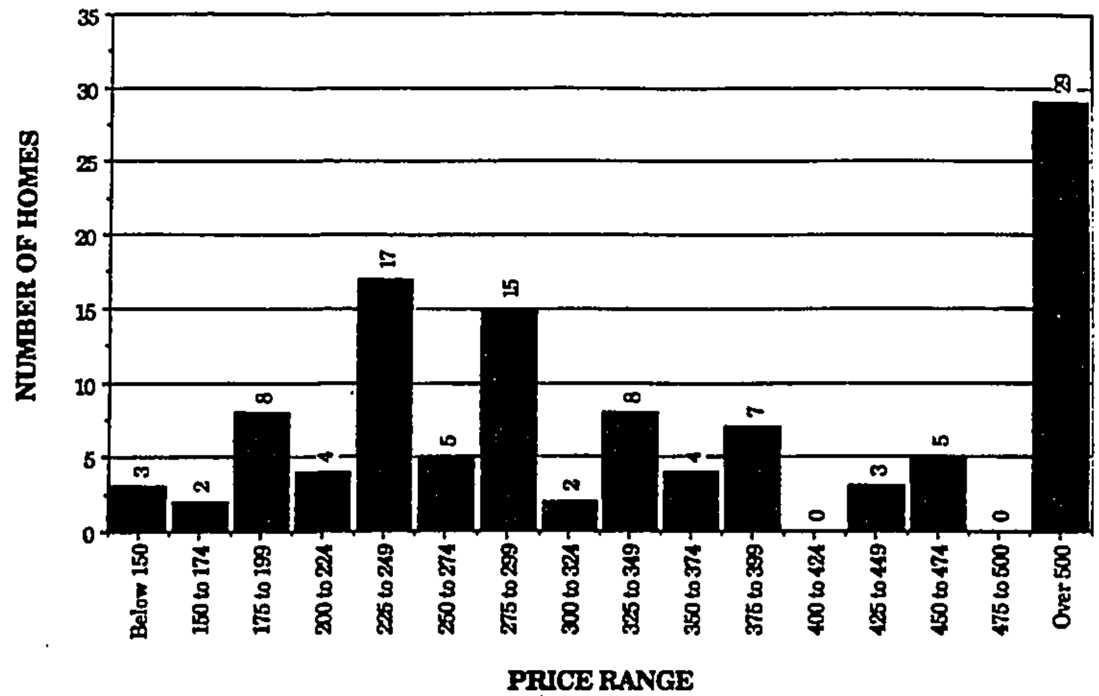


Figure VI-31

CENTRAL MAUI SINGLE FAMILY MLS LISTINGS AS OF 9/1989

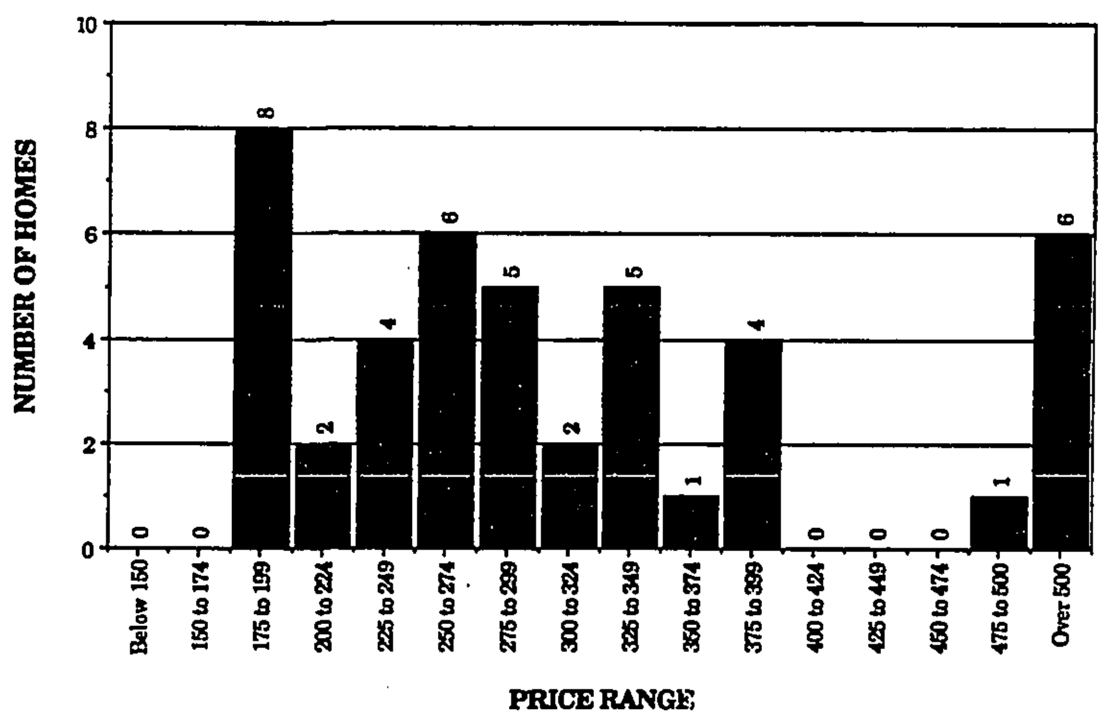


Figure VI-32

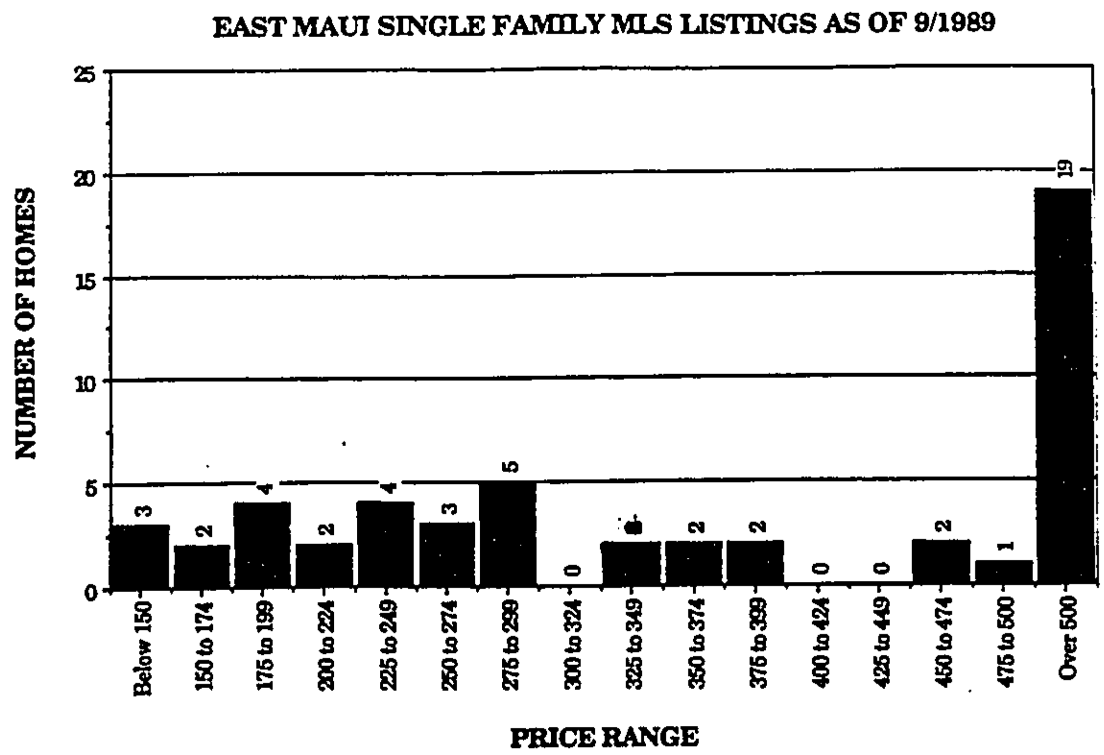


Figure VI-33

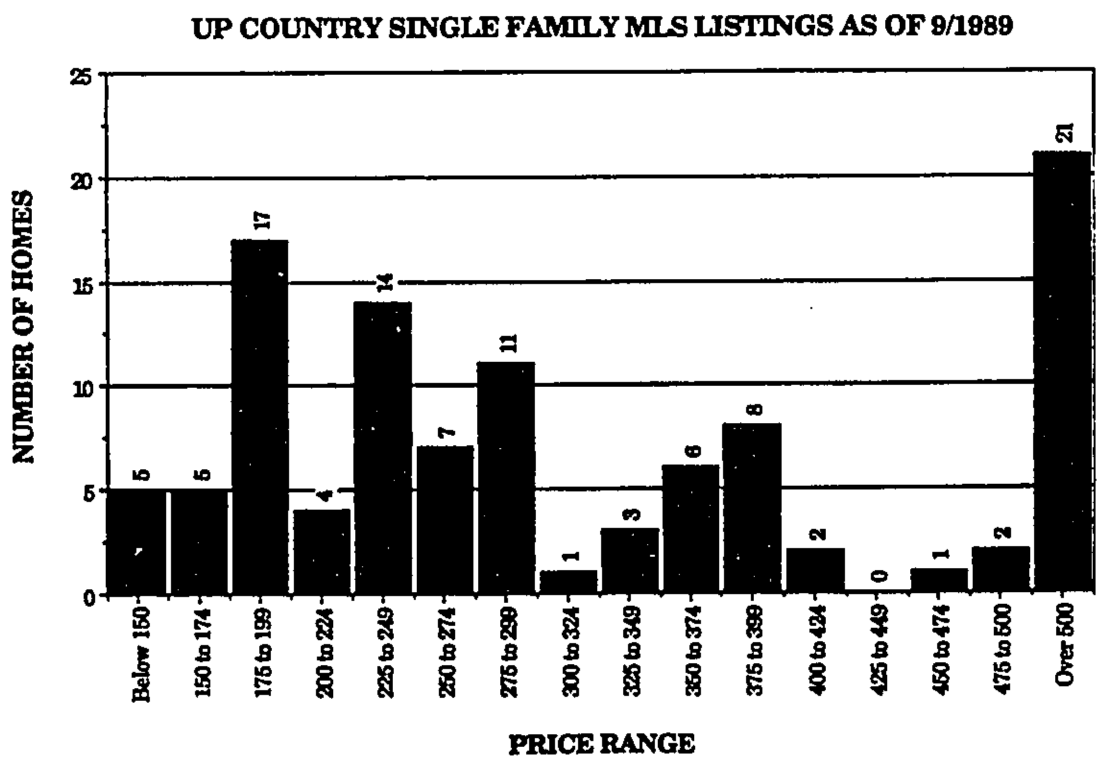


Figure VI-34

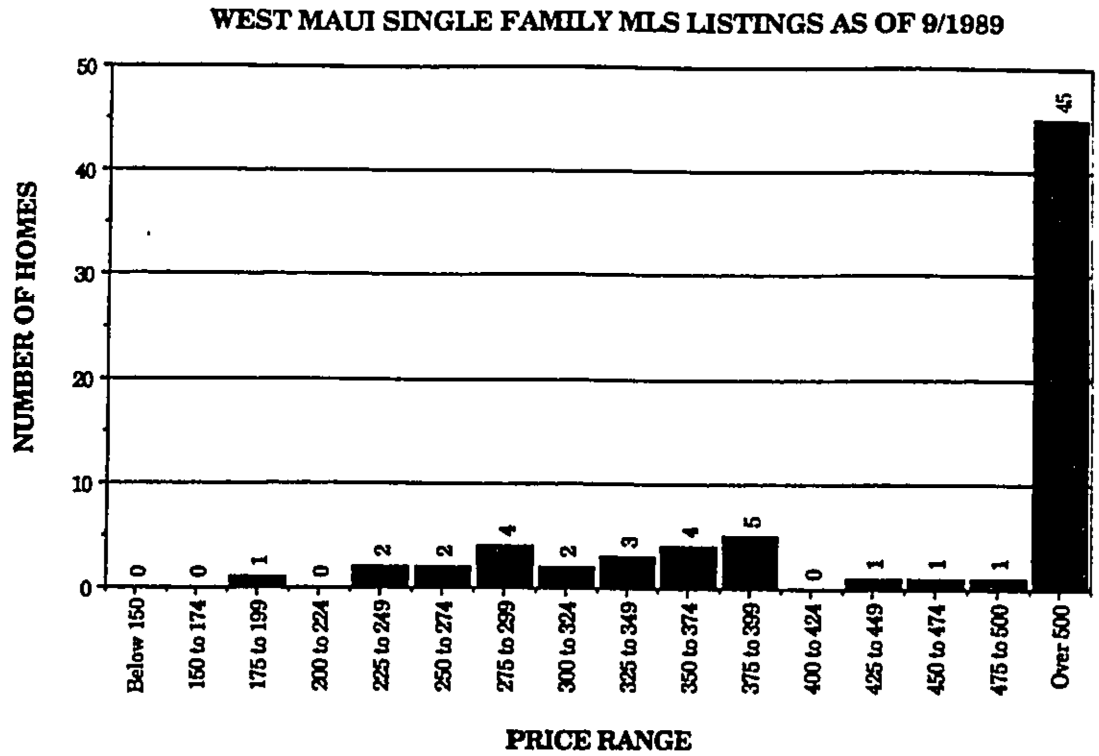


Figure VI-35

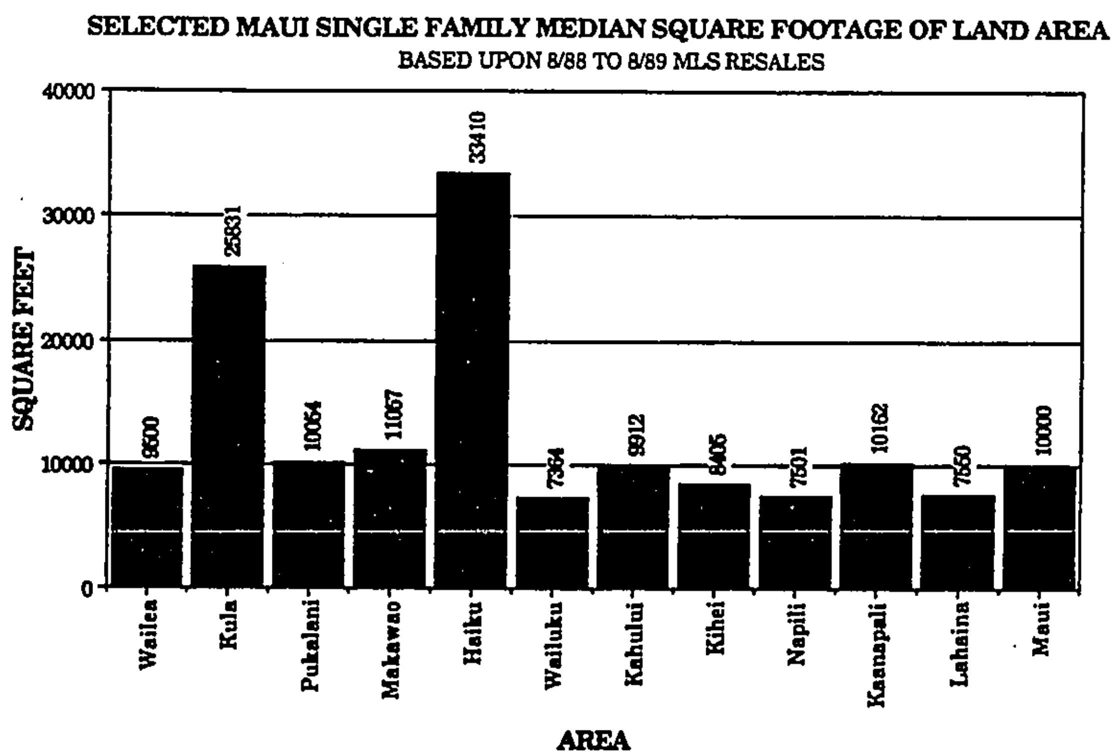


Figure VI-36

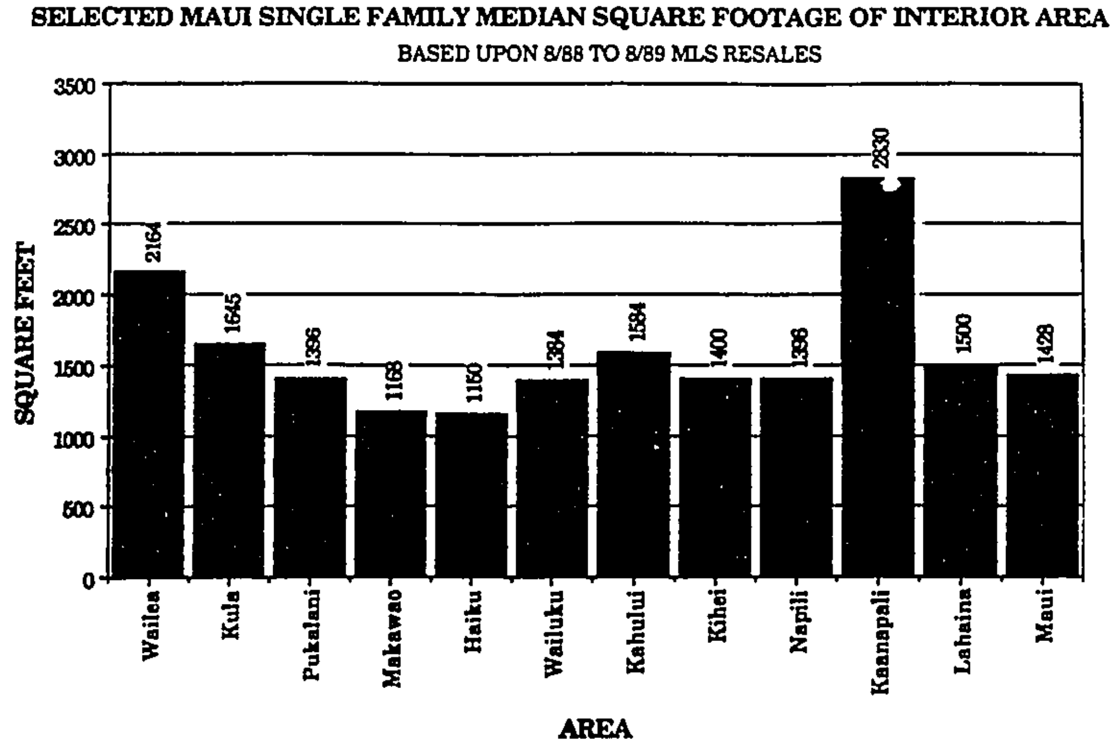


Figure VI-37

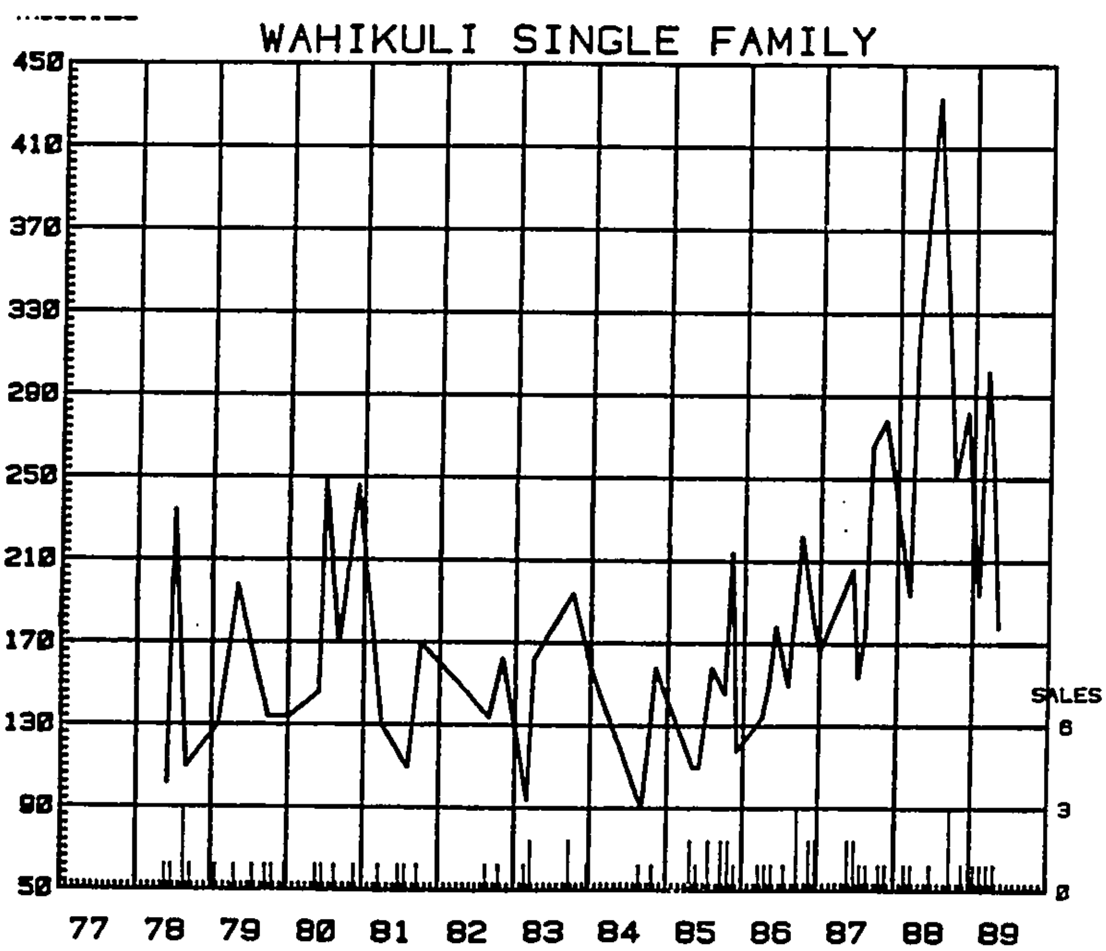
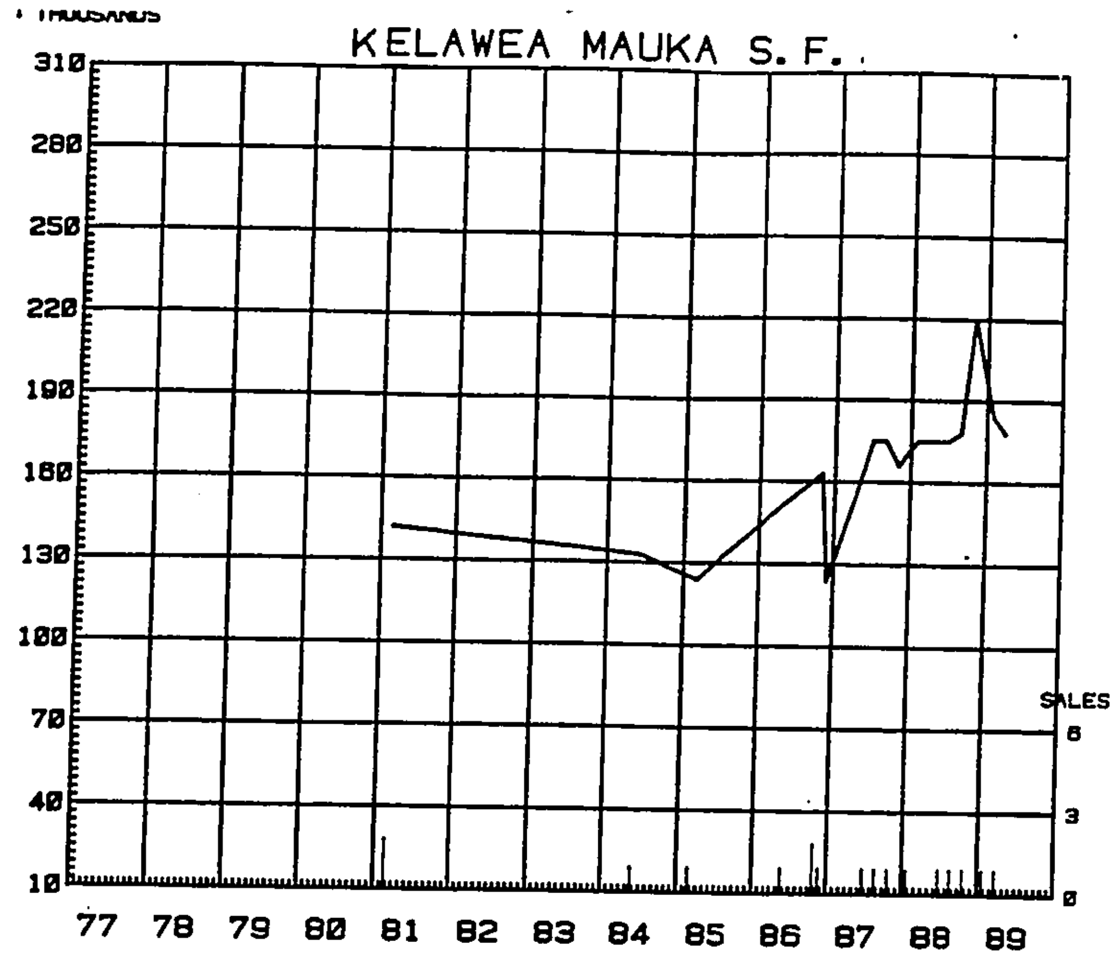


Figure VI-38



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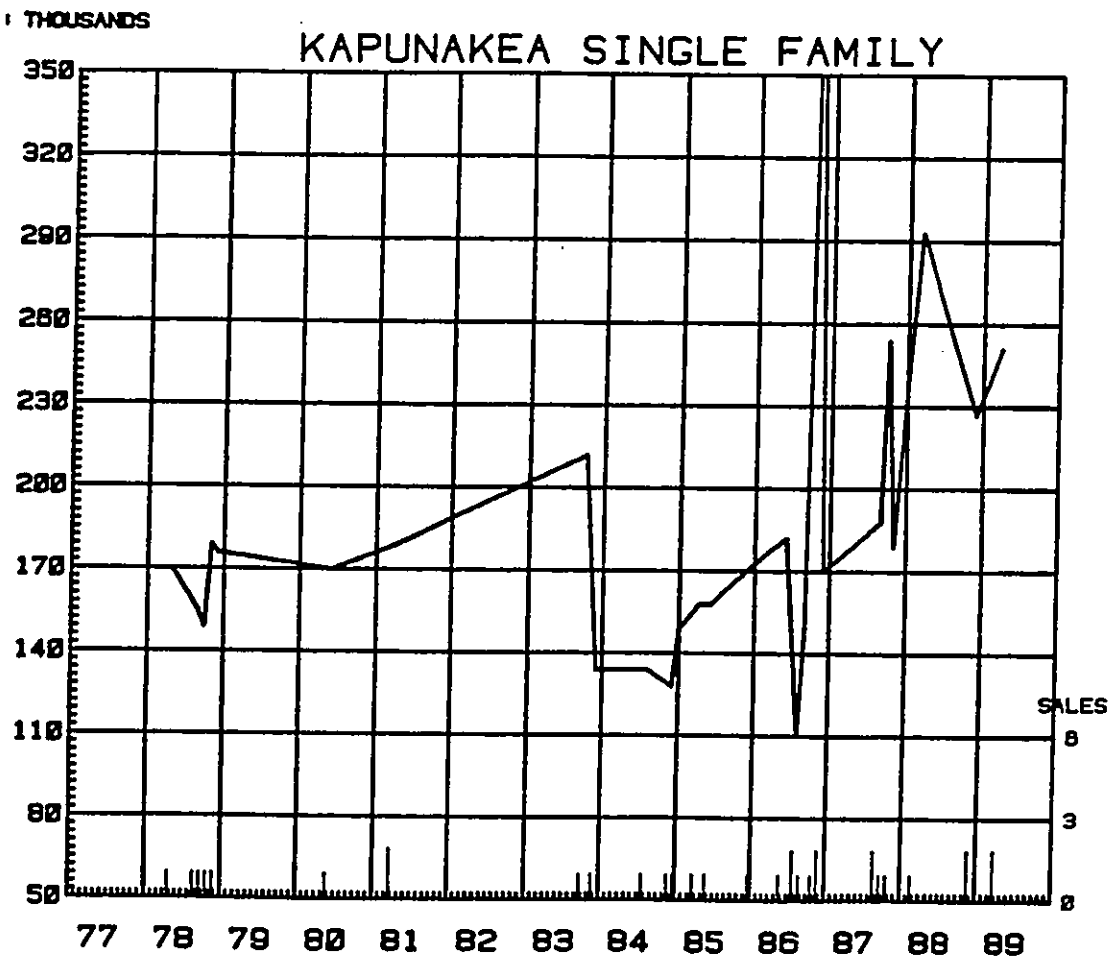

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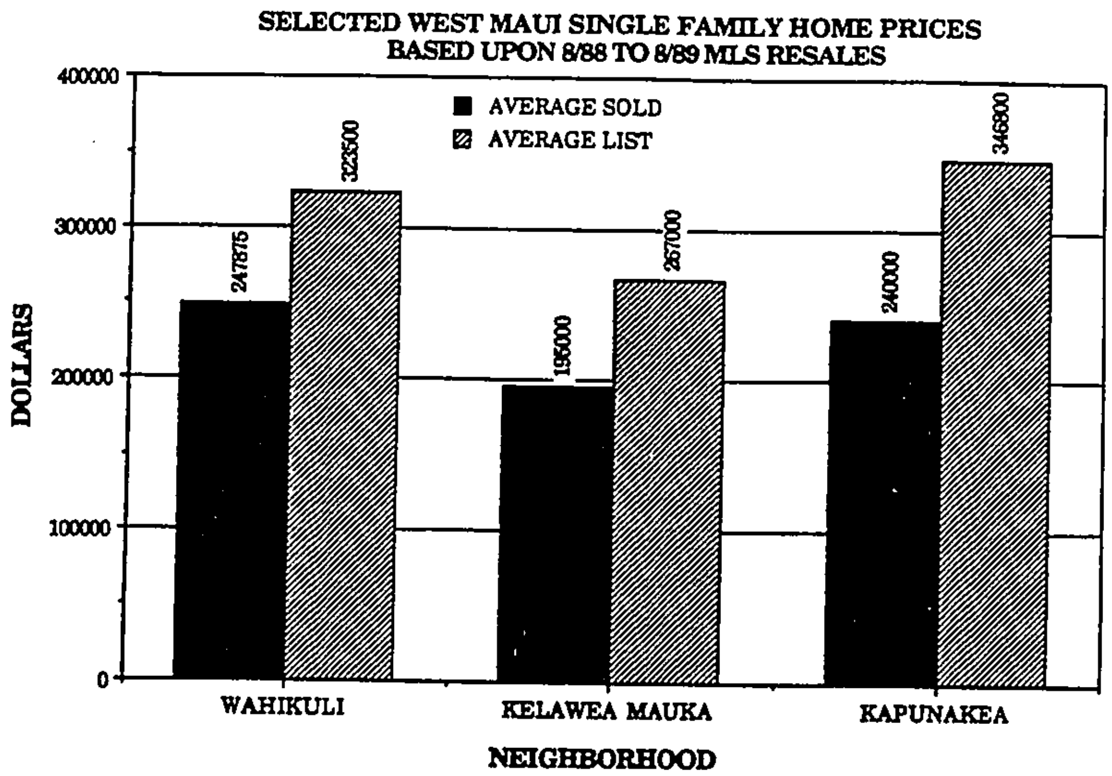

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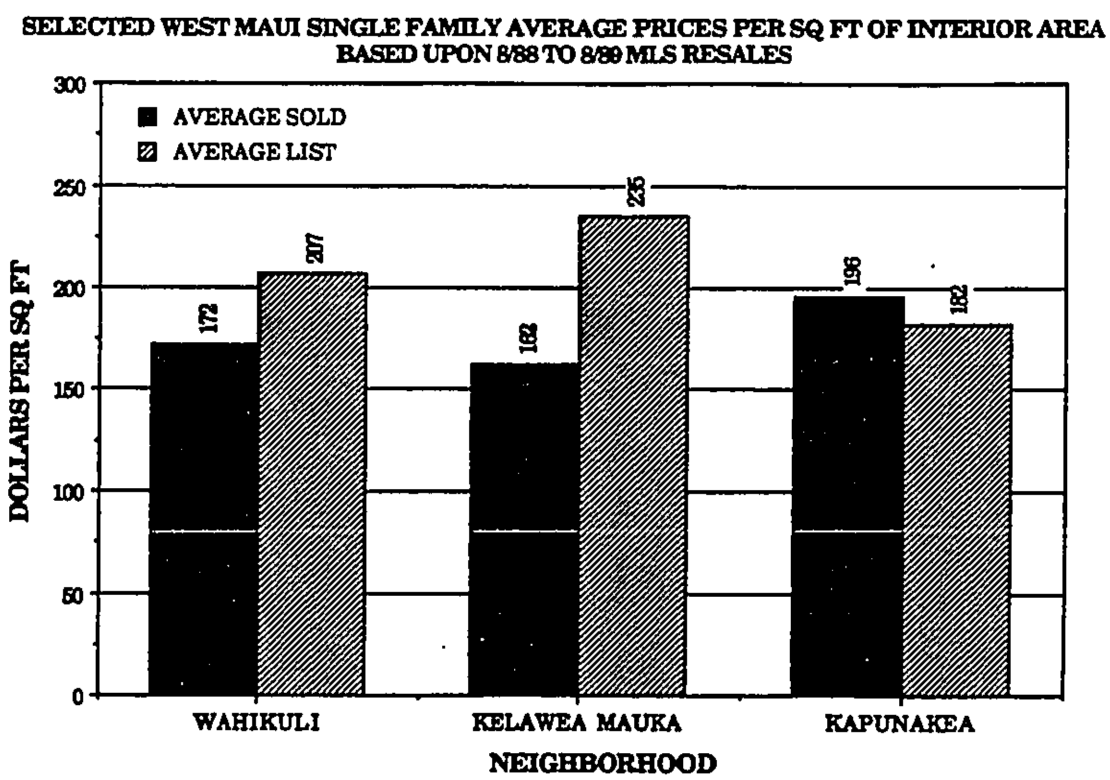


Figure VI-42

MAUI ISLAND VACANT LAND SALES BASED UPON 8/88 TO 8/89 MLS SALES

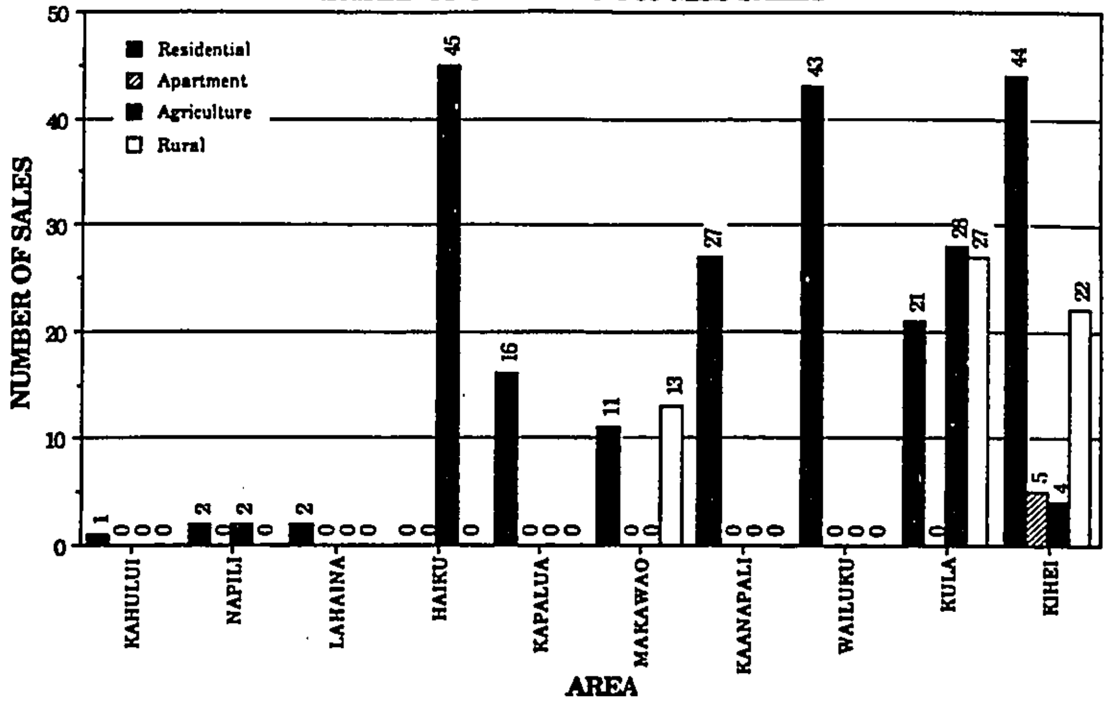


Figure VI-43

MAUI ISLAND VACANT LAND AVERAGE SALES PRICES BASED UPON 8/88 TO 8/89 MLS SALES

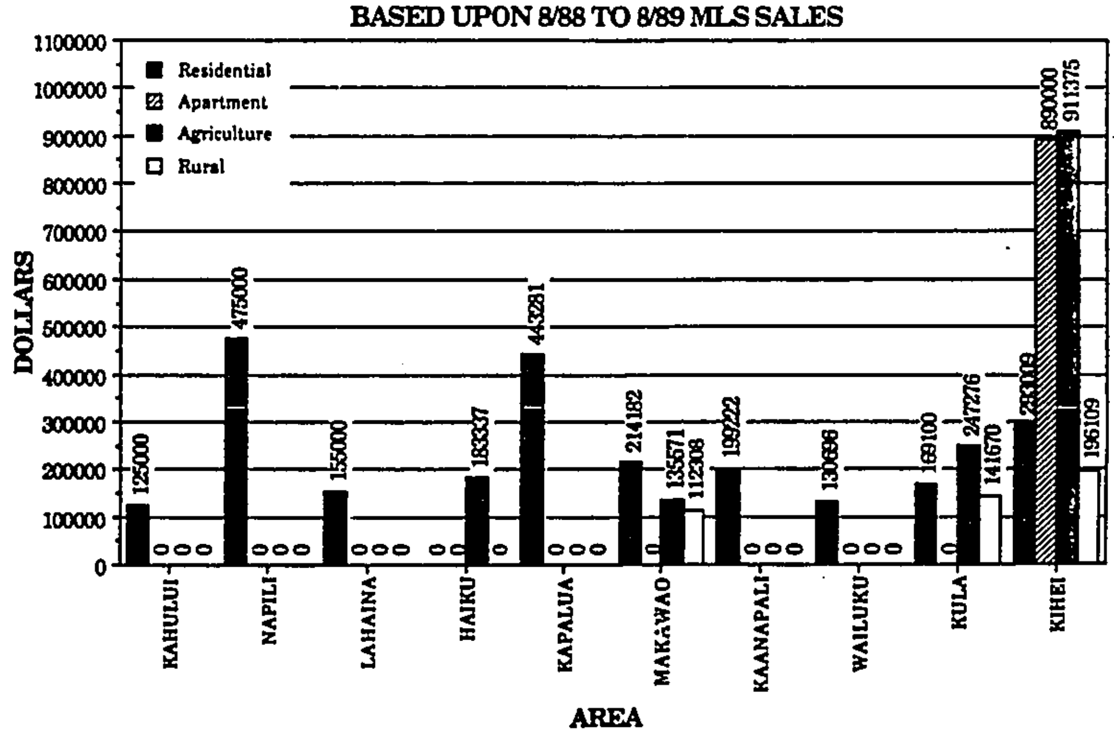


Figure VI-44

MAUI ISLAND VACANT LAND AVERAGE SALES PRICES PER SQ FT BASED UPON 8/88 TO 8/89 MLS SALES

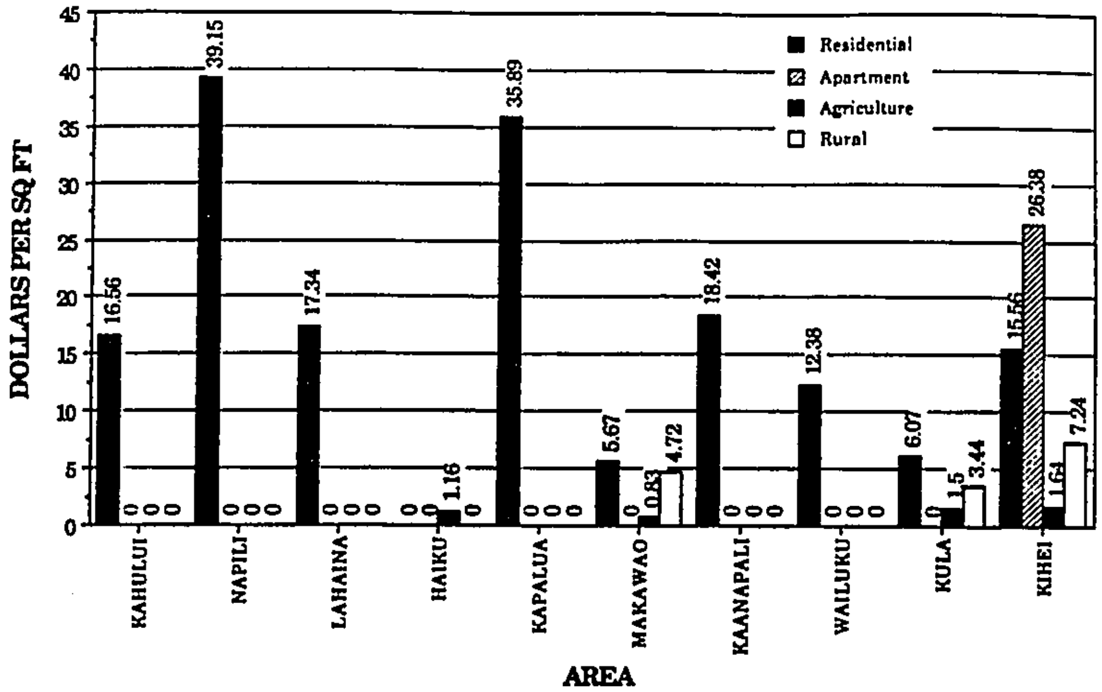


Figure VI-45

MAUI ISLAND VACANT LAND AVERAGE LOT SIZE BASED UPON 8/88 TO 8/89 MLS SALES

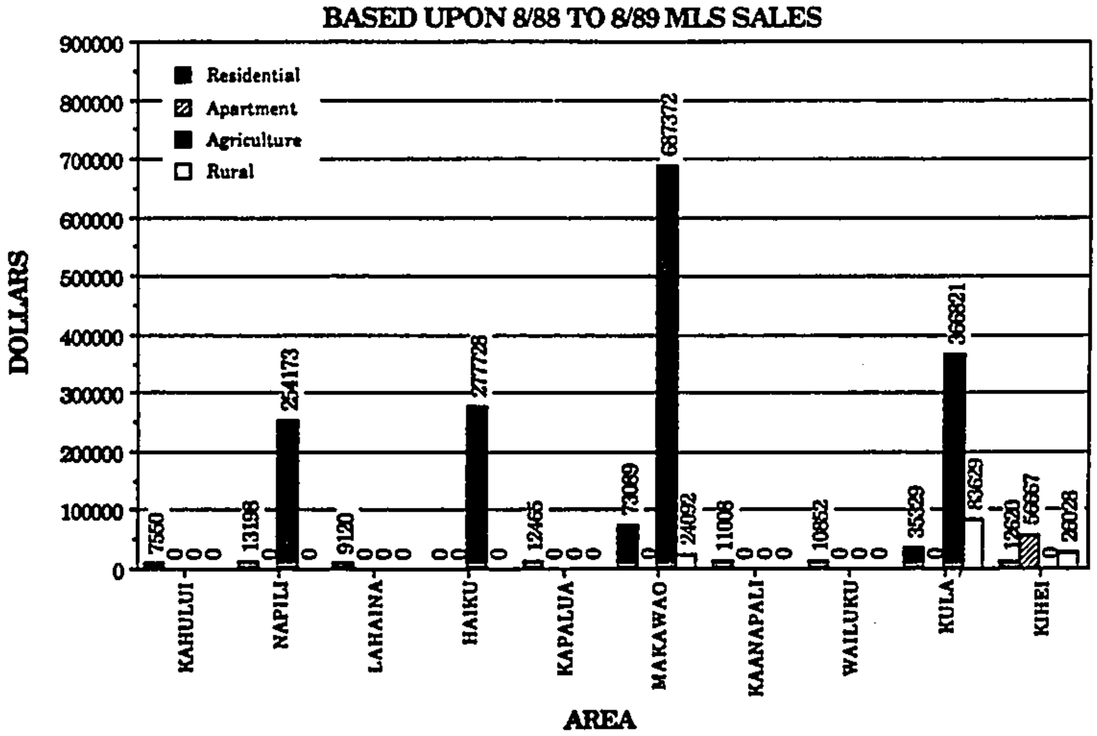


Figure VI-46

MAUI CONDOMINIUM MLS LISTINGS AS OF MID-YEAR

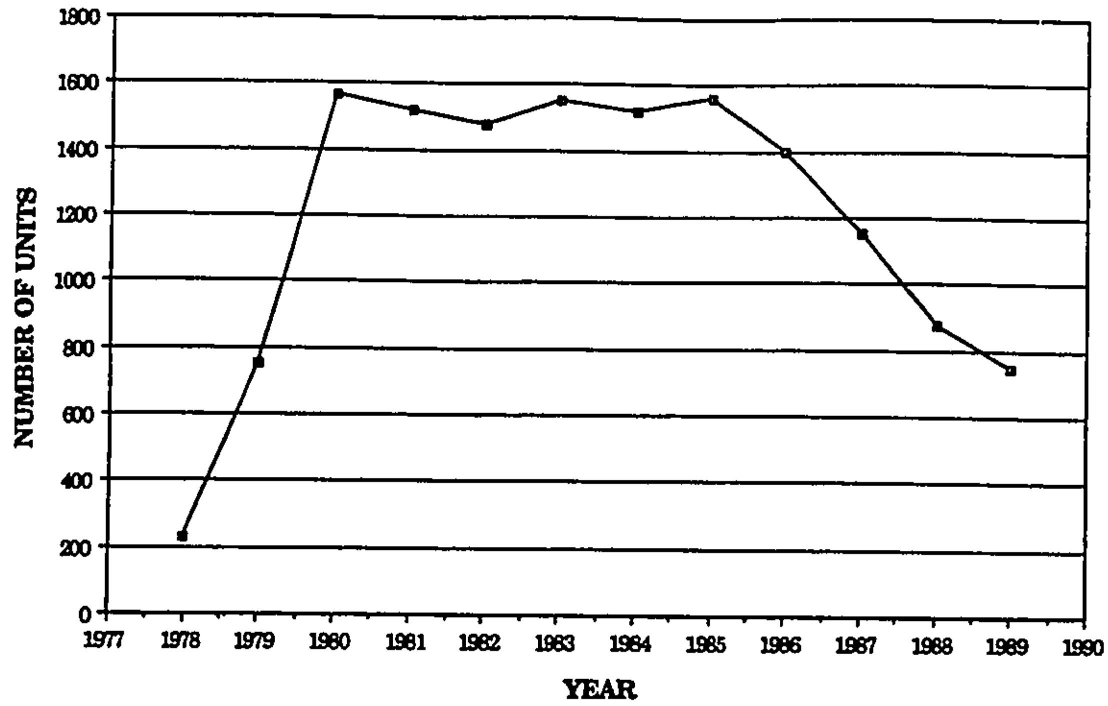


Figure VI-47

MAUI CONDOMINIUM AVERAGE SOLD MARKET TIME BASED UPON MLS RESALES

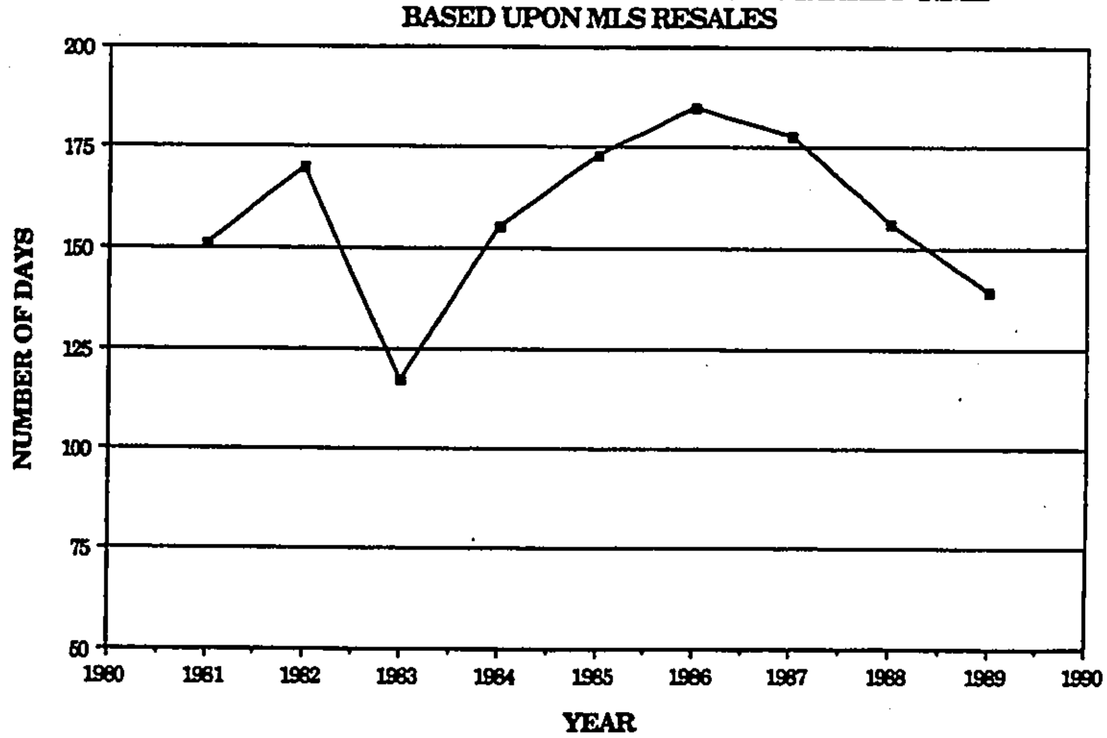


Figure VI-48

MAUI MLS CONDOMINIUM SALES

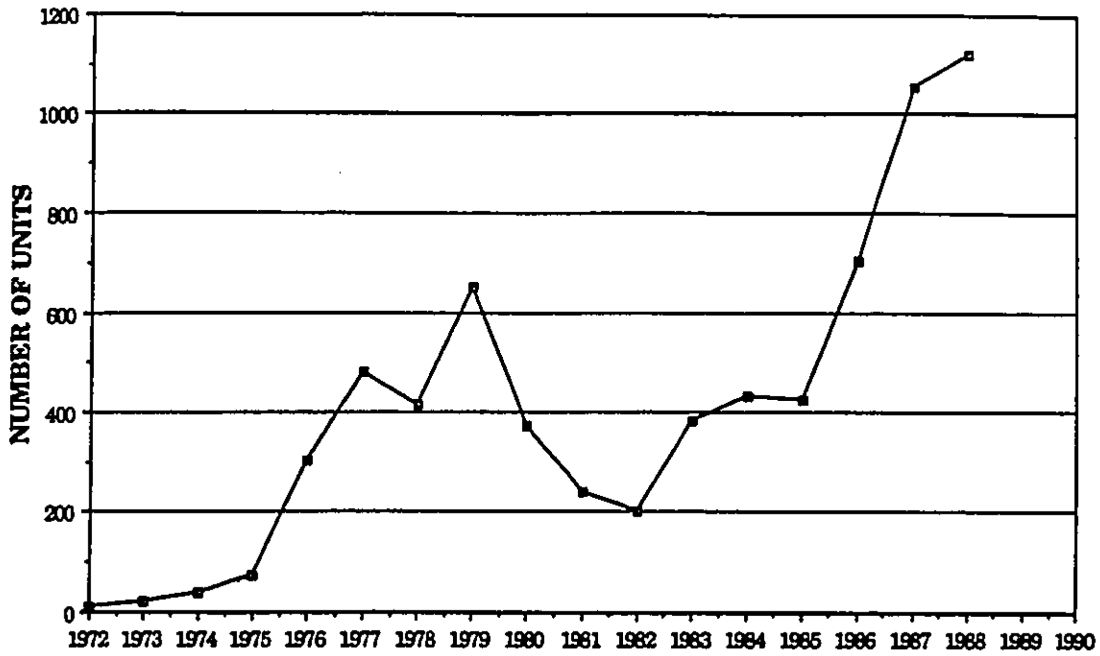


Figure VI-49

MAUI AVERAGE CONDOMINIUM RESALE PRICE

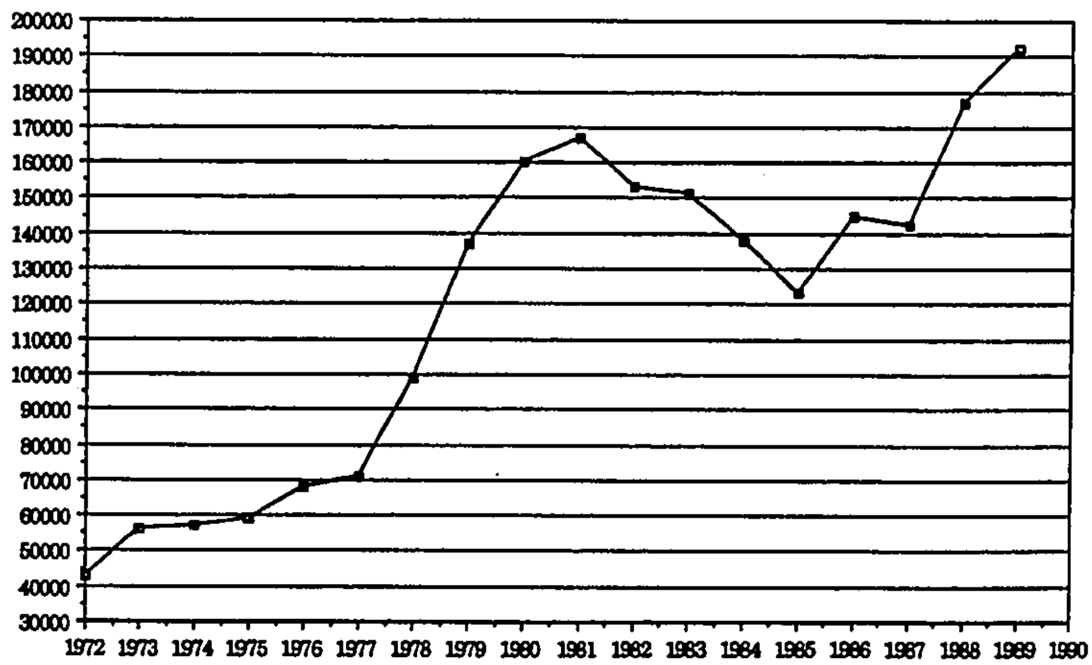
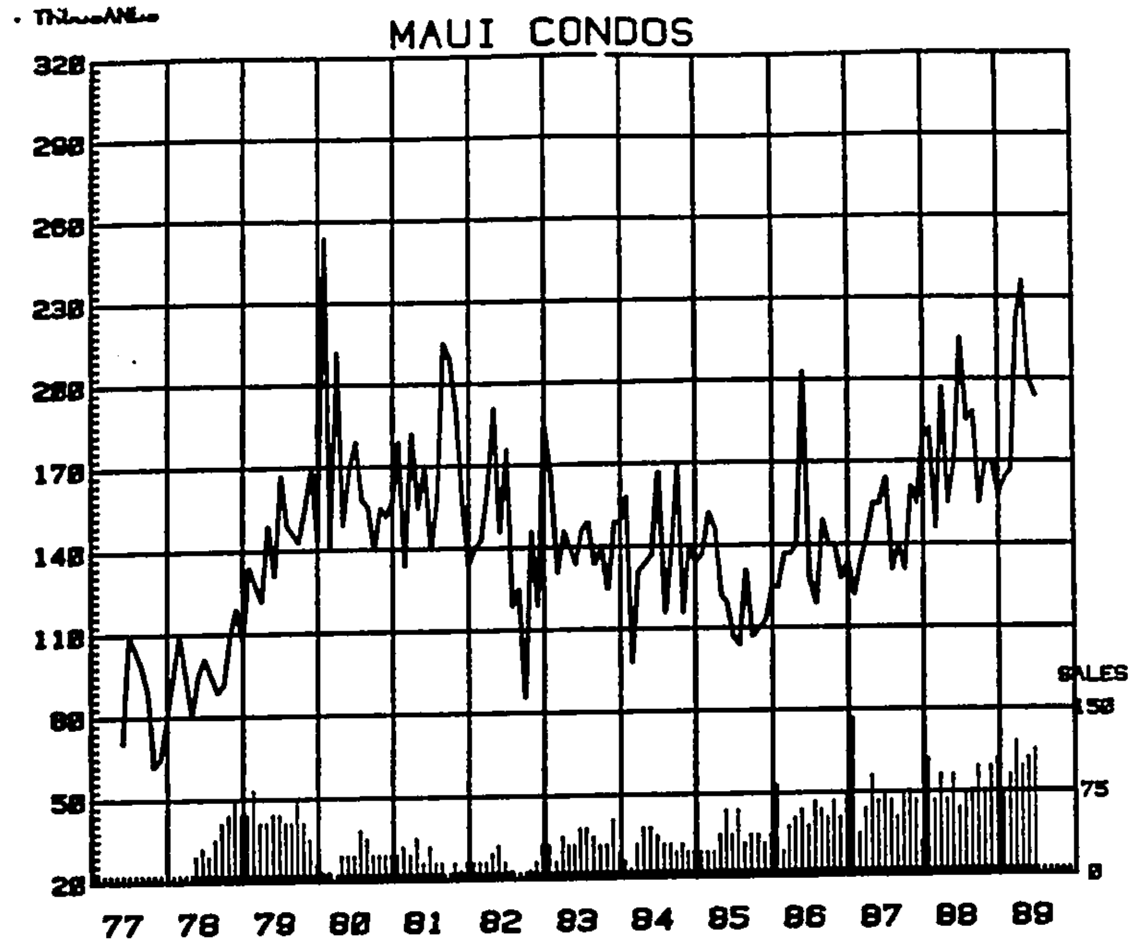


Figure VI-50



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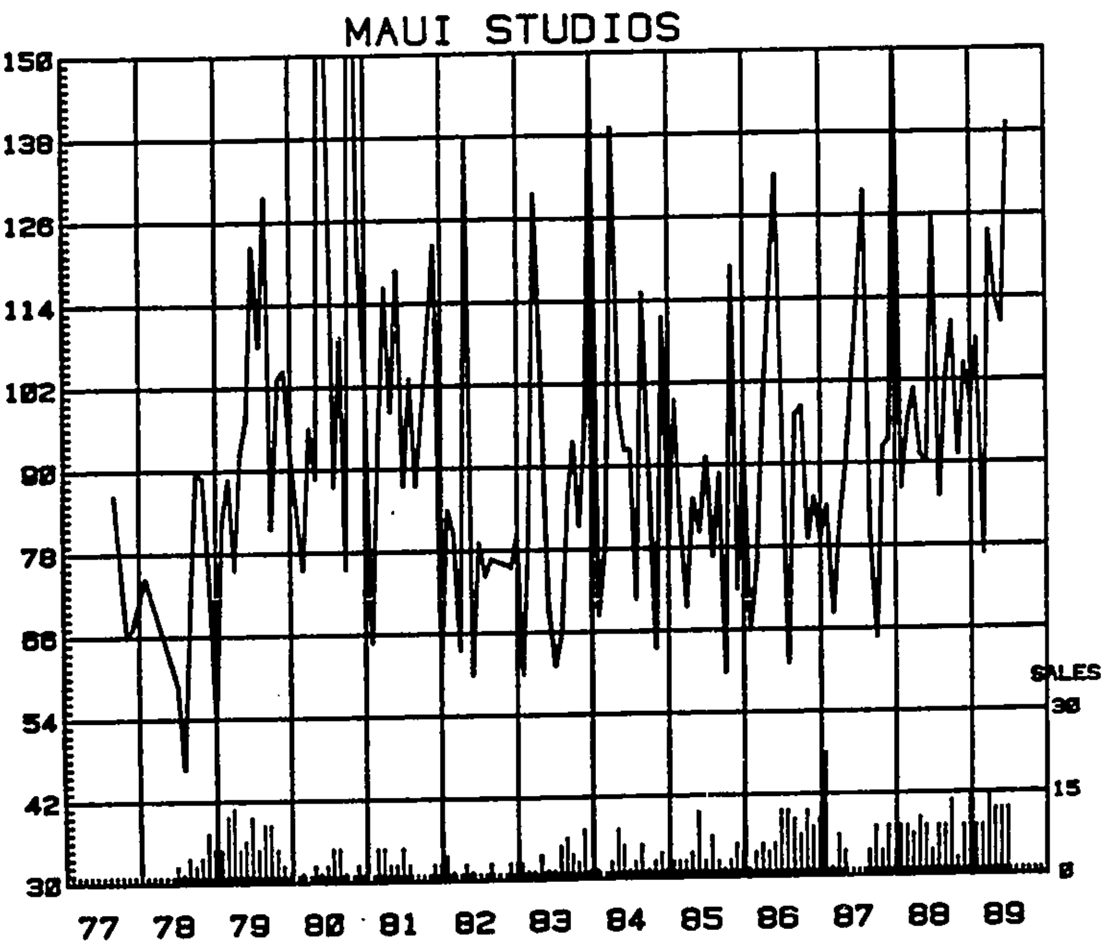

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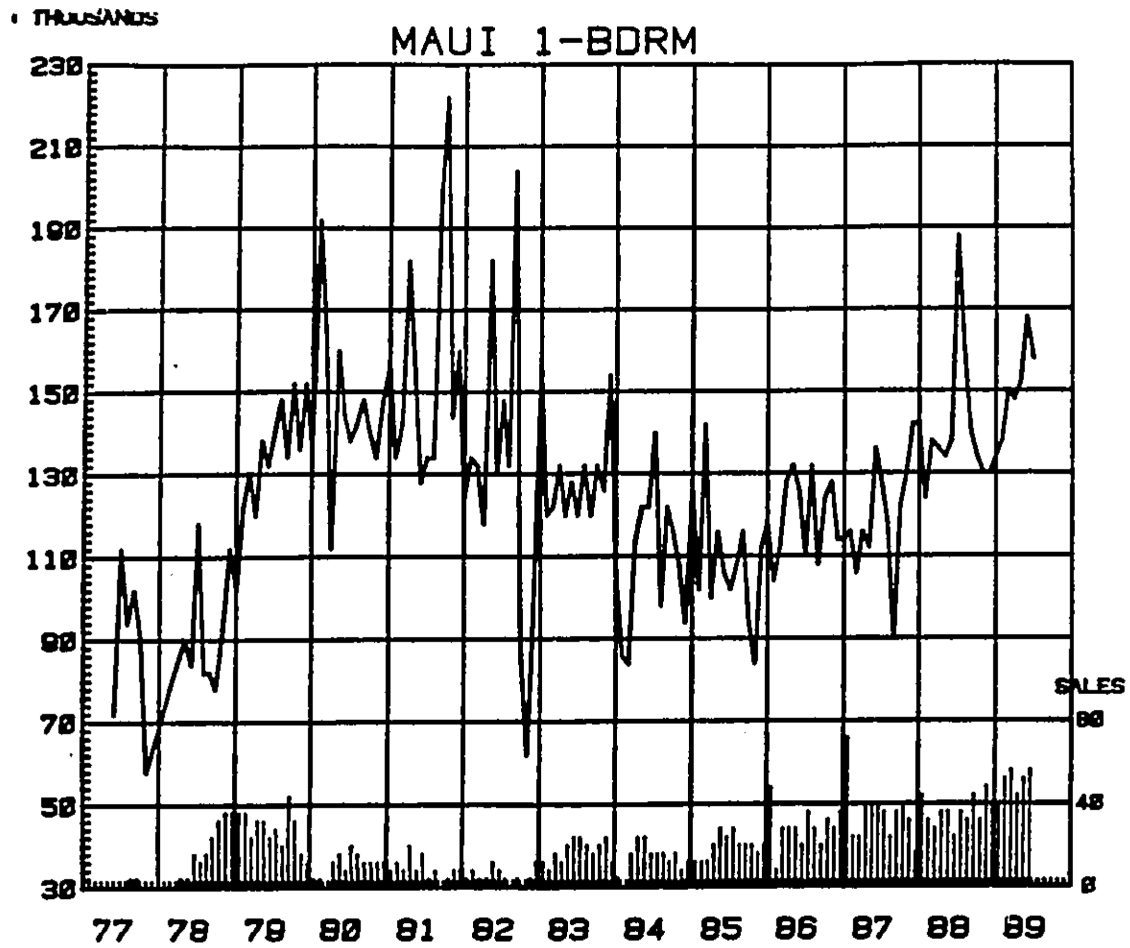

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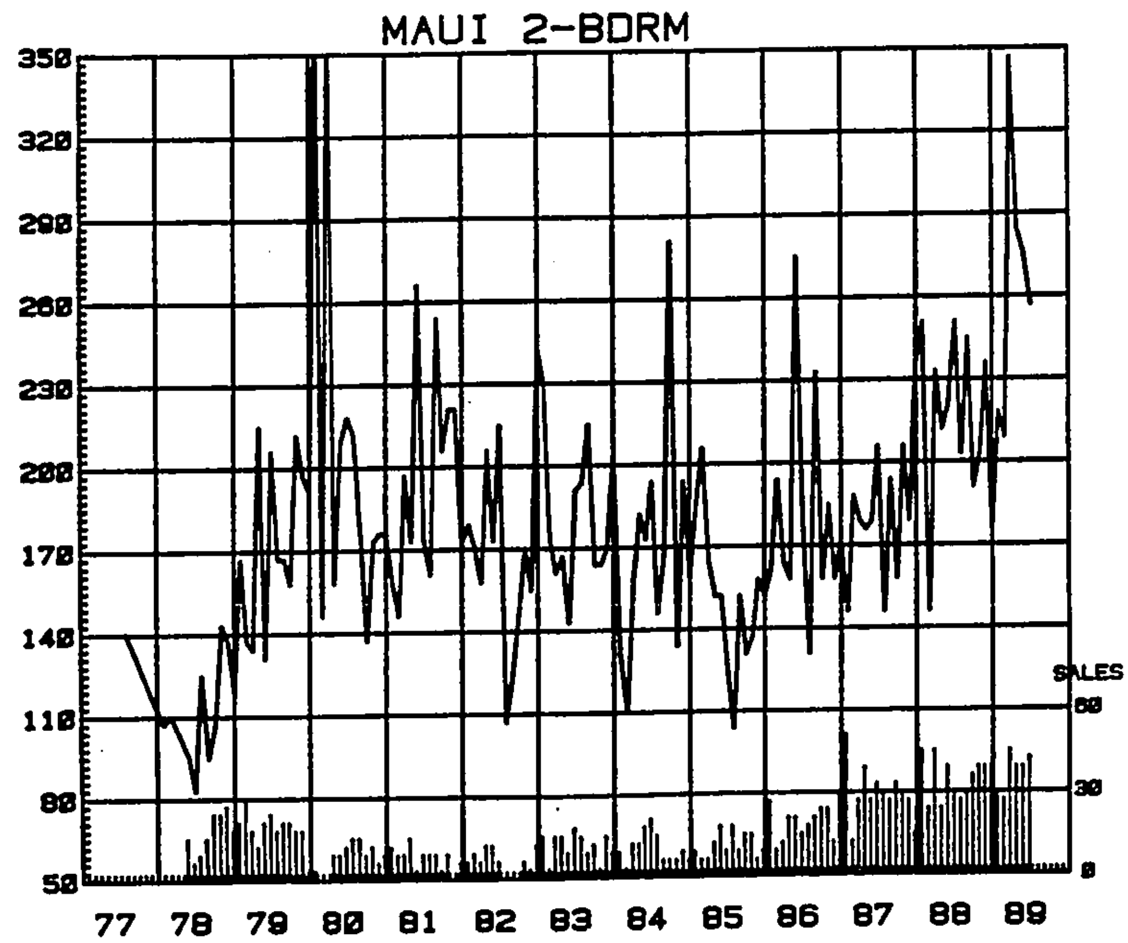

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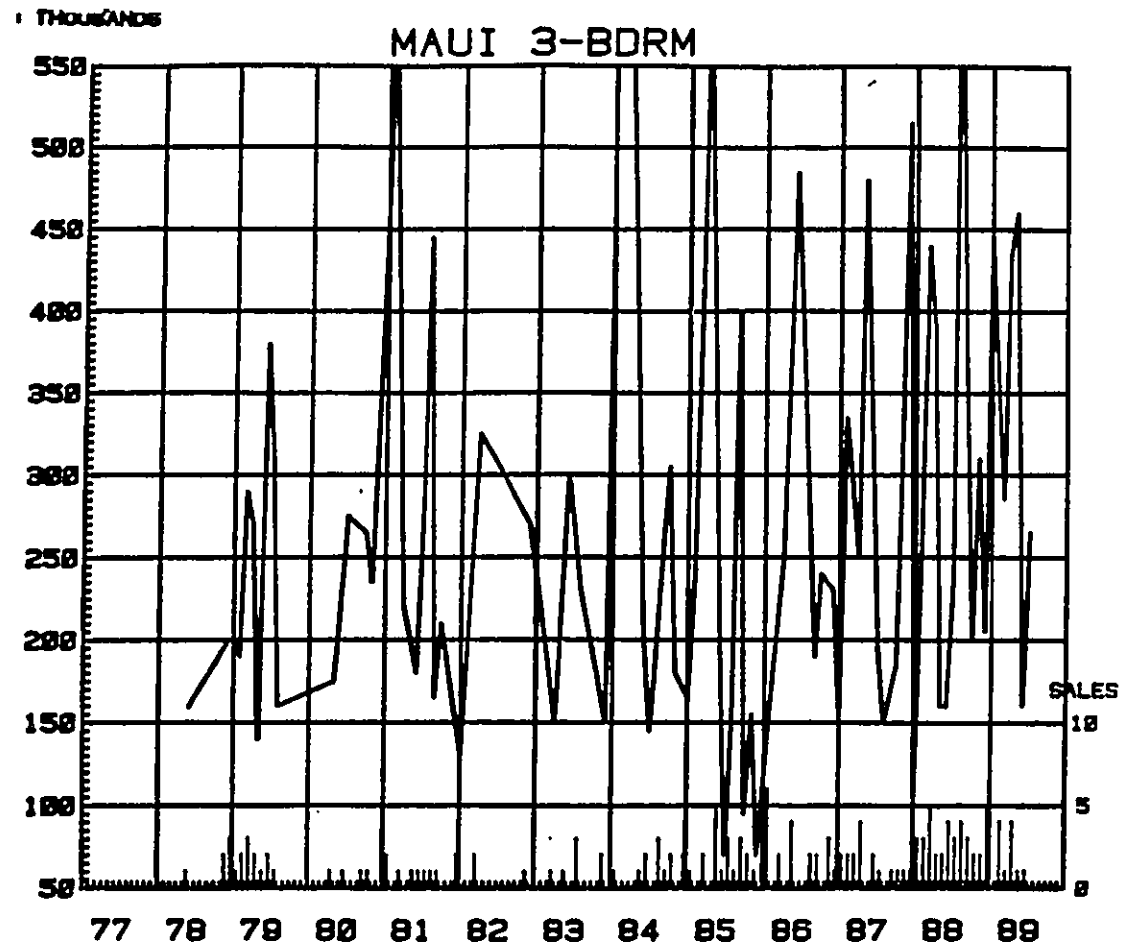

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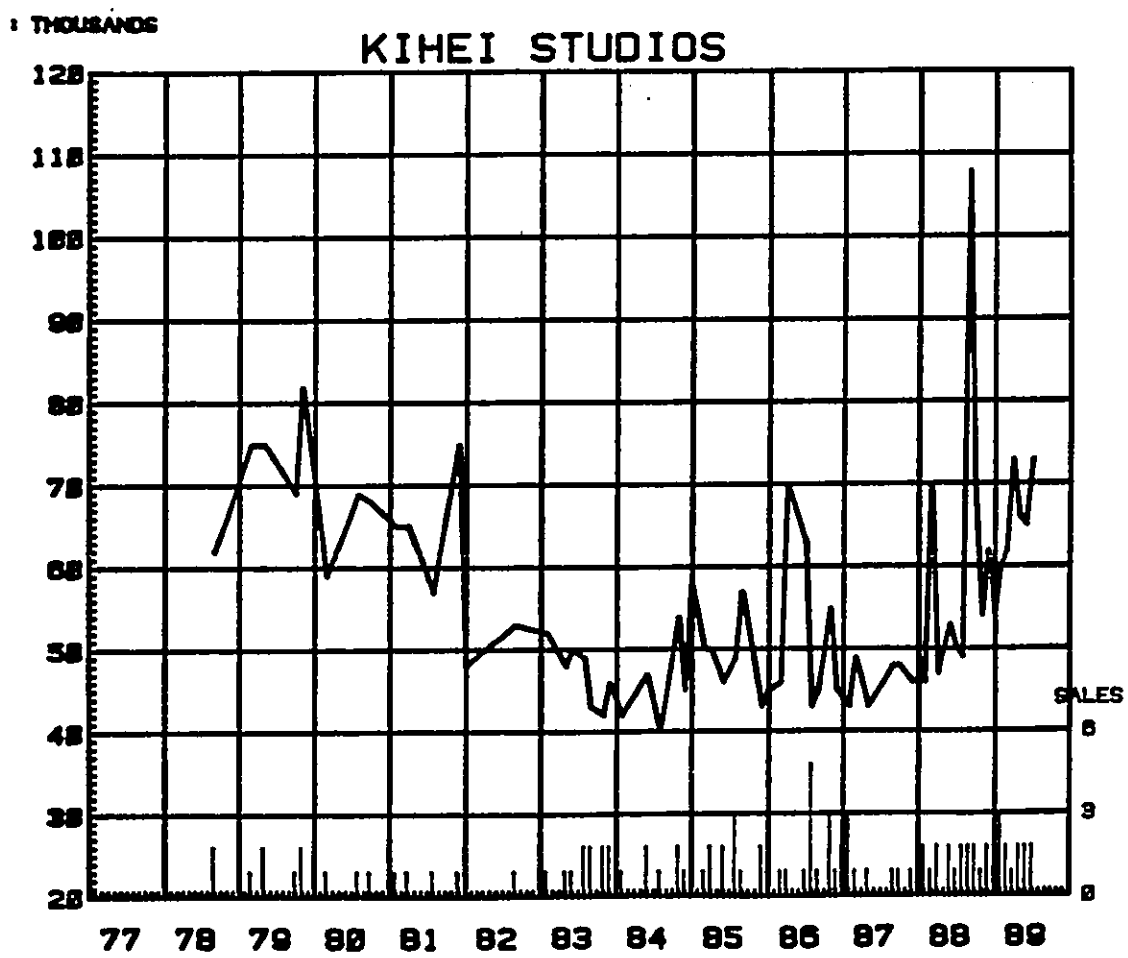
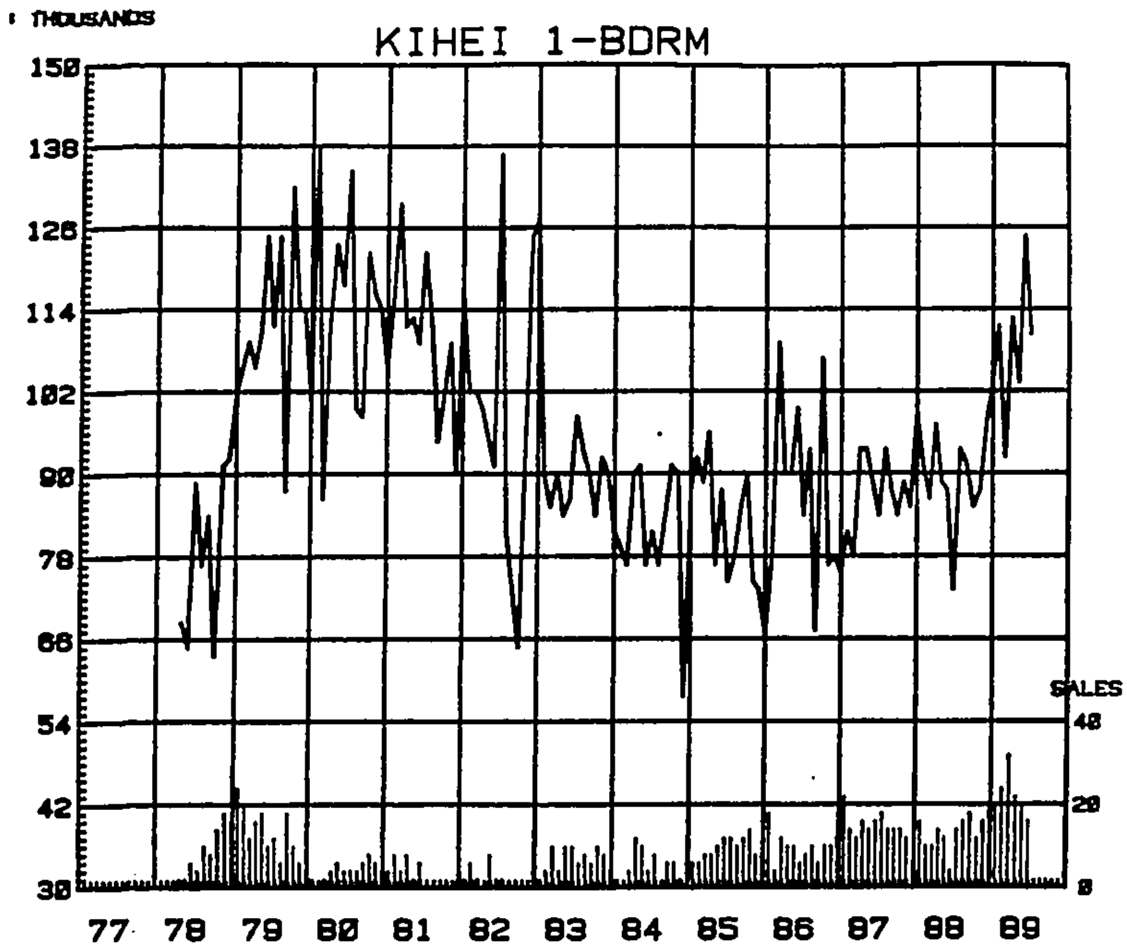


Figure VI-56



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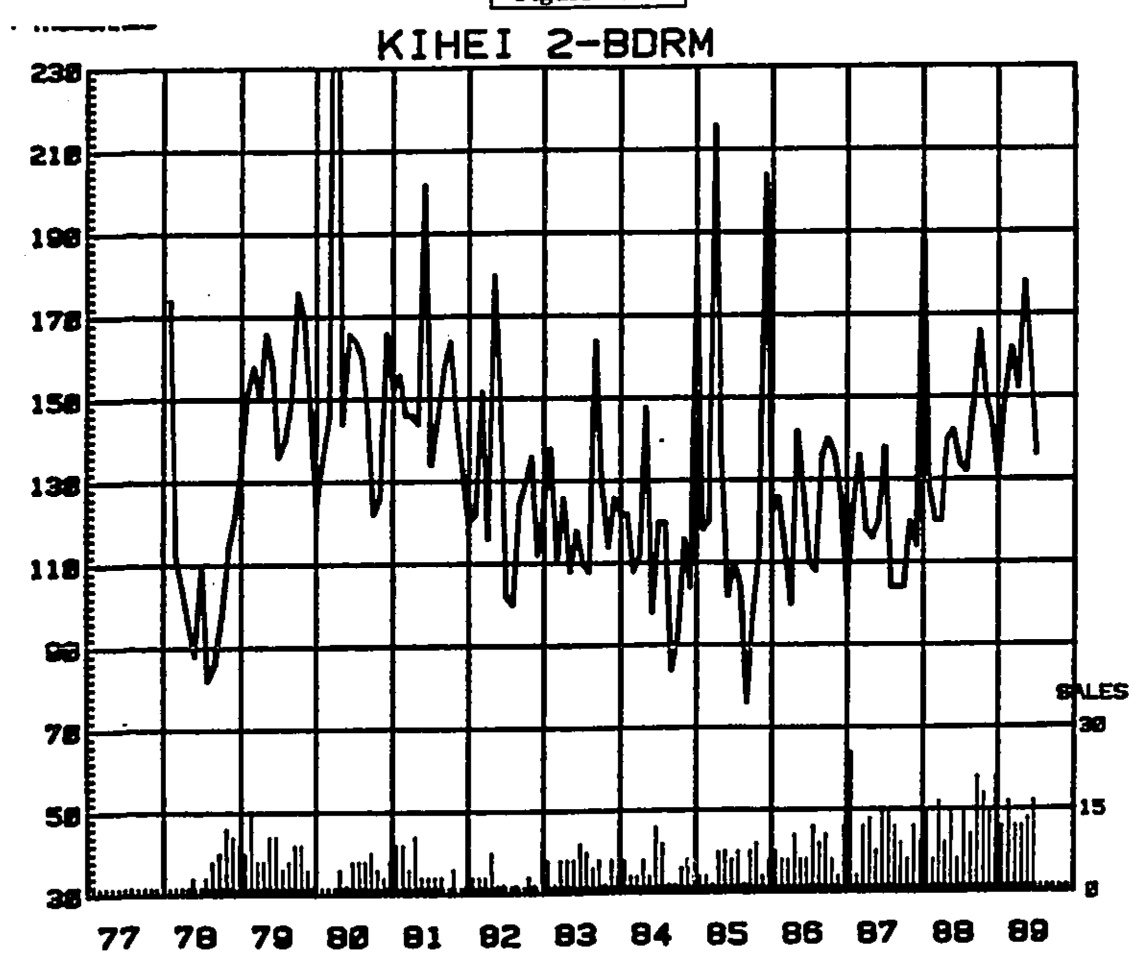

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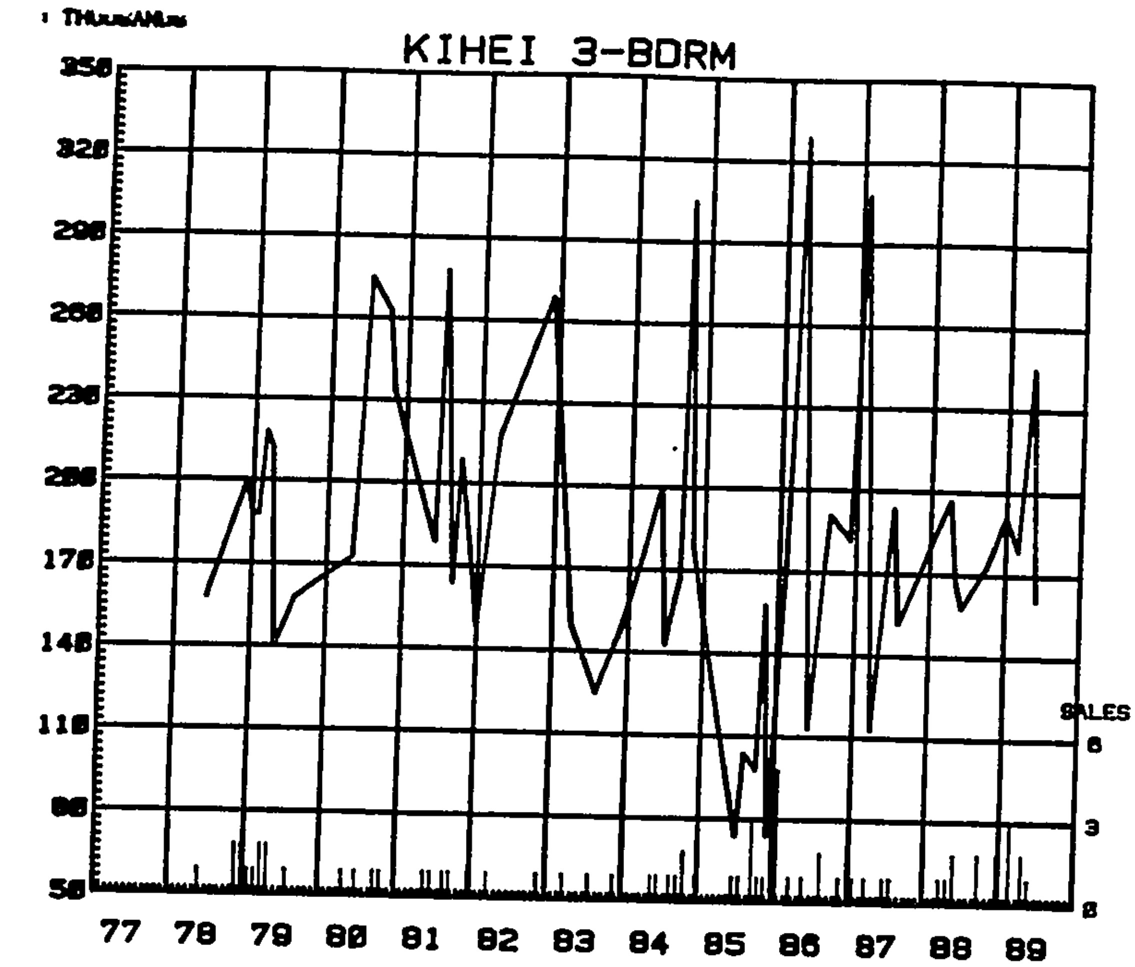


Figure VI-59

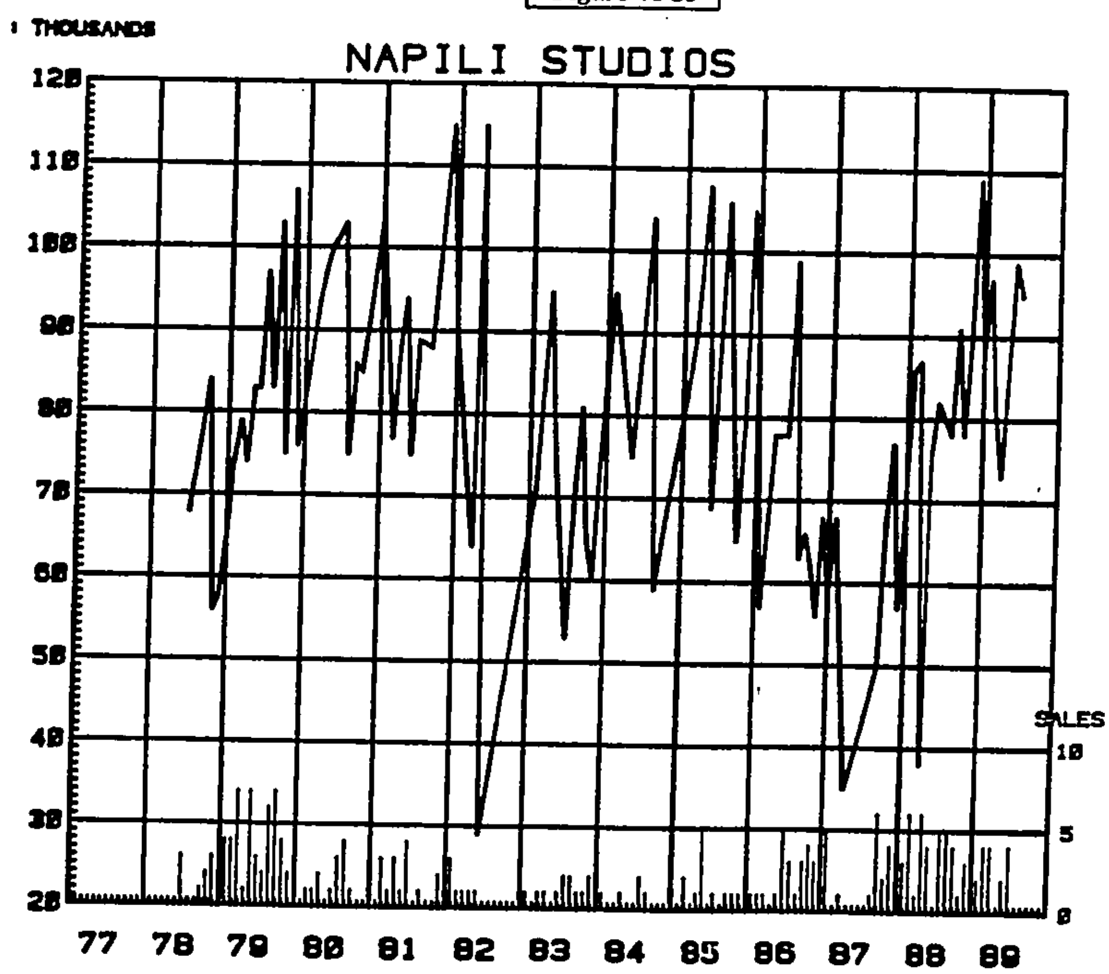


Figure VI-60

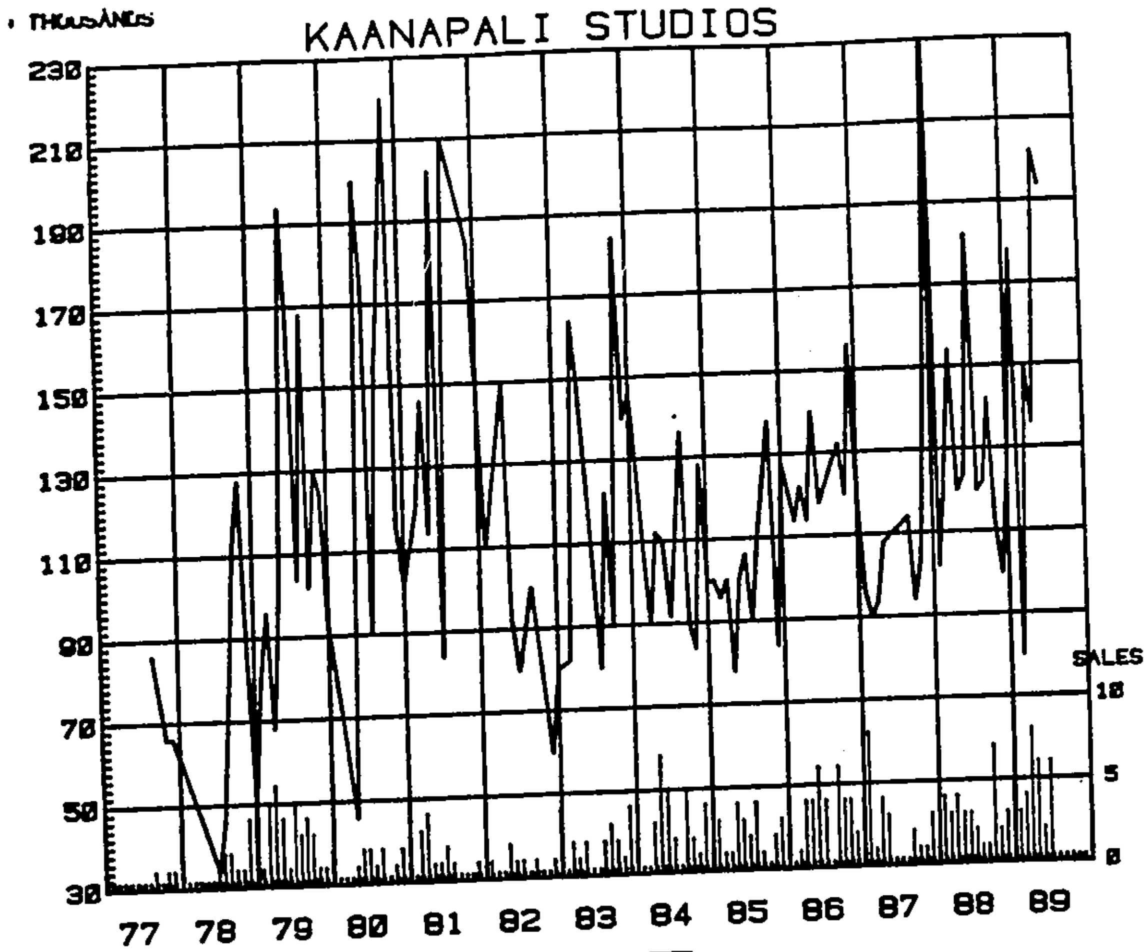
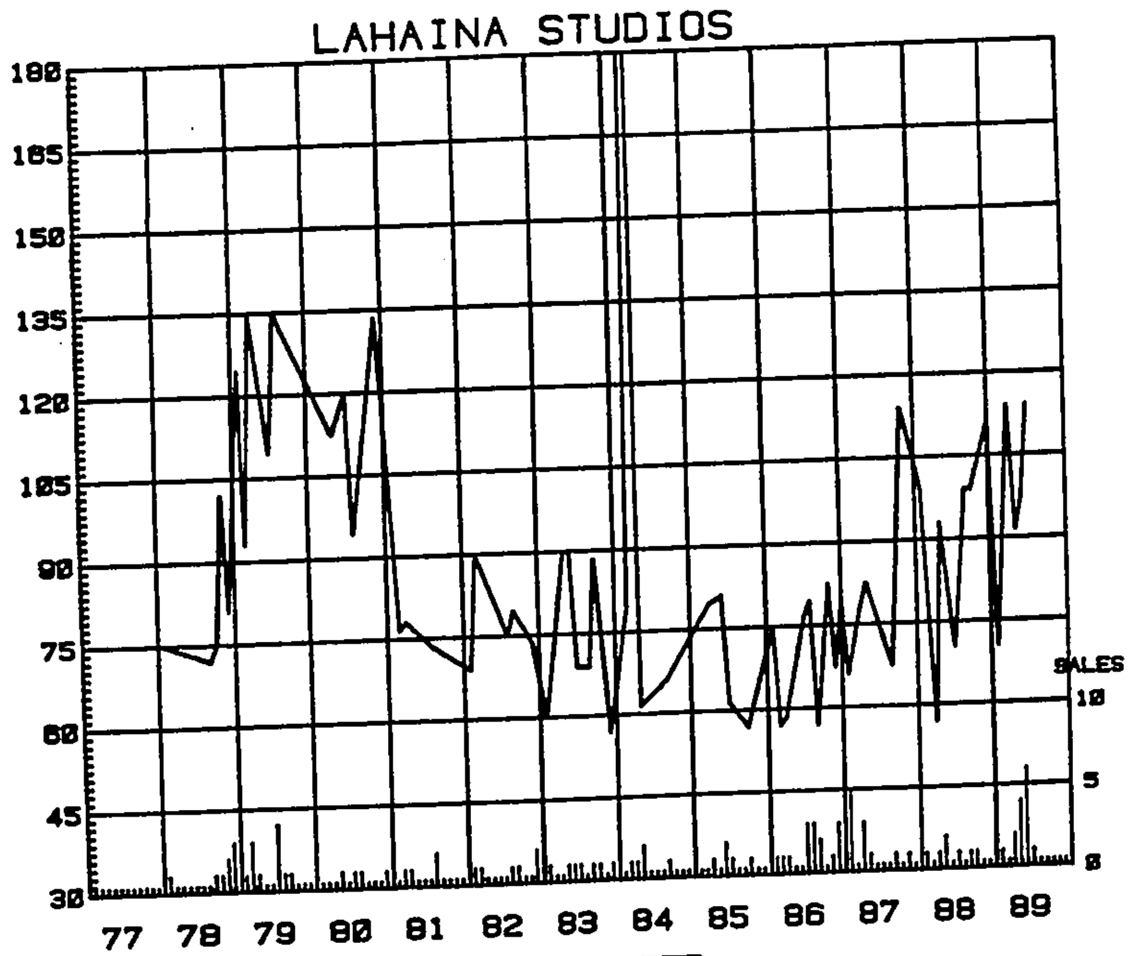


Figure VI-61



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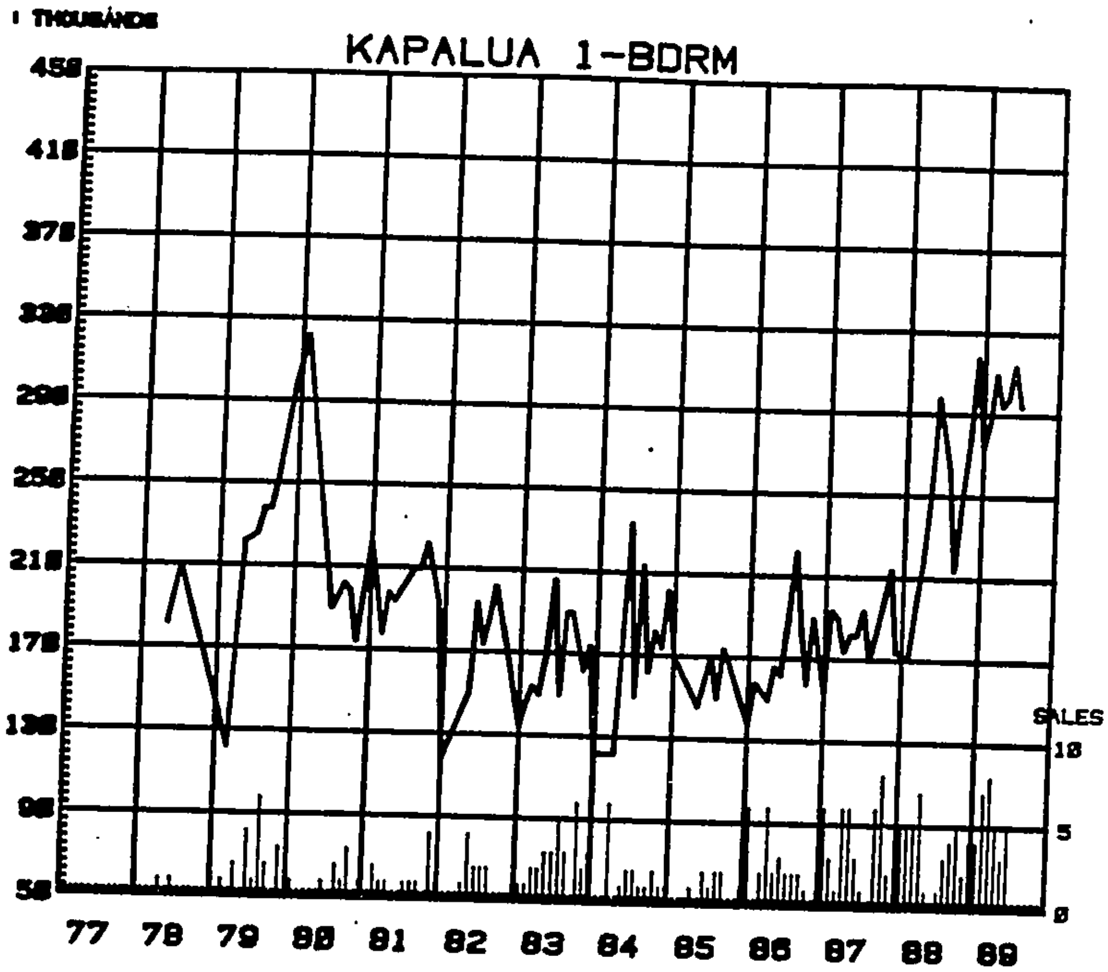

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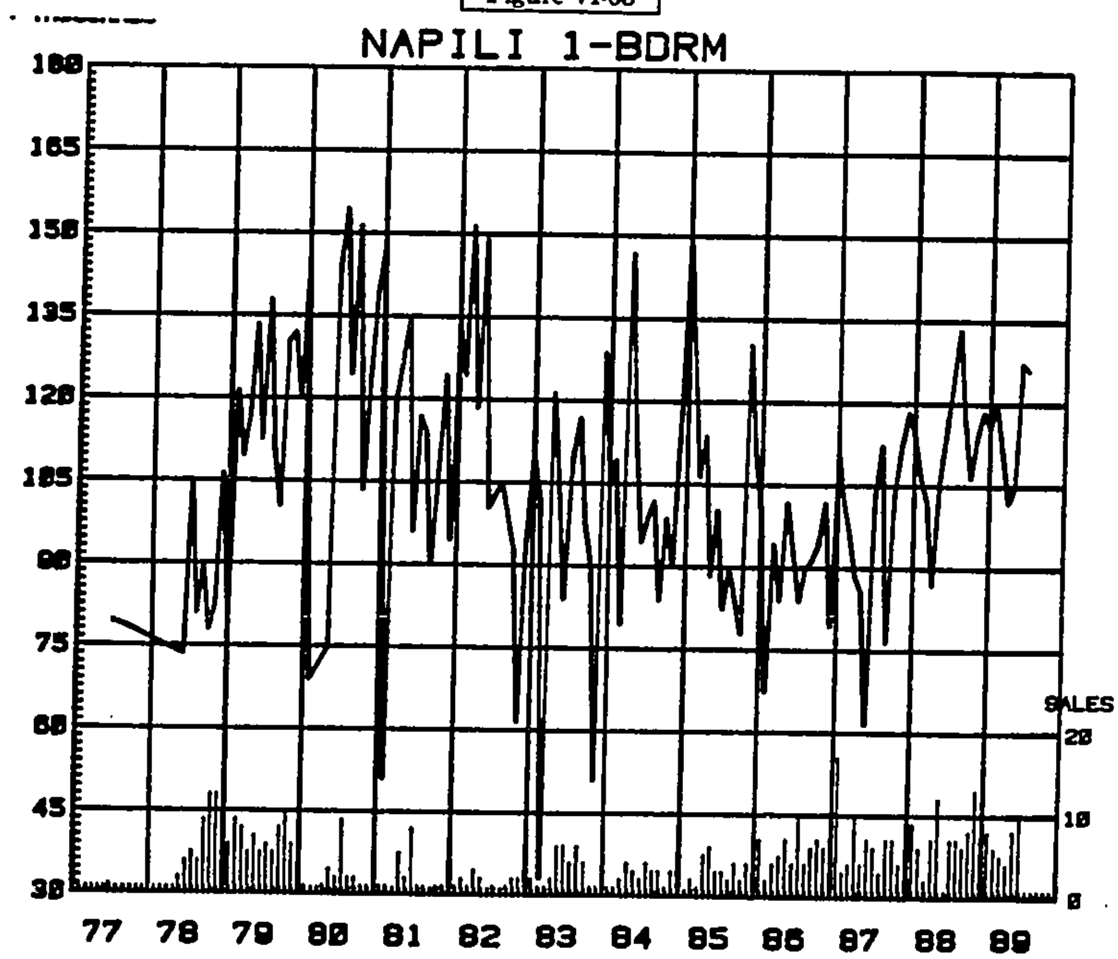

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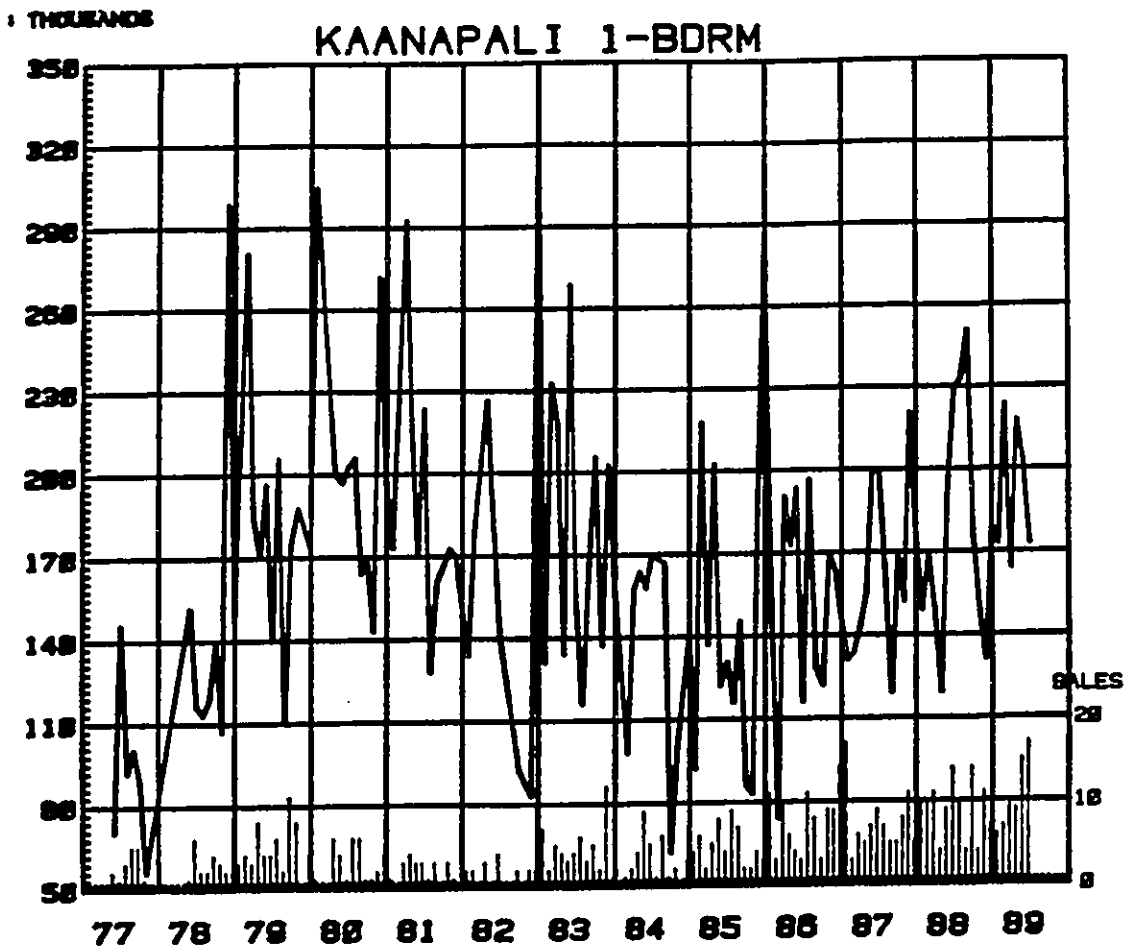

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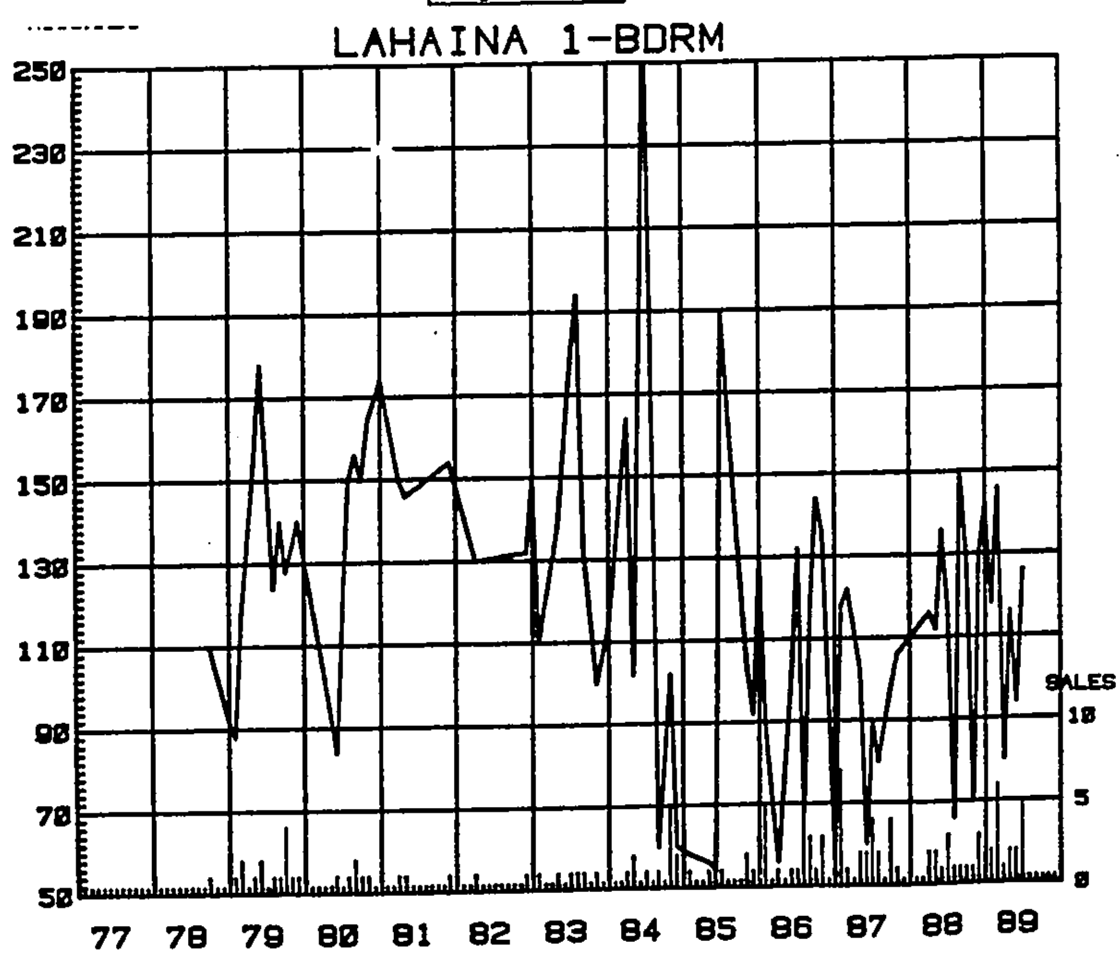

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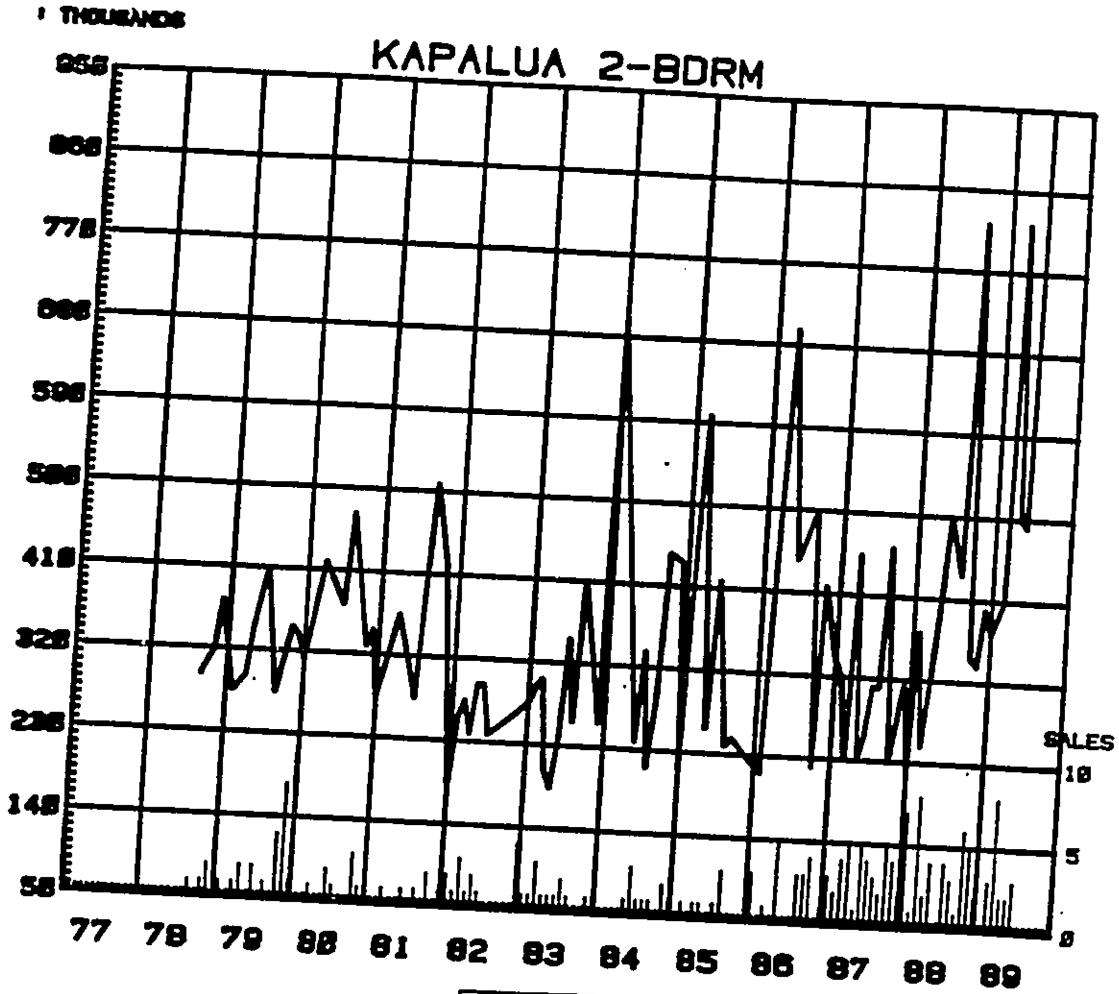

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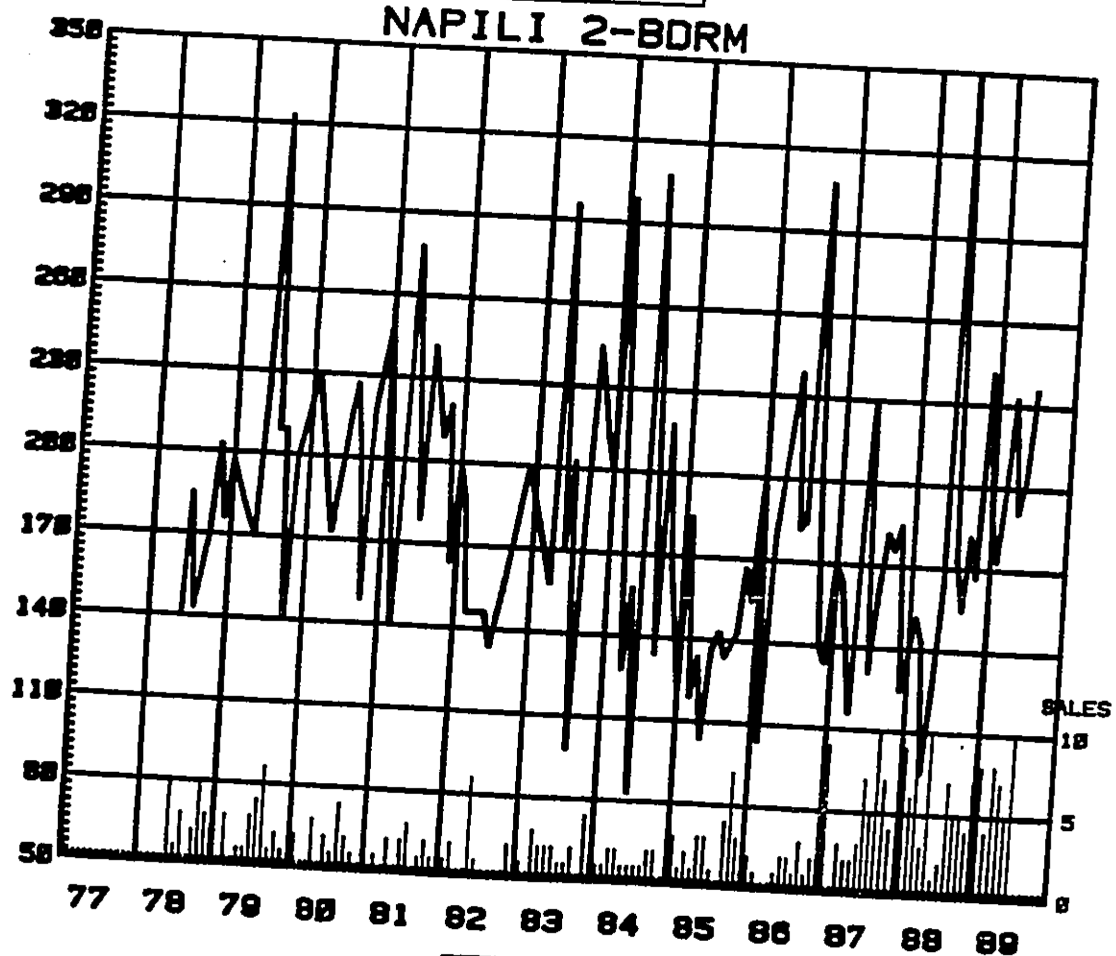

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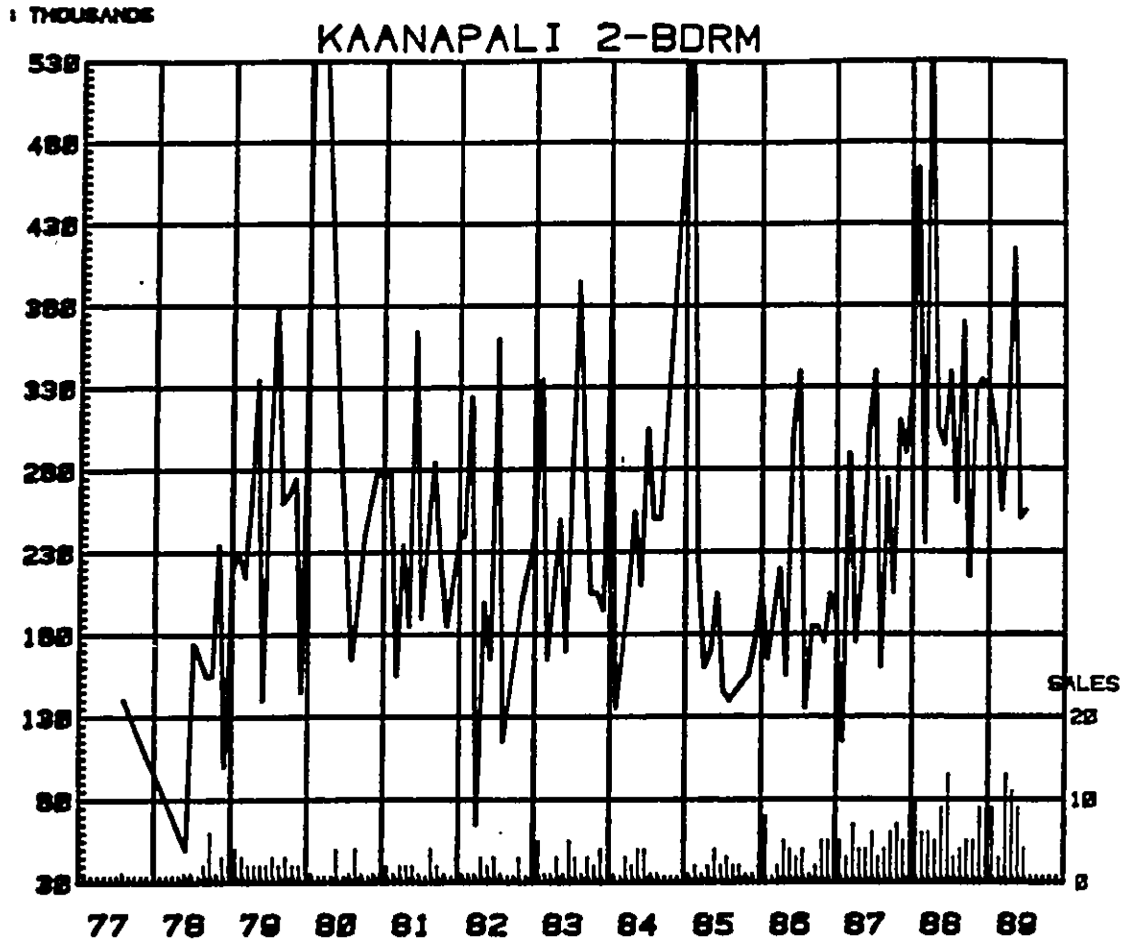

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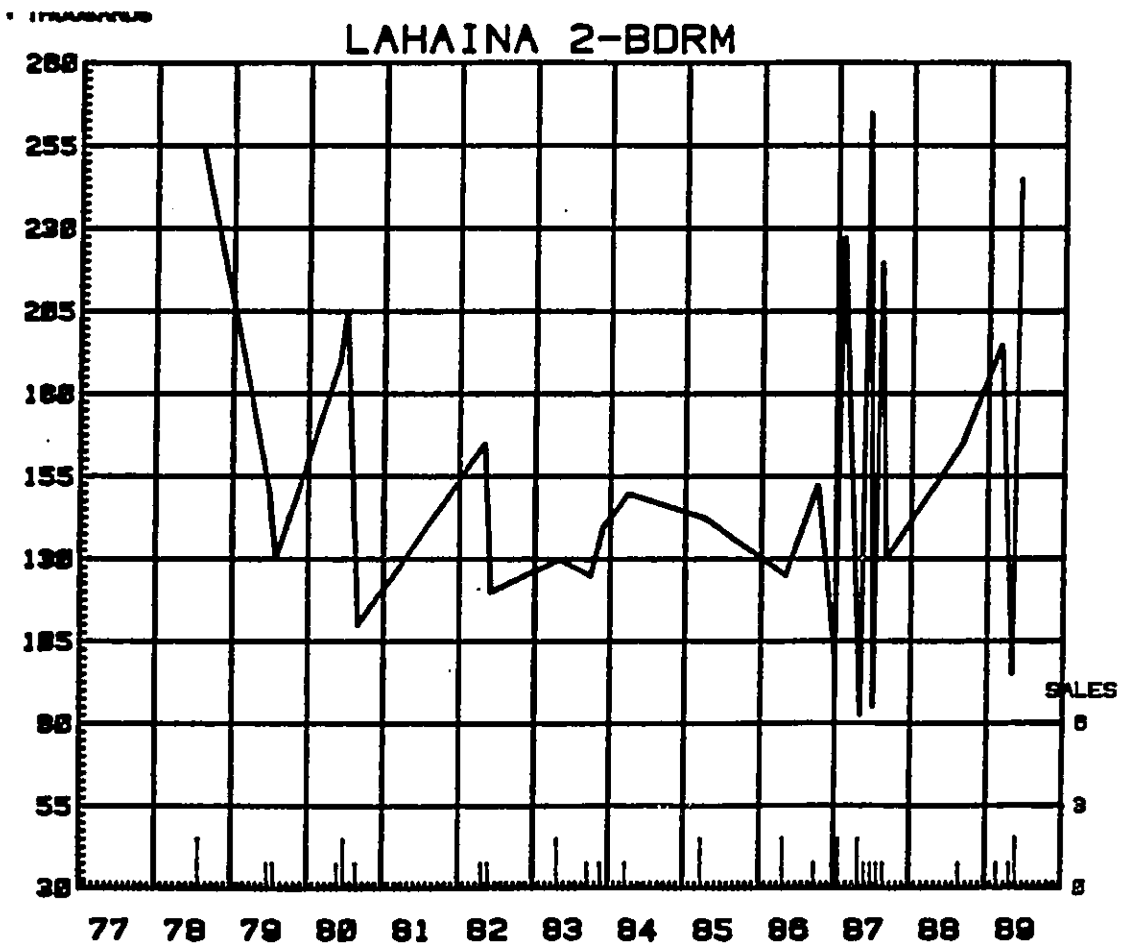


Figure VI-70

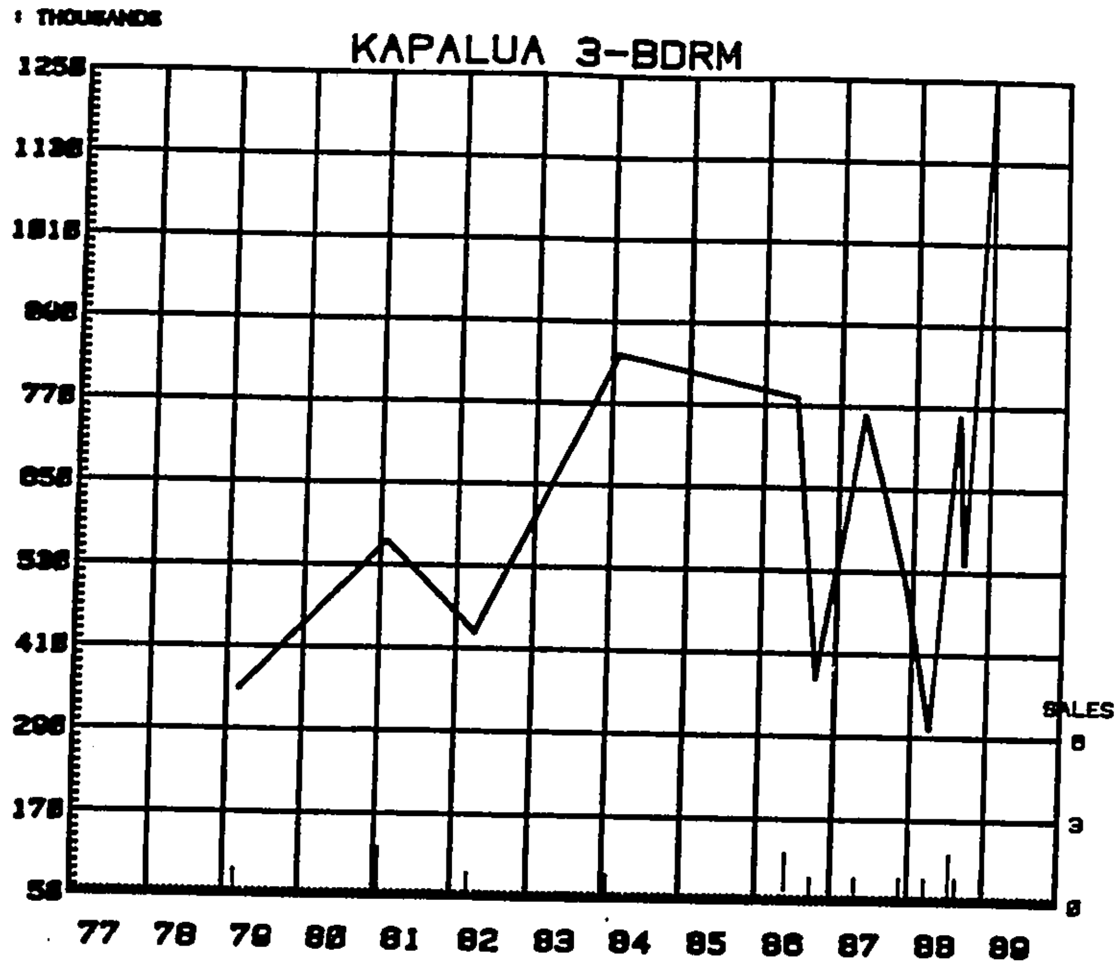
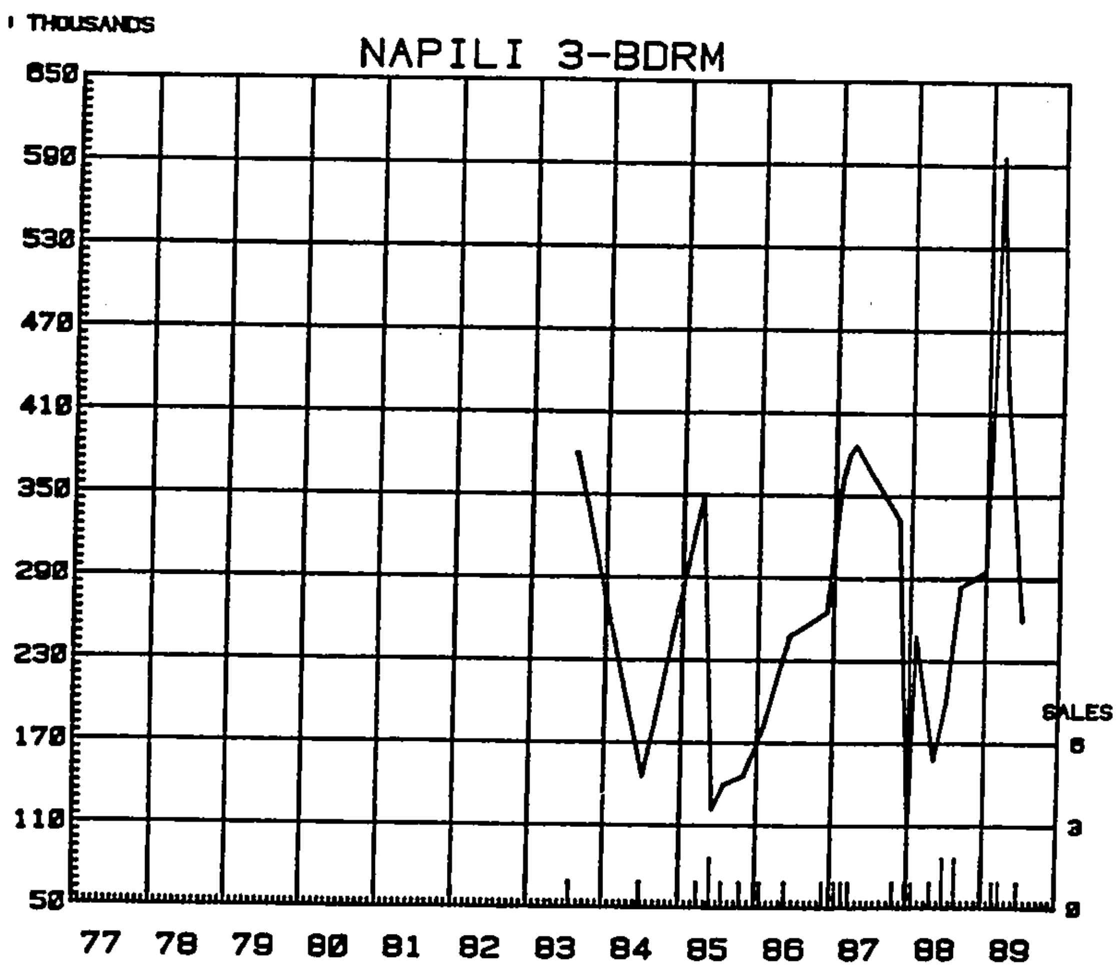


Figure VI-71



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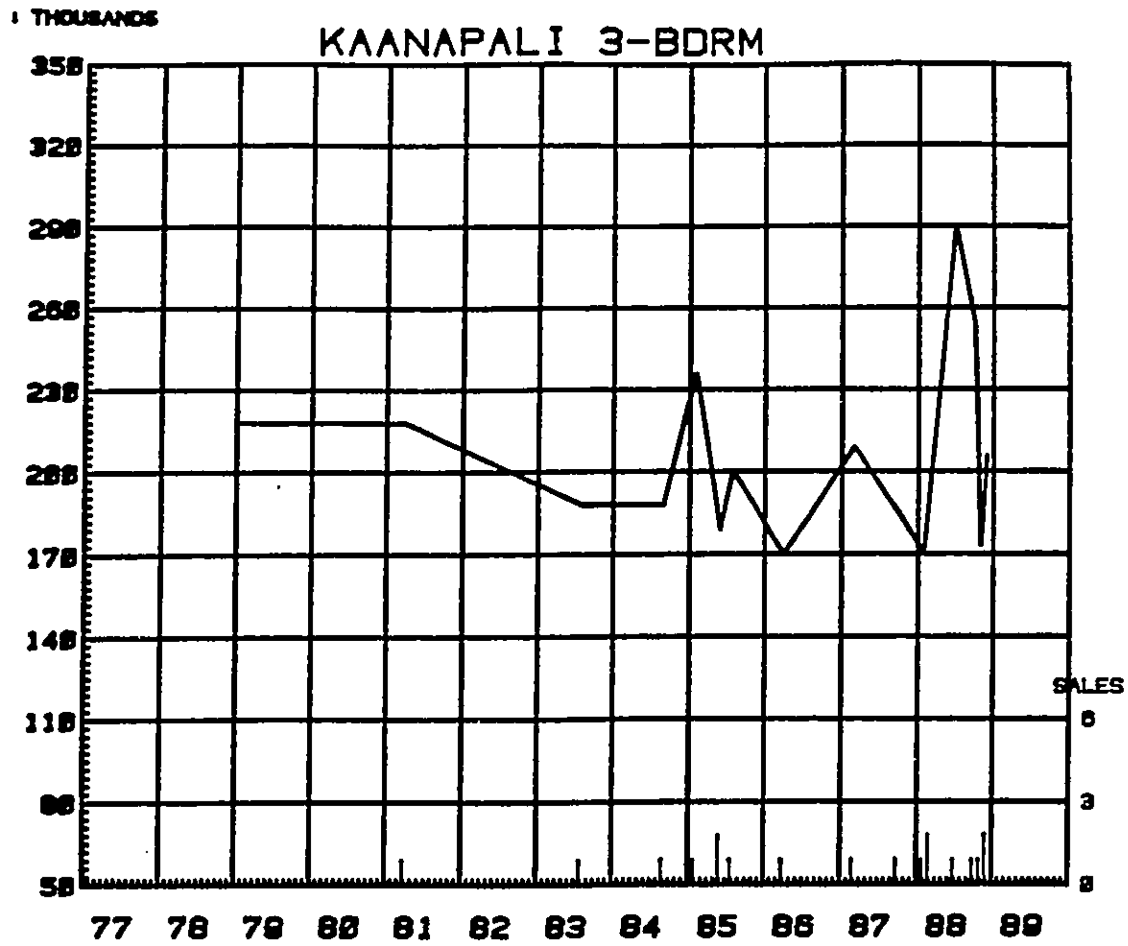

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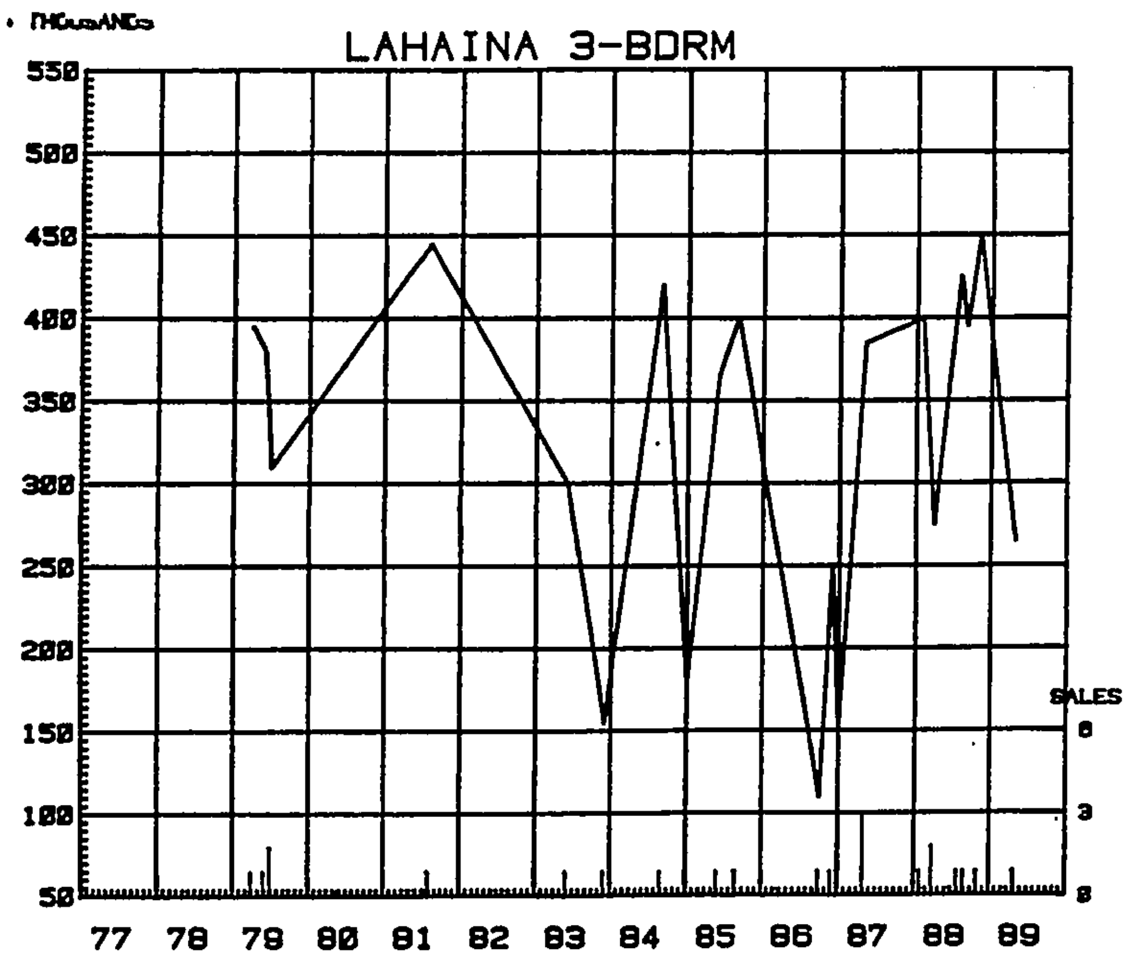
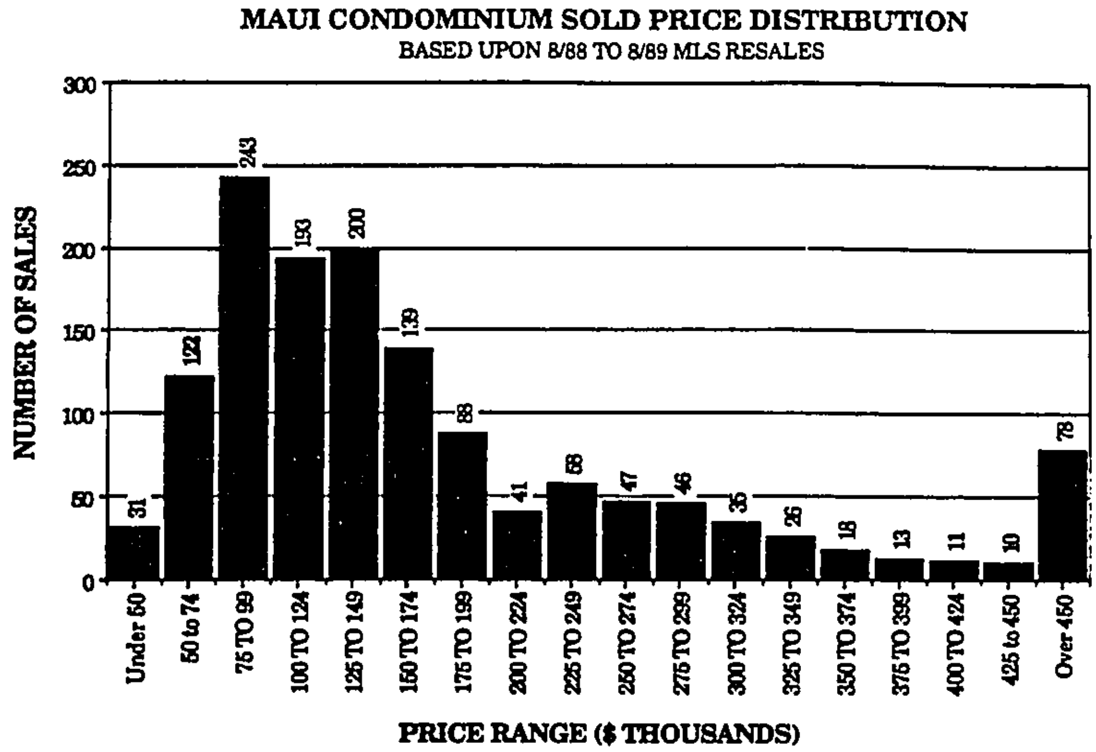


Figure VI-74



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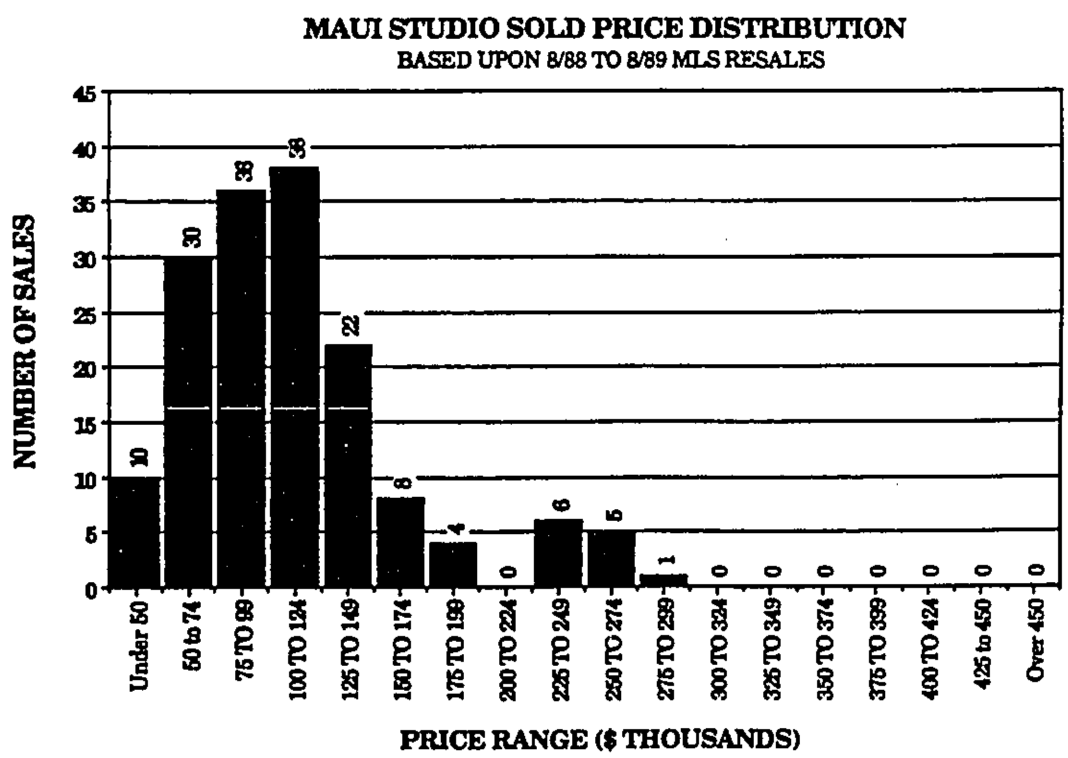
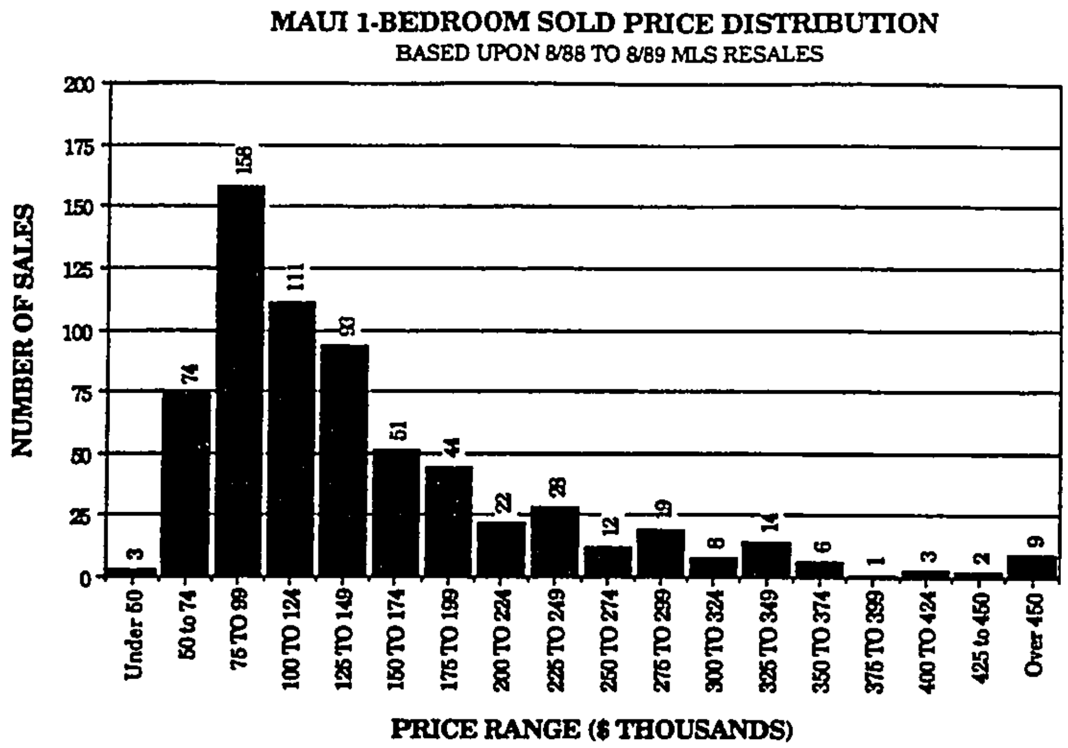


Figure VI-76



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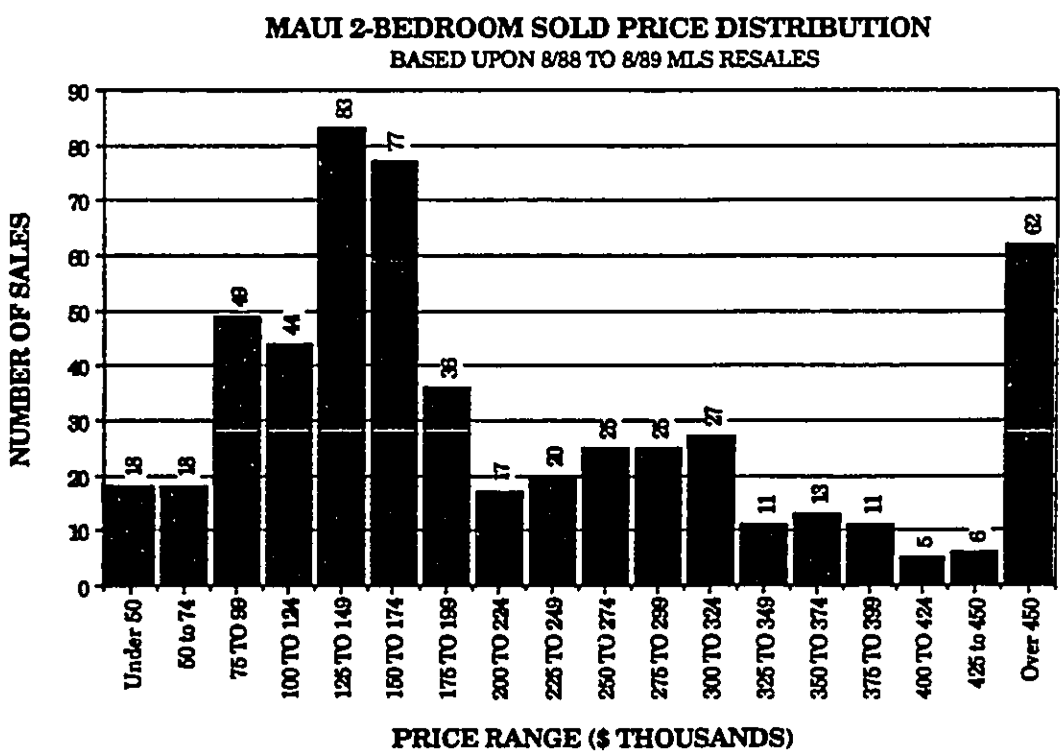

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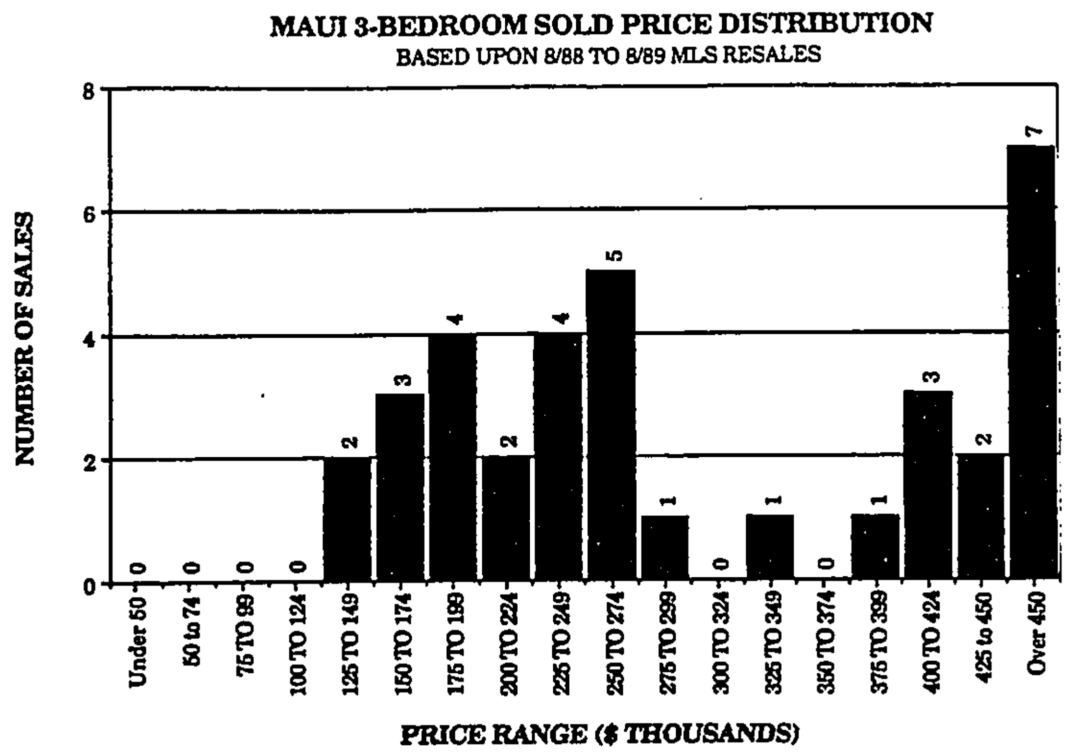


Figure VI-79

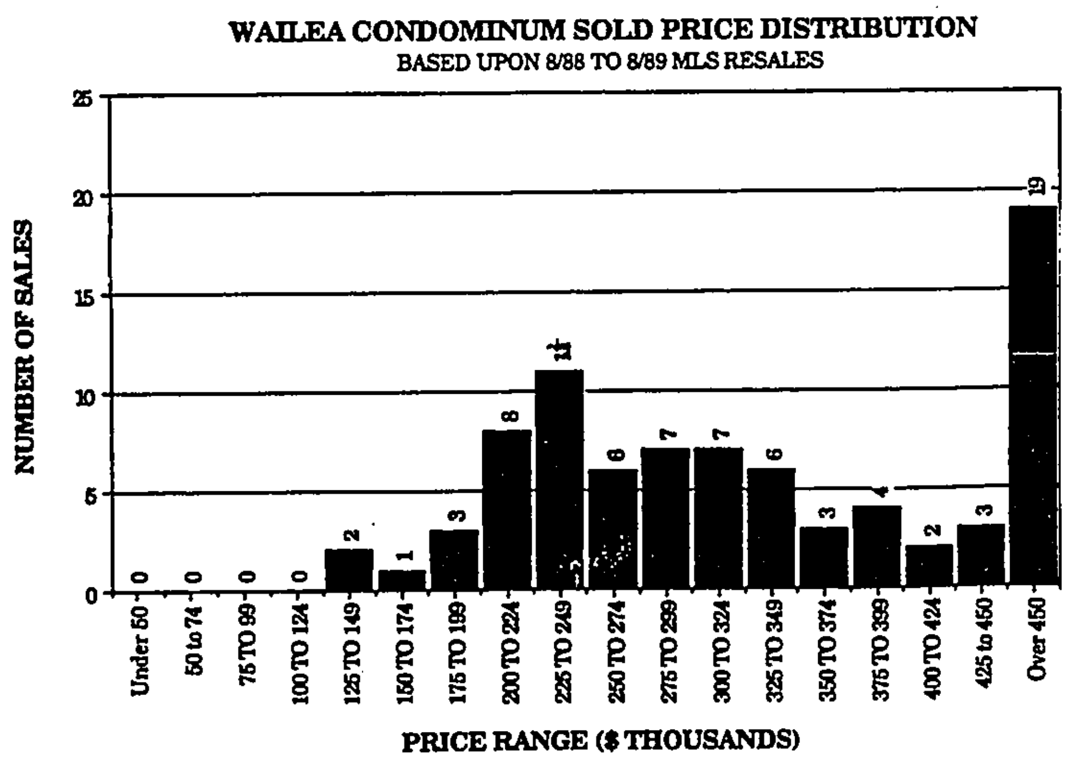


Figure VI-80

KIHEI CONDOMINIUM SOLD PRICE DISTRIBUTION
BASED UPON 8/88 TO 8/89 MLS RESALES

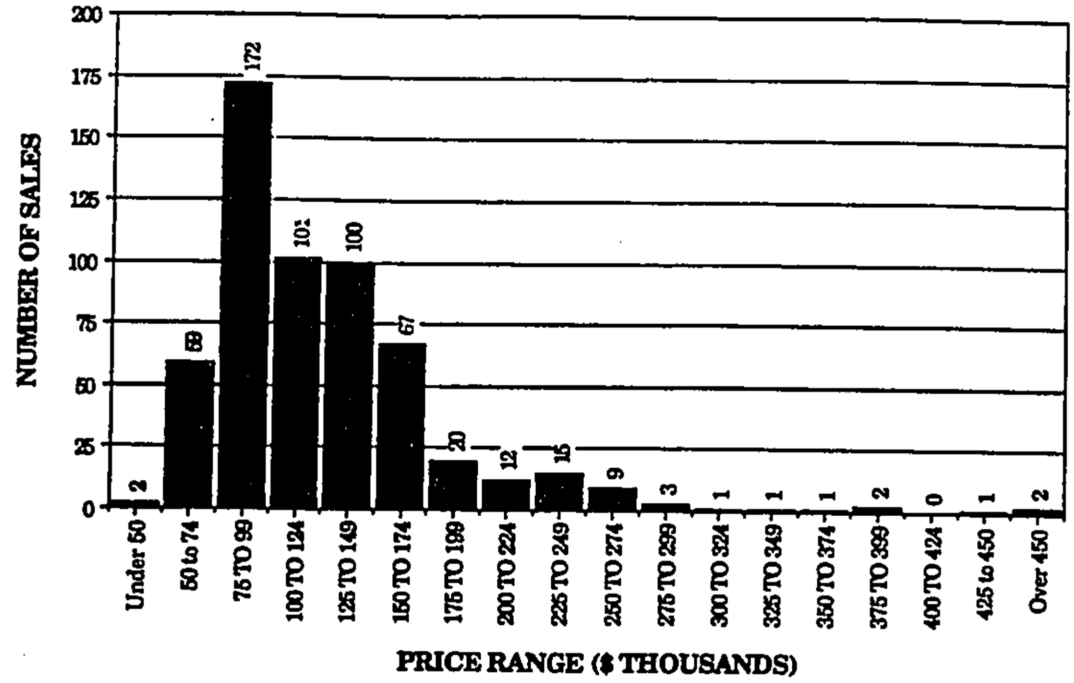


Figure VI-81

KIHEI 1-BEDROOM SOLD PRICE DISTRIBUTION
BASED UPON 8/88 TO 8/89 MLS RESALES

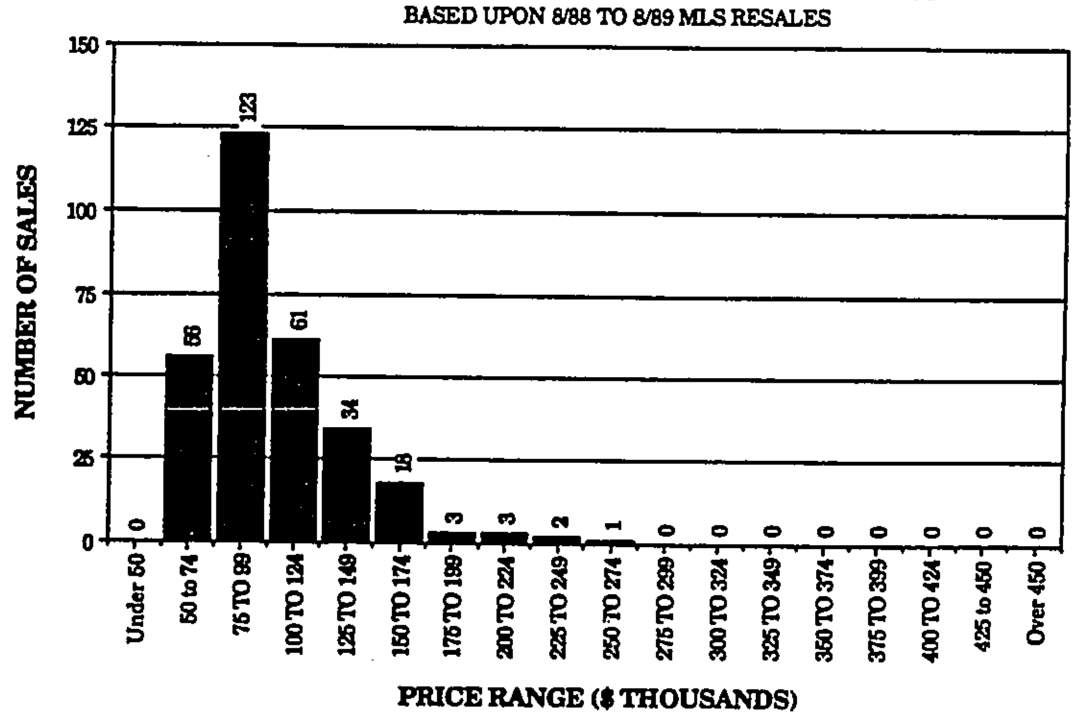


Figure VI-82

KIHEI 2-BEDROOM SOLD PRICE DISTRIBUTION
BASED UPON 8/88 TO 8/89 MLS RESALES

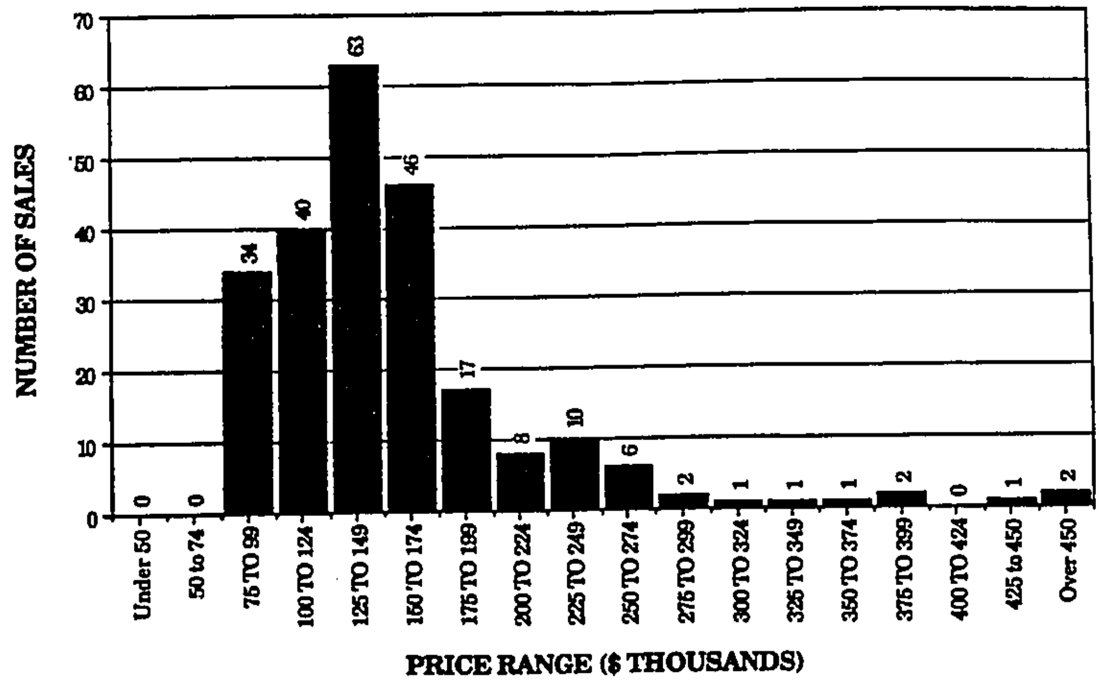


Figure VI-83

KAHULUI CONDOMINIUM SOLD PRICE DISTRIBUTION
BASED UPON 8/88 TO 8/89 MLS RESALES

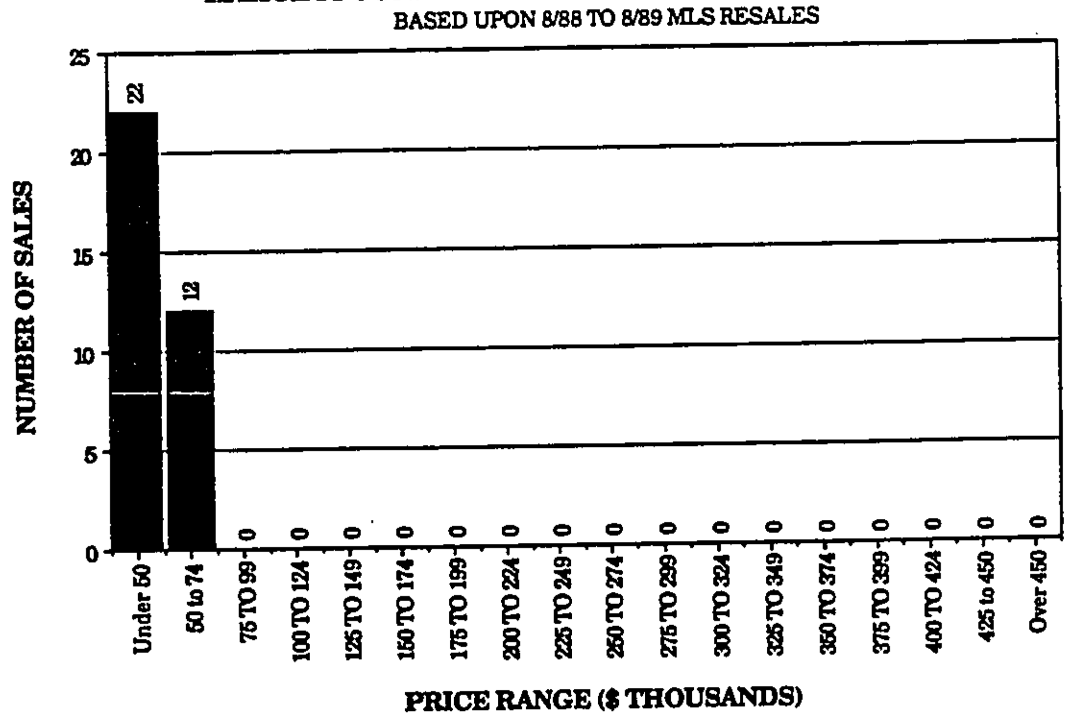


Figure VI-84

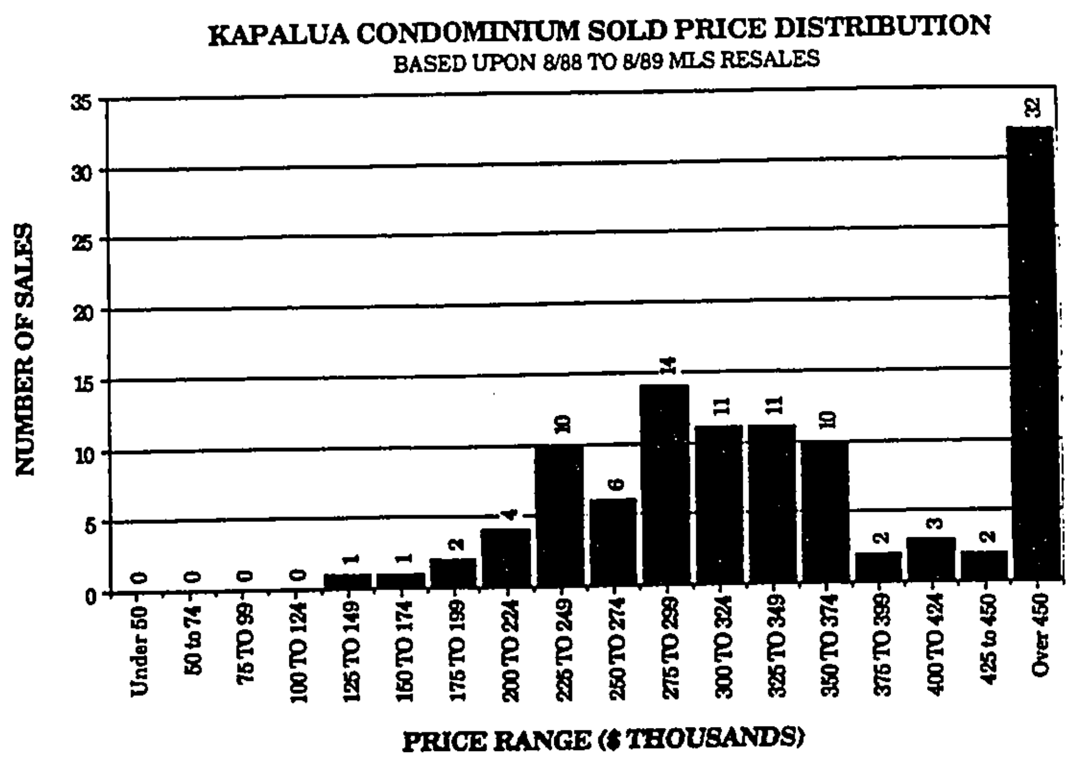


Figure VI-85

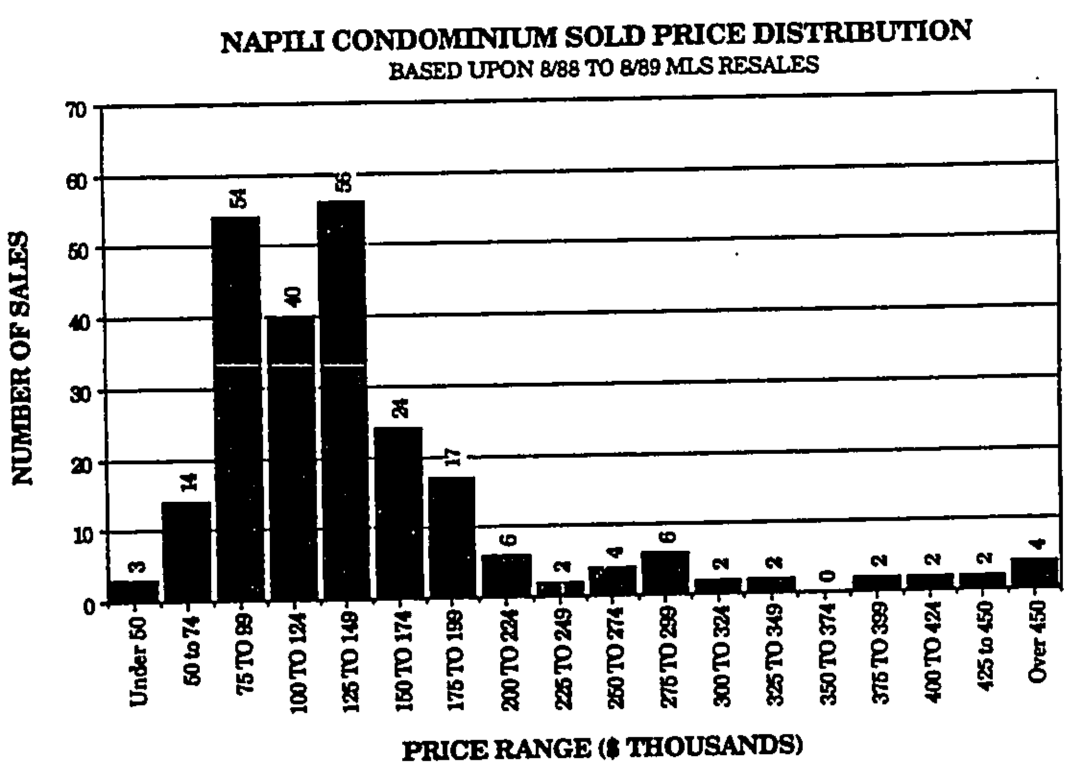


Figure VI-86

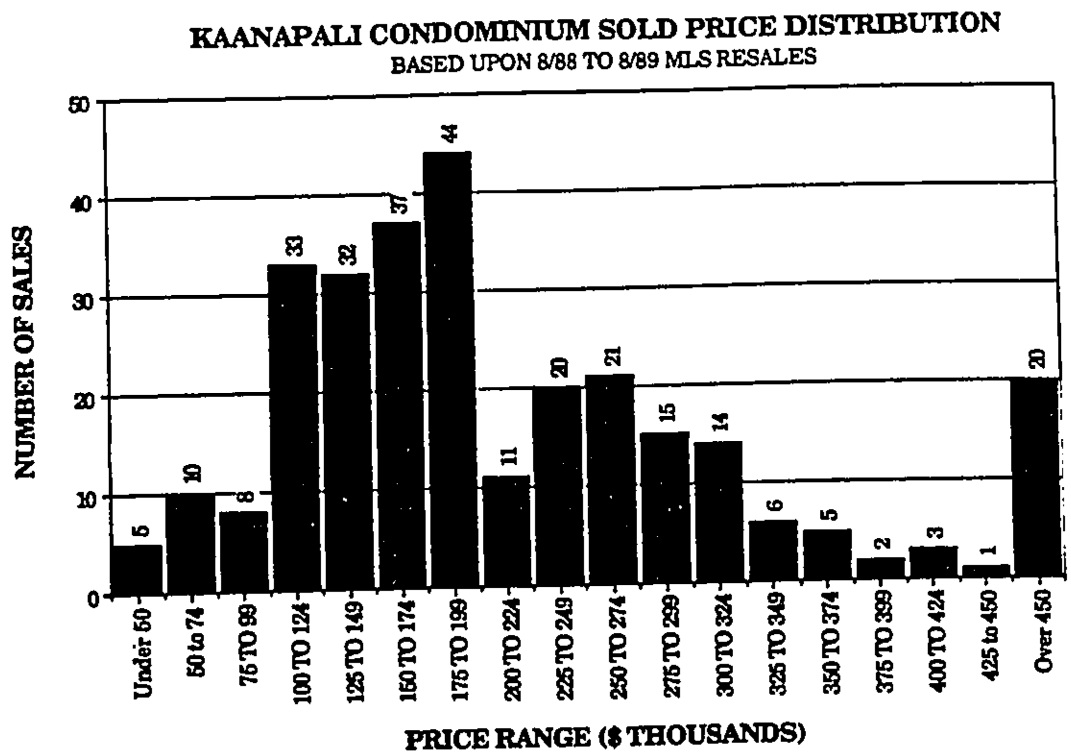


Figure VI-87

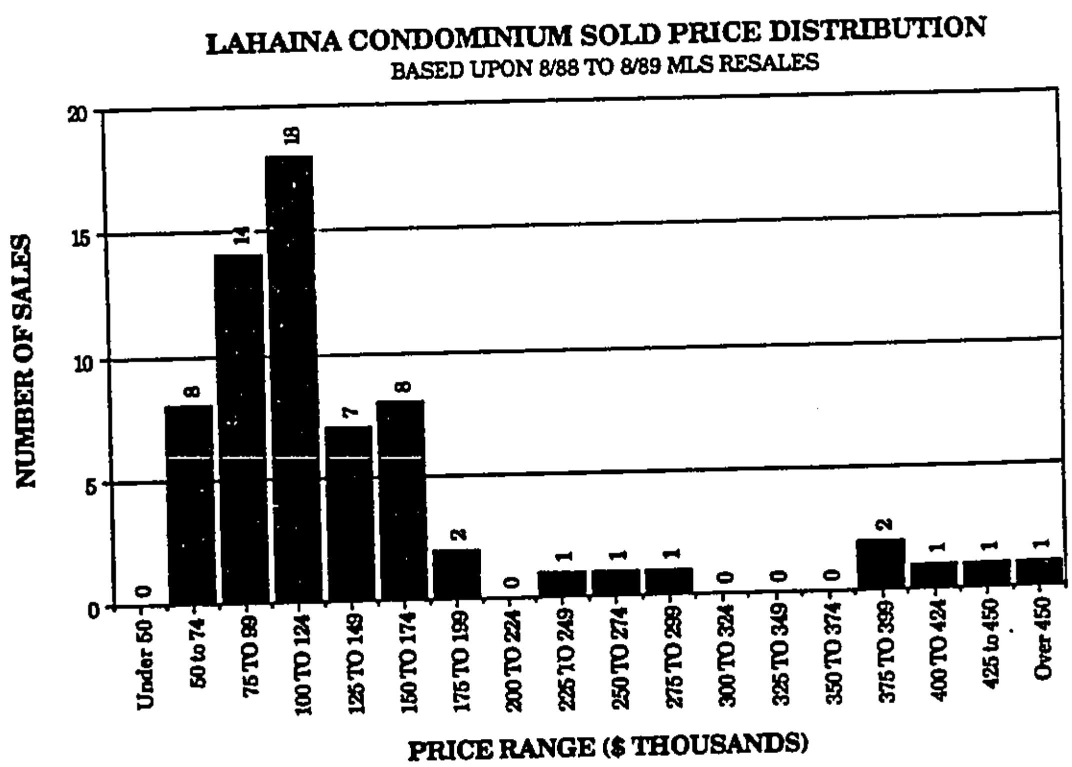


Figure VI-88

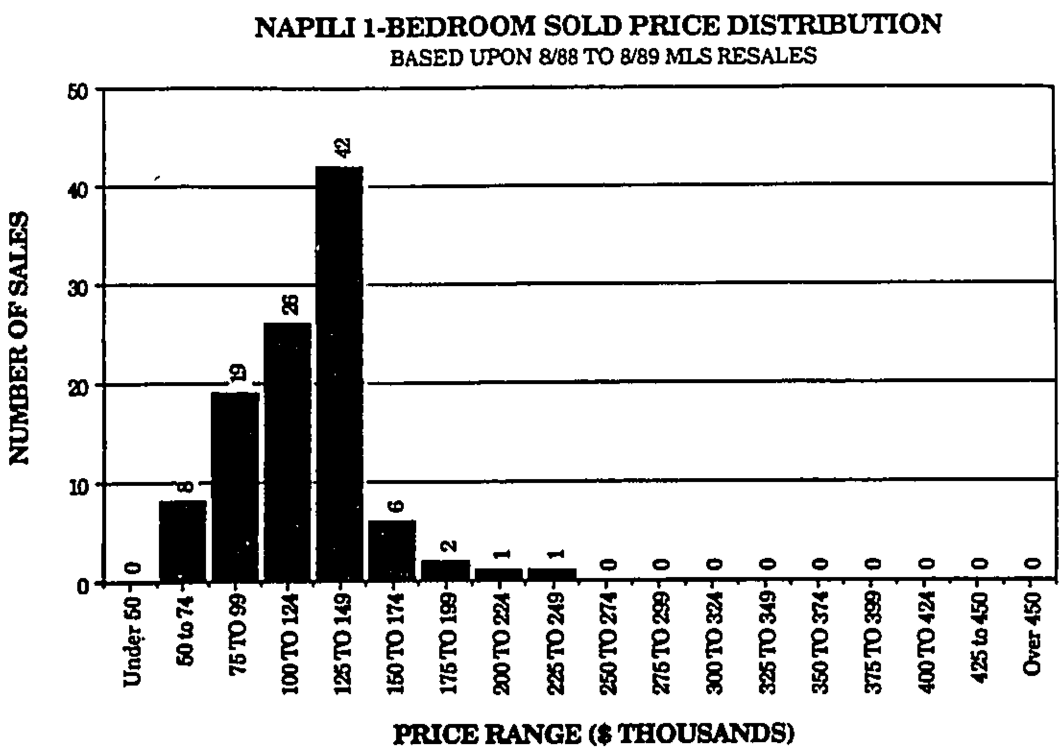


Figure VI-89

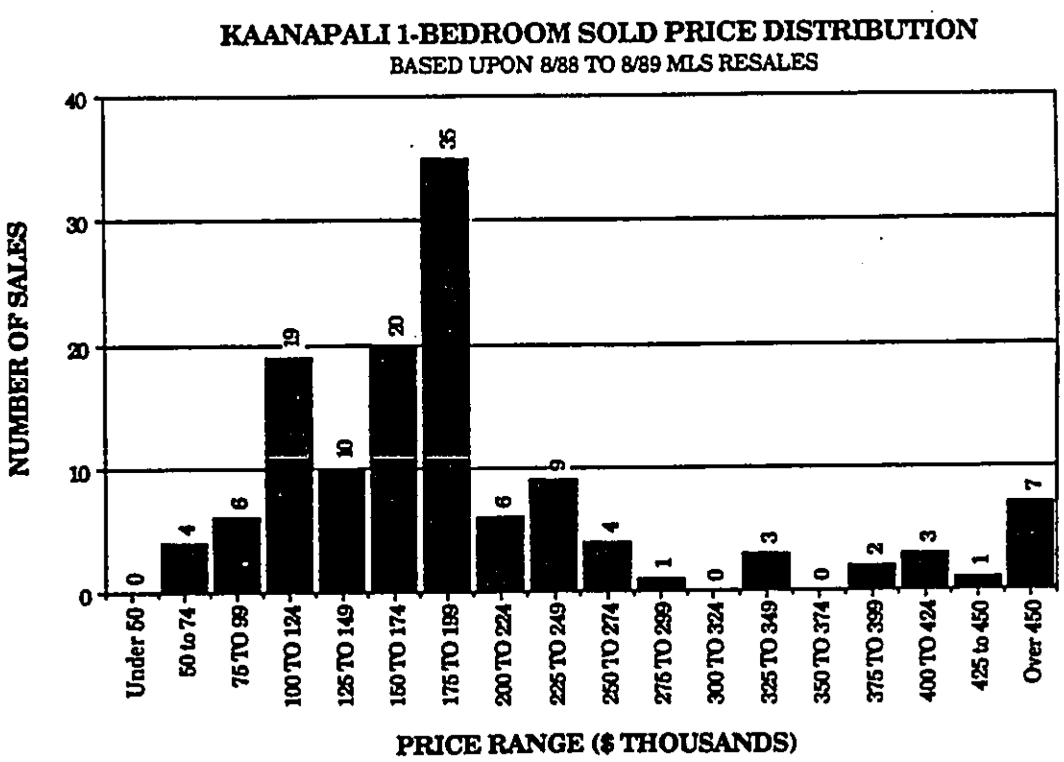


Figure VI-90

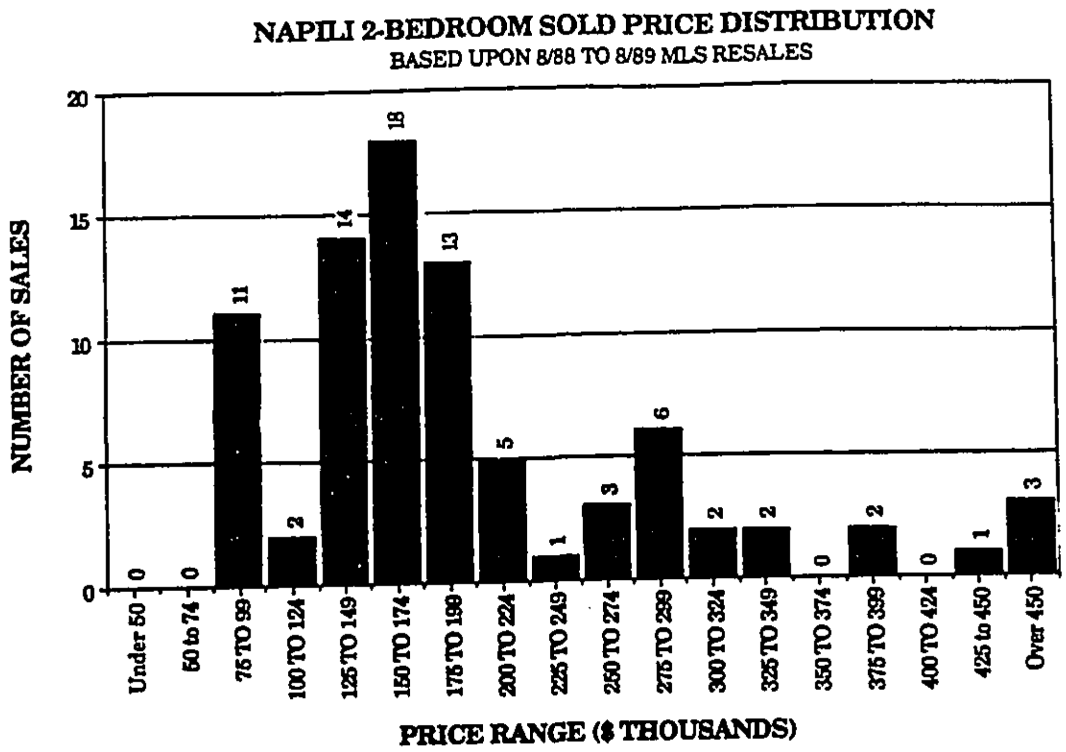


Figure VI-91

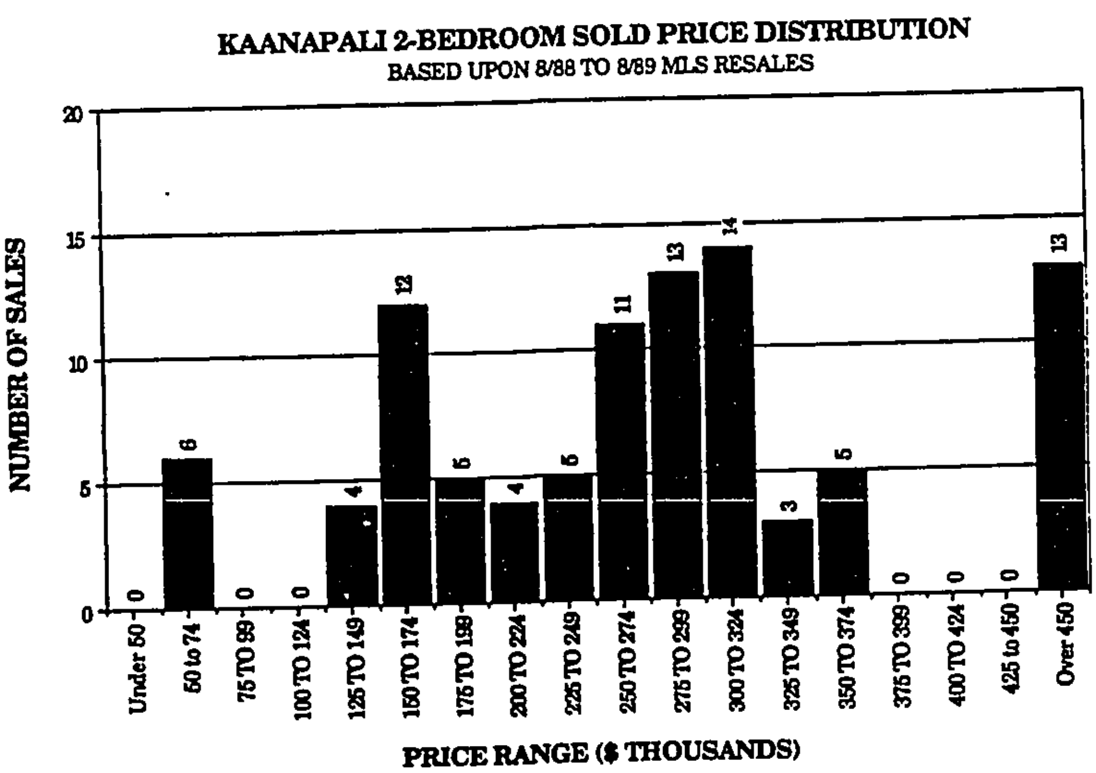


Figure VI-92

SELECTED MAUI STUDIO MEDIAN SALES PRICES
BASED UPON 8/88 TO 8/89 MLS RESALES

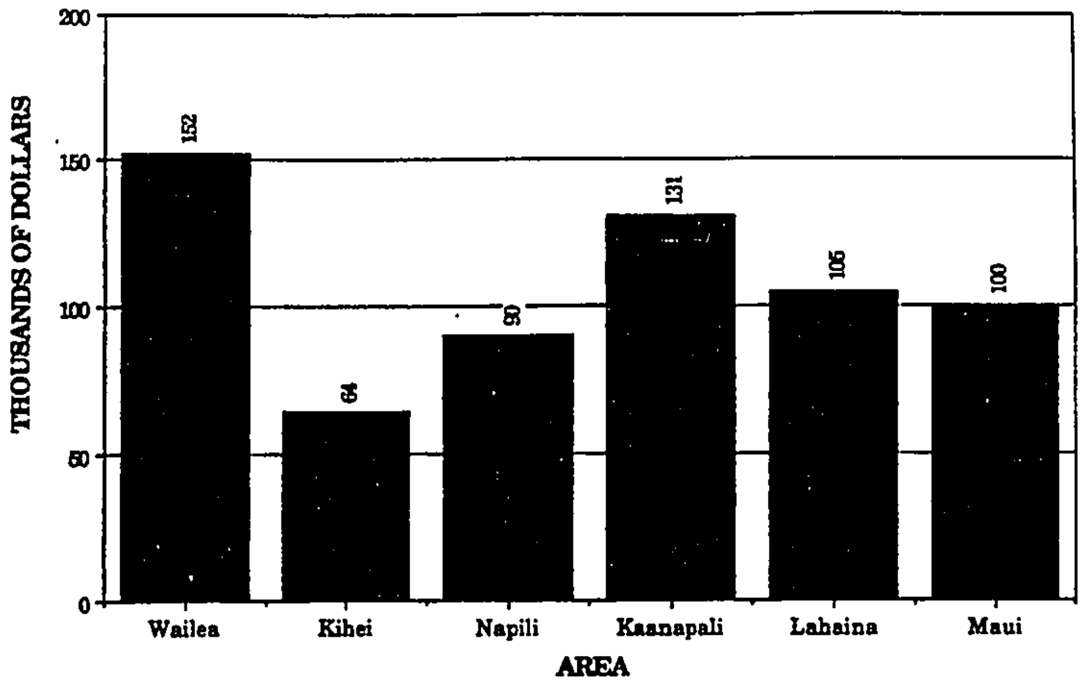


Figure VI-93

SELECTED MAUI 1-BEDROOM MEDIAN SALES PRICES
BASED UPON 8/88 TO 8/89 MLS RESALES

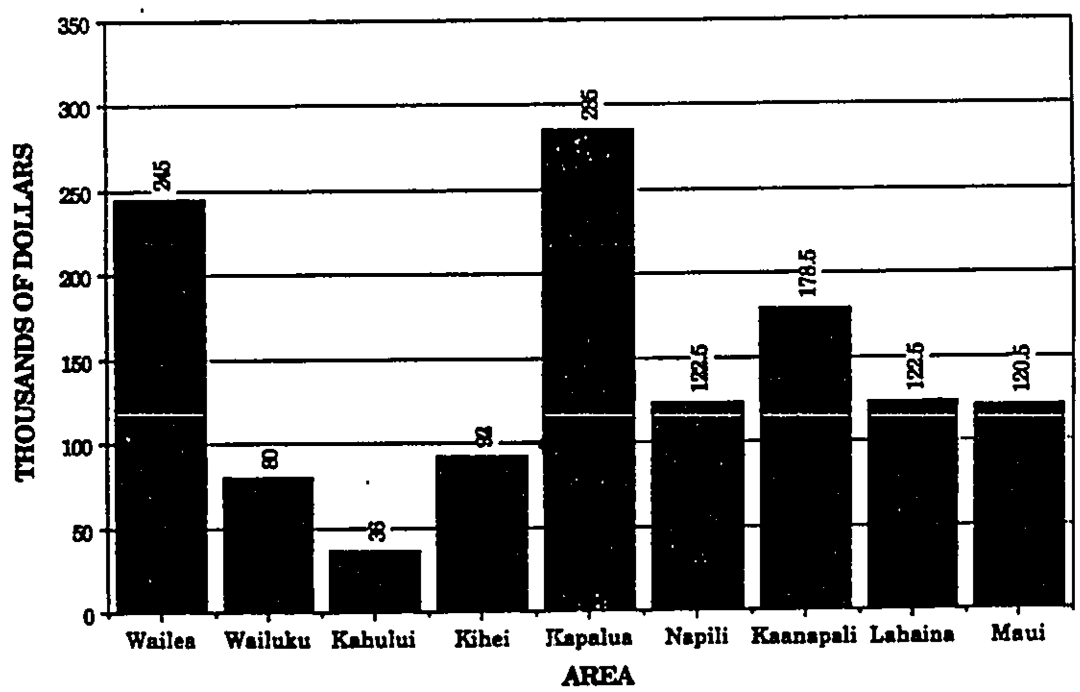


Figure VI-94

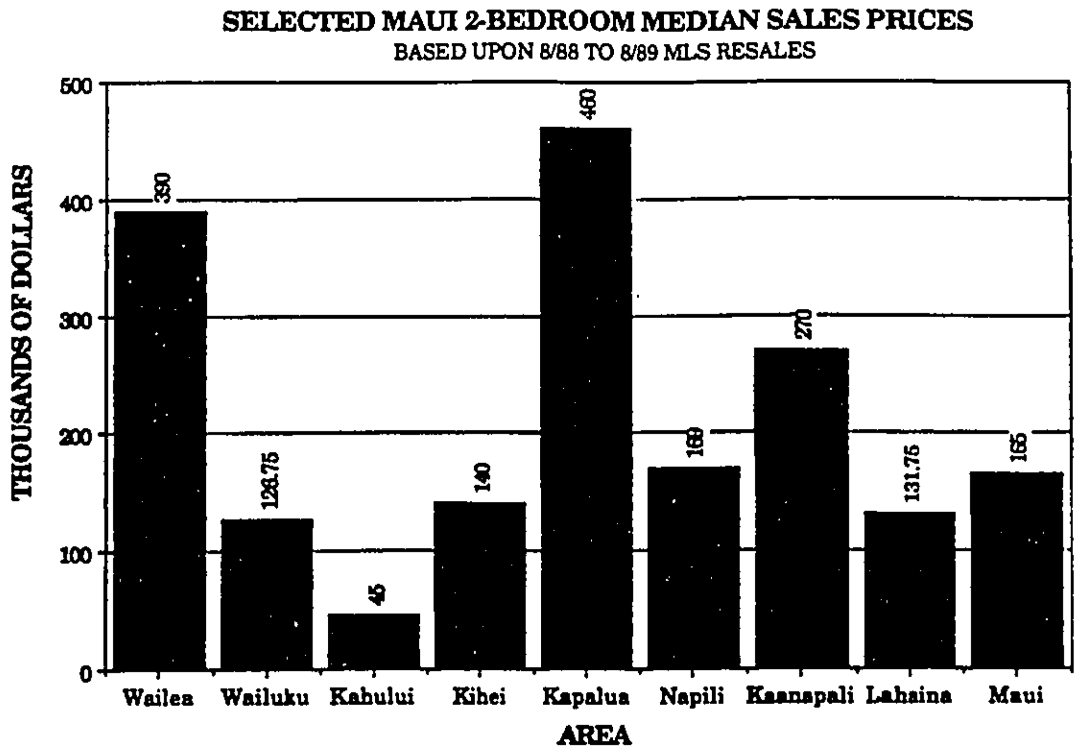


Figure VI-95

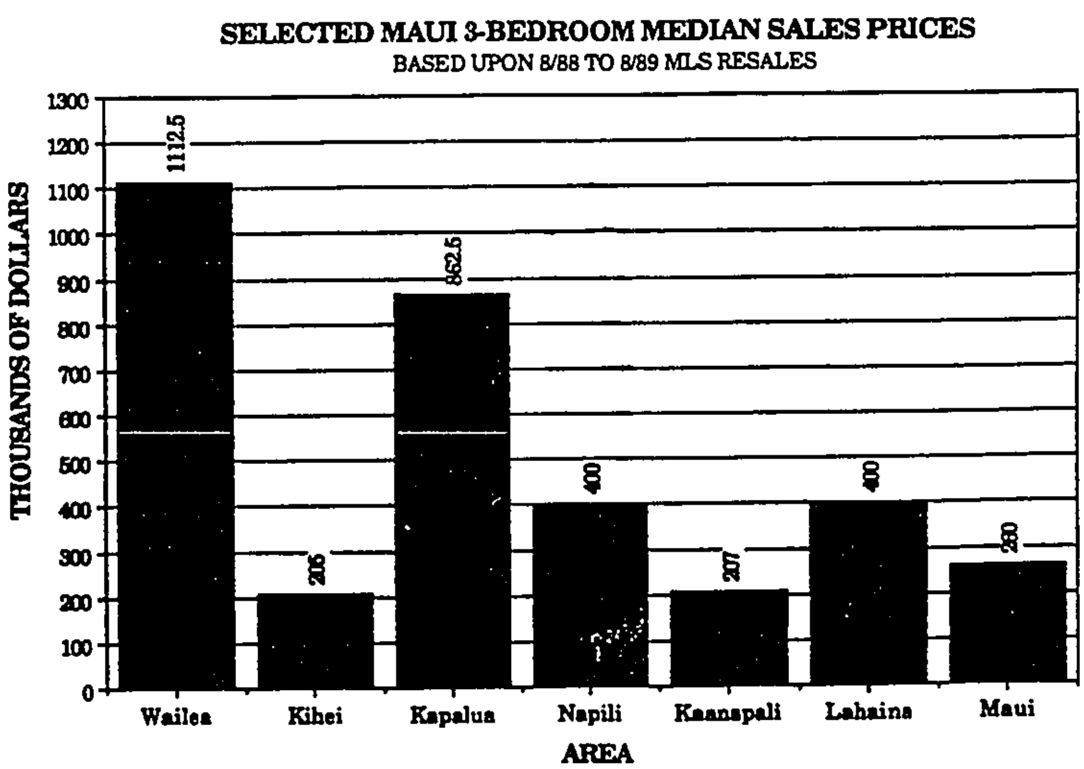


Figure VI-96

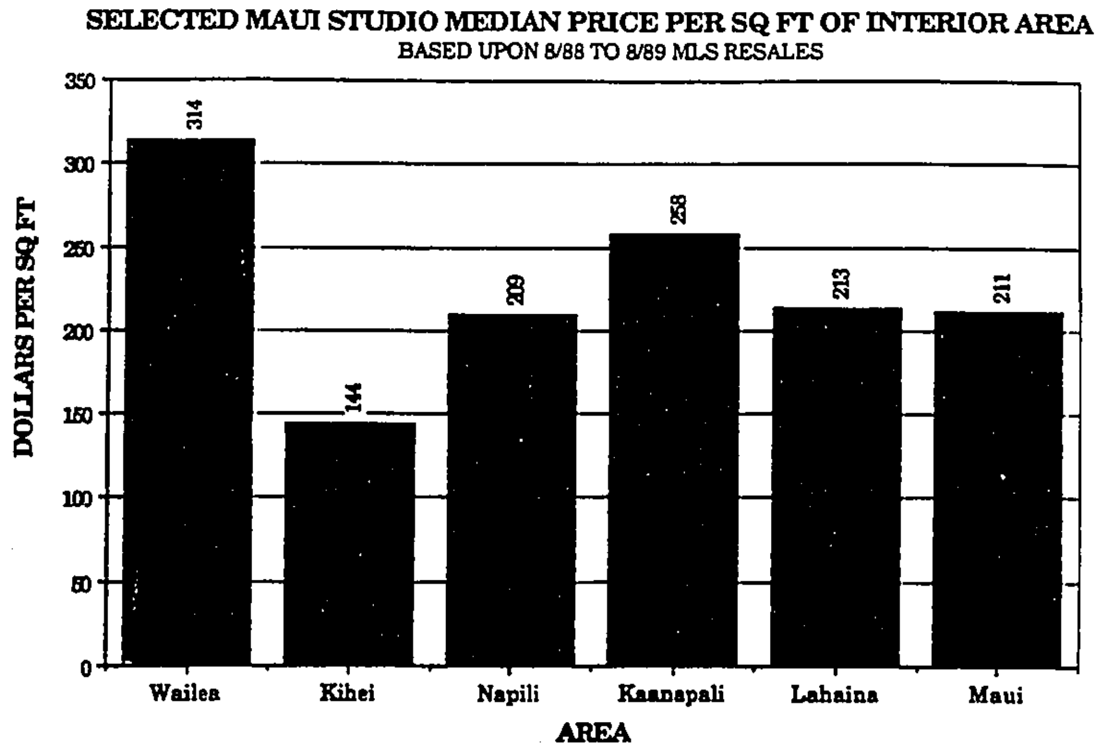


Figure VI-97

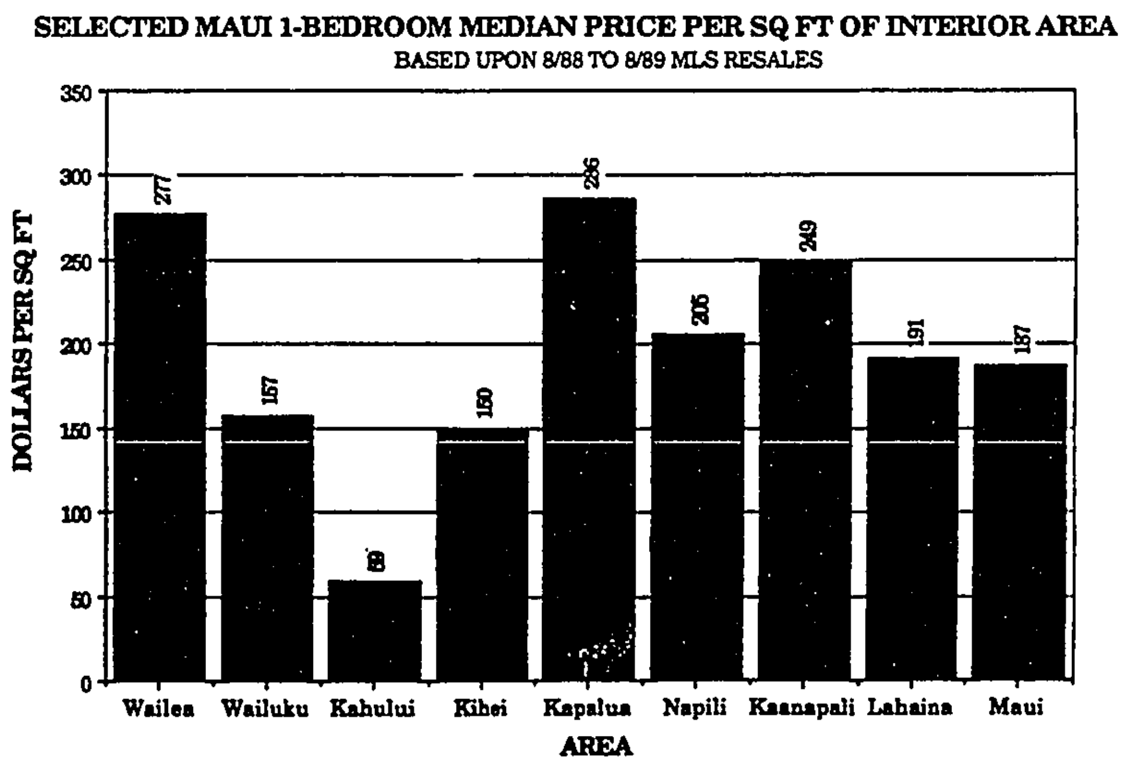


Figure VI-98

SELECTED MAUI 2-BEDROOM MEDIAN PRICE PER SQ FT OF INTERIOR AREA
BASED UPON 8/88 TO 8/89 MLS RESALES

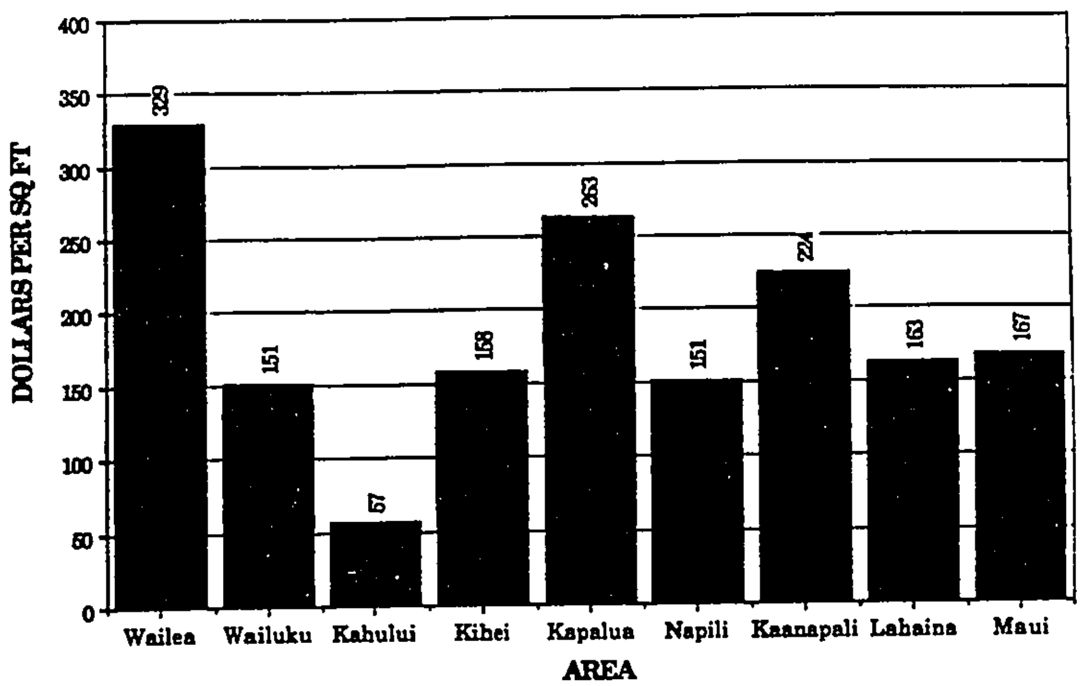


Figure VI-99

SELECTED MAUI 3-BEDROOM MEDIAN PRICE PER SQ FT OF INTERIOR AREA
BASED UPON 8/88 TO 8/89 MLS RESALES

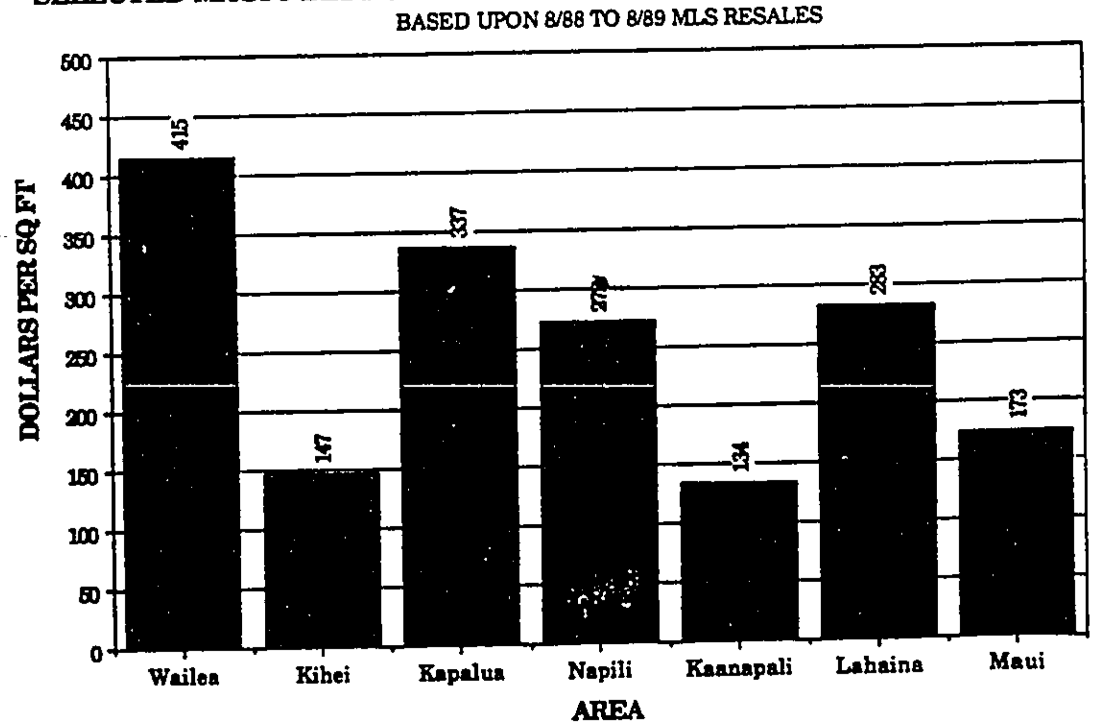


Figure VI-100

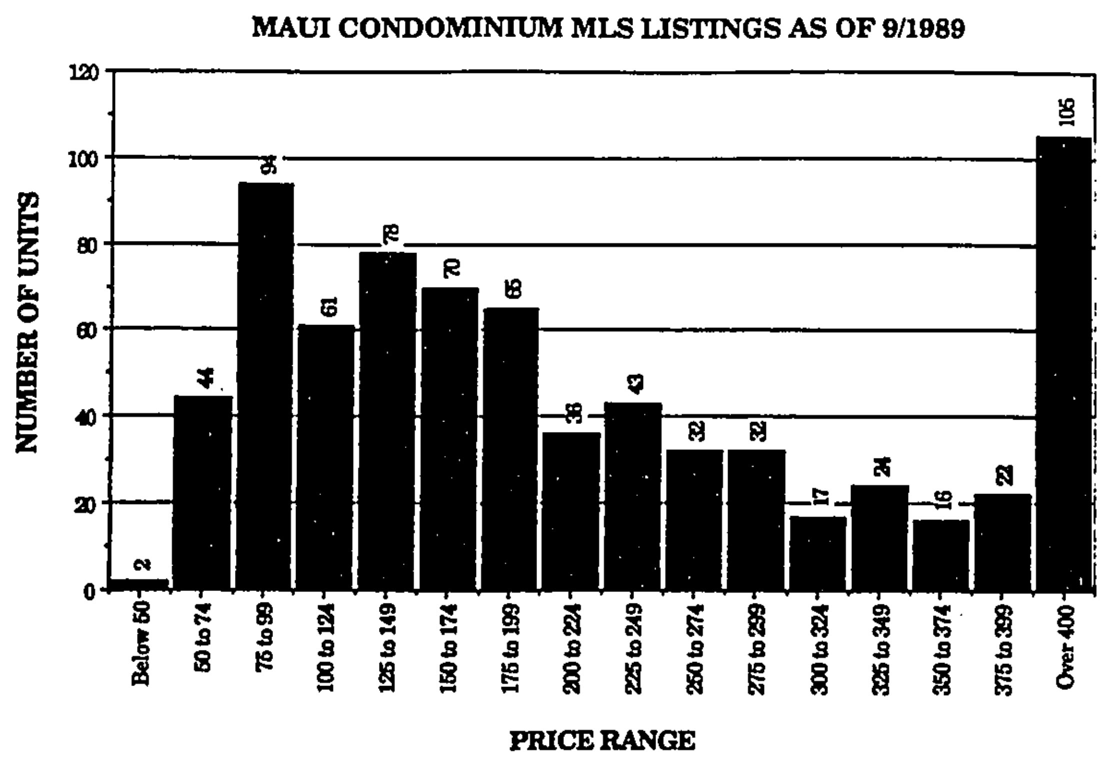


Figure VI-101

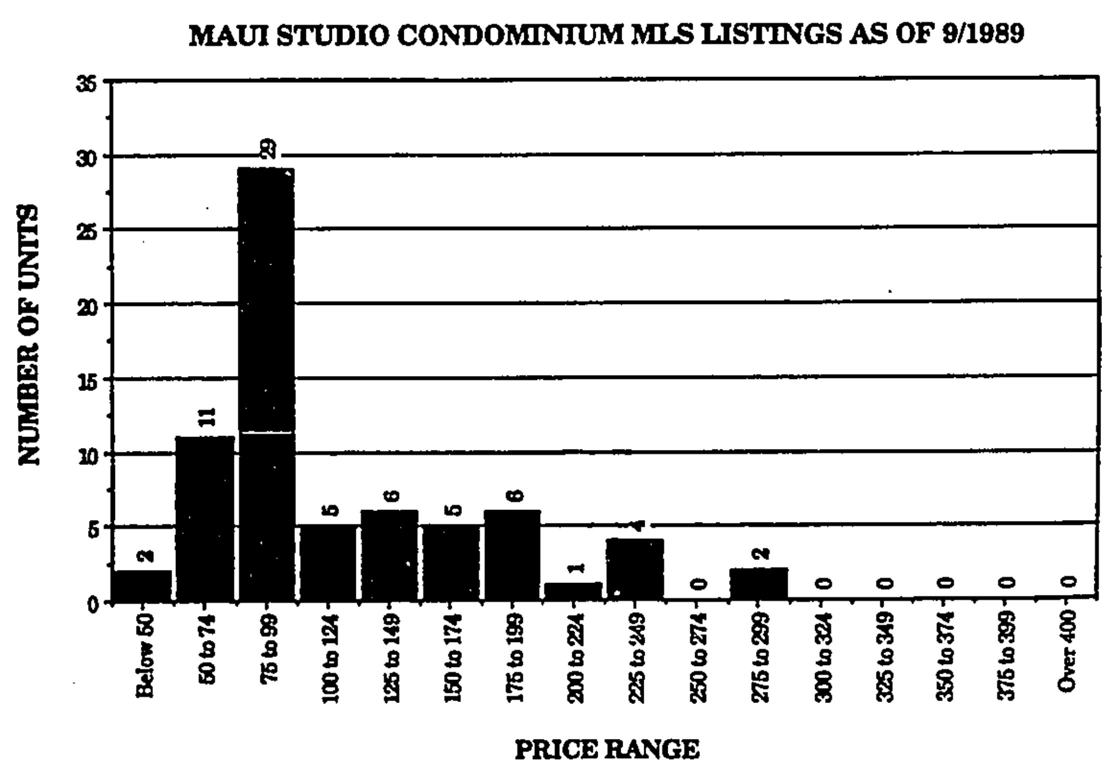


Figure VI-102

MAUI ONE BEDROOM CONDOMINIUM MLS LISTINGS AS OF 9/1989

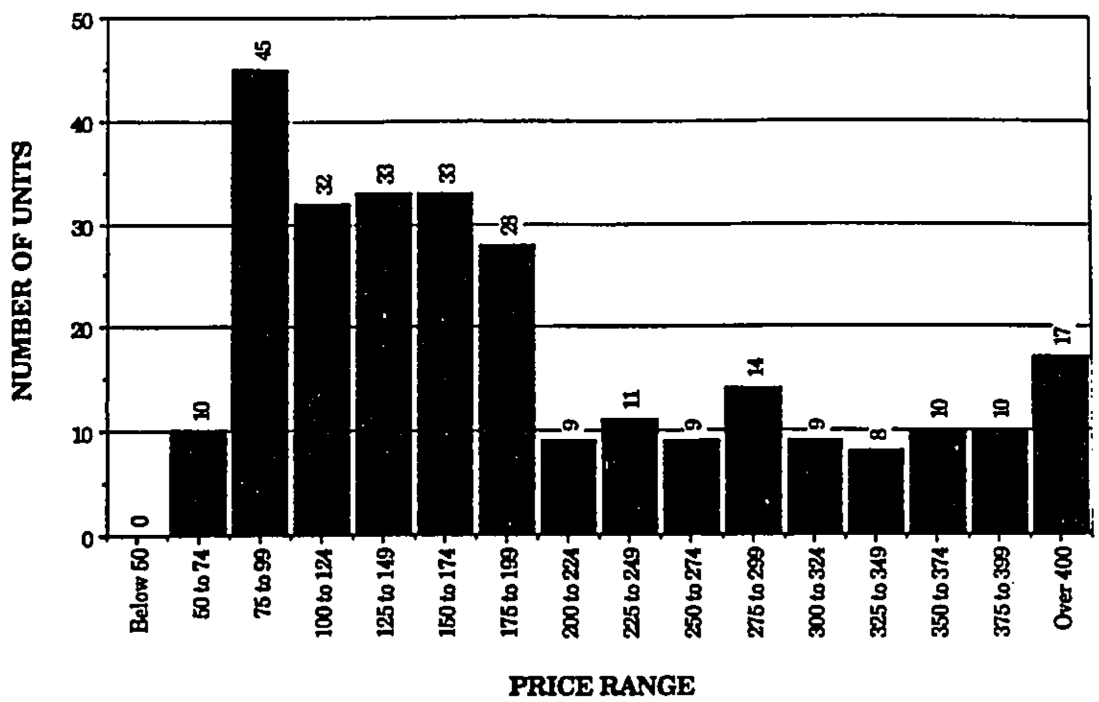


Figure VI-103

MAUI TWO BEDROOM CONDOMINIUM MLS LISTINGS AS OF 9/1989

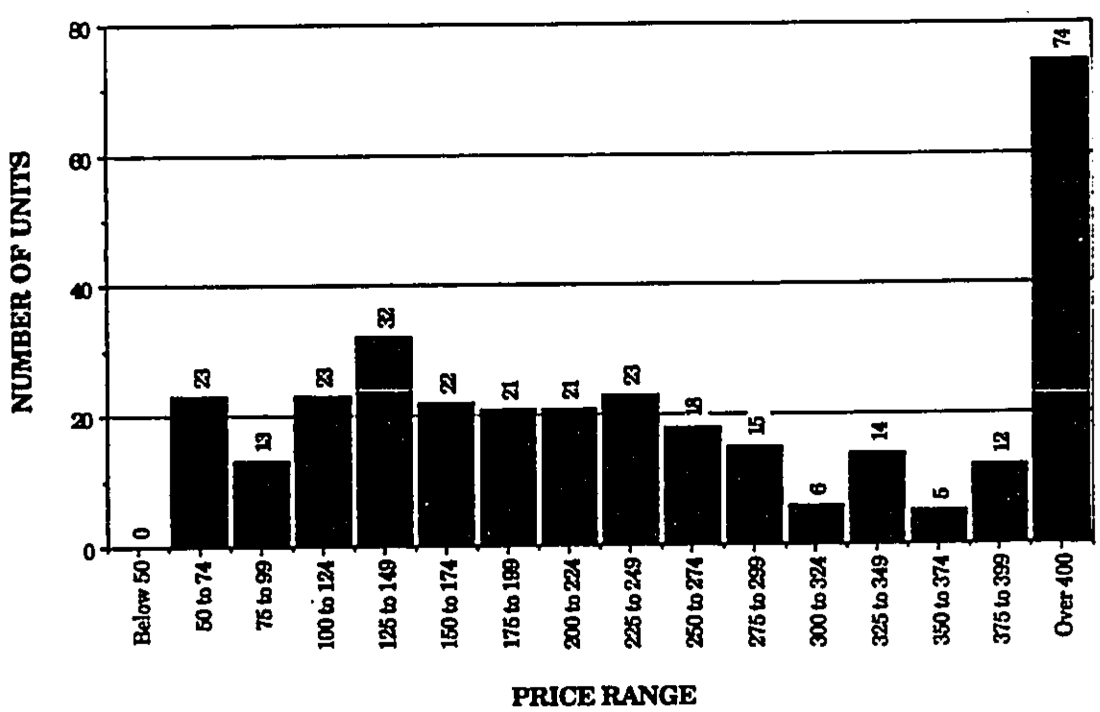


Figure VI-104

MAUI THREE BEDROOM CONDOMINIUM MLS LISTINGS AS OF 9/1989

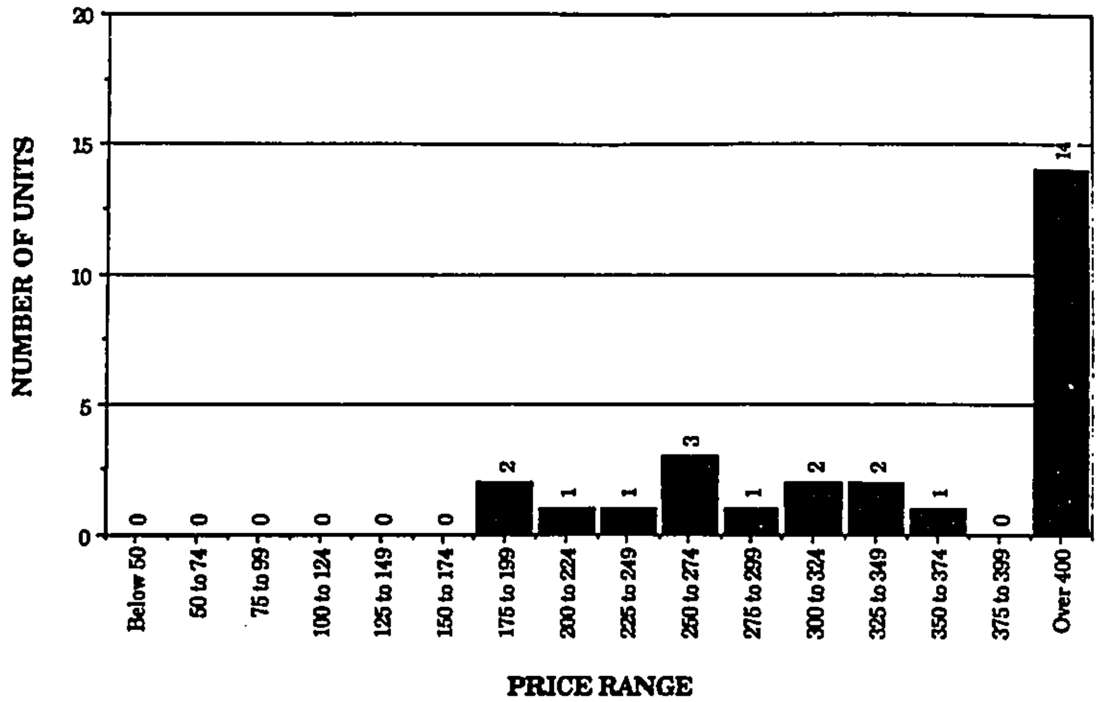


Figure VI-105

SELECTED STUDIO MEDIAN SQUARE FOOTAGE OF INTERIOR AREA

BASED UPON 8/88 TO 8/89 MLS RESALES

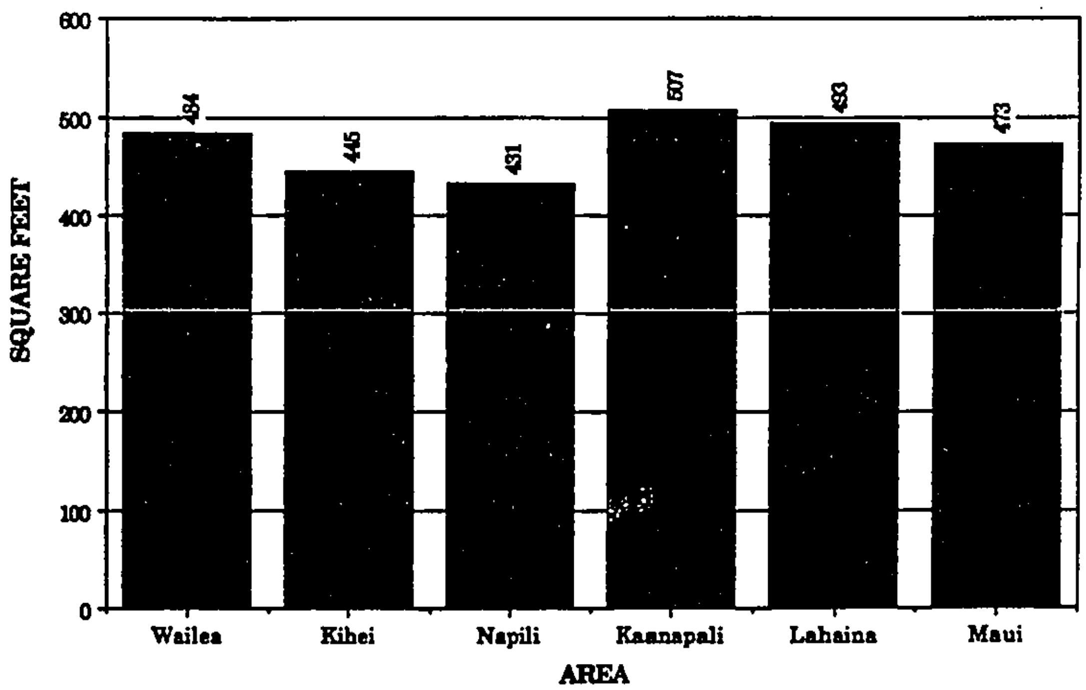


Figure VI-106

SELECTED MAUI 1-BEDROOM MEDIAN SQUARE FOOTAGE OF INTERIOR AREA

BASED UPON 8/88 TO 8/89 MLS RESALES

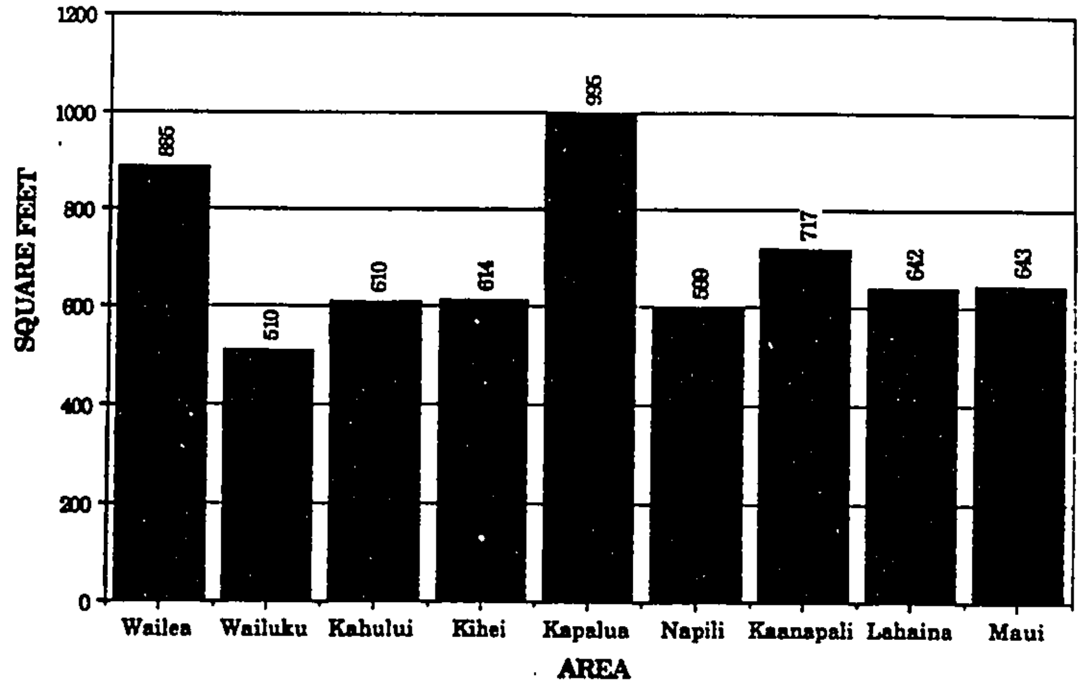


Figure VI-107

SELECTED MAUI 2-BEDROOM MEDIAN SQUARE FOOTAGE OF INTERIOR AREA

BASED UPON 8/88 TO 8/89 MLS RESALES

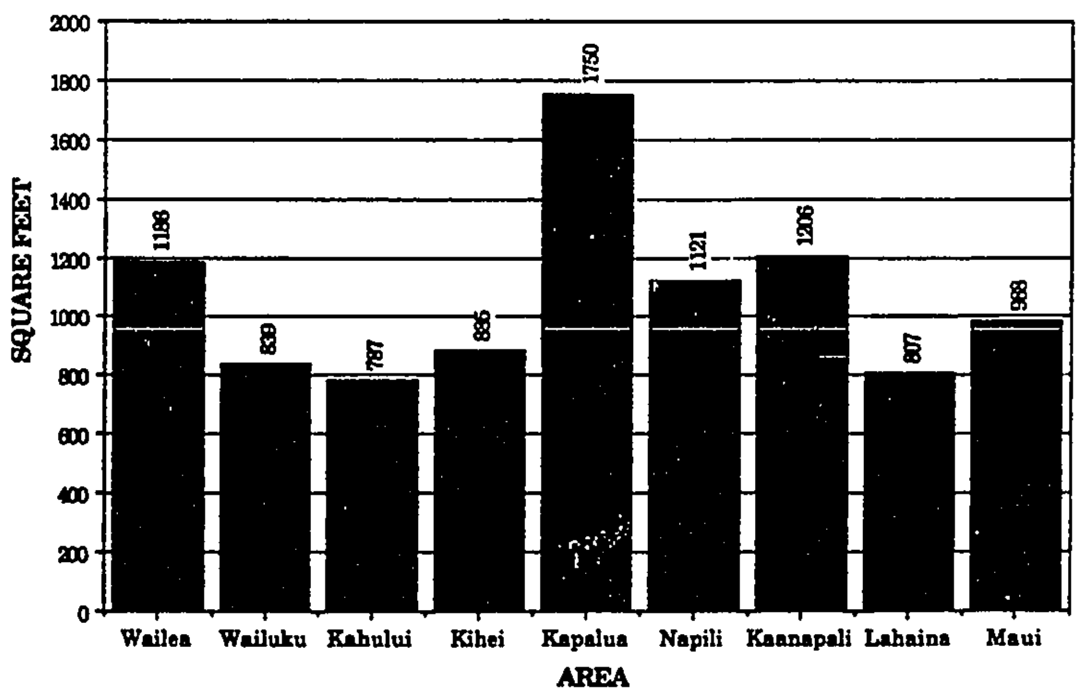


Figure VI-108

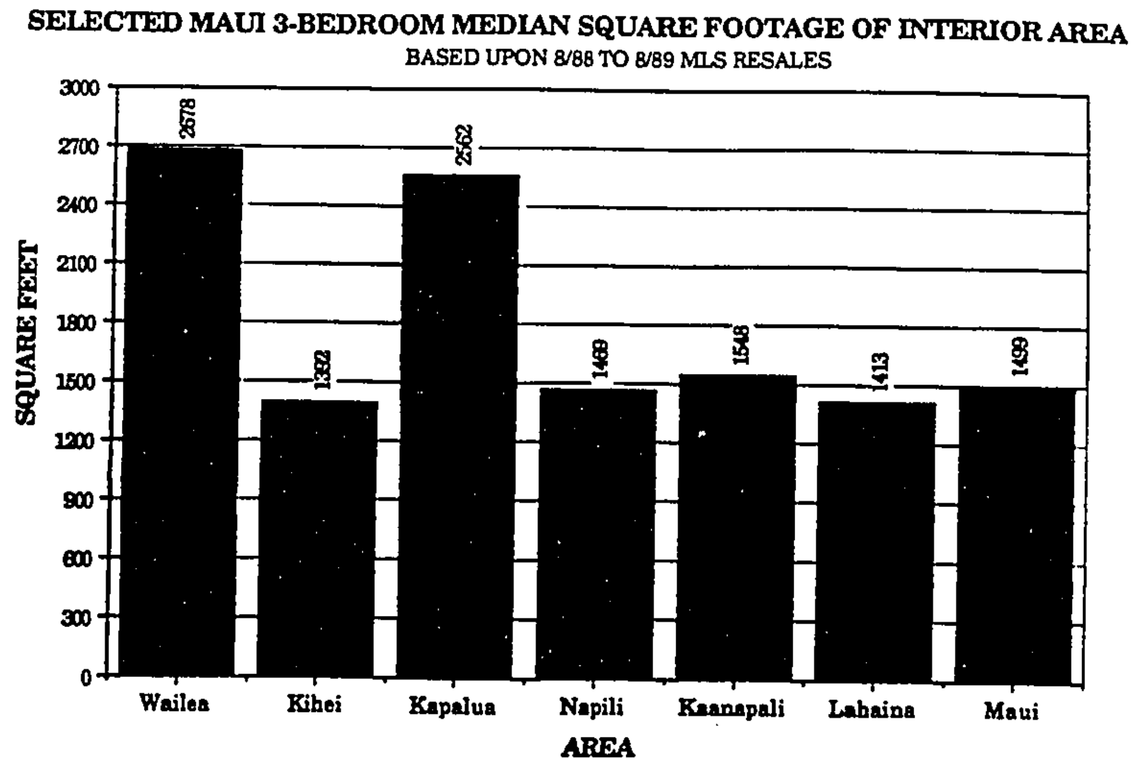


Figure VI-109

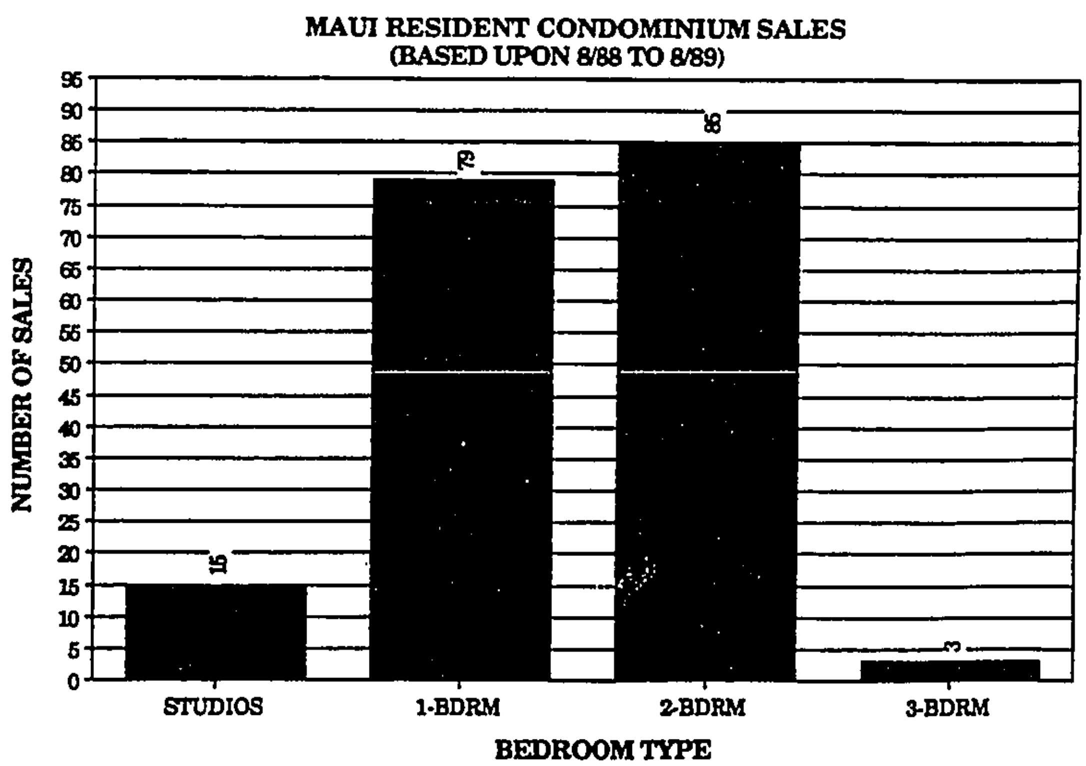


Figure VI-110

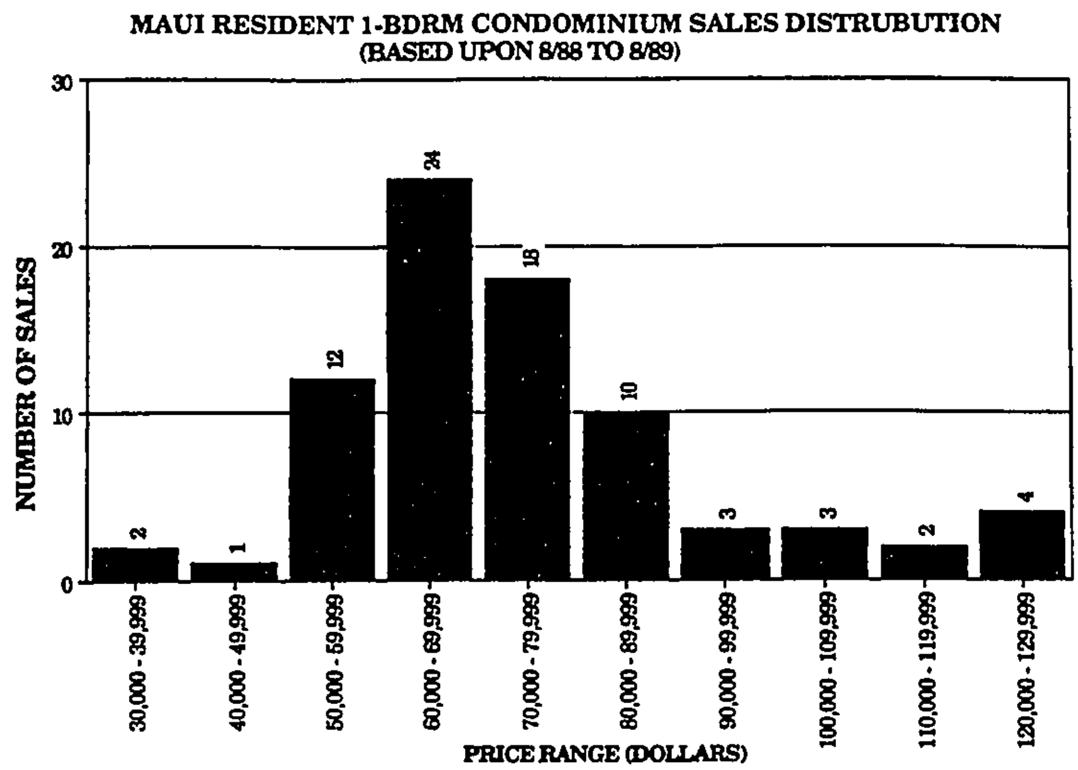


Figure VI-111

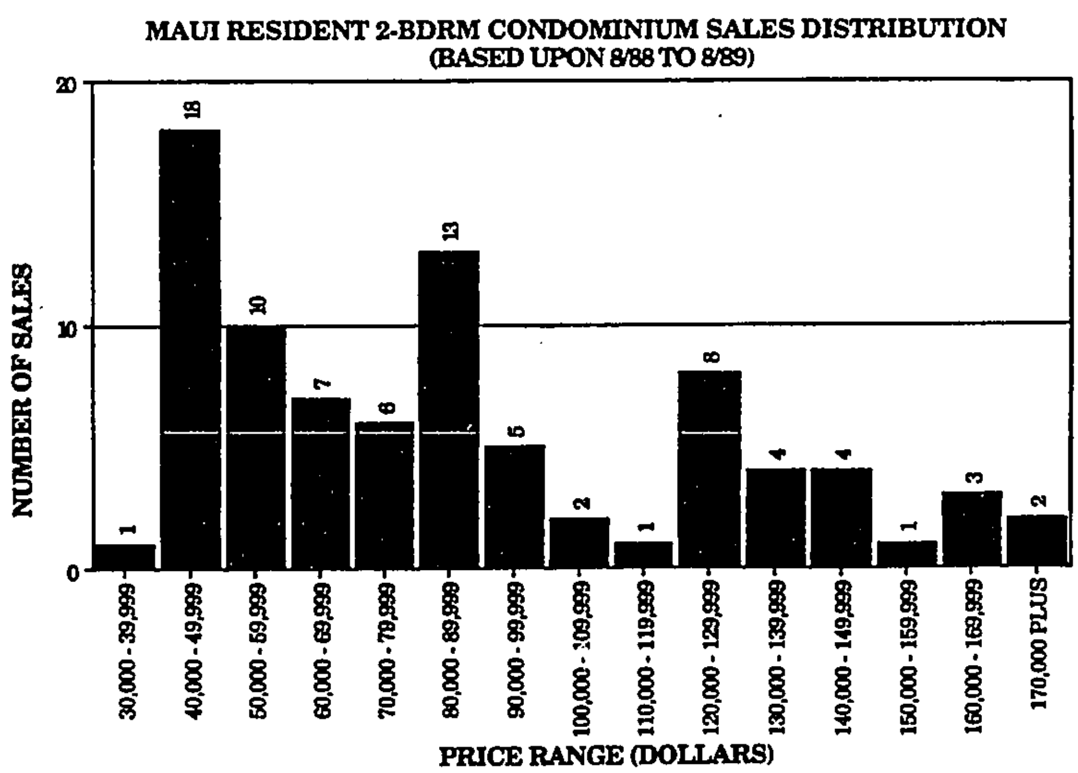


Figure VI-112

MAUI RESIDENT CONDOMINIUM AVERAGE & MEDIAN PRICE (BASED UPON 8/88 TO 8/89)

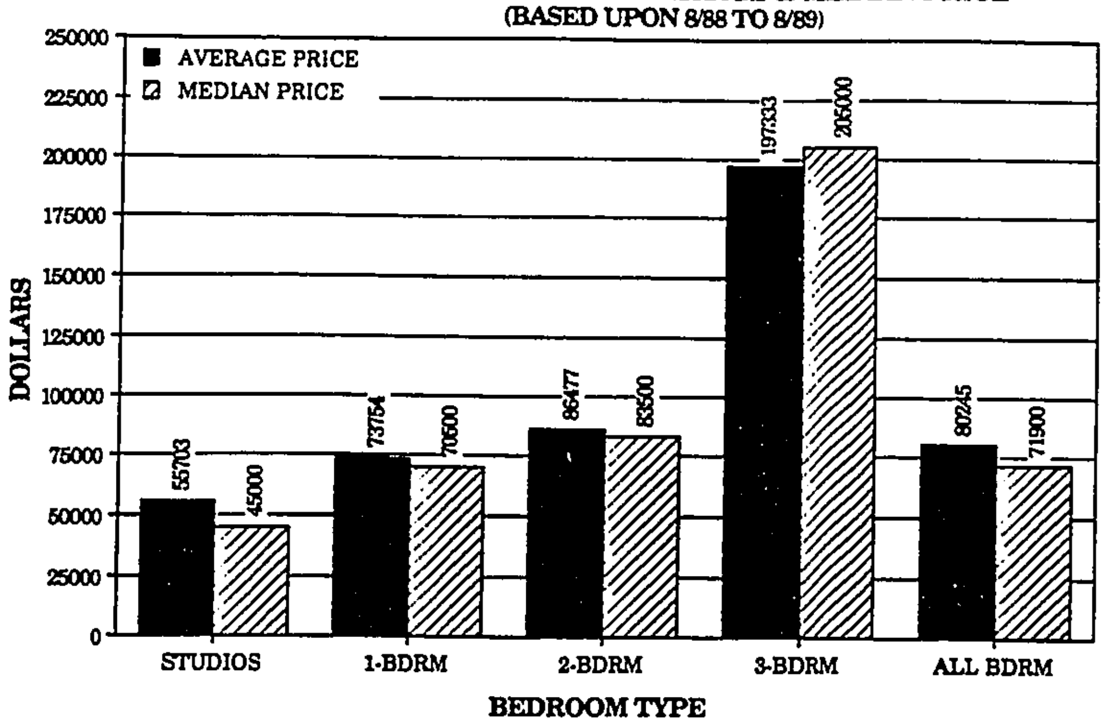


Figure VI-113

MAUI RESIDENT CONDOMINIUM AVERAGE & MEDIAN PRICE PER SQUARE FOOT OF INTERIOR AREA (BASED UPON 8/88 TO 8/89)

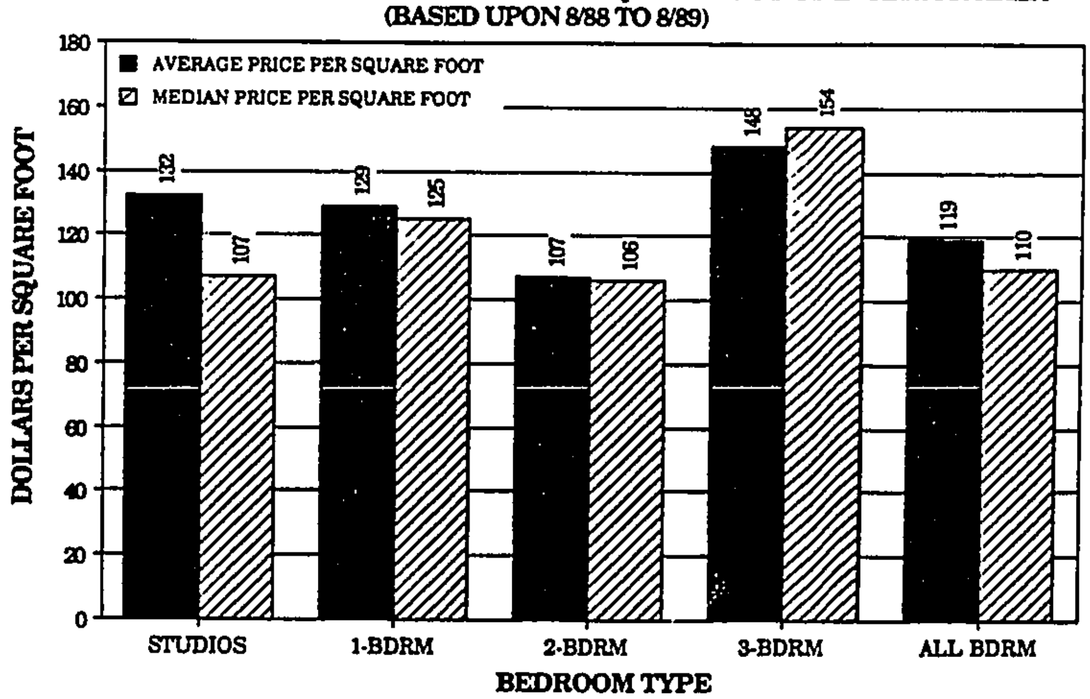


Figure VI-114

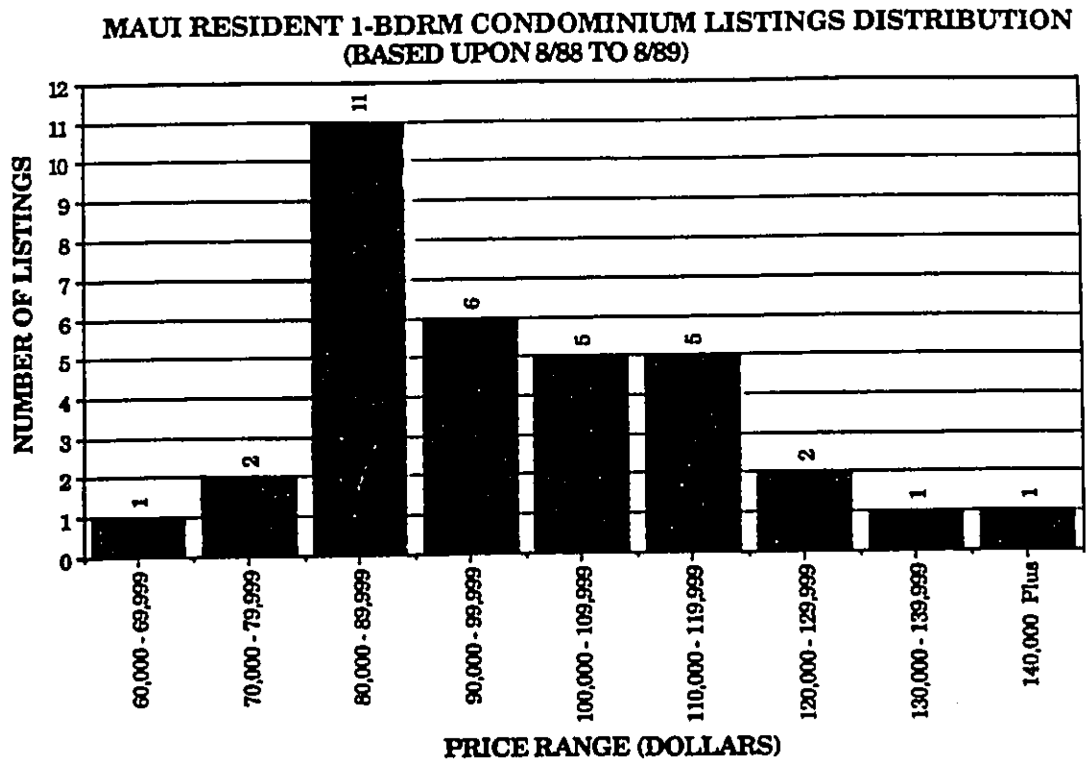


Figure VI-115

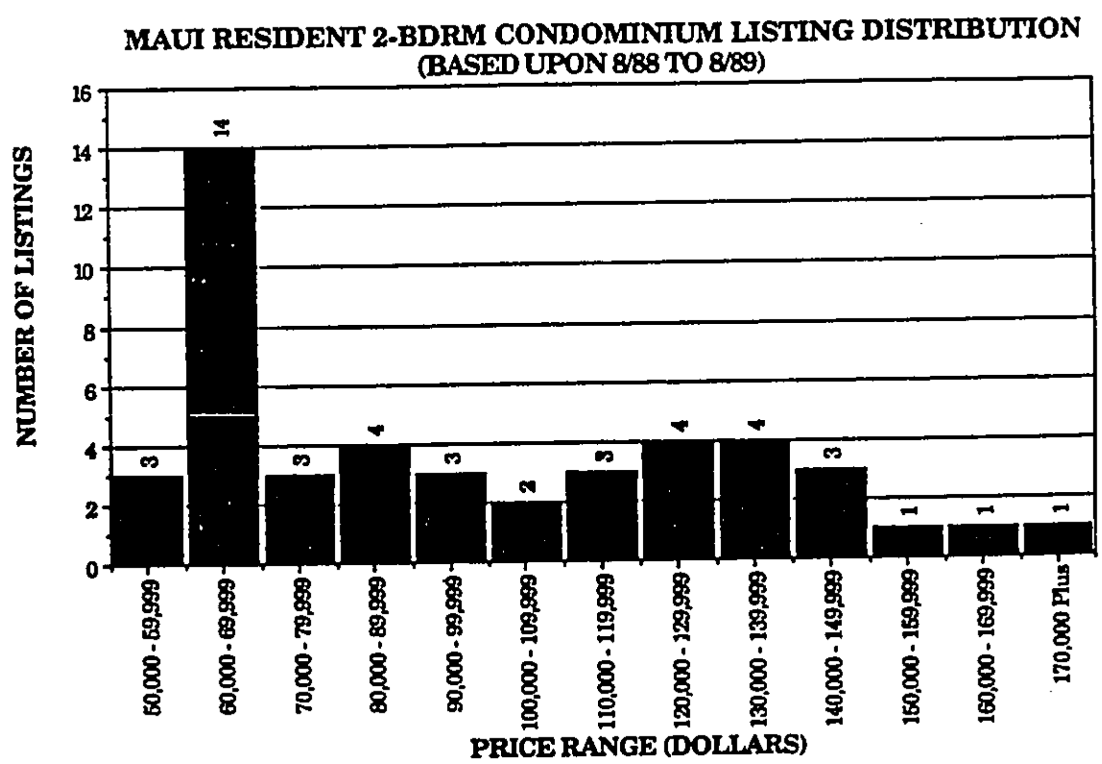


Figure VI-116

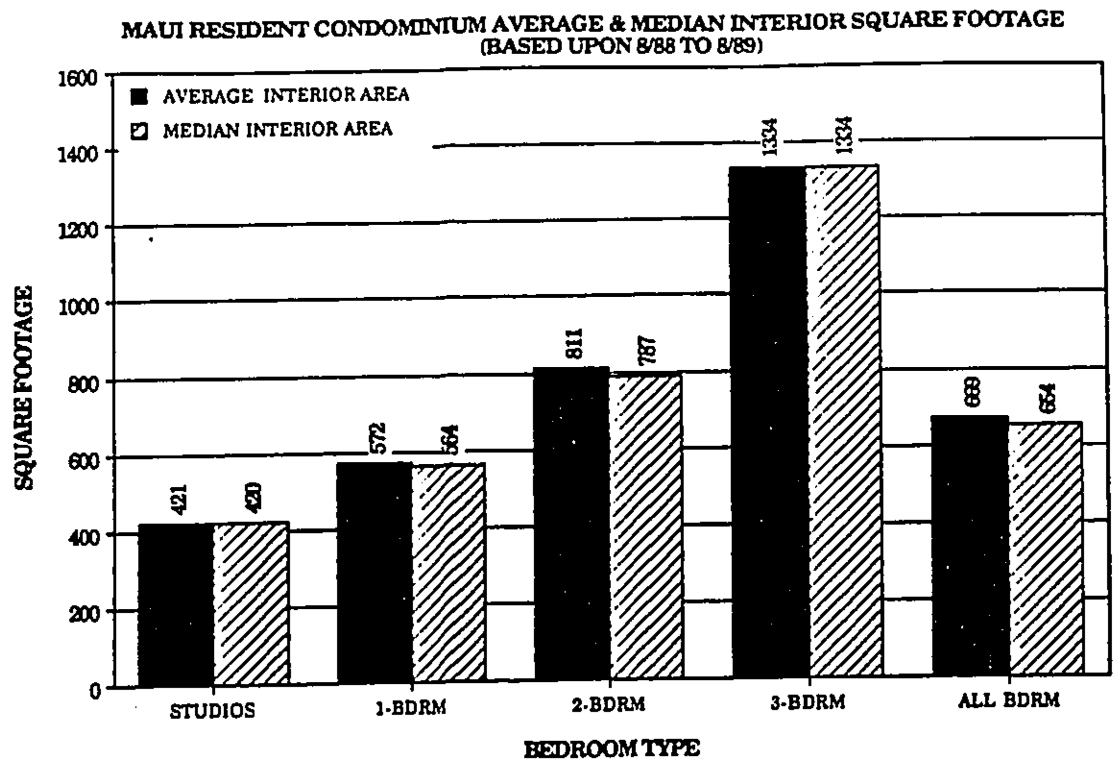


Figure VI-117

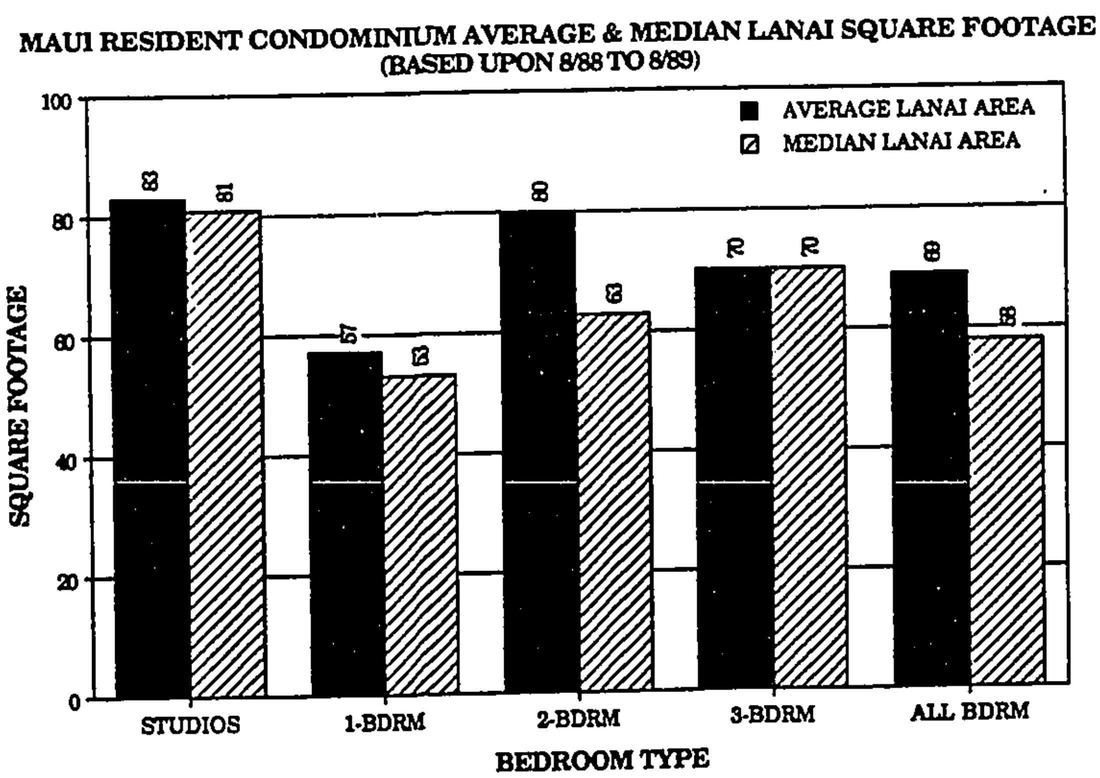


Figure VI-118

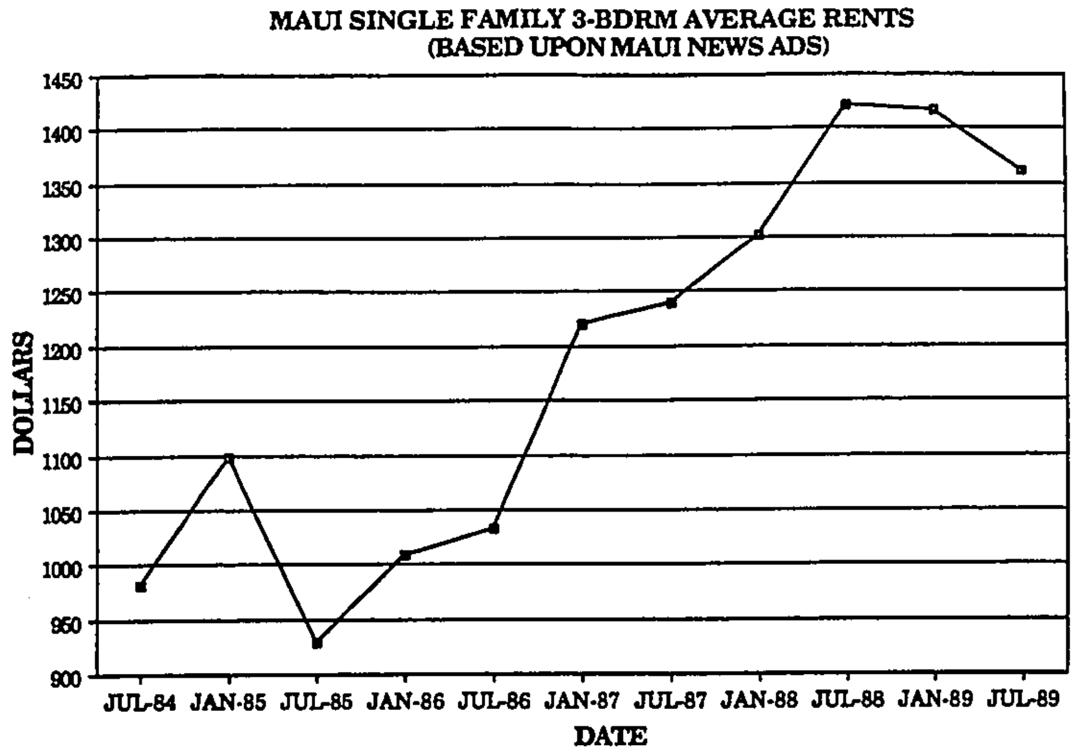


Figure VI-119

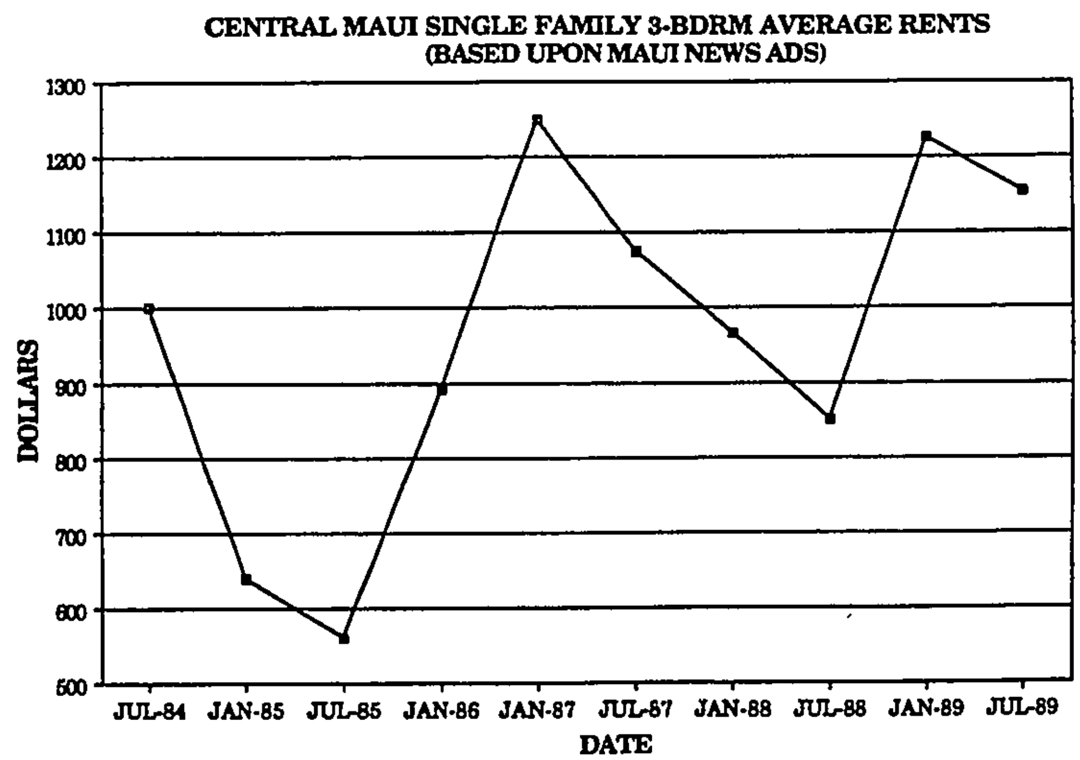


Figure VI-120

SOUTH MAUI SINGLE FAMILY 3-BDRM AVERAGE RENTS
(BASED UPON MAUI NEWS ADS)

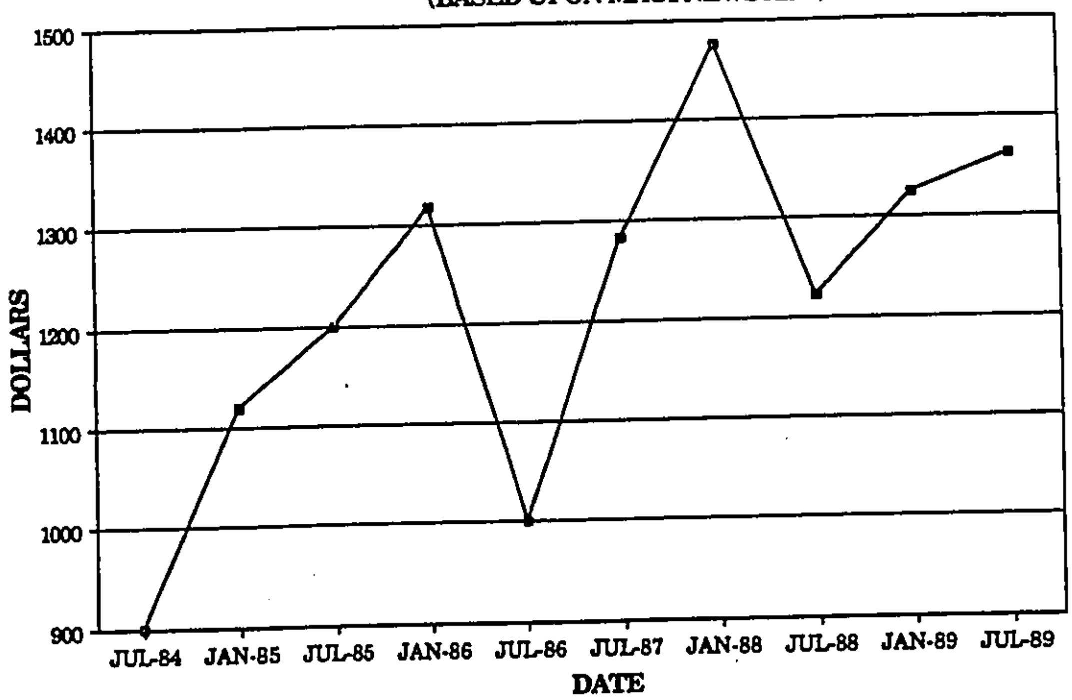


Figure VI-121

UPCOUNTRY MAUI SINGLE FAMILY 3-BDRM AVERAGE RENTS
(BASED UPON MAUI NEWS ADS)

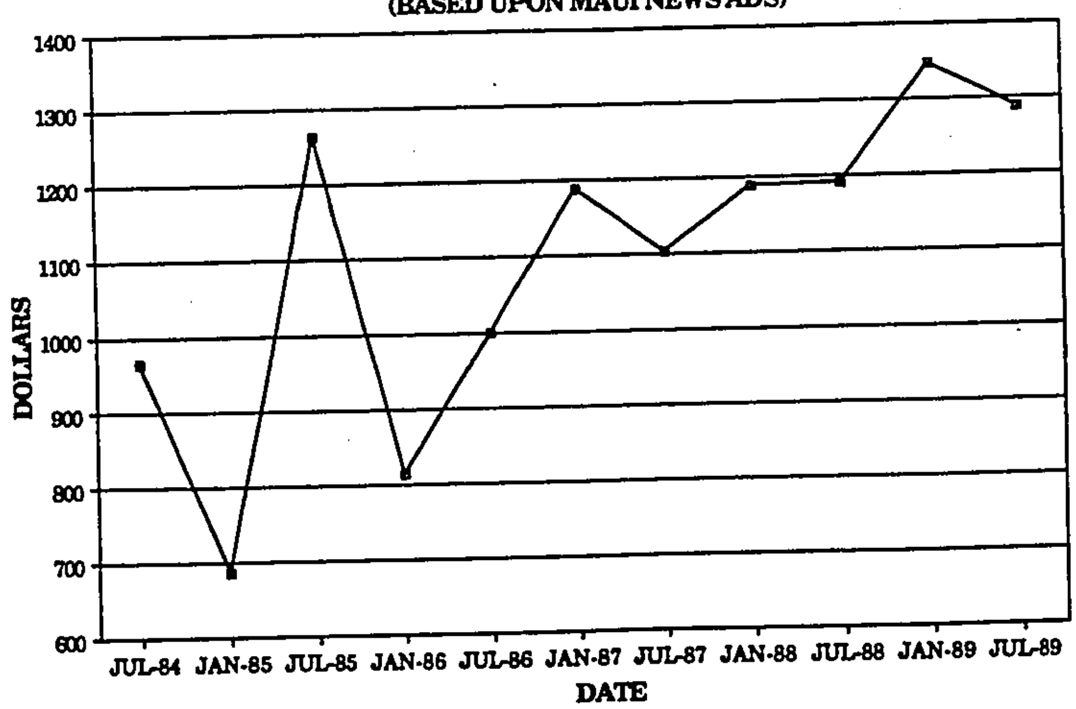


Figure VI-122

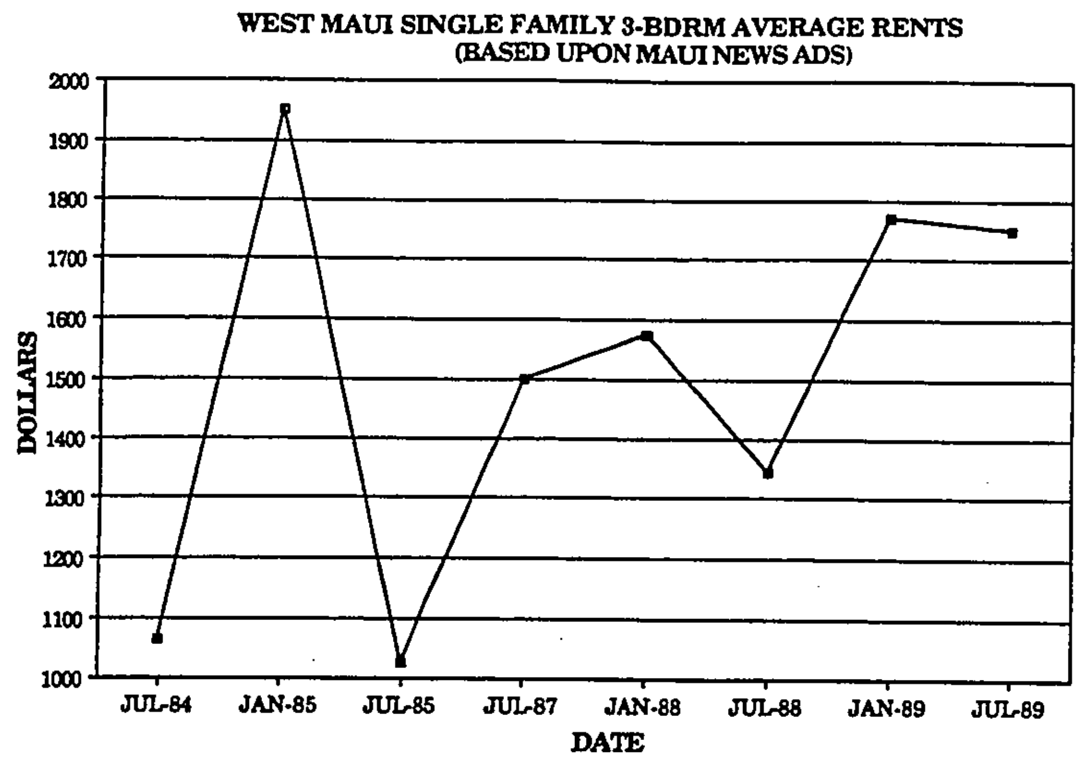


Figure VI-123

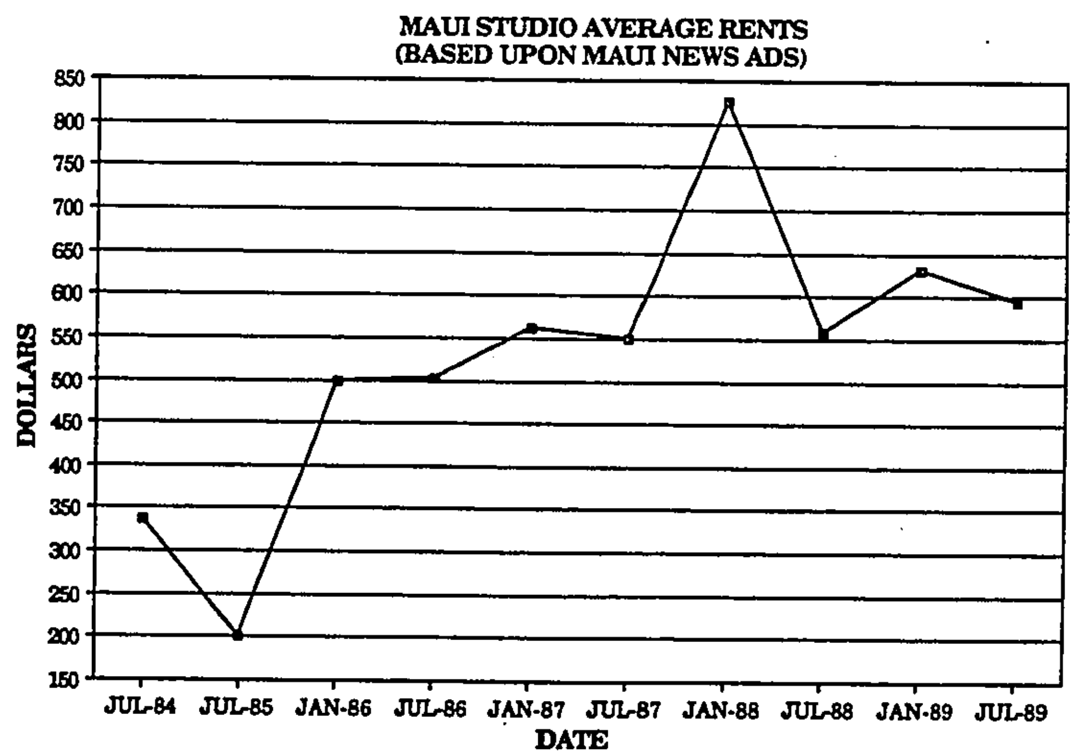


Figure VI-124

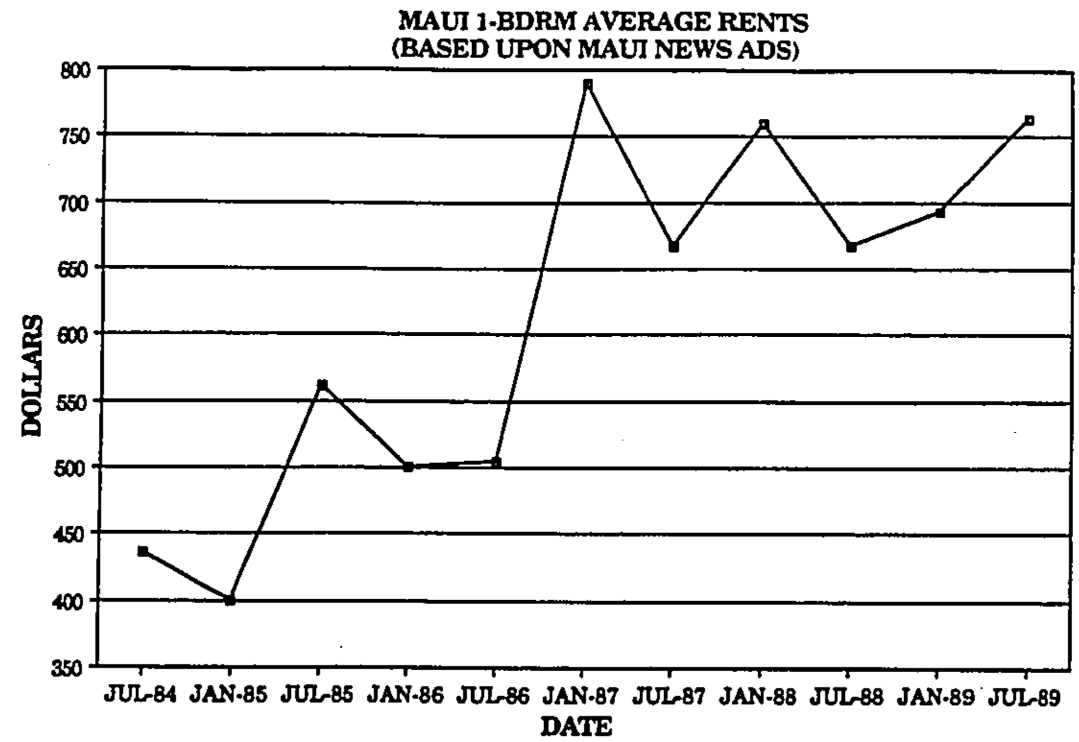


Figure VI-125

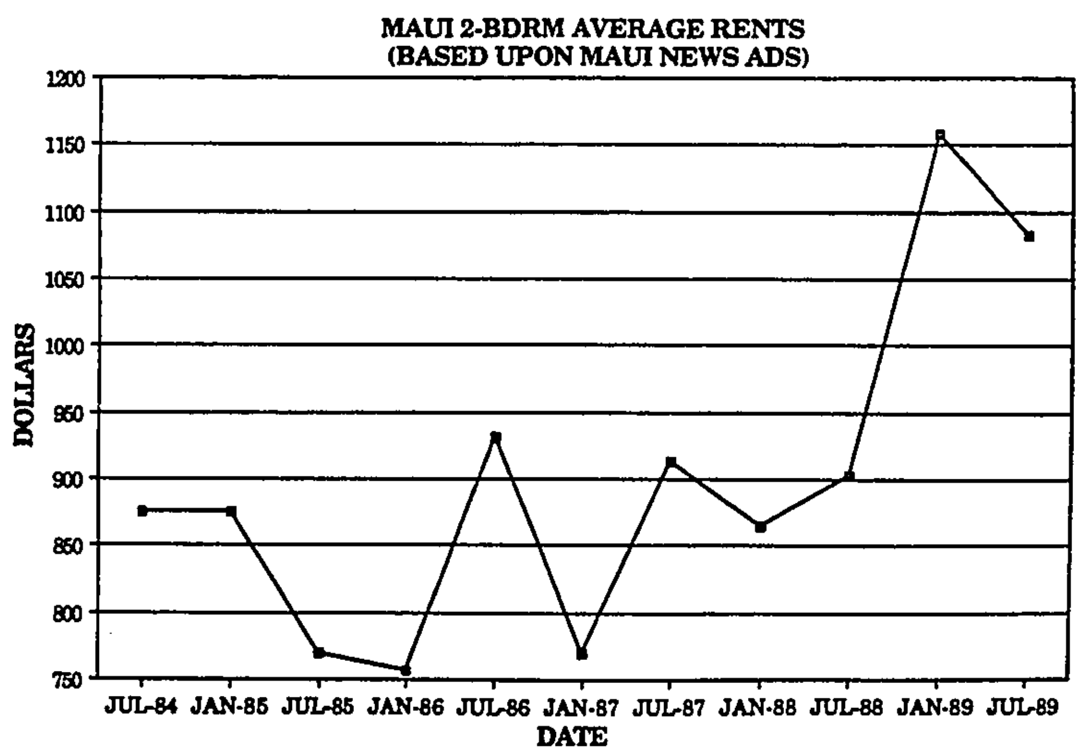


Figure VI-126

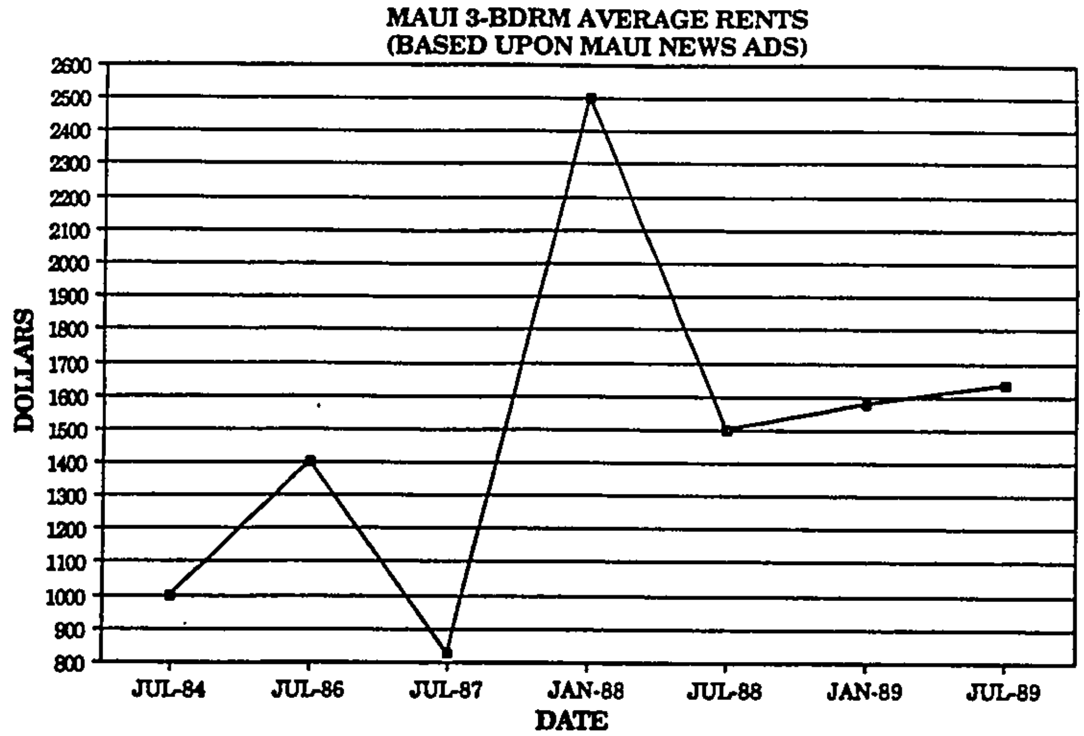


Figure VI-127

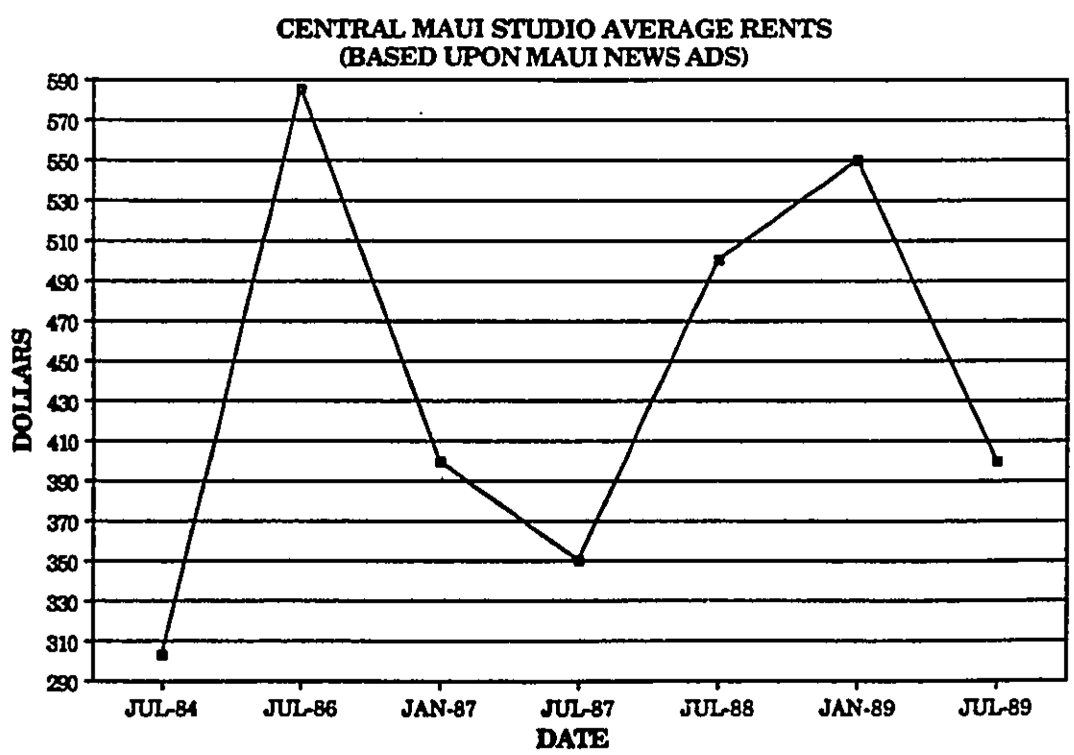


Figure VI-128

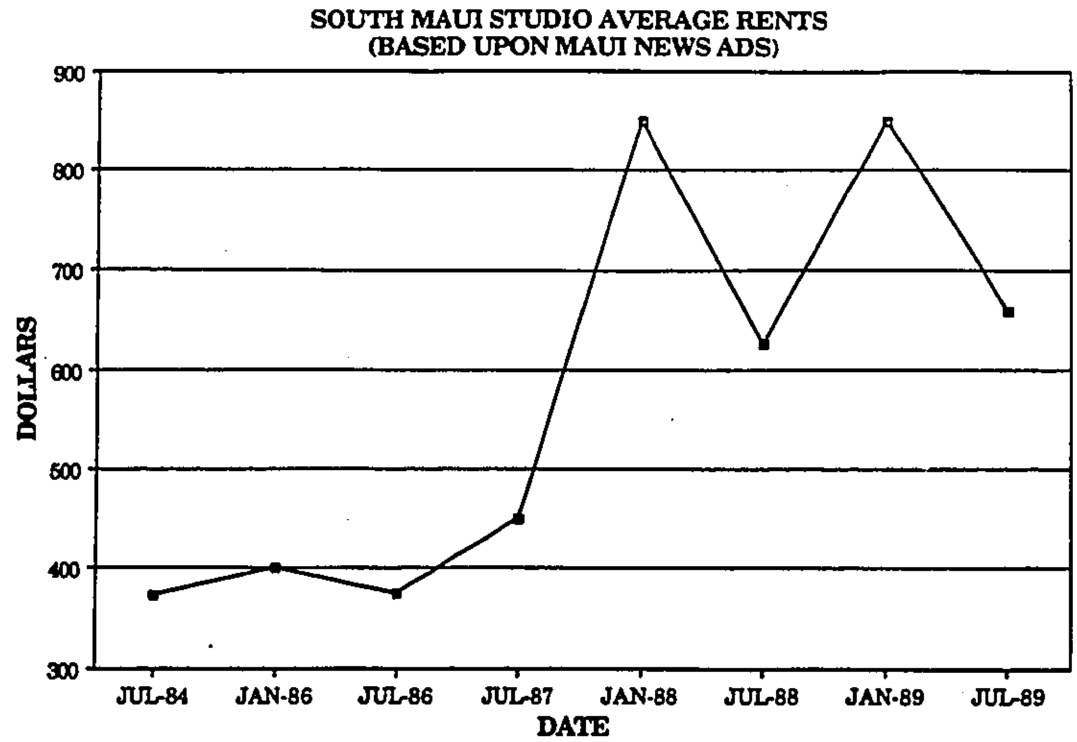


Figure VI-129

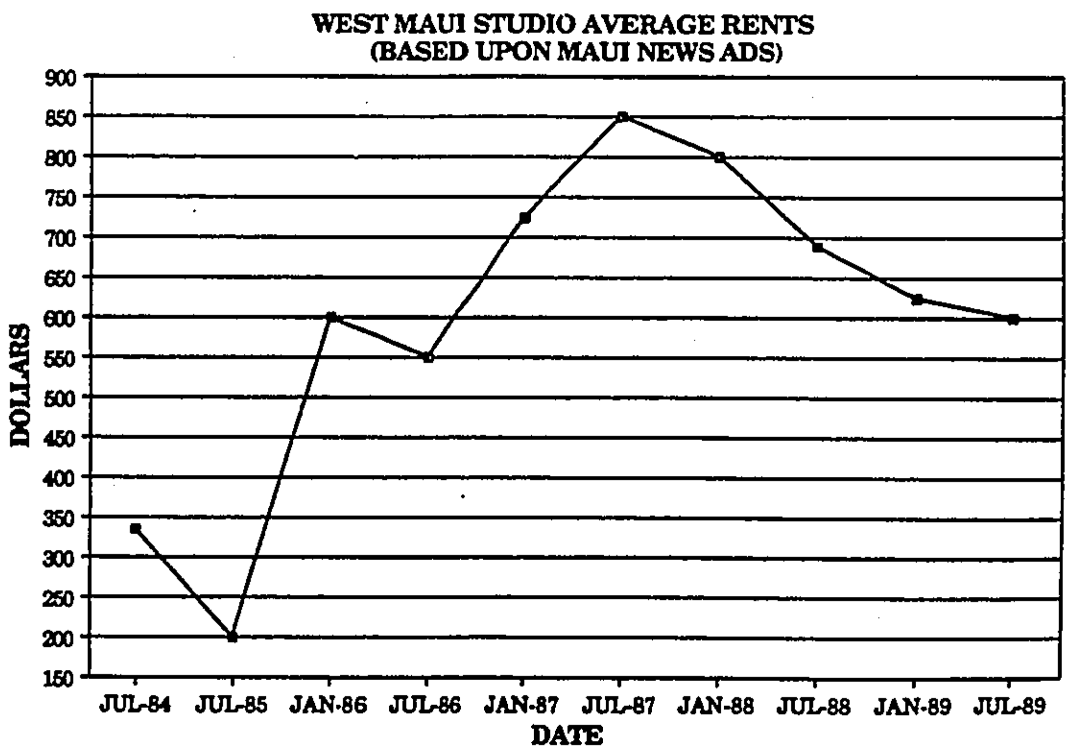


Figure VI-130

CENTRAL MAUI 1-BDRM AVERAGE RENTS
(BASED UPON MAUI NEWS ADS)

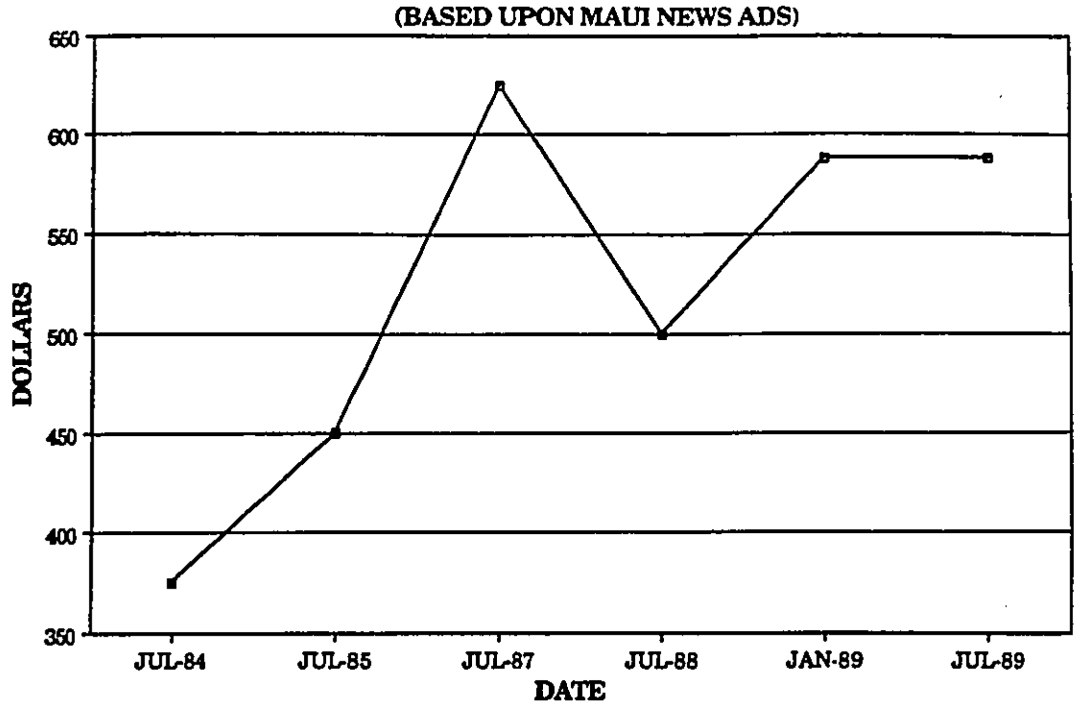


Figure VI-131

SOUTH MAUI 1-BDRM AVERAGE RENTS
(BASED UPON MAUI NEWS ADS)

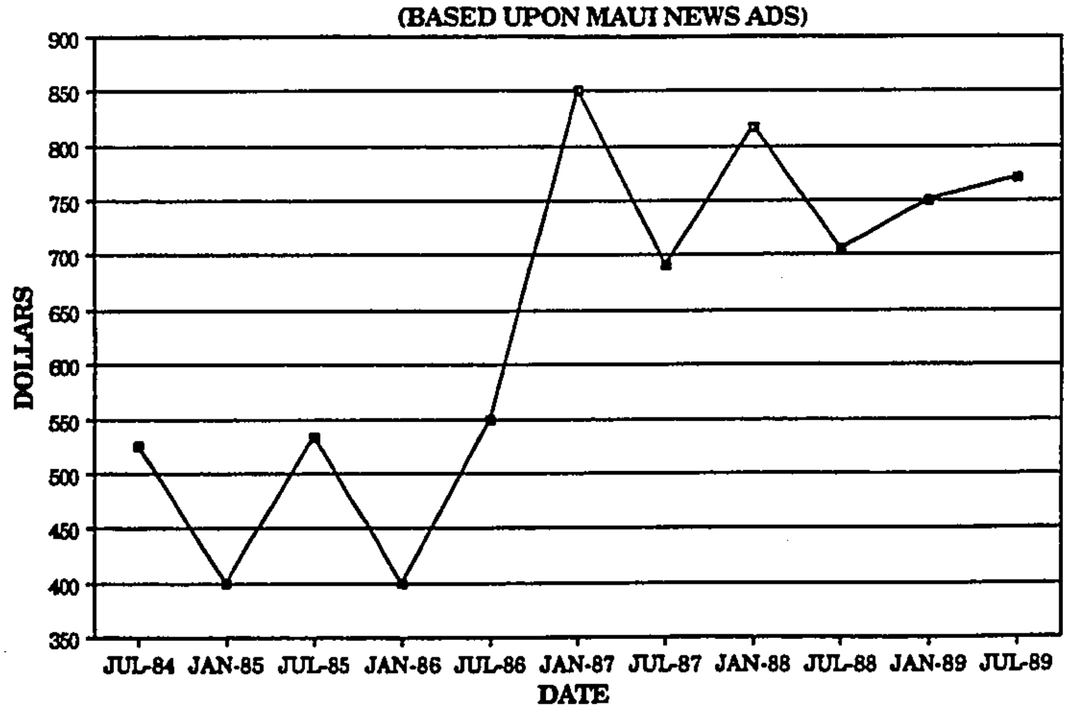


Figure VI-132

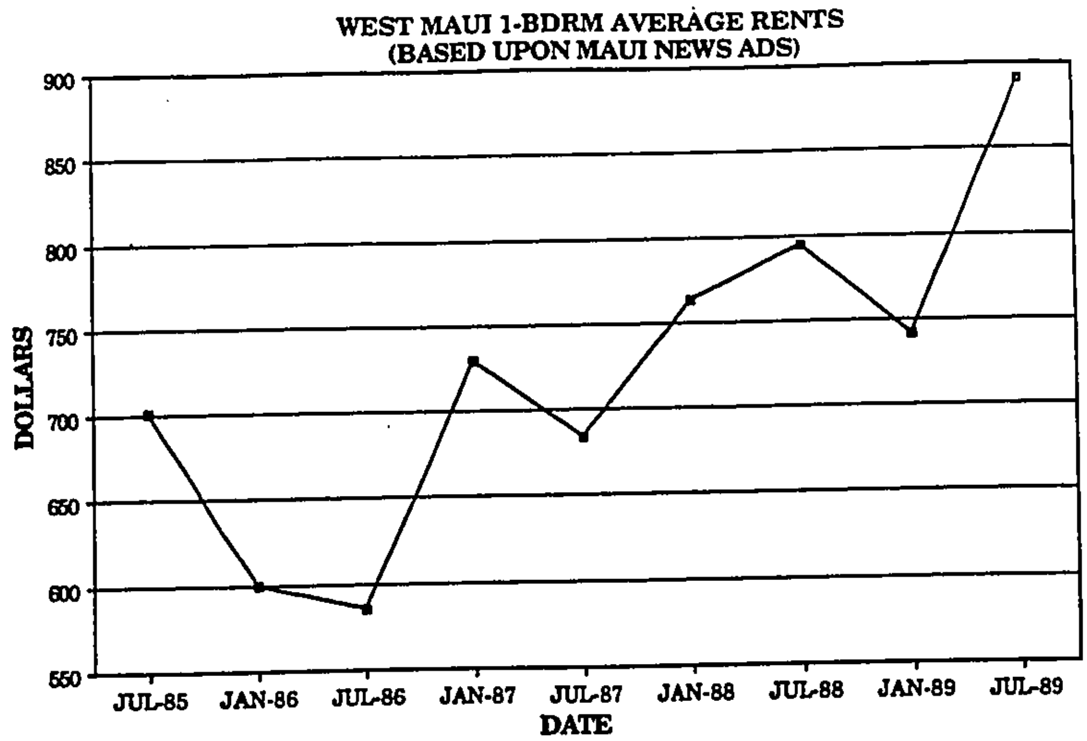


Figure VI-133

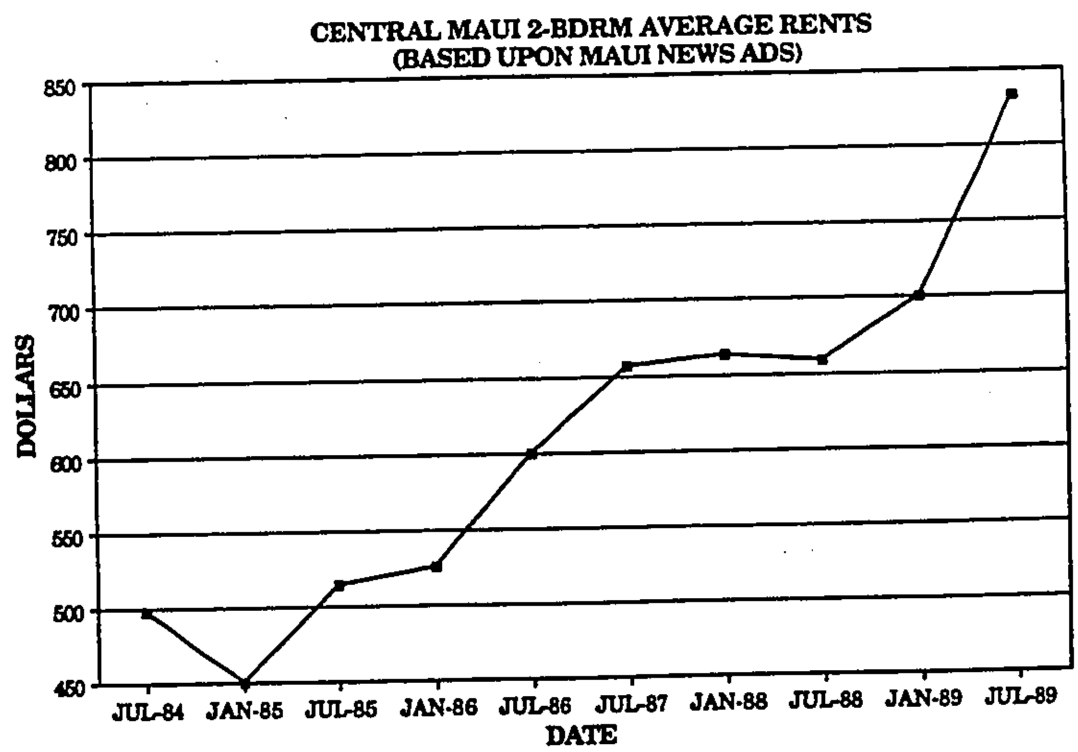


Figure VI-134

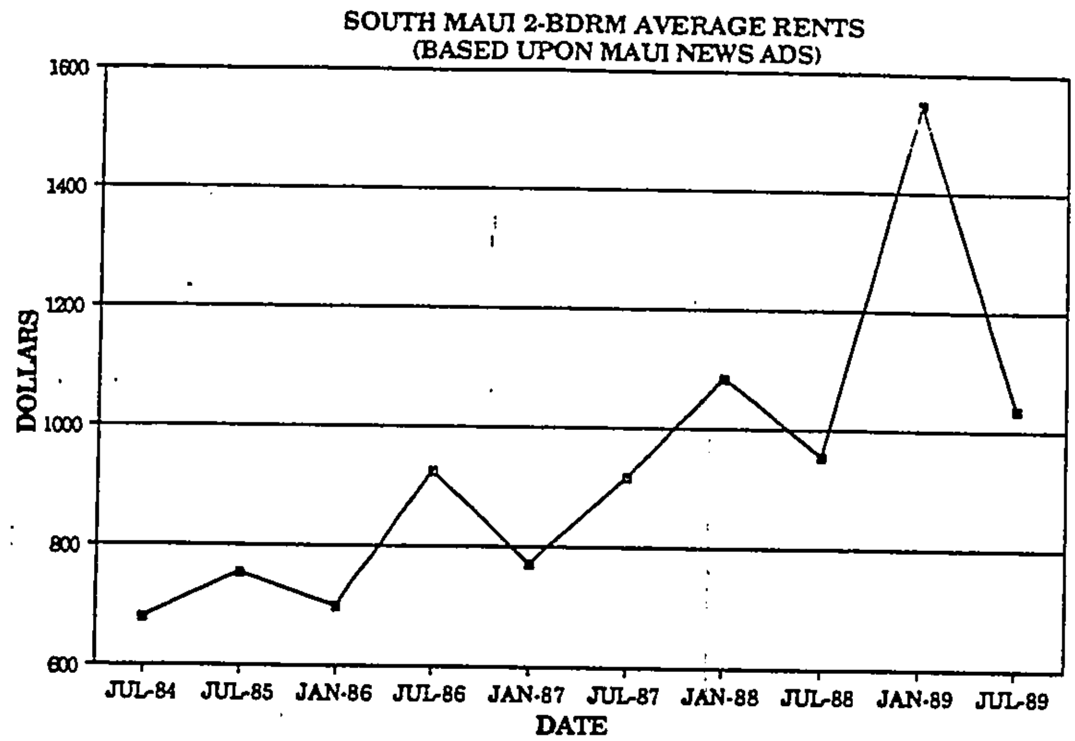


Figure VI-135

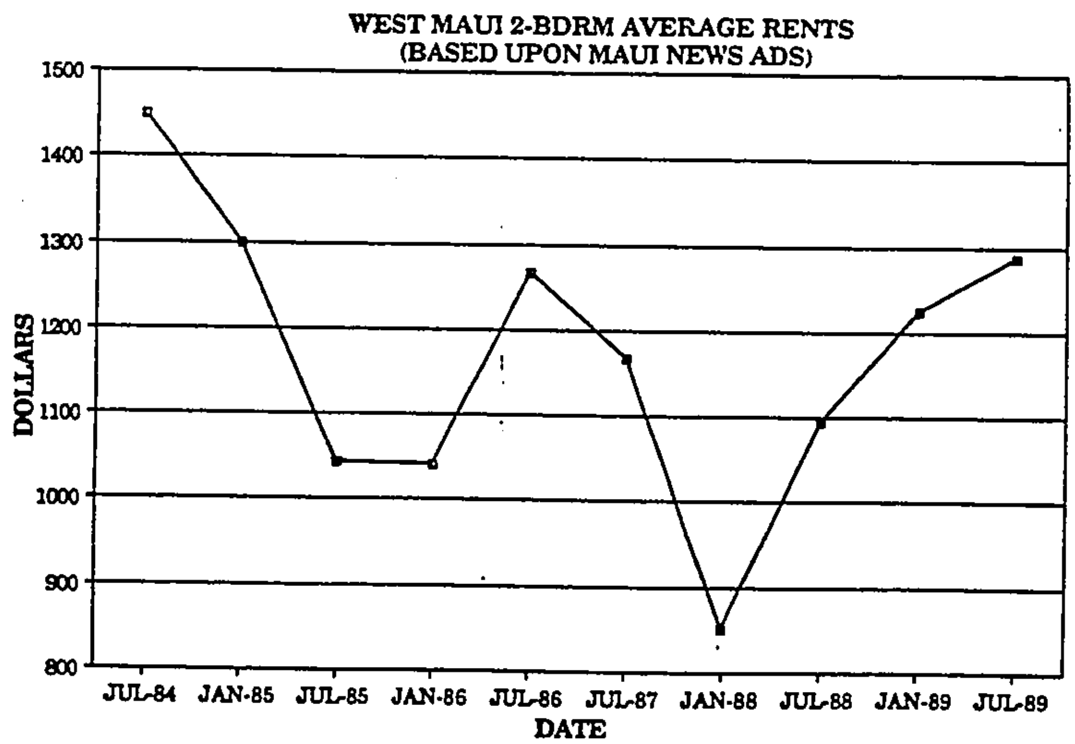


Figure VI-136

COMBINED NEIGHBOR ISLANDS RESIDENTIAL VACANCY RATE

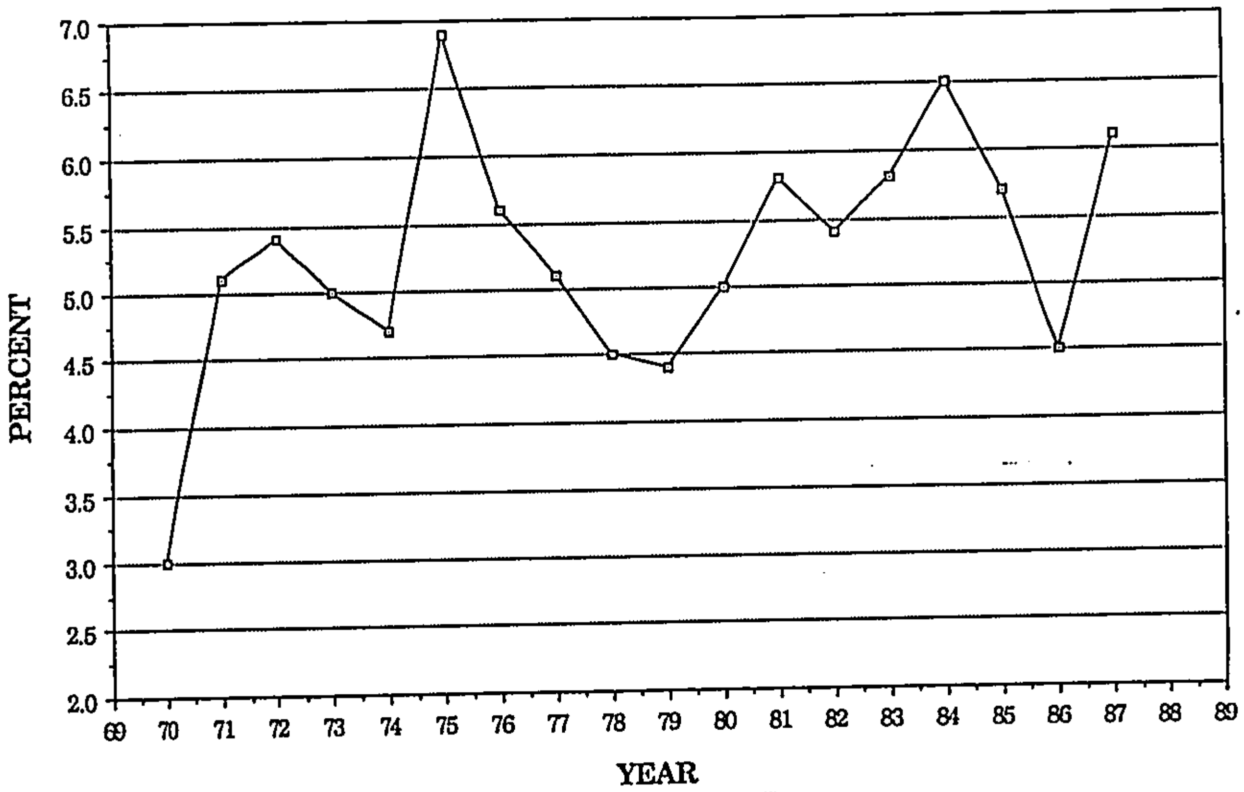


Figure VI-137

Maui Future Inventory

Name of Project	Type	Location	Developer or Source of Funds	Acres	Total Units	Single Family	Multi Family	Prices & Notes
AFFORDABLE UNITS								
Honokowai Subdivision	A	Napili	Maui L & P		30	30	0	
Kahana Residential Community	A	Lahaina	Amfac Property Dev Corp	40-50	0	**	**	Affordable
Maui Village (100%)	A	Kihei	James H. Schuler & Associates		332	0	332	$97,000 to $107,000
Honokohau Hale Subdivision	A	Lahaina	County/Developer's Contribution	7.5	62	42	20	$90,000
Lahaina Master Planned Comm. (60%)	A	Lahaina	HFDC		2340	**	**	3900 UNITS
Maui L & P Employee Housing**	A		Maui Land & Pineapple		50	50	0	
Maui Land (20%)	A	Wailuku	Maui Land Partners		660			3300 TOTAL 2640SF,660 MF
Maui Palisades Subdivision (20%)	A	Kihei	United Realty	141	202	350	650	1010 TOTAL 360SF,650 MF
Ohukai Subdivision	A	Kihei	FmHA	24	107	107	0	$78,000-$94,000
Pukalani Project District (100%)	A	Wailuku	C. Brewer		600	600	0	
Puu Kao Subdivision	A	Makawao	Maui L & P		48	48	0	
Waiehu Planned Development Elderly	A	Waiehu	HFDC		42	42	0	
Waiehu Planned Development Handicapped	A	Waiehu	HFDC		21	21	0	
Waiehu Planned Development Inc. B (50%)	A	Waiehu	HFDC		139			212 UNITS
Waiehu Planned Development Inc. C (50%)	A	Waiehu	HFDC		133			254 UNITS
Waiehu Planned Development Multifamily	A	Waiehu	HFDC		60	0	60	
Waikapu Housing **	A	Waikapu	FmHA	30	193	193	0	
Waikapu Village Expansion (60%)	A	Waikapu	C. Brewer		74			124 S.F.
Waikapu Project District (37.6)	A	Waikapu	C. Brewer		902			2400 S.F.
Waiwai Village	A	Lahaina	Amfac Property Dev Corp	65	0	**	**	Affordable
								AFFORDABLE UNITS
AFFORDABLE/MARKET UNITS								
Haiku Housing **	A/M	Haiku	FmHA	13	18	18	0	
Hailimaile Housing**	A/M	Hailimaile	FmHA	28	130	130	0	
Kihei Housing **	A/M	Kihei	FmHA	30	110	110	0	
Maalaea Single Family Housing**	A/M	Maalaea	A & B Properties Inc	60	0	**	**	
Makawao Housing**	A/M	Makawao	FmHA	20	130	130	0	
Paia Lot Housing**	A/M	Paia Lot	A&B Properties Inc	98	433	433	0	
								AFFORDABLE/MARKET UNITS
MARKET UNITS								
Alfred Levine Project	M	Kihei	Alfred Levine		160		160	Market
Country Club Subdivision	M	Spreck.	A&B Properties Inc		42	42	0	Market
Diamond Resort Employee/Additional Unit	M	Wailea			12			
Haiku Hill	M	Haiku	A&B Properties Inc		37	37	0	Market
Haolaka Residential Planned Community	M	Pukalani	Seaview Park, Ltd.		33			
Kahana Condominium Project	M	Kahana	Mark Ivey (867 6126)		60		60	24 1-br,262 br
Kea-Na-Ulu	M	Kihei	Harris		205	205	0	
Keonekai Heights Ph II	M	Kihei	Jesse & Mark Spencer (875 3307)		59	59		$225,000-$270,000
Keonekai	M	Kihei	Harris		220	0	220	
Lahaina Master Planned Comm. (40%)	M	Lahaina	HFDC	1100	1560	**	**	3900 UNITS
Maui Land (80%)	M	Wailuku	Maui Land Partners		2640			3300 S.F.
Maui Palisades Subdivision (80%)	M	Kihei	United Realty		808			1010 S.F.
Waiehu Planned Development Inc. B (40%)	M	Waiehu	HFDC		93	232	0	232 S.F.
Waiehu Planned Development Inc. C (40%)	M	Waiehu	HFDC		102	254	0	254 S.F.
Waikapu Village Expansion (40%)	M	Waikapu	C. Brewer		50	124	0	124 S.F.
Waikapu Project District (62.4)	M	Waikapu	C. Brewer		1498	2400	0	2400 S.F.
								MARKET UNITS
RESORT UNITS								
Grand Champion Villas	R	Wailea	Grand Champion Villas Venture		188		188	
Maui L & P Resorts**	R	Kapalua	Maui Land & Pineapple		100	100	0	
Maui Wailea 670 Project	R	Wailea	VMD		2000	2000	0	
Palms @ Wailea	R	Wailea	The Palms @ Wailea Venture		150	0	150	
Palms @ Wailea Phase II	R	Wailea	Palms At Wailea		120		120	$400,000-$800,000
Wailea Resort Co., Inc	R	Wailea			97			
Wailea Resort Co., Inc	R	Wailea			670	670		
								RESORT UNITS
RENTAL UNITS								
Bryan Curtis Duplexes (Rentals)	Rent	Lahaina			4		4	Luxury
Dowling Development Co. (Rental Apt)	Rent	Kihei			203			
Honokowai	Rent	Honokowai	State	11.5	184	0	184	
Hoolehua	Rent	Pukalani	Brookfield Hawaii Corp.		38	38	0	$225,000
Kahana Gateway (Apt. Rentals)	Rent	Kahana	Makaweli Hale of Hawaii		72		72	Rentals $500 to $900
Maui L & P Dormitory Housing**	Rent	Kapalua	Maui Land & Pineapple		60	0	60	Rental
Paniolana Place (rental)	Rent	Honokowai			159		159	stu $662,1br $795,2br $1060
								RENTAL UNITS

Figure VI-138

Maui Future Inventory

Name of Project	Type	Location	Developer or Source of Funds	Acres	Total Units	Single Family	Multi Family	Prices & Notes	Timetable	Unknown Timetable	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
UNKNOWN UNITS																											
Aloha Makai Na Fia Development	U				275					275																	
BIOI USA, Inc.	U				73					73																	
Business Investments	U				178					178																	
Business Investments	U				39		39			39																	
F & S Land	U				32					32																	
Frank Caravalho	U				10					10																	
Haiku Land	U	Haiku	Plantation Properties Inc.		14					14																	
Hale Kanaloa	U	Waiehu	Hale Kanaloa Inc.	0.18	4	0	4		1990			4															
Hale Kihei	U	Kihei	Hale Kihei Inc.	0.24	5	0	5		1989		5																
Hale Lokahi Akahi	U	Wailuku	Hale Lokahi Akahi Inc.	1.02	21	0	21		1989		21																
Hale Mahoalu Ekolu	U	Wailuku	Hale Mahoalu Ekolu II Inc.	2.4	42	0	42		1990			42															
Honoapiilani Partners	U				139					139																	
John Aloha Group (lots)	U	Kihei	Tom Barlow		8					8																	
John Keon	U				20					20																	
Kahului Housing** (Infill Sites)	U	Kahului	A & B Properties Inc.	**	0	**	**		**																		
Kahana Apt.	U	Kahana			19					19																	
Kahana Gardens	U	Kahana			13					13																	
Kahana Mauka Subdivision	U	Kahana			13	13				13																	
Kahili Condominiums	U				48					48																	
Kalola Heights Subdivision	U		Maui Kalola Heights Group		27	27	0			27																	
Kamaole Beach Park Ph I	U	Kihei	Kamaole Land Venture		231	0	231		1992					231													
Kamaole Beach Park Ph II	U	Kihei	Kamaole Land Venture		230	0	230		1992					230													
Kihei Bay Vistas	U				60					60																	
Kipa Hui Apartments	U				14					14																	
Kuleana Village	U				156					156																	
Little Kamlaupi	U				4					4																	
Luke Hale	U	Kihei	Y & M Investors, Ltd.		4					4																	
Maui Isana	U				48					48																	
Maui Kamaole	U	Kihei	Maui Kamaole Enterprises		228	0	228		1991				228														
Maui Kamaole Phase III	U	Kihei	Maui Kamaole Enterprises	8	88	0	88		1990			88															
Maui View Villas	U		Robert Orlsson		38					38																	
Myron Roarick	U				62					62																	
Hart Olana	U				21					21																	
Ocean Front Association	U				28					28																	
Ocean West Arizona Co.	U				136					136																	
Olowalu Planned Community	U	Olowalu	Amfac Property Dev Corp.	880	0	**	**																				
Pacific Shores Apartments	U	Kihei	Ocean West Developers		138	0	138		1989		138																
Piilani Residential Community	U	Kihei	Baldwin Pacific		785	455	330		1990			785															
Pukalani Housing	U	Pukalani	Blackfield Hawaii Corp.		108	108	0		1990			108															
Puu Hao Lai	U				59	59				59																	
Realty Mortgage	U				18					18																	
Rose Fisher Apartments	U	Kihei			4					4																	
Upper Paia Housing**	U	Paia	FmHA	10	300	300	0		**	300																	
				TOTAL	22604			UNKNOWN UNITS		1879	162	1027	228	461													
Sources:			A = AFFORDABLE																								
Brokers			M = MARKET																								
Developers			R = RESORT																								
MFDC			RENT = RENTAL																								
Real Estate Agents			U= UNKNOWN TIMETABLE																								
Builders			** = PROPOSED																								
Lawyers																											

Figure VI-138

MAUI INVENTORY SUMMARY SHEET

YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AFFORDABLE UNITS	524	656	854	887	629	619	619	598	438	437	377	69	69	69	69	69
UNKNOWN TIMETABLE AFFORDABLE (195 UNITS OVER 15 YEARS)	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	0
MARKET UNITS	529	619	1214	672	672	672	672	659	498	494	266	115	115	115	115	115
AFFORDABLE/MARKET UNITS (881 UNITS OVER 15 YEARS)																
AFFORDABLE (20%)	12	12	12	12	12	12	12	12	12	12	12	12	12	12	11	0
MARKET (80%)	47	47	47	47	47	47	47	47	47	47	47	47	47	47	44	0
RENTAL UNITS																
AFFORDABLE RENTAL UNITS (50%)	226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MARKET RENTAL UNITS (50%)	227	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNKNOWN AFFORDABLE RENTAL UNITS (50% OF 268 UNITS OVER 15 YEAR	10	10	10	10	10	10	10	10	10	10	10	10	10	8	6	0
UNKNOWN MARKET RENTAL UNITS (50% OF 268 UNITS OVER 15 YEARS)	10	10	10	10	10	10	10	10	10	10	10	10	10	8	6	0
UNKNOWN UNITS																
UNKNOWN UNITS AFFORDABLE (20%)	32	205	46	96	0	0	0	0	0	0	0	0	0	0	0	0
UNKNOWN UNITS MARKET (80%)	130	822	182	385	0	0	0	0	0	0	0	0	0	0	0	0
UNKNOWN UNITS NO TIMETABLE (1879 UNITS OVER 15 YEARS)																
AFFORDABLE (20%)	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	0
MARKET (80%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	0
YEAR	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
TOTAL AFFORDABLE UNITS	842	921	959	843	689	675	679	658	498	497	437	129	129	127	124	69
TOTAL MARKET UNITS	1043	1598	1554	1214	829	829	829	816	655	651	423	272	272	270	265	115
TOTAL NEW UNITS IN MAUI	1885	2519	2513	2057	1518	1508	1508	1474	1153	1148	860	401	401	397	389	184
TOTAL AFFORDABLE UNITS WITHOUT LAHAINA PLANNED DEVELOPMENT	842	760	384	532	378	368	368	347	187	186	129	129	129	127	124	69
TOTAL MARKET UNITS WITHOUT LAHAINA PLANNED DEVELOPMENT	1043	1519	1269	1062	677	677	677	664	503	499	272	272	272	270	265	115
TOTAL NEW UNITS IN MAUI WITHOUT LAHAINA	1885	2279	1653	1594	1055	1045	1045	1011	690	685	401	401	401	397	389	184

Figure VI-139

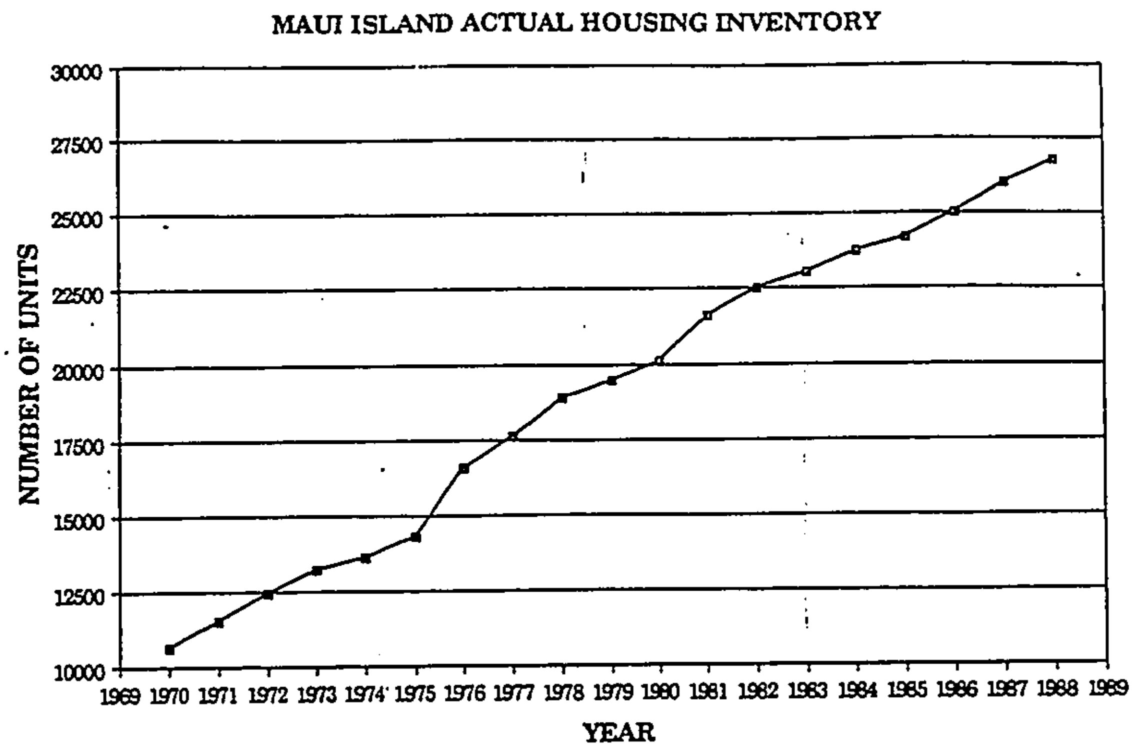


Figure VI-140

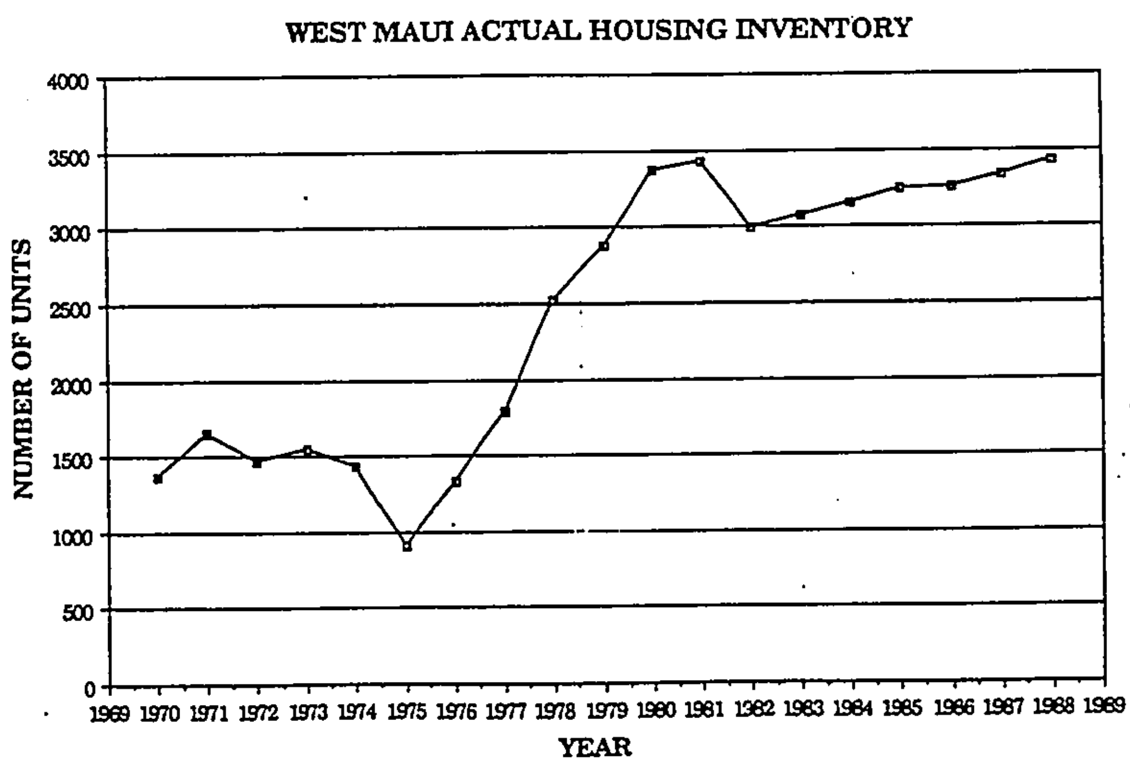


Figure VI-141

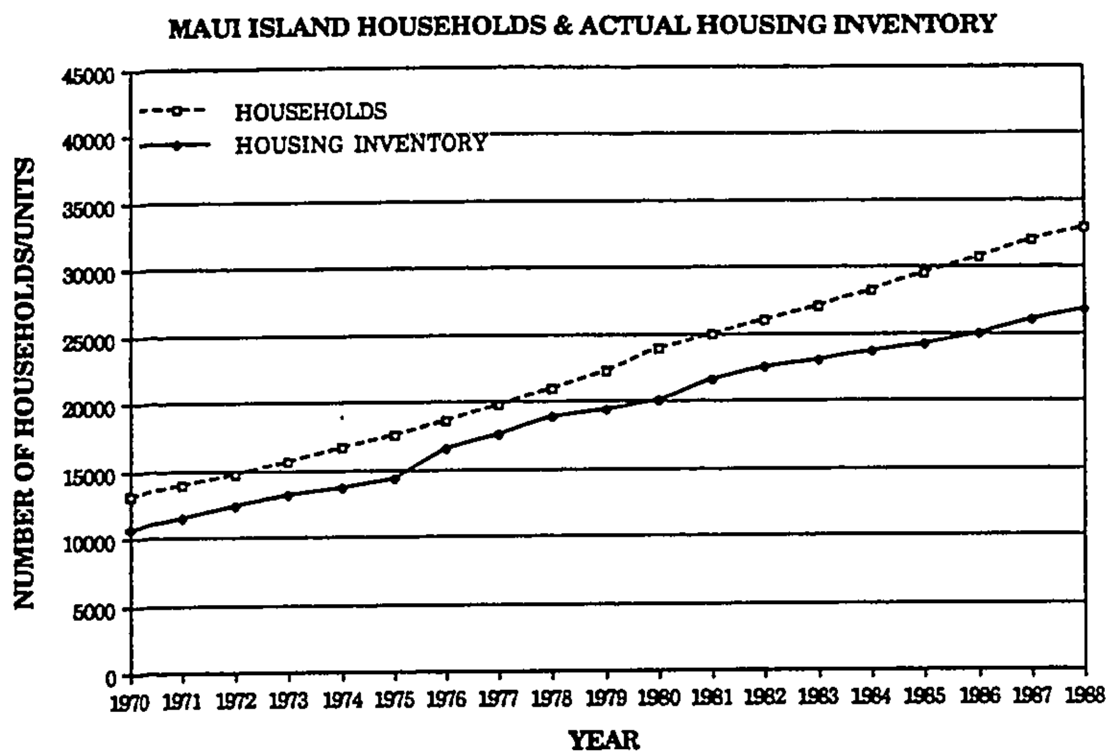


Figure VI-142

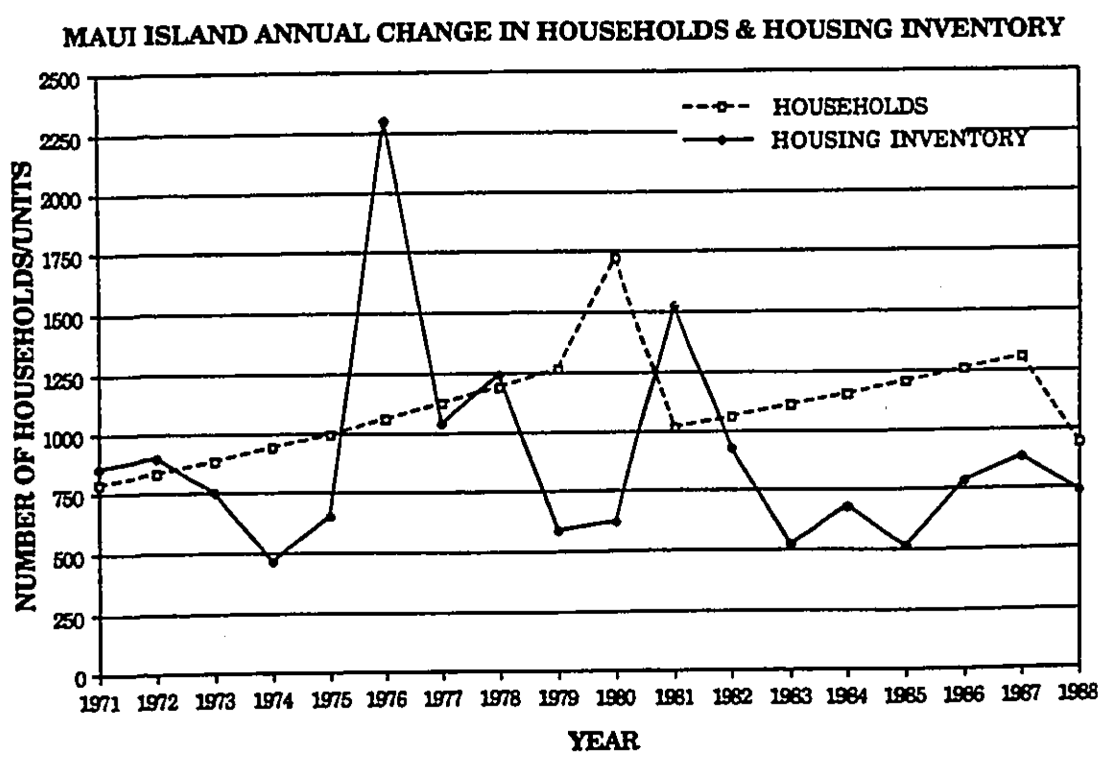


Figure VI-143

WEST MAUI ANNUAL CHANGE IN HOUSEHOLDS & HOUSING INVENTORY

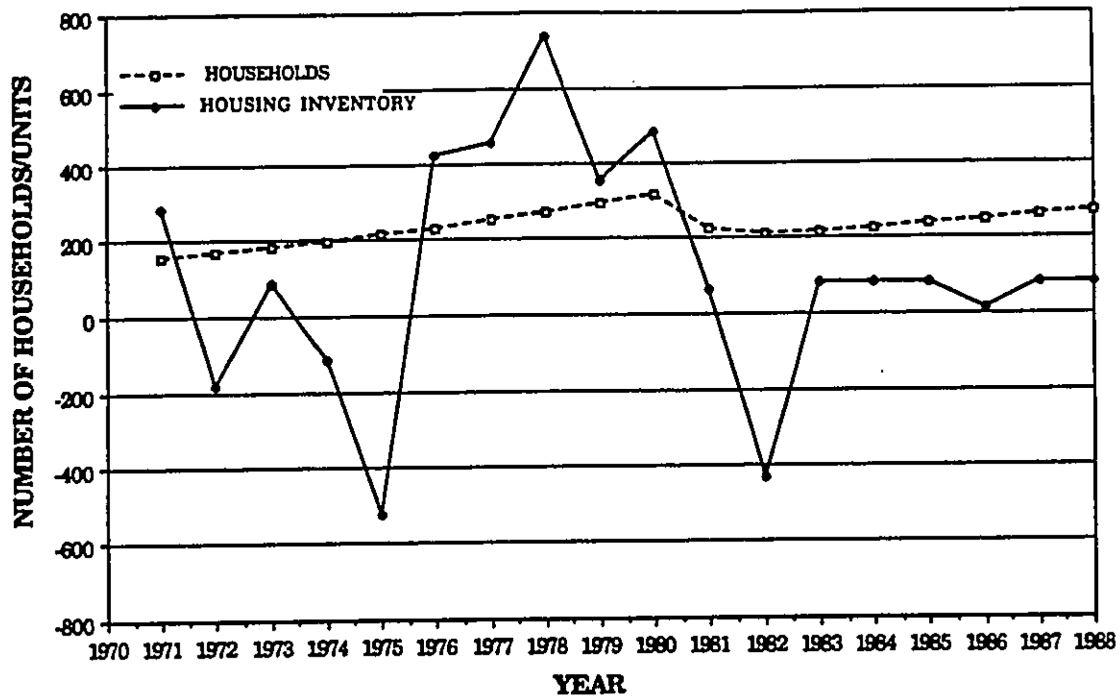


Figure VI-144

Maui West Maui Housing Supply and Demand

Maui Island Housing Demand

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Housing Demand	8357	9170	10146	11148	12179	13239	14329	15195	16080	16984	17906	18852	19702	20682	21402	22282	23102
Lahaina Planned Community	0	0	240	860	463	463	463	463	463	463	463	459	0	0	0	0	0
Other Housing Units	393	1885	2279	1653	1594	1055	1045	1045	1011	690	685	401	401	401	397	389	184
Total New Housing Units	393	1885	2519	2513	2057	1518	1508	1508	1474	1153	1148	860	401	401	397	389	184
Total Other Housing Supply (75% Built after 1989)	393	1414	1709	1240	1196	791	784	784	758	518	514	301	301	301	298	292	138
Lahaina Planned Community Supply	0	0	240	860	463	463	463	463	463	463	463	459	0	0	0	0	0
Total Incremental New Housing Supply (5% Vacant)	373	1343	1852	1995	1576	1192	1184	1184	1160	931	928	722	286	286	283	277	131
Total Culmulative New Housing Supply	373	1716	[illegible]	[illegible]	[illegible]	[illegible]	9614	10809	11859	12791	13718	14440	14726	15012	15295	15572	15703
Total Excess Housing Demand	7984	7454	6577	[illegible]	5040	4809	4515	4496	4221	4193	4190	4412	4976	5540	6107	6680	7399

West Maui Housing Demand

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Housing Demand	3235	3445	[illegible]	3927	4195	4439	4689	4939	5189	5439	5689	5939	6189	6439	6689	6939	7189
Lahaina Planned Community	0	0	240	860	463	463	463	463	463	463	463	459	0	0	0	0	0
Other Housing Units (100% Built)	56	469	72	10	10	10	10	0	0	0	0	0	0	0	0	0	0
Total Incremental New Housing Supply (0% Vacant)	56	469	312	870	473	473	473	463	463	463	463	459	0	0	0	0	0
Total Culmulative New Housing Supply	56	525	837	1707	2180	2653	3126	3589	4052	4515	4978	5437	5437	5437	5437	5437	5437
Total Excess Housing Demand	3179	2923	[illegible]	2220	2015	1786	1563	1350	1137	924	711	502	752	1002	1252	1502	1752

Figure VI-145

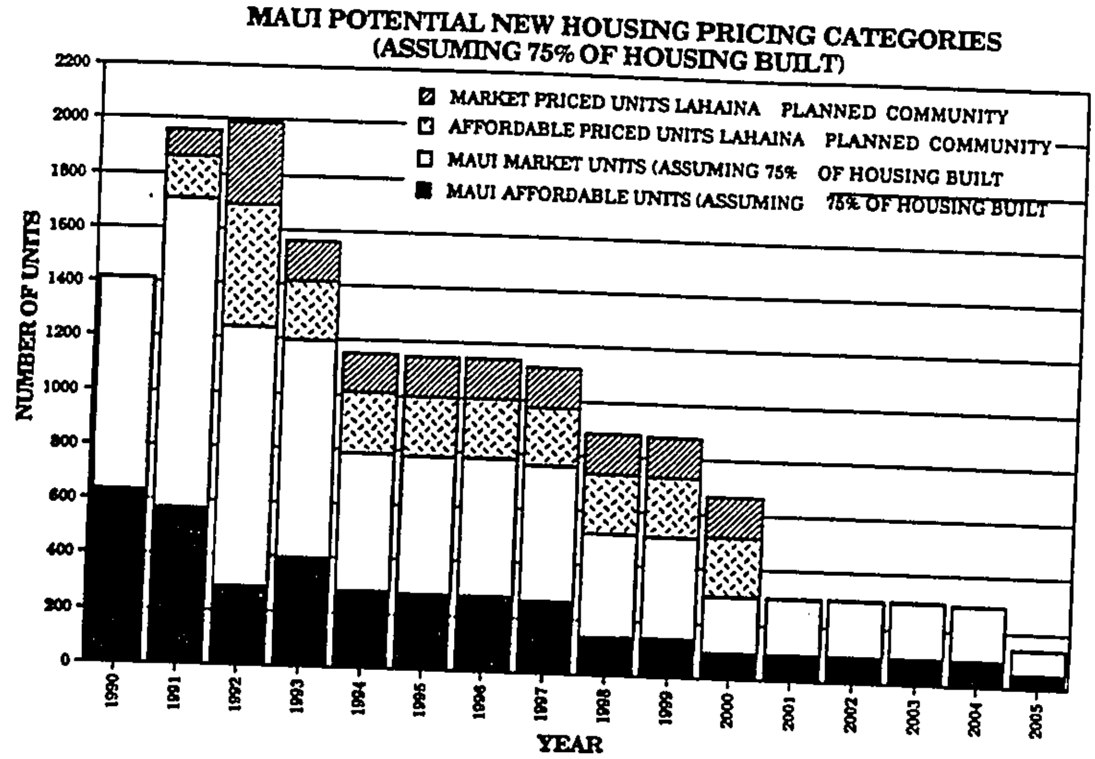


Figure VI-146

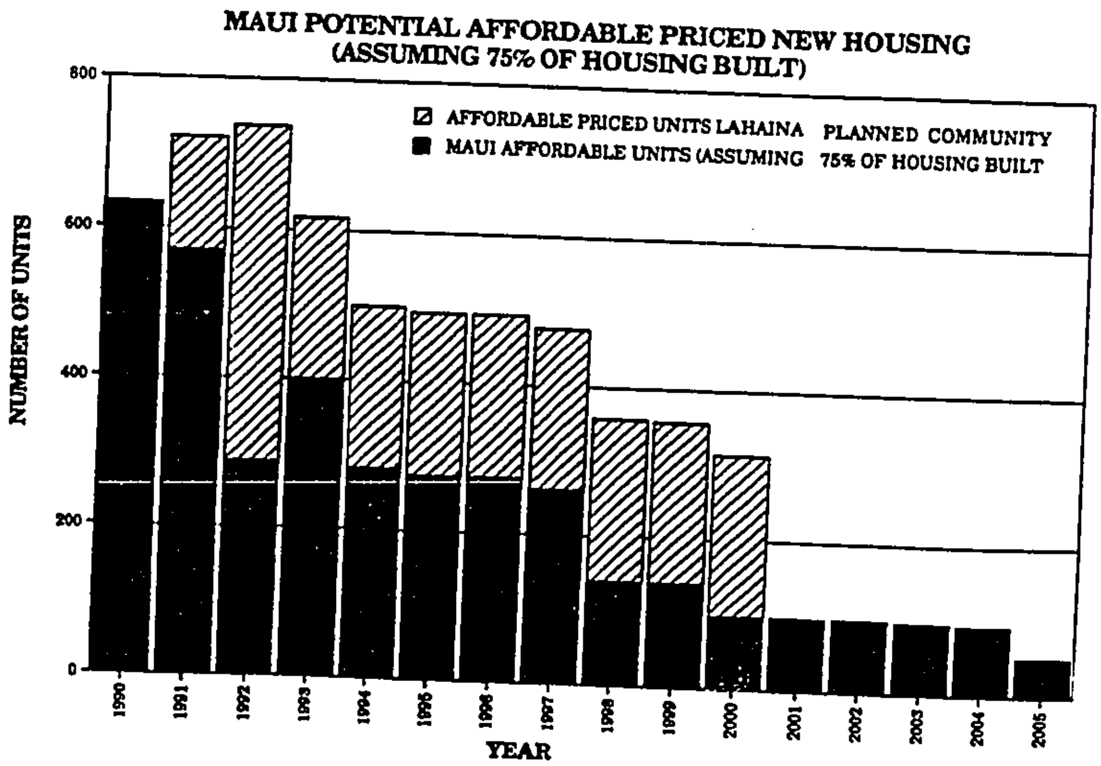


Figure VI-147

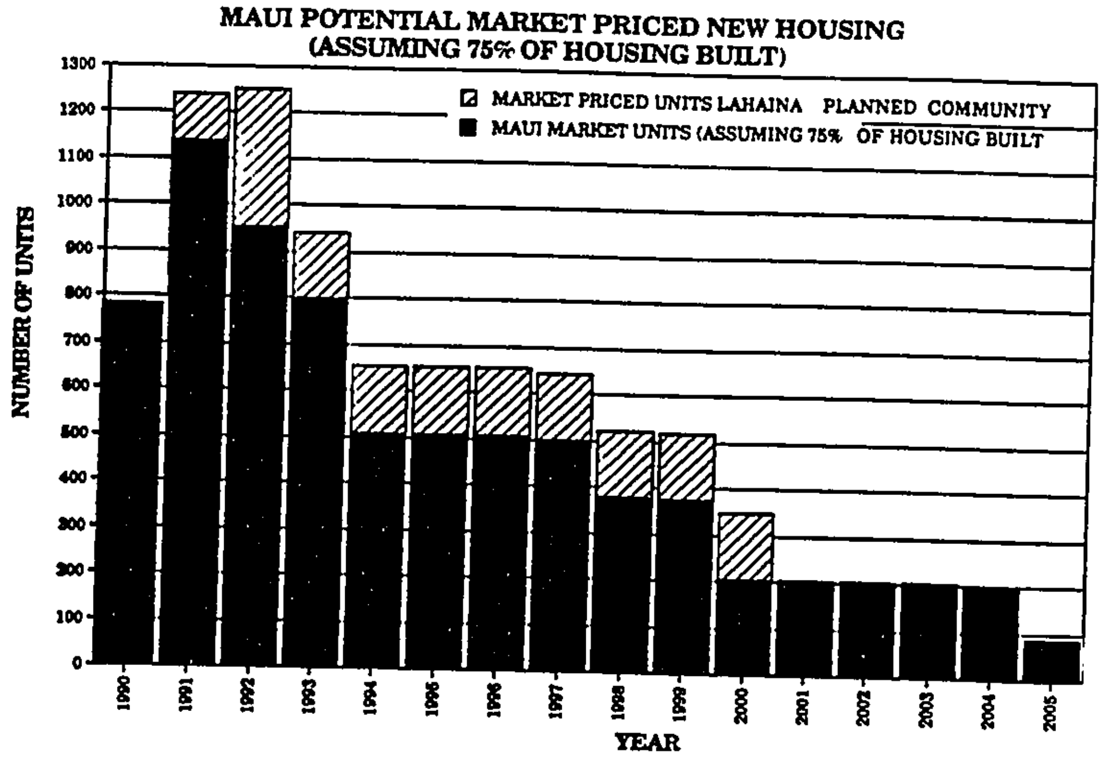


Figure VI-148

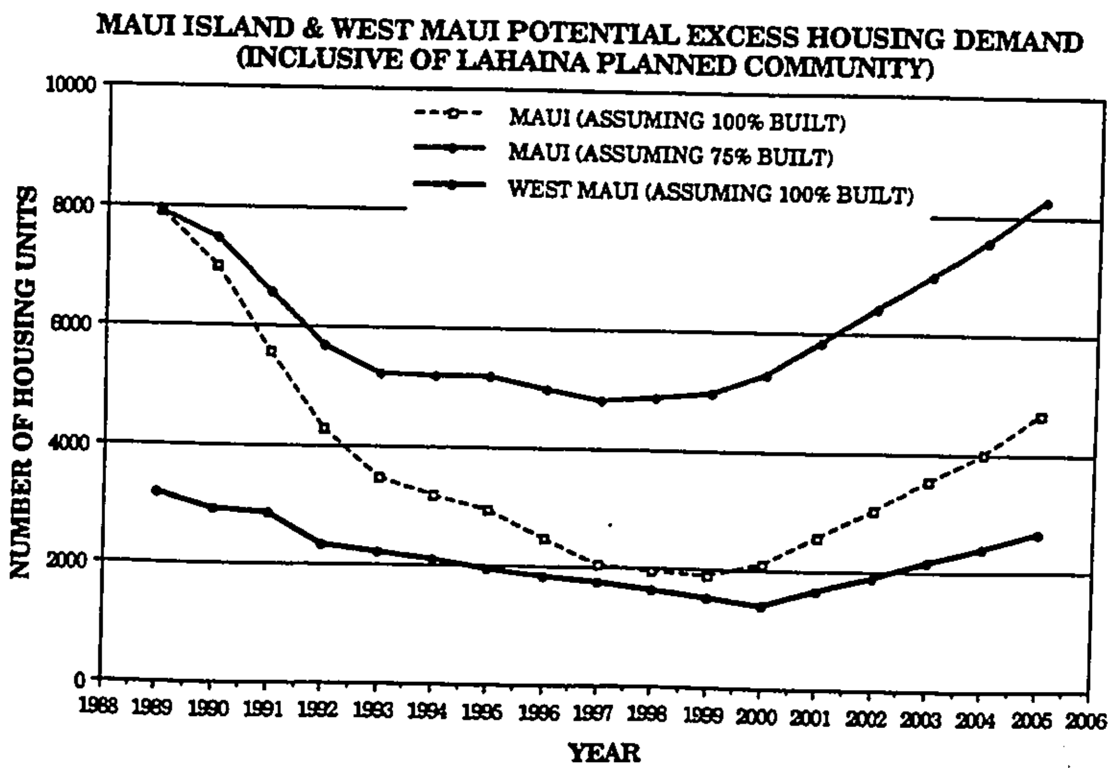


Figure VI-149

MAUI COUNTY HISTORICAL AND PROJECTED EMPLOYMENT

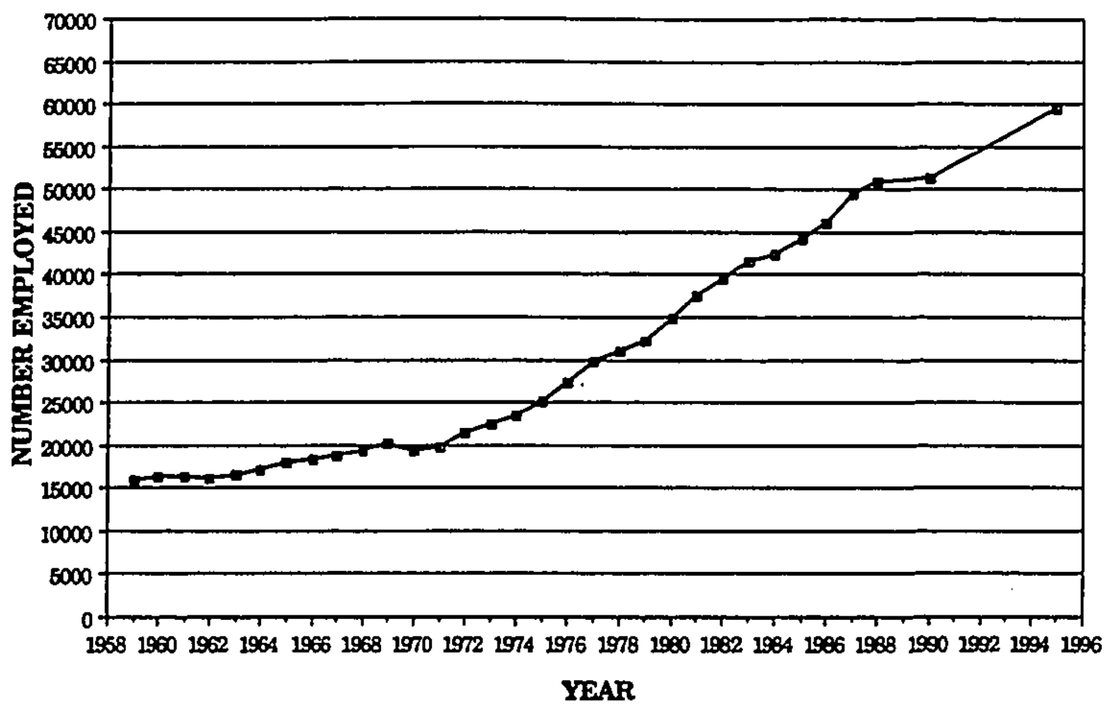


Figure VI-150

Maui Housing Suuply and Demand Based on Population and Employment

Year	Maui Island Population	Estimated HH Size	Households by Population	Maui County Employment	Maui Island Emp (92%)	Estimated Jobs Per Household	Households by Employment	Maui Island Housing Inv	Maui Island Avail Inv 5% Vac	Annual Excess Demand by Pop	Annual Excess Demand by Emp	Average of Pop and Emp
1970	38691	2.95	13130	19250	17710	1.53	11575	10854	10121	3009	1464	2231
1971	40613	2.92	13919	19650	18078	1.53	11816	11507	10932	2988	884	1936
1972	42630	2.89	14756	21400	19688	1.52	12953	12408	11788	2956	1165	2067
1973	44747	2.86	15643	22450	20654	1.52	13588	13160	12502	3141	1086	2113
1974	46969	2.83	16583	23350	21482	1.52	14133	13621	12940	3643	1193	2418
1975	49302	2.80	17579	25050	23046	1.51	15262	14276	13562	4017	1700	2858
1976	51751	2.78	18636	27250	25070	1.51	16603	16571	15742	2893	860	1877
1977	54321	2.75	19755	29800	27416	1.51	18156	17609	16729	3027	1428	2227
1978	57019	2.72	20943	30900	28428	1.50	18952	18851	17908	3034	1044	2039
1979	59851	2.70	22201	32100	29532	1.50	19688	19437	18465	3736	1223	2479
1980	62823	2.63	23927	34750	31970	1.50	21313	20059	19056	4871	2257	3564
1981	65157	2.61	24945	37450	34454	1.49	23123	21578	20499	4446	2624	3535
1982	67578	2.60	26006	39550	36386	1.48	24420	22509	21384	4622	3037	3829
1983	70089	2.59	27112	41450	38134	1.48	25766	23033	21881	5230	3885	4558
1984	72693	2.57	28265	42250	38870	1.48	26264	23711	22525	5739	3738	4739
1985	75394	2.56	29467	44100	40572	1.48	27414	24225	23014	6453	4400	5426
1986	78195	2.55	30720	46050	42366	1.47	28820	25008	23759	6962	5062	6012
1987	81100	2.53	32027	49450	45494	1.47	30948	25990	24691	7336	6258	6797
1988	83053	2.52	32958	50800	46736	1.46	32011	26730	25394	7574	6617	7096
1990	87100	2.52	34563	51300	47196	1.46	32326	28536	27109	7454	5217	6336
1995	100100	2.52	39722	59500	54740	1.44	38014	36744	34907	4815	3107	3961
2000	111500	2.52	44246	67700	62284	1.43	43555	41931	39834	4412	3721	4066

Figure VI-151

Income	Mortgage Amount	Purchase Price-5% Downpayment	Purchase Price-10% Downpayment	Purchase Price-20% Downpayment
$27,200				
Int-Rate				
8.00%	94323	99288	104804	117904
8.50%	90012	94749	100013	112516
9.00%	86017	90544	95574	107521
9.50%	82311	86643	91456	102888
10.00%	78867	83018	87630	98583
10.50%	75662	79644	84069	94578
$29,999				
Int-Rate				
8.00%	104030	109505	115589	130037
8.50%	99274	104499	110305	124093
9.00%	94868	99862	105409	118586
9.50%	90781	95559	100867	113476
10.00%	86982	91560	96647	108728
10.50%	83448	87840	92720	104310
$34,999				
Int-Rate				
8.00%	121369	127756	134854	151711
8.50%	115821	121916	128689	144776
9.00%	110680	116506	122978	138351
9.50%	105911	111486	117679	132389
10.00%	101480	106821	112756	126850
10.50%	97357	102481	108174	121696
$39,999				
Int-Rate				
8.00%	138707	146008	154119	173384
8.50%	132367	139333	147074	165459
9.00%	126492	133150	140547	158115
9.50%	121042	127413	134491	151302
10.00%	115978	122082	128864	144972
10.50%	111265	117121	123628	139081
$40,800				
Int-Rate				
8.00%	141485	148932	157206	176856
8.50%	135018	142124	150019	168772
9.00%	129025	135816	143362	161282
9.50%	123466	129964	137184	154332
10.00%	118300	124526	131445	147875
10.50%	113493	119467	126104	141867
$47,600				
Int-Rate				
8.00%	165066	173754	183407	206333
8.50%	157520	165811	175023	196901
9.00%	150530	158452	167255	188162
9.50%	144044	151625	160048	180054
10.00%	138017	145281	153352	172521
10.50%	132409	139378	147121	165511

Figure VI-152

Maui Housing Demand

Income Bracket $	% Of Median Income	Affordable Monthly Rent Range	Number of Qualified Households/Year	No. of Interested and Qualified Households/Year
17000 to 27200	50% to 80%	430 to 687	2622	262

Income Bracket $	% Of Median Income	Affordable Price Range	Number of Qualified Households/Year	No. of Interested and Qualified Households/Year
27200 to 29999	80% to 88%	96000 to 105000	1267	127
30000 to 34999	88% to 103%	105000 to123000	2087	209
35000 to 40800	103% to 120%	123000 to 143000	1311	131
		Total	4665	467
40801 to 47600	120% to 140%	143000 to 168000	487	49
47,601 & Above	Above 140%		6986	699
		Total Housing Demand per Year		1476

Current Pent-up Demand = 7574 Units
Will Grow by Approximately 800 to 900 units/year

West Maui Housing Demand

Income Bracket $	% Of Median Income	Affordable Monthly Rent Range	Number of Qualified Households/Year	No. of Interested and Qualified Households/Year
17000 to 27200	50% to 80%	430 to 687	1306	131

Income Bracket $	% Of Median Income	Affordable Price Range	Number of Qualified Households/Year	No. of Interested and Qualified Households/Year
27200 to 29999	80% to 88%	96000 to 105000	461	46
30000 to 34999	88% to 103%	105000 to123000	690	69
35000 to 40800	103% to 120%	123000 to 143000	547	55
		Total	1698	170
40801 to 47600	120% to 140%	143000 to 168000	306	31
47,601 & Above	Above 140%		1642	164
		Total Housing Demand per Year		496

Current Pent-up Demand = 2938 Units
Will Grow by Approximately 250 to 300 units/year

Notes:

1989 Maui Median Household Income = $34,000 (According to HUD)

% of Median Inc	Income	Type of Household	Type of Unit
50% of Median	17000	Renter	Rental
80% of Median	27200	Renter	Sale
120% of Median	40800	Renter	Sale
140% of Median	47600	Renter	Sale
>140% of Median	47601	All Households	Sale

Figure VI-153

MAUI ISLAND RENTER HOUSEHOLD INCOME DISTRIBUTION

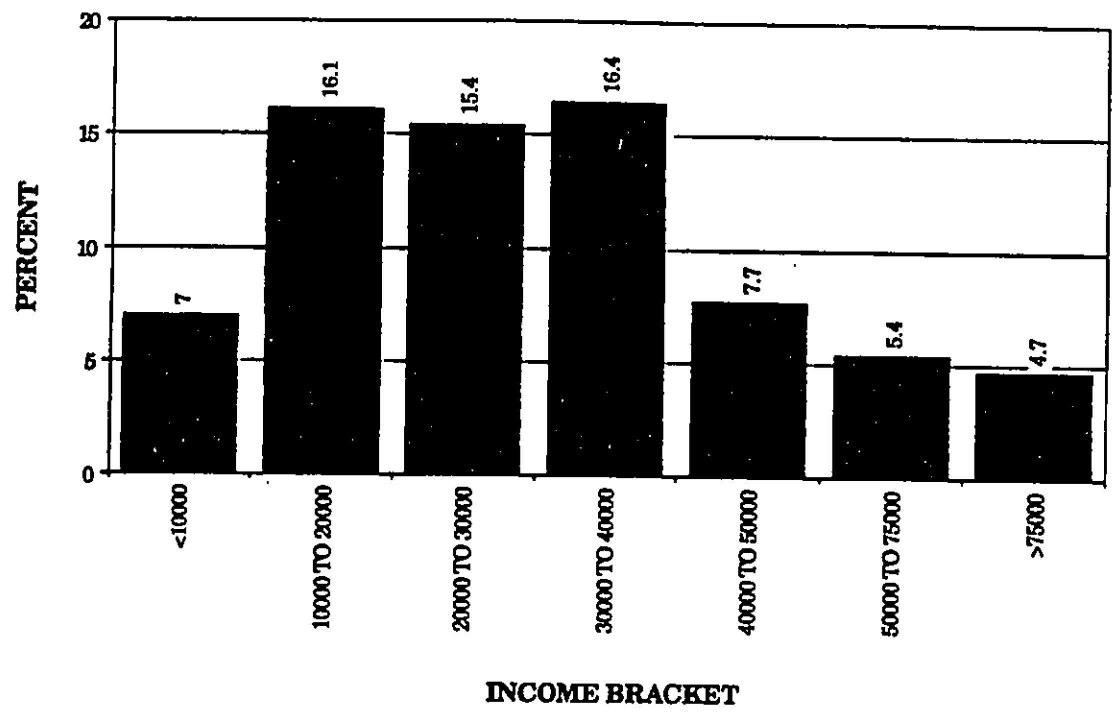


Figure VIII-1

WEST MAUI RENTER HOUSEHOLD INCOME DISTRIBUTION

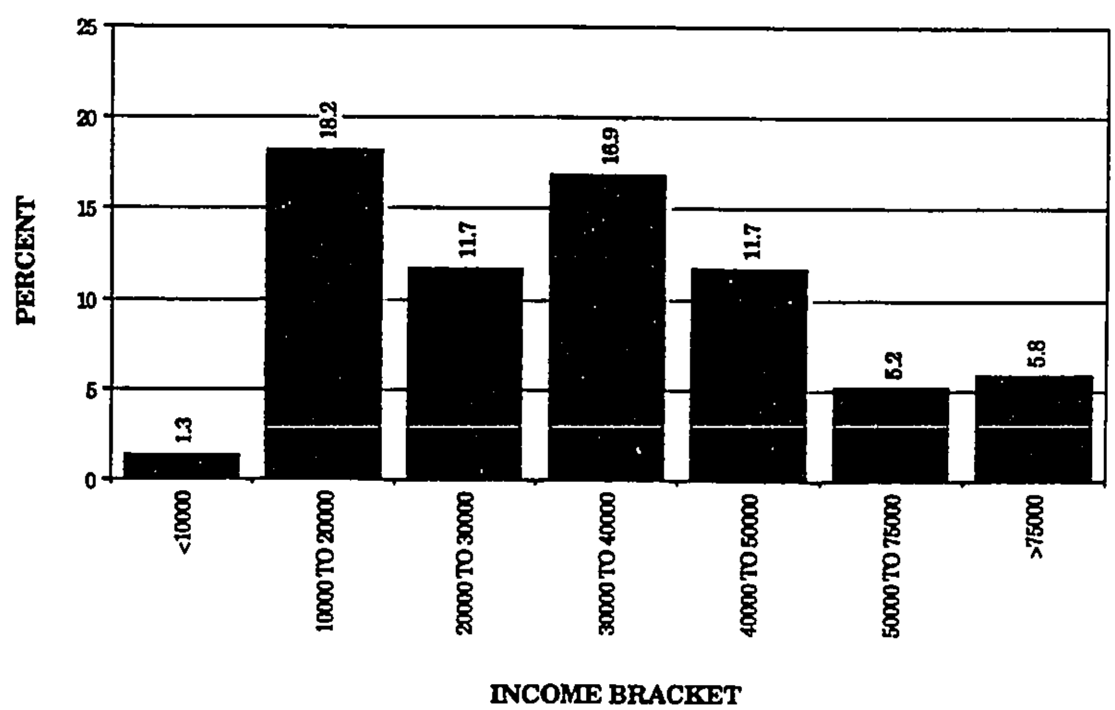


Figure VIII-2

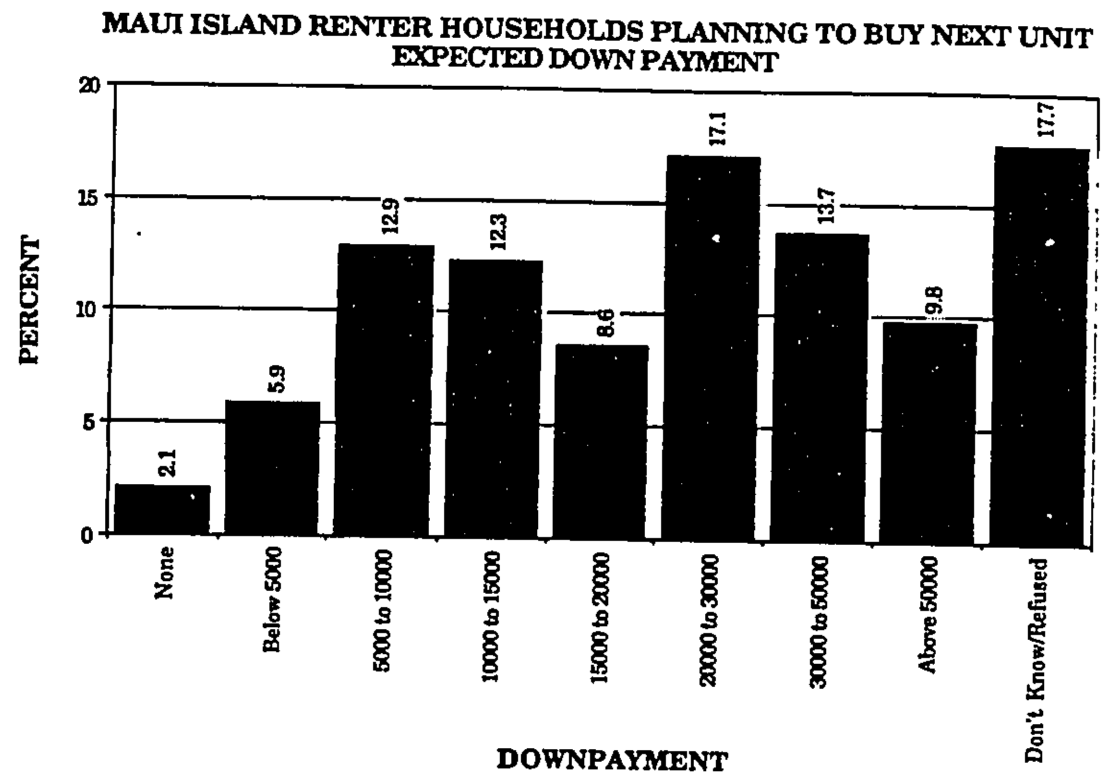


Figure VIII-3

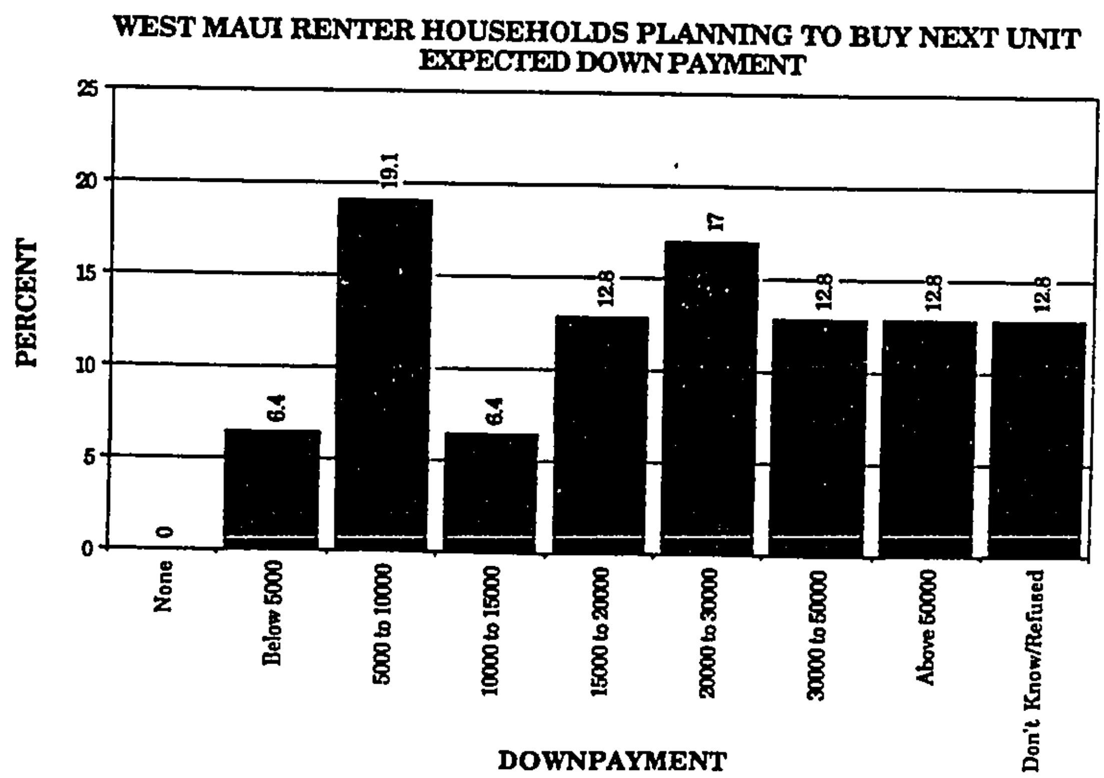


Figure VIII-4

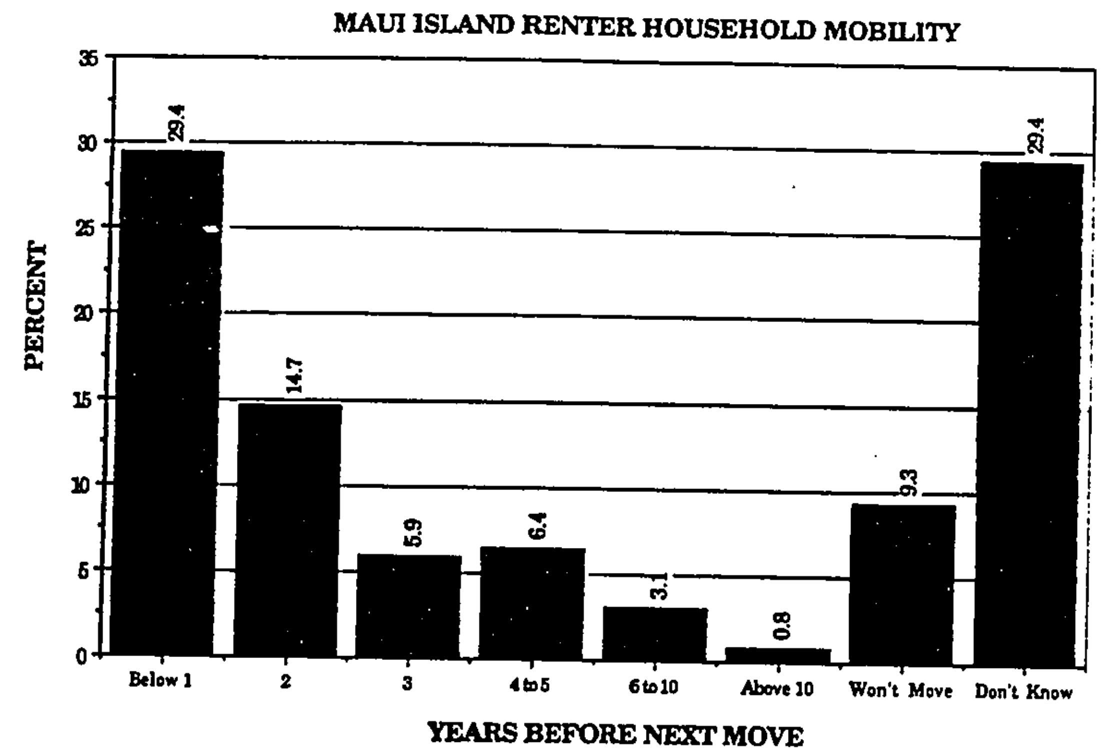


Figure VIII-5

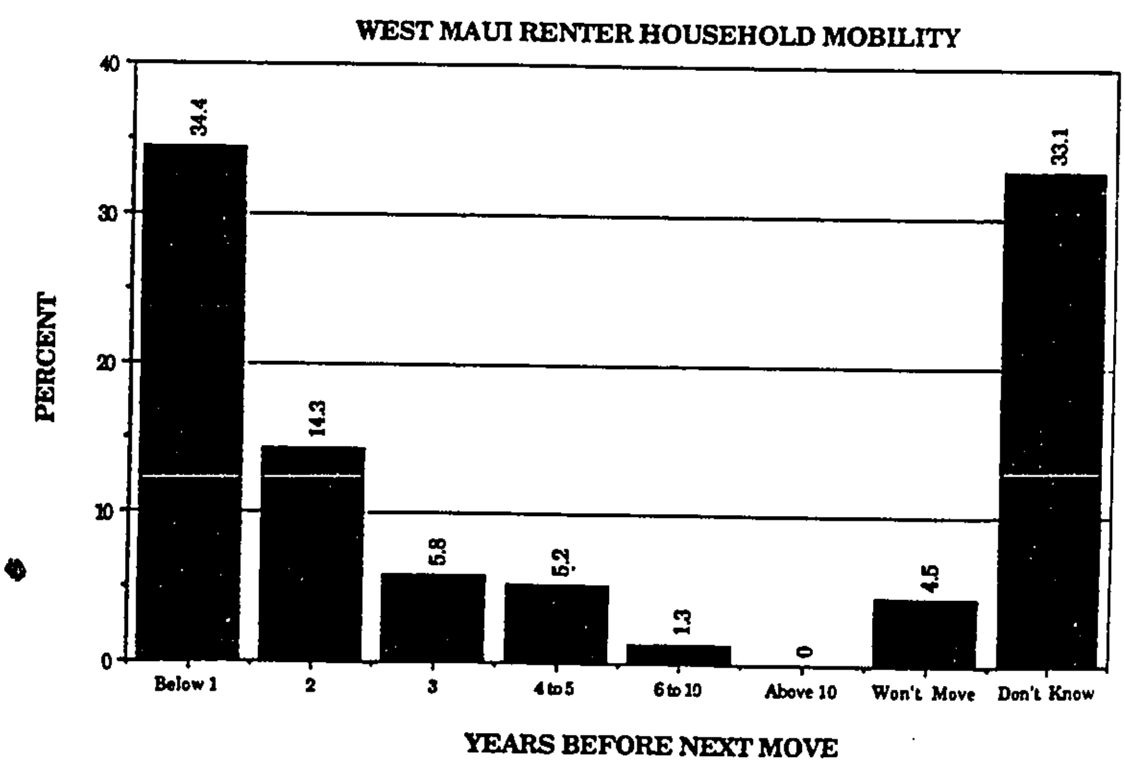


Figure VIII-6

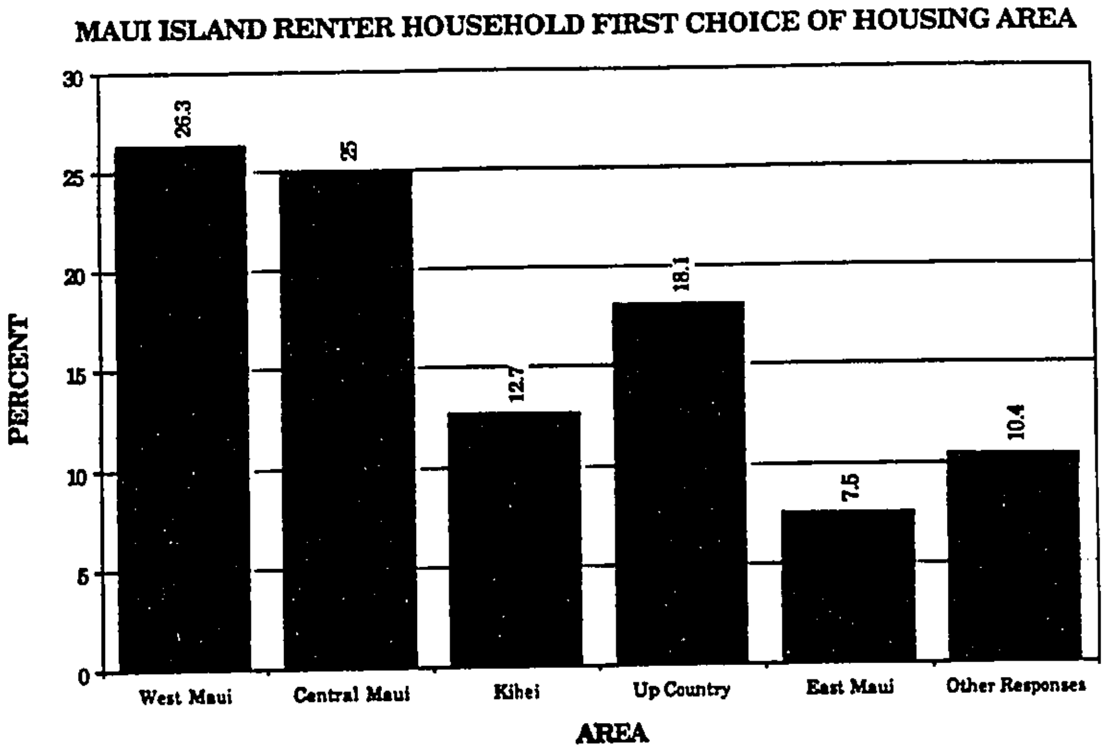


Figure VIII-7

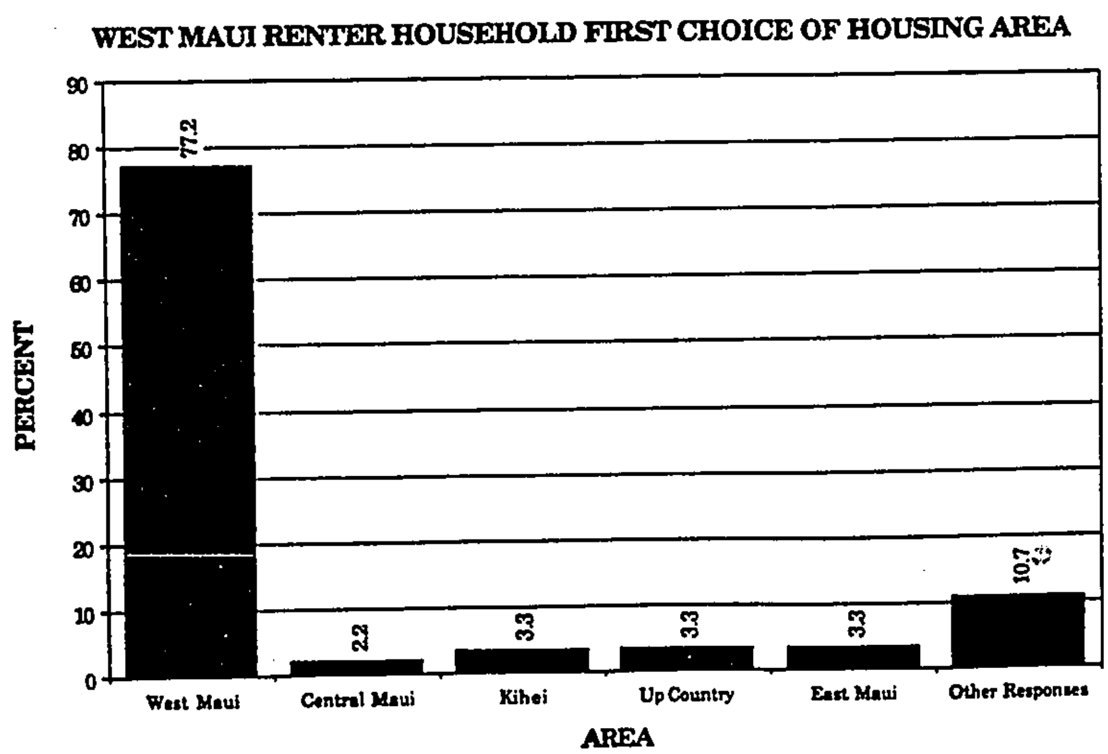


Figure VIII-8

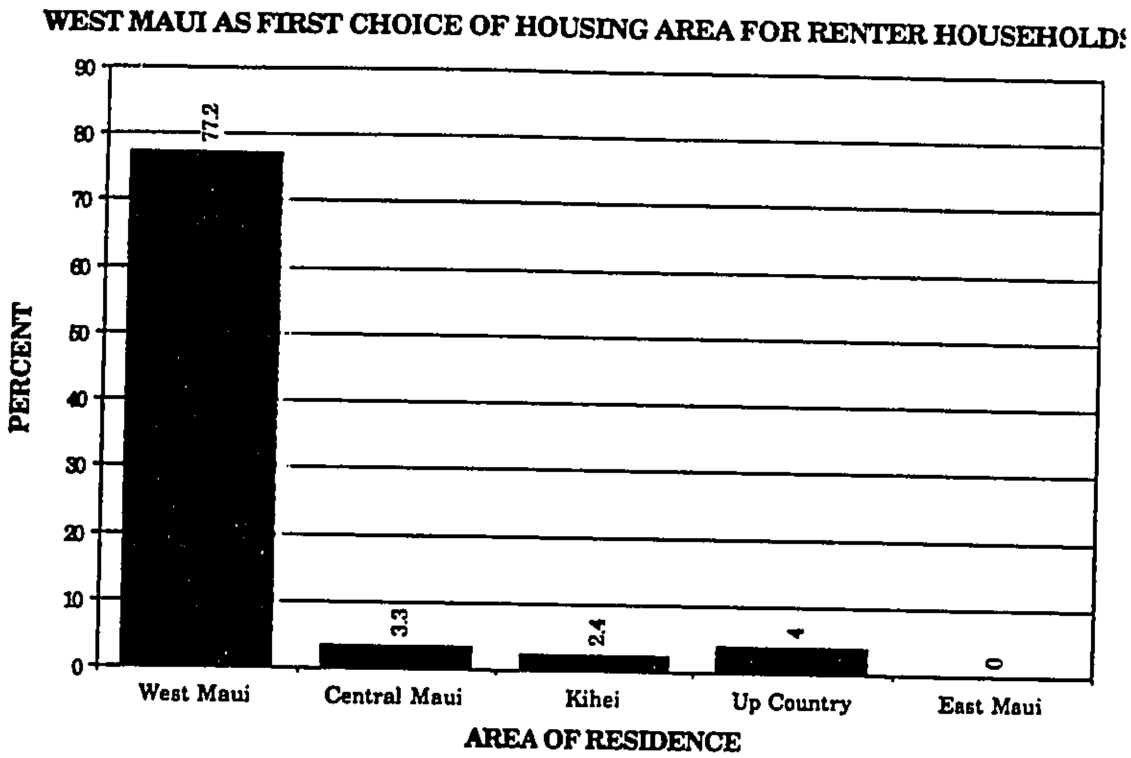


Figure VIII-9

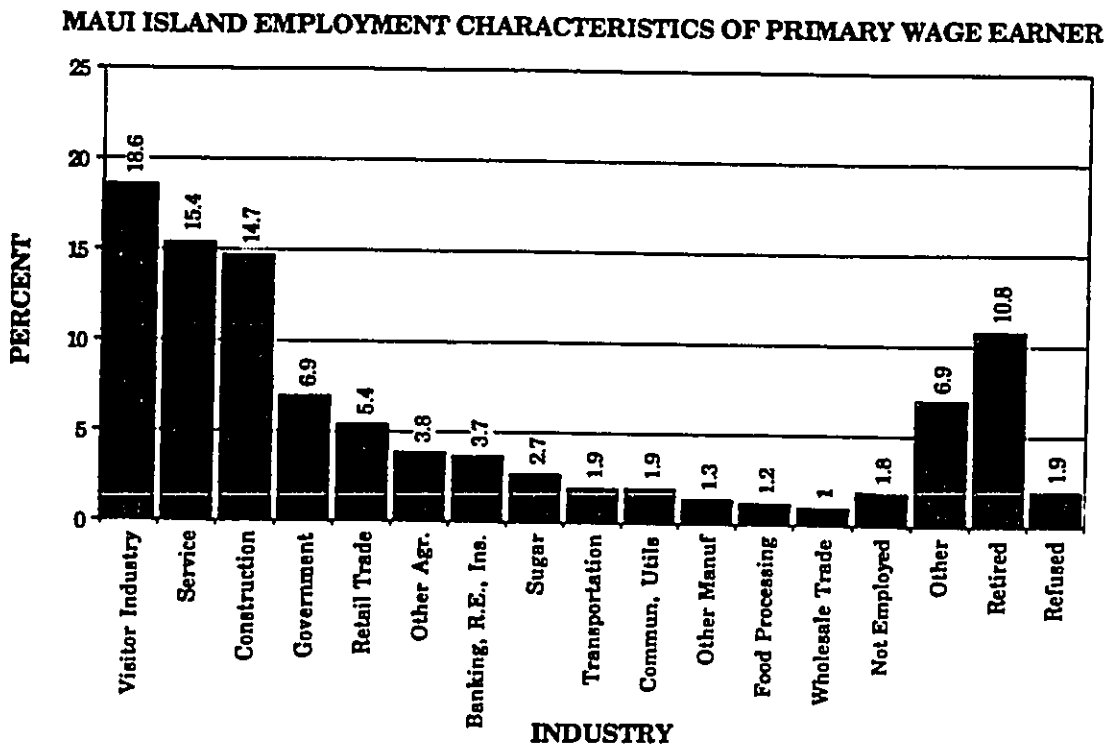


Figure VIII-10

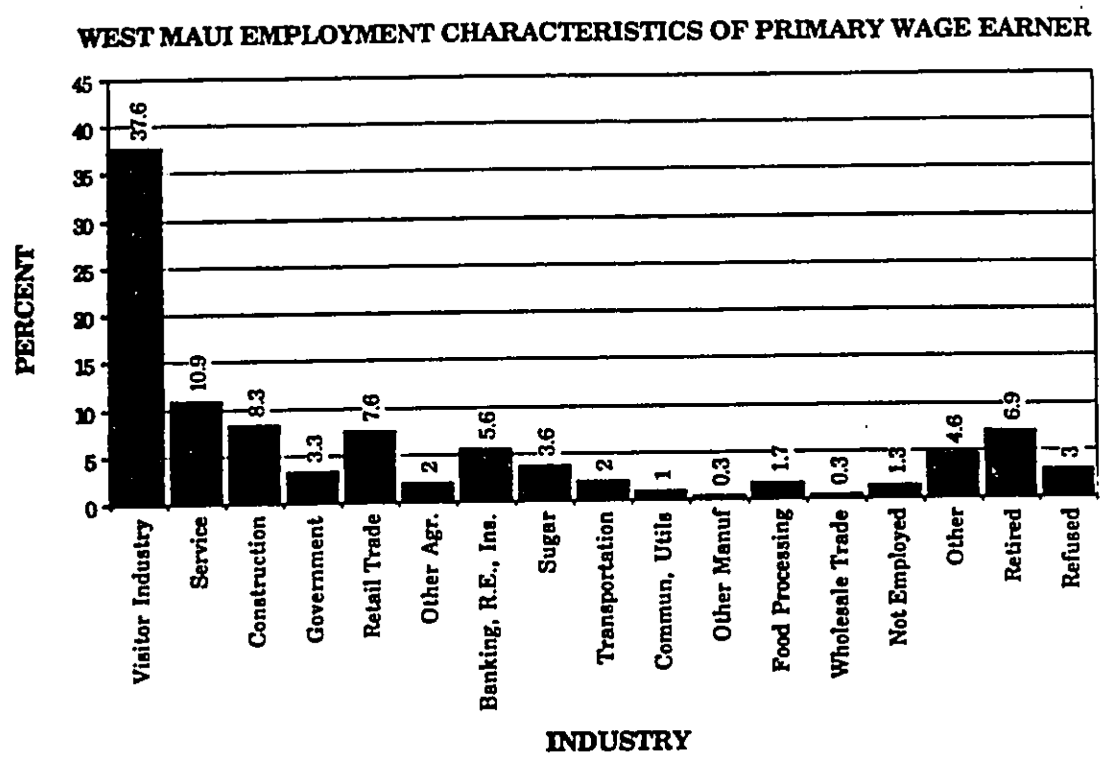


Figure VIII-11

SELECTED MAUI SINGLE FAMILY AVERAGE SALES PRICES
BASED UPON 9/88 TO 9/89 MLS RESALES

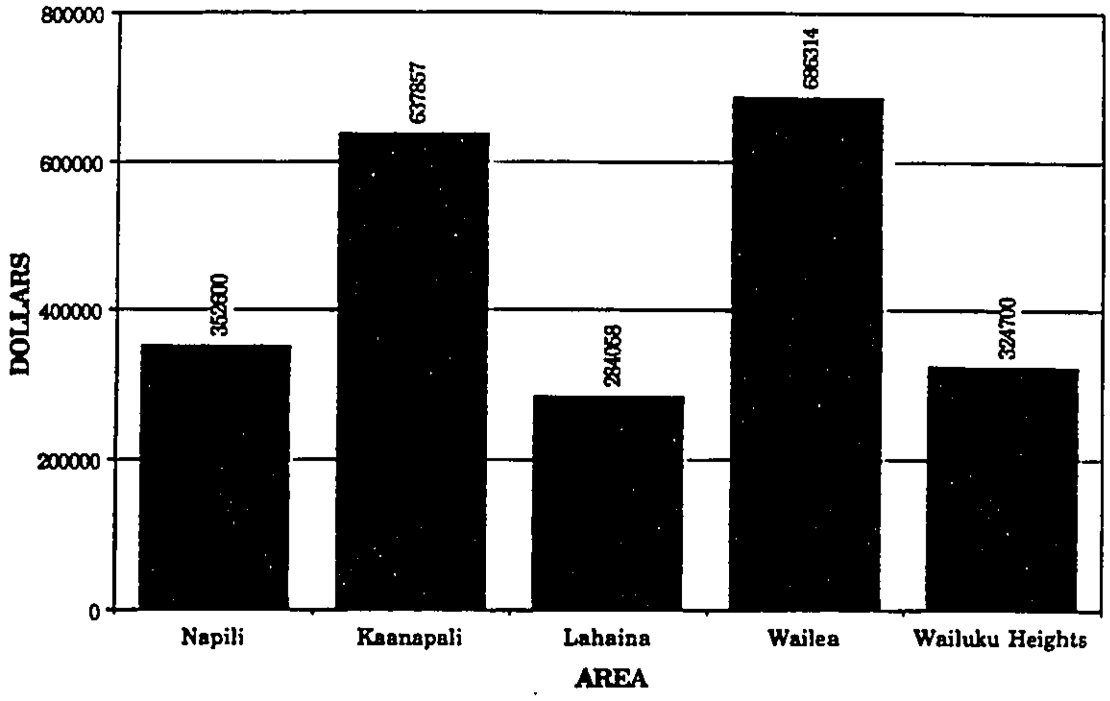


Figure IX-1

SELECTED MAUI SINGLE FAMILY AVERAGE PRICE PER SQ FT OF INTERIOR AREA
BASED UPON 9/88 TO 9/89 MLS RESALES

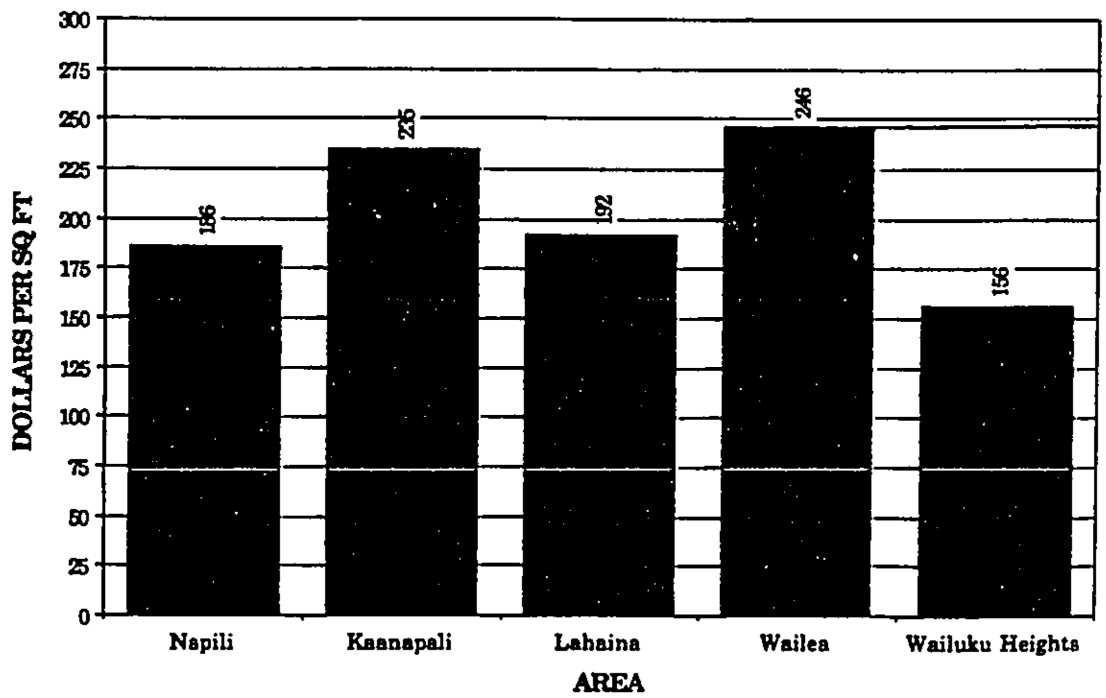


Figure IX-2

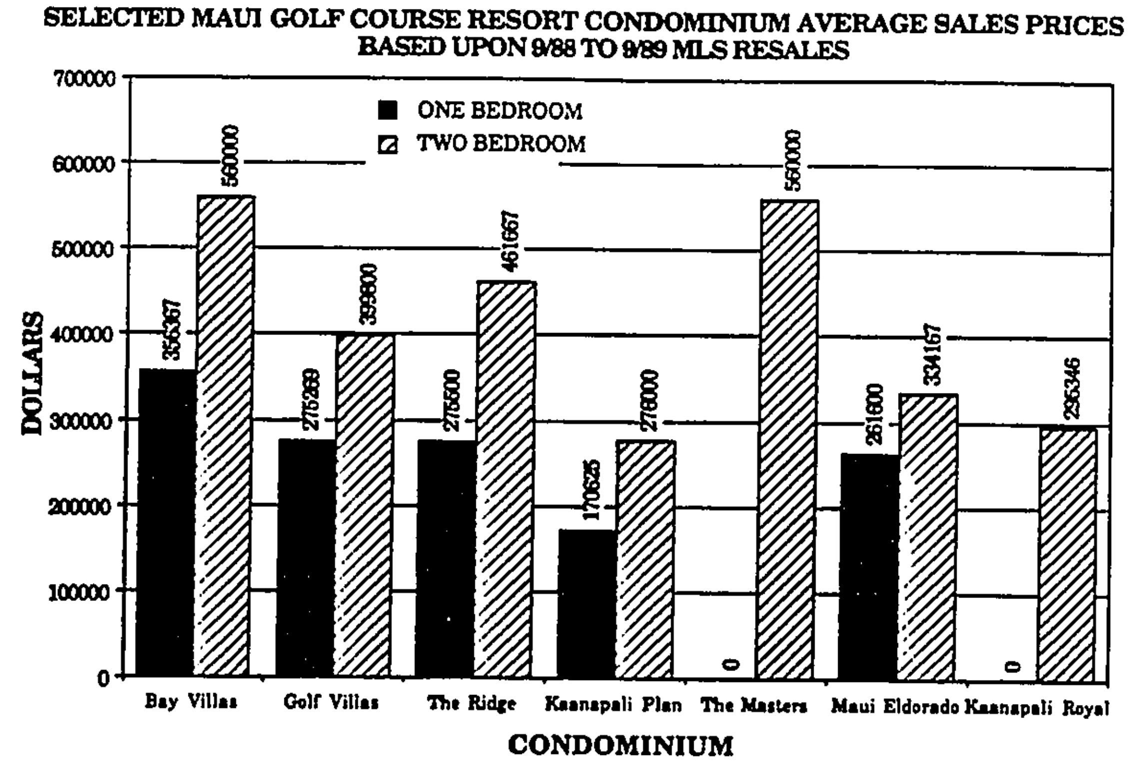


Figure IX-3

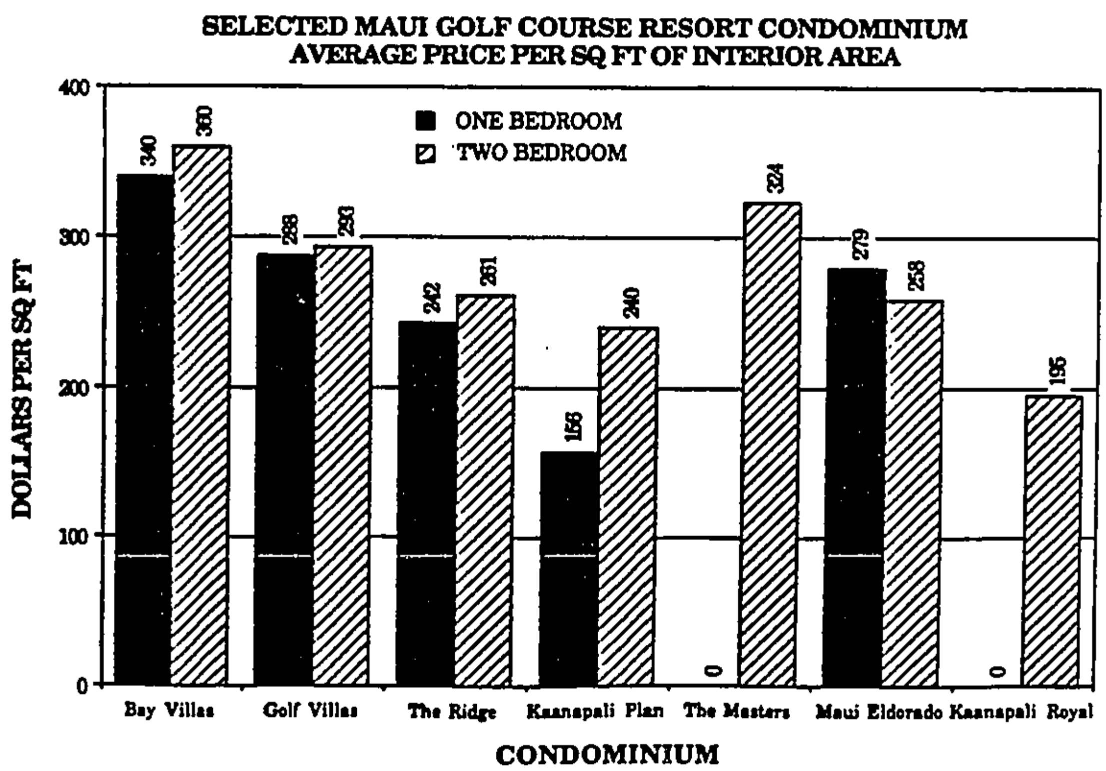
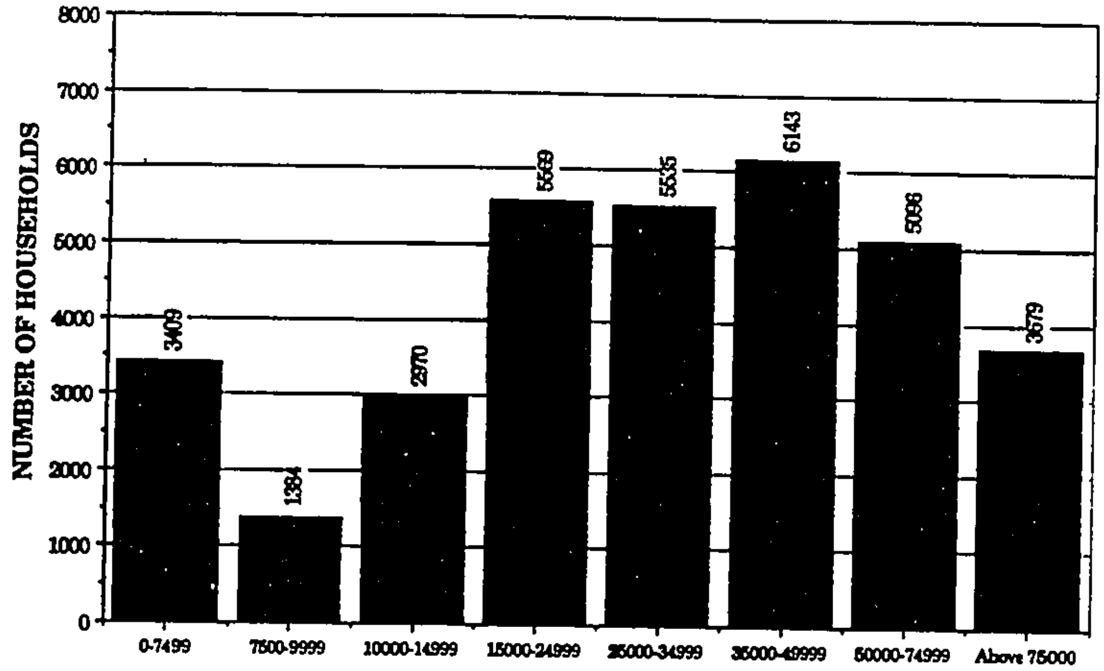


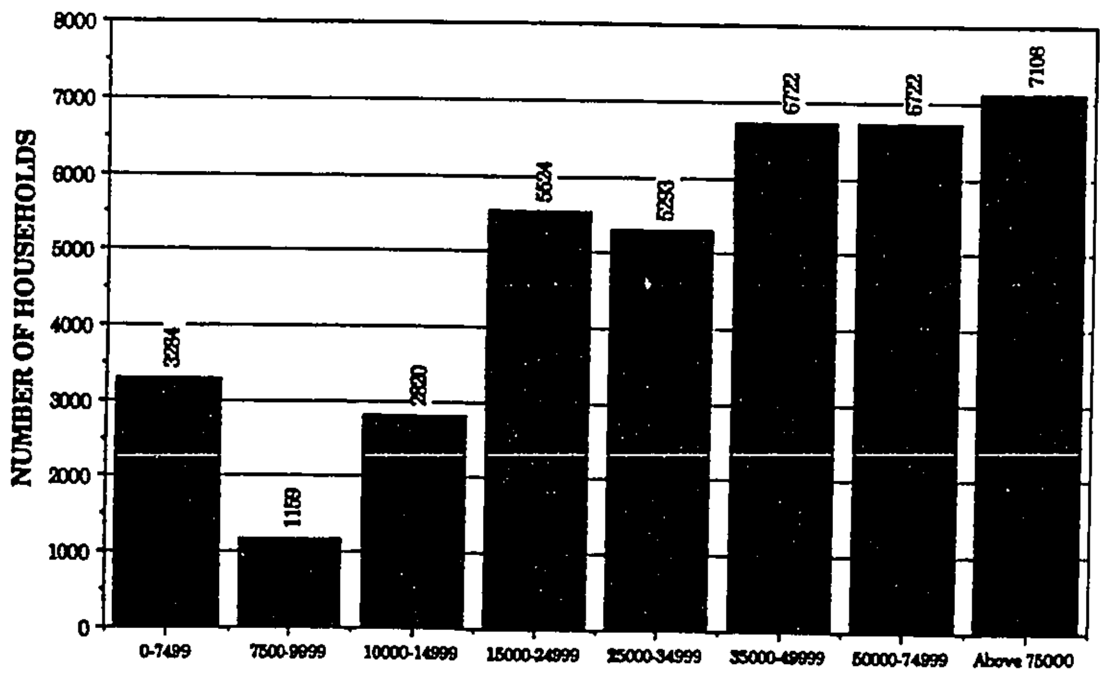
Figure IX-4

MAUI ISLAND 1989 HOUSEHOLD INCOME DISTRIBUTION



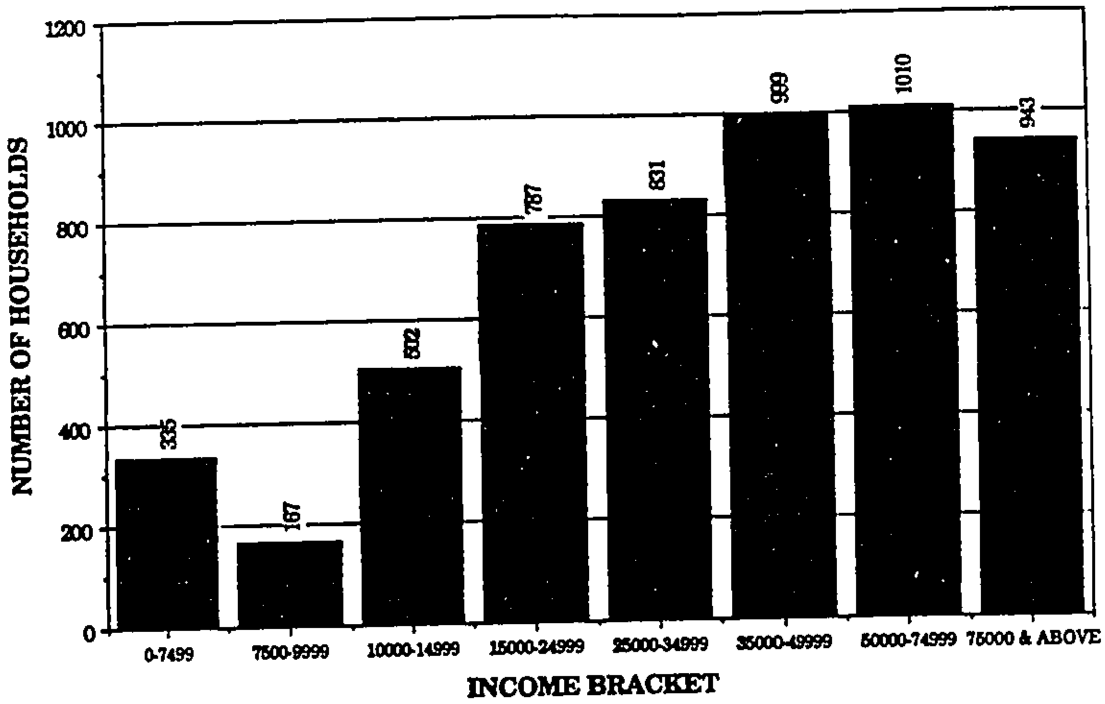
Appendix I

MAUI ISLAND 1994 PROJECTED HOUSEHOLD INCOME DISTRIBUTION



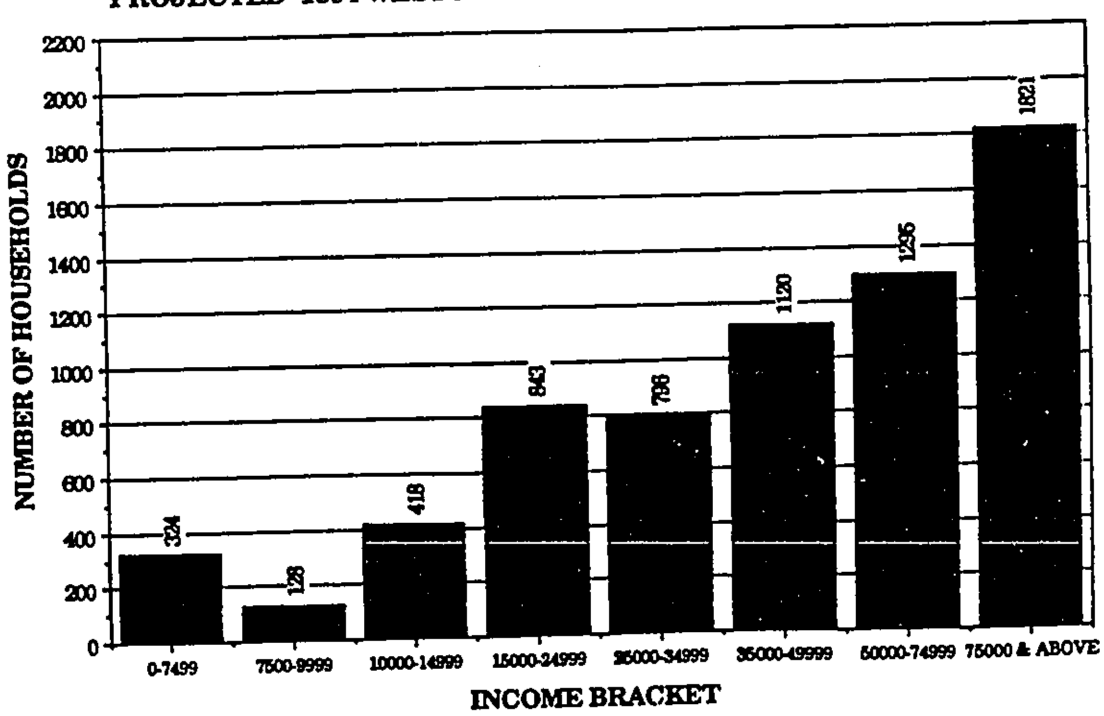
Appendix I

1989 WEST MAUI HOUSEHOLD INCOME DISTRIBUTION



Appendix I

PROJECTED 1994 WEST MAUI HOUSEHOLD INCOME DISTRIBUTION



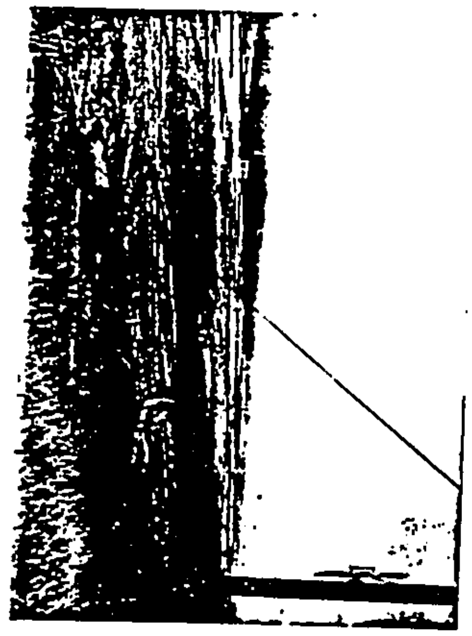
Appendix I

Project Site Location

Appendix II

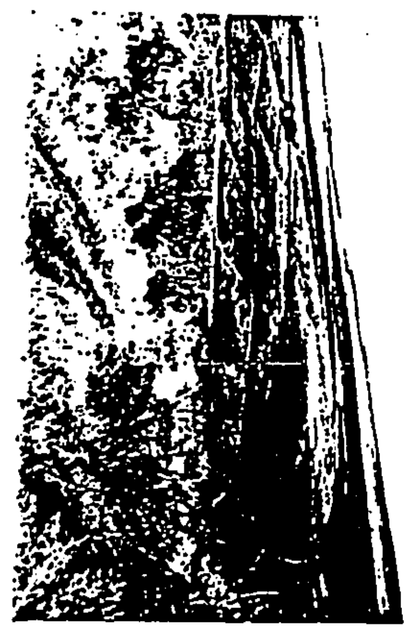
Project Site Location

Appendix II



Project Site Location

Appendix II

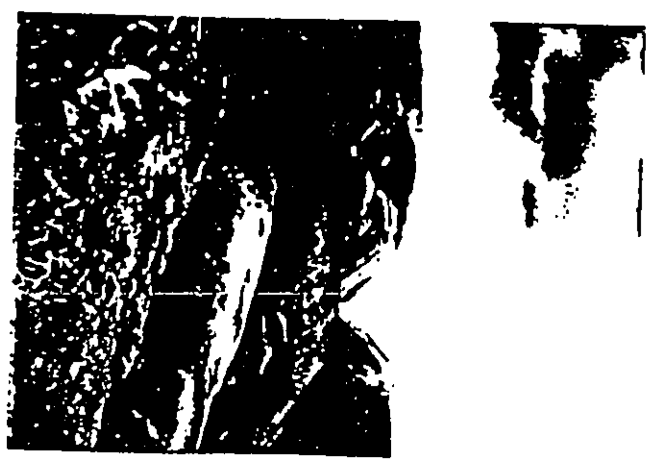


Project Site Location

Appendix II

Project Site Location

Appendix II

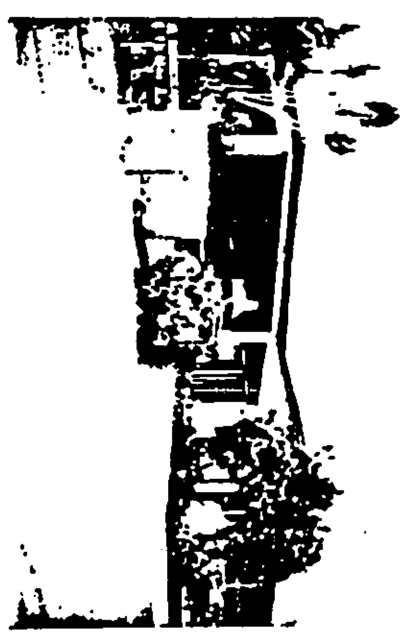


Project Site Location

Appendix II

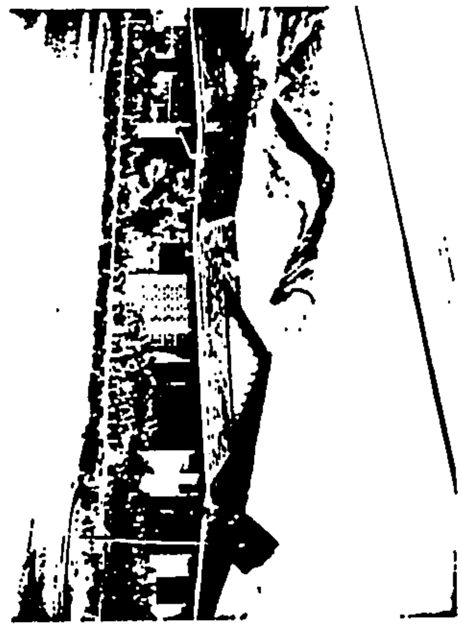
Project Site Location

Appendix II



Wahikuli Subdivision

Appendix II

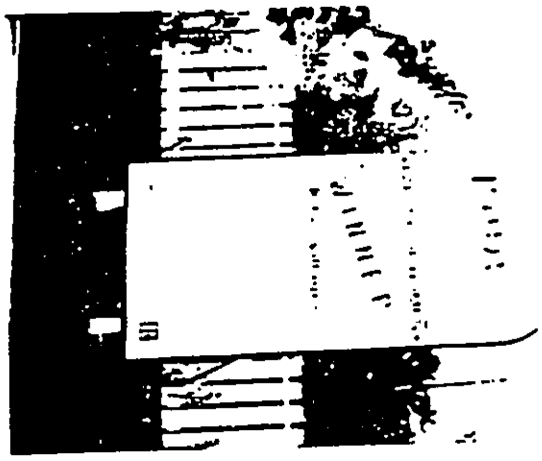


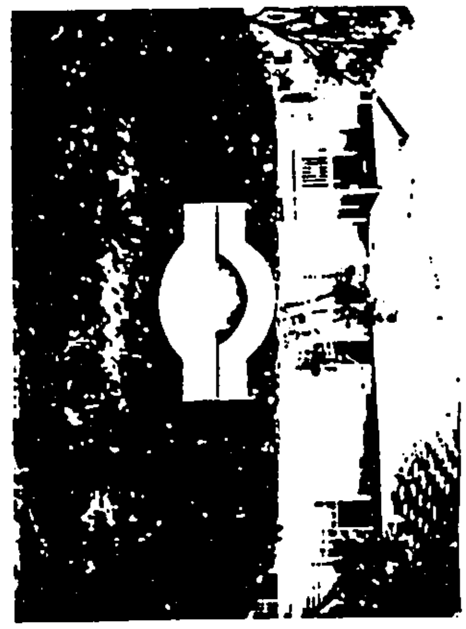
Kelawea Mauka Subdivision

Appendix II

Komohana Hale Project

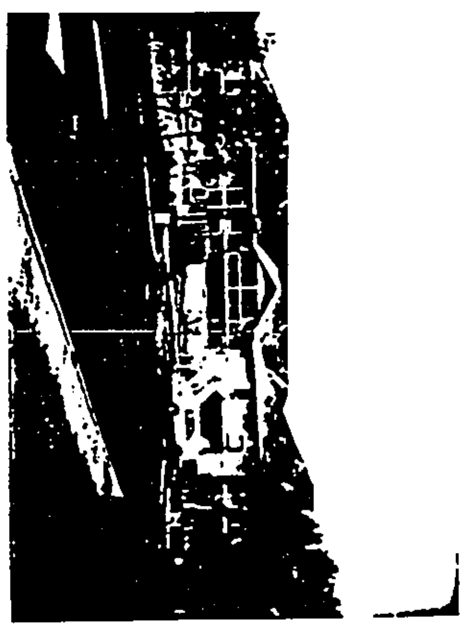
Appendix II

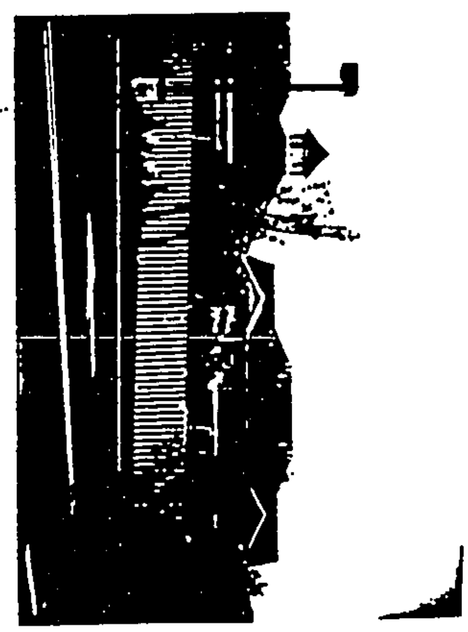




Kihei Villages

Appendix II



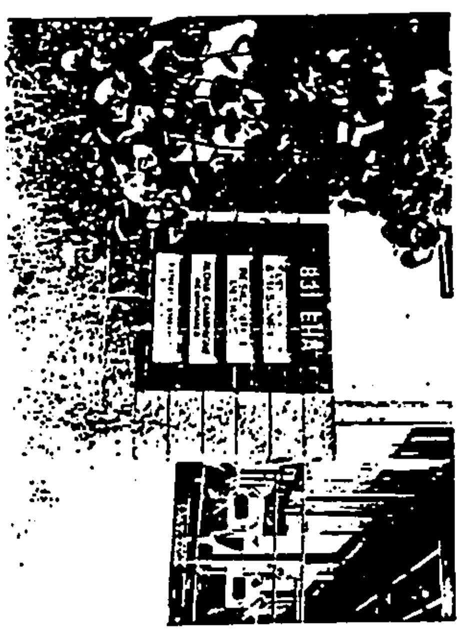


Kihei Villages

Appendix II

Kihei Villages

Appendix II

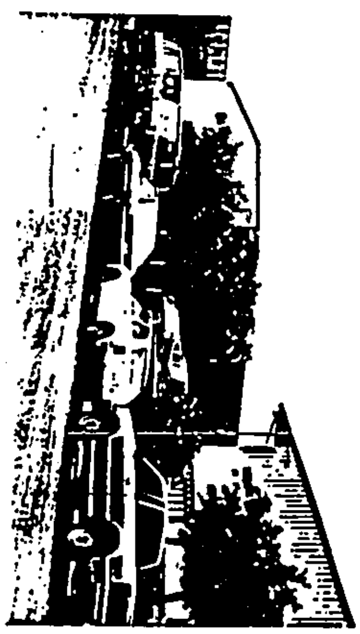


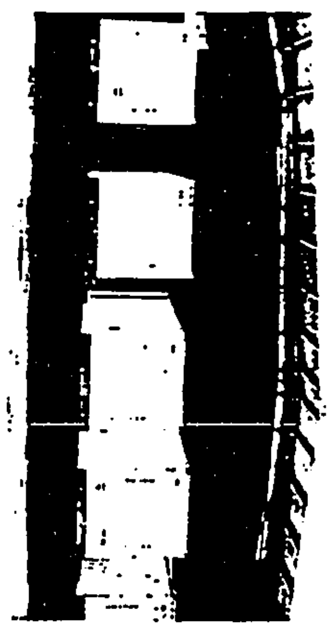
Wailuku Industrial Park

 Appendix II

Lahaina Cannery

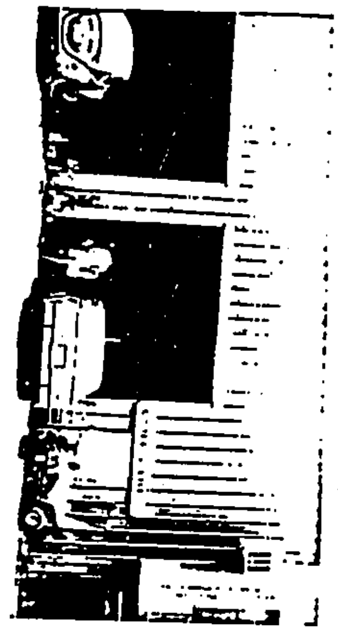
Appendix II





Wailuku Industrial Park

Appendix II



Wailuku Industrial Park

Appendix II

SMS RESEARCH
& MARKETING SERVICES, INC

MAUI HOUSING STUDY, 1989
A SURVEY OF CONDITIONS AND PREFERENCES

FINAL

Prepared for:

The Housing Finance and Development Corporation
and
A Consortium of Housing Developers
November 1989

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EXECUTIVE SUMMARY

- In October 1989, a consortium of housing developers and planners was formed to support a survey of housing conditions and preferences on the Island of Maui. The study was based on 1,256 telephone interviews with Maui residents.

- The basic characteristics of Maui's housing stock have not changed significantly since the last comprehensive study in 1982. Maui's housing is about 56 percent ownership units with very little leasehold property. With the exception of recently developed units in Kihei and West Maui, most units are single family detached dwellings.

- The study found evidence of crowding in Maui housing units. The average household size was 3.42 and 6.7 percent were crowded according to US Census definitions. About twelve percent of all housing units were being shared by two or more families, and an additional five percent had taken in unrelated roomers.

- Study findings suggested that the need for housing to fulfill the expectations of current Maui residents has increased since the 1982 study. In 1982, about 6,200 units would have been needed to satisfy the needs of all those who desired to move and could specify the type of housing they required. In 1989, that number would be slightly in excess of 8,700 housing units.[1]

- About 73 percent of all those who will be moving in the next five years intended to move into owned units, and 27 will move to rental units. This assumes that sufficient housing at reasonable prices exists to facilitate their move.

- The study describes the characteristics of housing units needed by both renters and owners in detail.

- As expected, the major part of the demand for owned units on Maui will come from current renters. Since the vacancy rate on Maui is estimated to be very low at the time of the survey, this suggests the need for additional ownership units on Maui.

- Most of the current homeowners have a fairly realistic understanding of the costs and financial requirements for purchasing new units, and most appear to be qualified to buy again. Current renters who want to buy are less qualified. Perhaps ten percent of them are unqualified to purchase any unit, and 40 to 45 percent would likely require the assistance of some form of public housing program to provide affordable housing.

- About 45 percent of all those who intend to move would be willing to live in West Maui. Central Maui edges out the West in terms if first choice, and Upcountry Maui, being "everyone's favorite second choice," is still the most preferred are of the Island in which to live.

[1] This is not an estimate for new housing unit demand. Demand estimates were prepared separately for this study.

INTRODUCTION

BACKGROUND

In 1989, the issue of housing in Hawaii reached the status of the most important issue in the minds of the people.[2] Housing prices soared during the last half of the decade, and even though real personal income increased and Hawaii enjoyed the lowest unemployment rate in the nation, housing supply was unable to keep pace with the market. On Maui, it was suspected that pent-up demand was higher than on some other islands, and there was opportunity for development there.

The state government, through the Housing Finance and Development Corporation, was set to begin one of the largest and most important mixed income housing developments in the state. Proposed for the West Maui area, the development would produce nearly 4,000 new units. Single family and multi-family, ownership and rental, market and affordable housing units would be produced, over a five year project period. In a desire to plan well for such a large undertaking, HFDC determined to conduct a housing study on Maui to provide information that would support sound planning and rational development. Upon hearing of HFDC's study, several developers and housing planners and developers formed a consortium to support the proposed study.

PURPOSE

The consortium sponsored a large scale study of Maui housing conditions and preferences. It was intended to provide baseline information for planning and development over the first half of the 1990s. The information collected was to include data on the current housing of Maui residents, including an inquiry into possible crowding of existing units. It was also intended to determine the number and types of households who would be seeking new homes in the next five years, and the types of housing units they would like to have. The study went further to inquire into the financial preparation of intended new owners and renters, and included several items about development in the West Maui region. A full set of demographic and household characteristics rounded out the survey instrument.

This report presents the findings of the consortium's housing study on Maui. The following section briefly describes the method used to collect and analyze data. That is followed by a presentation of the findings. Appendices have been prepared to present a full description of survey methods, additional data tabulations, and a copy of the survey instrument used.

[2] The SMS Research & Marketing Services Quarterly Consumer Survey showed that housing, or the lack of it, surpassed transportation as the people's most important issue facing policy makers near the end of 1988. It has reached its highest ratings since the QCS began in 1983.

METHOD

The Maui Housing Study, 1989, was based on a telephone survey of 1,262 residents of Maui households. The survey instrument was developed in consultation with the funding consortium and approved by them. The sample selection method was disproportionate stratified sampling random within strata. A complete description of the survey methods is presented in the appendix to this report.

The survey divided the island of Maui into five regions: West Maui, Central Maui, Kihei/Wailea, Upcountry Maui, and East Maui. The rationale for the division process was simply to provide a geographic basis for estimating mobility from one part of the island to another. Finer geographic detail are available in the survey and have been used for some analyses. In general, however, we present results either for the island as a whole or for the five defined regions. Sample error estimates for smaller areas would be too high to support most analysis.

FINDINGS

This section of the report presents the findings of the Maui Housing Survey, 1989. All results shown here were taken directly from survey responses of Maui residents. Data have been weighted to adjust for disproportionate sampling, and expanded to the estimated number of households on Maui in 1989.

OVERVIEW OF THE POPULATION

Large households are the rule on Maui. Average household size was 3.42 for all households in the survey. That is notably higher than the Census Bureau 1989 estimate of 2.99 persons per household. Overall, 12.6 percent of households had six or more members, and that extended to 24 percent in East Maui. But the large households did not appear to be the result of large families. Only 54 percent of the households in the survey had any children at all, and the median number of children in households with children was 2.07. Other data showed that about 12 percent of all households were shared by more than one family, and that seven percent of the one-family households were sharing accommodations with unrelated individuals.

The length of residence in Maui reflected the history of migration to the island. Overall, a little less than 30 percent were born on Maui, 43 percent lived there twenty years or more, and about 21 percent moved in less than five years ago. Kihei and West Maui were the exceptions. More than a third of West Maui residents were recent arrivals, and 37 percent of Kihei residents moved in within the last five years.

At a period when Hawaii is enjoying the lowest unemployment rate in history, 11.5 percent of the households in our survey reported that no one in their family was currently employed. When we subtract the households where the adults were retired, about two percent of the remaining households had no adult employed. That is exactly consistent with unemployment rates for October, 1989.

In households where one or more adults were employed, the primary wage earner was most often employed in the visitor industry (18.6%), services industry (15.4%), or construction industry (14.7%). Employment patterns varied widely across the island. Nearly 40 percent of West Maui primary wage earners work in the visitor industry. Close to 20 percent of Kihei and Upcountry Maui primary wage earners were in construction, and East Maui wage earners were employed in the widest range of different kinds of jobs.

Most of Maui's primary wage earners were employed near their homes. Overall, 54.8 percent of them worked in the same area in which they live. Those who work further away from home were most likely to be employed in Central Maui, where the majority of the jobs are located. West and Central Maui had the highest rates of employment near home, and Kihei and Upcountry had the highest numbers of commuters.

Median household income on Maui was $32,570. Income varied from one part of the island to another. East Maui's $19,940 was at the low end, and Central Maui was at $29,150. West Maui and Kihei were above the median at $35,005 and $35,560, and Upcountry had a median income of $36,150. Most income was from wages and salaries, or pensions for older families. About four percent of Maui households receive some public assistance with some differences across districts. About two percent of Kihei and West Maui households received some public assistance income, versus 7.1 percent for East Maui households. Savings were relatively low, with about 22 percent of households having savings in excess of $20,000.

HOUSING CONDITIONS ON MAUI, 1989

The 1989 Survey of Maui Housing focused on five major areas of the Island: West Maui, Central Maui, Kihei/Wailea, Upcountry Maui, and East Maui. The areas are shown in Figure 1, a map of Maui.

Current Housing

The results are representative of an estimated 26,853 housing units for the entire Island in 1989[3]. The tenancy and size of housing units in each of the five survey areas in 1989 are shown in Table 1.

Table 1
Tenancy and Size of Housing Units on Maui, 1989

Type & Size of Unit	Total	West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
OWNED UNITS	14,979	2,868	5,179	2,098	3,501	1,334
Percent	55.7	45.6	59.2	57.0	62.5	34.3
Median rooms	6	6	6	6	7	6
RENTED UNITS	10,734	3,202	3,263	1,520	1,860	889
Percent	40.0	51.6	37.3	41.3	33.2	34.3
Median rooms	5	5	5	6	6	5
OTHER	1,140	215	254	62	241	368
Percent	4.3	3.6	3.5	1.7	4.3	14.1
Median Rooms	6	5	6	5	5	6
TOTAL	26,853	6,285	8,696	3,680	5,602	2,591
Percent	100.0	100.0	100.0	100.0	100.0	100.0
Median Rooms	6	6	6	6	7	6

3 The estimate is taken from Donnelley Marketing Information Services (DMIS), CONQUEST database system for 1989. DMIS bases estimates on figures from the US Bureau of the Census and estimates are consistent with Current Population Surveys estimates for 1988 and with Hawaii Department of Business and Economic Development estimates for 1985

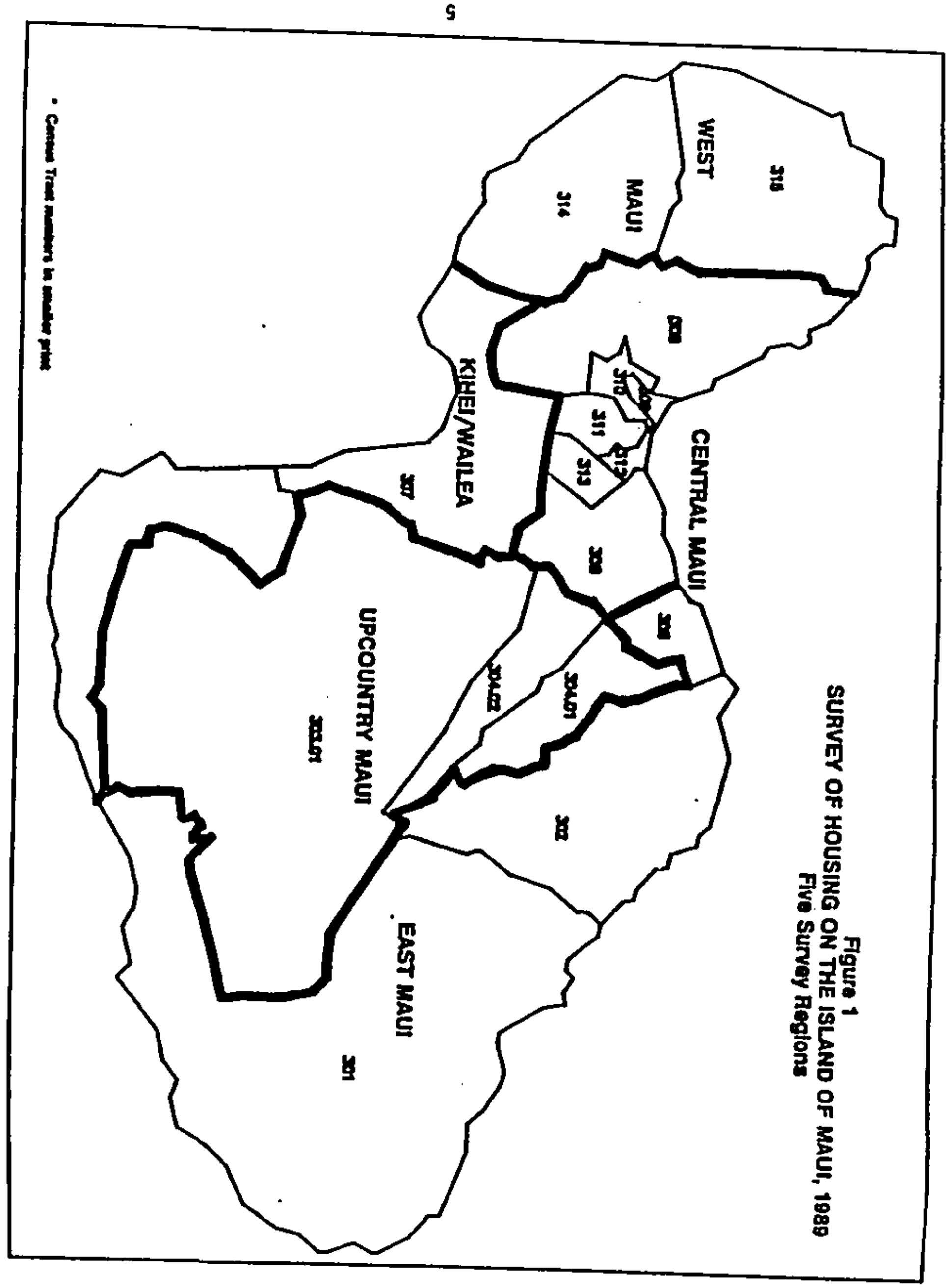


Figure 1
SURVEY OF HOUSING ON THE ISLAND OF MAUI, 1989
Five Survey Regions

Owned units included those that were fully owned and those for which a mortgage was being paid by a resident of the housing unit. Rental units included those for which cash rent was paid by the renting family. "Other" units were chiefly those occupied without payment of cash rent. Such units included Ohana units occupied by children or other relatives of the owner, apartment managers units where supervisory services were delivered in lieu of rent, parsonages, etc.

Maui housing units covered in this survey are relatively large, with an overall median of six rooms. There was very little difference across the five survey areas. East Maui households, with a median unit size of seven rooms, was the only deviation from this standard.

Owned Units

Over 56 percent of housing units on Maui are owned units. As has been the pattern on Maui for years, less than seven percent of those units were leasehold units. Most Maui real estate is fee simple property, and only in West Maui does the percent of leasehold units exceed ten percent.

Home owners were more likely than renters to live in relatively large households with several adults, and more likely to be sharing accommodations. They were equally likely to had children, but usually have more children (2.5 vs 1.3 children per family). Most of the retired heads of household are home owners. Home owners were more likely to be locals (non-Caucasian), long-time residents of Hawaii, and wealthier than renters.

The value of housing in Maui and the typical monthly housing payments are shown in Table 2. The value of owned units is reported as the owner's best estimate of the current market value of their homes, and monthly shelter costs are shown for mortgage payments and utilities payments. The total shelter cost is probably the most accurate figure shown in Table 2, since some respondents were unable to separate mortgage and utilities payments.

Table 2
Estimated Value and Shelter Costs for Housing Units on Maui, 1989

Value and Shelter Cost	Total	West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
Median Value	$186,990	$183,770	$188,050	$217,420	$210,380	$179,270
Monthly Mortgage	794	928	712	984	883	387
Monthly Utilities	116	124	119	128	107	93

All figures shown in Table 2 are median dollar values. Detail on costs can be found in the appendix to this report. Housing unit values were highest in the Kihei/Wailea area, where some of the newer housing units are located. Average monthly mortgage costs were also highest in that area, since mortgages were more likely to have been arranged in the last few years. Overall, shelter costs were strongly related to length of ownership. This factor is demonstrated in Table 3.

Table 3
Monthly Mortgage Payment by Years in Unit, 1989

Number Years in Unit	Median Monthly Mortgage Payment					
	Total	West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
Less than 3 years	$1,116	$1,252	$879	$1,180	$1,180	$575
Four to ten years	959	883	864	997	1,120	950
more than 10 years	883	650	665	712	636	378

One of the important indicators of housing cost in Maui is the ratio of shelter cost to household income. That ratio has been calculated for respondents in this survey and presented in Table 4. We note that the figures shown in Table 4 are different from the ratio usually used by lenders to qualify mortgage loans. The household incomes were for very large households, a significant percentage of which were shared units. We might assume that if some of these families were to buy new homes, the income component of the ratio would not include the entire household income measured in this survey. The sharing family may not move to the new home.

Table 4
Ratio of Shelter Cost to Household Income For Homeowners

Type of Household	Total	Ratio for Area				
		West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
One Family	34.4	38.2	33.8	34.5	32.8	36.2
Multiple Families	43.4	54.9	40.5	43.2	30.9	--
Other	27.8	--	--	20.4	32.1	--

Multiple family units were those in which two families, either related or unrelated, shared a single housing unit. Table 4 shows that those families had rent-to-income ratios nearly ten points higher than single families. The reason for this does not appear to be housing cost alone. Rather, the sharing families tended to have lower incomes—even when the overall household income from all sources is used. Rent-to-income ratios were notably higher in Central Maui than in other areas. Unit values in Kihei and Upcountry Maui were higher than Central Maui units, but incomes were somewhat lower.

Rented Units

About 45 percent of Maui housing units were rental units, with four or five percent occupied without payment of cash rent. This section of the report deals only with those units for which cash rent is paid.

As shown in Table 1, rental units were usually smaller than owned units, having a median of five rooms per unit. About 30 percent of all rented units were furnished, and 17 percent were partially furnished. More than half (55%) are unfurnished.

Renters were more likely than owners to be Caucasian (53%), short-term (35 percent less than five years), residents of Maui. They were more likely to be employed in the visitor industry, to live in smaller households with fewer children. They were just as likely as owners to have children. They had lower incomes, less savings, and fewer automobiles per household.

Rental cost data for Maui units is shown in Table 5. The median monthly rent for the whole Island in 1989 was $659. Utilities payments had a median of $101, and we note that utilities were more likely to be included in the rent than for owner units.

Rents differed across the five areas of the Island in a manner similar to that shown for owned units. Rents were highest for Kihei/Wailea and West Maui, lower for Central and East Maui. About seven percent of all renters received some sort of government rental assistance.

Table 5
Monthly Shelter Costs for Rented Units, 1989

Shelter Cost per Month	Total	Median Monthly Shelter Costs: West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
Monthly rent	$659	$803	$496	$782	$742	$406
Monthly utilities	101	94	101	116	116	108

Length of residence in rental units is usually shorter than for owned units because renters are more mobile as a group. The median rental period for this study was four years and four months. It differed somewhat across regions, being even shorter in Kihei and West Maui. Owned units were purchased an average of 6.1 years ago, with a very high standard deviation.

Finally, the ratio of shelter cost to household income for all Maui households is shown in Table 6. The shelter costs are shown for one-family units and for shared units. These ratios, sometimes referred to as rent-to-income ratios, are an indication of the percent of total income that is paid by the family for shelter, and are used by lenders to determine qualification for financing[4].

Table 6
Ratio of Shelter Cost to Household Income for Renters

Type of Household	Total	Ratio for Area: West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
One Family	38.5	40.2	44.5	42.1	34.3	27.0
Multiple Families	33.9	33.2	38.9	48.1	29.6	21.1
Other	39.2	48.0	22.0	63.7	26.6	—

Rent-to-income ratios for renters are somewhat lower than for home owners, and lower for multiple family households than for single families. Multiple family households in the Kihei/Wailea region were an exception with their ratio of 48. The "Other" group included single-person households and groups of unrelated individuals—a category that is more common among the renters than among the owners. Their rent-to-income ratios vary widely.

Crowding

Several comments have been made to this point with regard to the fact that housing units on Maui were relatively crowded at the time of the survey. Sponsors of the survey were quite interested in the possibility that Maui housing units might be crowded, especially if crowding was caused by doubling up of families or taking in roomers. Several pieces of information were collected during the course of the survey to investigate this phenomenon. The overall results are shown in Table 7.

4 The ratios calculated here are gross estimates based on total household income and total household size. They differ somewhat from the exact formulae used by lenders, but are sufficient to estimate the general level of shelter cost for Maui households in 1989.

Table 7
Crowding in Maui, 1989

Crowding Indicator	Total	Owned Units	Rented Units
Persons per Housing Unit	3.41	3.67	3.06
Crowded Units	6.7%	6.8%	5.7%
Doubling-Up	11.7%	10.7%	13.0%
Shared Units	13.1%	8.1%	20.4%
Total Affected Units	6,090 22.7%	2,770 18.8%	2,996 28.0%

NOTE: Total affected units includes 340 units that were occupied without payment of cash rent.

The number of persons per household is expressed as an average, and calculated using all residents of a household for whom that housing unit was the usual place of residence for at least five months of the last year. In 1980, the average household size was 3.06 on Maui, and 3.14 for the state[5]. In 1988, the Census Bureau estimated that the average household size for the state was 2.99[6]. If change in Maui had been parallel to that for the whole state, we might therefore expect to find the Maui average household size at about 2.92. Instead, the survey found an average household size of 3.41 for the island, suggesting that the number of persons per household has been increasing in Maui for the last nine years[7]. The last major housing study on Maui[8] was done in 1982, and that study found an average household size of 3.3. There is little doubt that housing units on Maui have been becoming more crowded since that time.

5 US Department of Commerce, Bureau of the Census, 1980 Census of Population, Detailed Population Characteristics, Hawaii. PC80-1-D13, October 1983, Table 206(A), p 65

6 Special tabulation by Hawaii Department of Business and Economic Development, Research and Economic Analysis Division, based on tapes from US Bureau of the Census, 1987

7 The survey household size is not exactly comparable to the Census household size because surveys of this type tend to underestimate single-member households and slightly over represent very large household sizes. Therefore the household size shown by the survey results is more likely to be high than to be low.

8 County of Maui, Department of Human Concerns, Housing Division. Maui Housing Study, 1982, three volumes. Prepared for the Housing Division by SMS Research, Inc., 1982

The number of crowded units on Maui was determined using the crowding index developed by the US Bureau of the Census[9]. A crowding index of 1.01 or higher is usually assumed to indicate "crowding" by this definition. Crowding by the Census definition was most common in East Maui where 14 percent of all units had crowding indices greater than 1.01. Table 7 shows the percent of owned and rented units that were crowded by this definition. A total of 1,022 owned units (6.8%) and 607 rented units (5.7%) were crowded.

Doubling-up is the phenomenon of families sharing housing units with other families. In 1989, 11.7 percent of all Maui housing units were shared by two or more families. Sharing units was much higher in West Maui, where 20.8 percent of all units were shared with other families. It was lowest in East Maui, with 7.1 percent of all units shared by two or more families. We are aware of no comparable figures for the past. The figures for 1989 are consistent with some discussions among housing planners that housing supply on Maui is low, and this may be causing some doubling-up[10].

Shared units are defined as those where a family[11] is sharing a housing unit with persons unrelated to them by birth, marriage, or adoption. In 1989, 13.1 percent of all housing units on Maui contained at least some persons who were unrelated to the survey respondent. Further analysis showed that there was about 24,000 family households, and of those, almost 15 percent contained one or more individuals who were unrelated to the family.

Finally, Table 7 shows the total number of "affected units". The numbers reflect the net units affected[12] by any of the crowding indicators listed in Table 7. In the fall of 1989, there were a total of 6,090 households on the island of Maui (22.7%), that were crowded by one or more of the definitions discussed here. Crowding was only slightly more common in rental units than for owned units, owing largely to the fact that more rented units were shared with unrelated individuals. The owned units were more likely to be affected by doubling-up, which involved sharing a household unit with another family.

9 US Department of Commerce, Bureau of the Census. 1980 Census of Housing, Detailed Housing Characteristics, Hawaii. HC80-1-B13. Data shown in Table 96. Method shown on p. B-6. The index reflects the ratio of persons in the household to rooms in the unit, where the definition of rooms excludes garages, lanais, closets, utility rooms, etc.

10 This does not mean that all doubling-up is undesirable. The extended family system in Hawaii is part of our cultural heritage and represents a desired condition for many families. The percentage of two-family households with unrelated families, however, suggests a less than optimum condition for housing supply in 1989

11 Note that a family is defined as two or more persons related by birth, marriage or adoption. The definition excludes single-member households, unmarried couples, and other forms of group living.

12 As might be expected, the indicators are highly correlated. Doubled-up households are likely to be crowded, households with an unrelated family are double counted in the estimate of families living with unrelated individuals, and so forth. The procedure used to estimate the net number of households affected was an unduplicated count of households affected by one or more of the crowding indicators

Quality

The study was not focused in any way on the quality of units on Maui in 1989. There were, however, some indicators of quality offered by respondents who were intending to move in the next five years. These comments on the condition of their current units are summarized in Table 8.

Table 8
Quality Indicators for Housing on Maui, 1989

Quality Indicator	Owned Total	Rented Units	Units
Unit is too small	24.1%	22.9%	24.6%
Unit is too old, run down, or not well maintained	15.3	12.9	16.2
Unit does not have needed facilities (parking, air conditioning, recreation, etc.	7.5	6.0	7.3
Unit without adequate plumbing	1.6	0.0	2.2

The most serious concern of those who wanted to move out of their current unit was size. Almost a fourth of all intended movers were concerned that the unit was too small for their family. Another 16 percent said that they needed additional privacy. Smaller numbers were concerned about the actual condition of the unit, and with the absence of one or more facilities that would make life more pleasant. The plumbing item is of special interest because it can be compared to 1980 Census results. In 1980, fully four percent of Maui housing units were described as having no bathroom or only a half bath[13]. This would indicate that the condition of the housing stock on Maui may have improved significantly over the past nine years.

[13] US Department of Commerce, Bureau of the Census. 1980 Census of Housing. Detailed Housing Characteristics. Hawaii. HC80-1-B13. Table 94, p59.

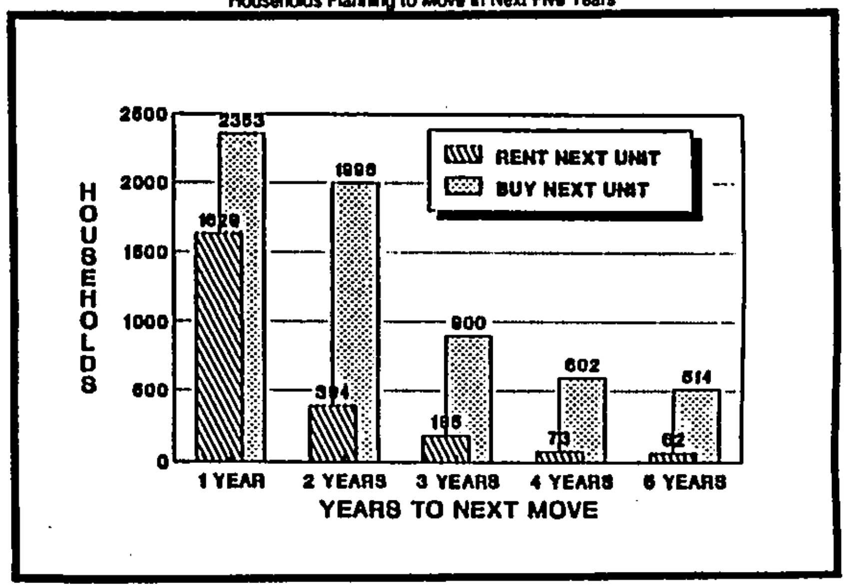
PREFERENCE FOR NEW UNITS

The survey was designed to measure housing conditions and demand for the Island of Maui in 1989. The formal demand analyses were carried out as a separate part of the project, and this report covers the information relevant to those analyses.

We began by asking all respondents if they would be moving to a new housing unit in the next 12 months. For those respondents who were not going to move, we asked how long it might be until they did move to a new unit.

About a third (33.6%) of Maui households indicated that they would be moving to a new housing unit between 1989 and 1994. Of those who intended to move, about 71 percent said they would be moving to an owned unit. Figure 1 shows the distribution of preference for owned and rented units over the next five years.

Figure 2
Households Planning to Move In Next Five Years



In order for all of the households shown in Figure 1 to realize their housing objectives in the next five years, it is likely that ideal conditions would have to exist in the Maui housing market. The supply-side discussions in the previous section of the report suggest that is not the case. Nevertheless, we shall present the remaining analyses for the entire group of households that said they would be moving. The information presented in this section includes data on the qualifications of intended movers, as well as their preferences for housing types and conditions.

Relocating

One of the important questions for housing planners is the extent to which the preferences of new owners and renters represent a change from current conditions. The study addressed change in tenancy, location and value of housing units. Table 9 shows the results for changes in tenancy.

Table 9
Preferred Change in Tenancy for Housing on Maui, 1989

Current Tenancy	Household Prefers ... Owned Unit Num	Owned Unit Pct	Rented Unit Num	Rented Unit Pct	Not Sure Num	Not Sure Pct	Total Num	Total Pct
Home owners	2,456	94.9	132	5.1			2,588	100.0
Renters	3,624	60.0	2,141	35.5	272	4.5	6,037	100.0
Others	[illegible]	76.1	70	17.1	29	[illegible]	410	100.0
Total	[illegible]	70.7	2,343	25.9	300	3.4	9,035	100.0

Table 9 covers all households on Maui that intended to move to a new housing unit in the next five years, and who expressed a preference for either an owned or rented unit. The .esults are not surprising. Nearly all home owners prefer to remain homeowners and many renters intend to get into owned units. Renters, reflecting their higher mobility overall, will make up two-thirds of the moves between now and 1994. But perhaps the most important finding of this study is that demand for owned units over the next five years is likely to be comprised most heavily of renters who intend to become home owners. The "Others" group is made up primarily of people occupying rental units without payment of cash rent. Most will be moving to rental units

Table 10 presents the preferred change-in-location data. The majority (74%) of Maui households would prefer to remain in the same general area in which they currently live. Of those who prefer to live in a new area, the preference patterns favor West and Central Maui.

Table 10
Preferred Changes in Location for New Units, 1989

Preferred location for new unit	Total	Location of Current Unit: West Maui	Central Maui	Kihei/Wailea	Up Country	East Maui
TOTAL	8,635	2,843	2,432	1,557	1,787	487
West Maui	24.5	73.0	2.3	2.4	2.6	0.0
Central Maui	25.1	8.8	72.4	8.8	9.0	10.5
Kihei/Wailea	11.7	2.9	3.4	67.3	0.0	0.0
Upcountry	29.7	8.8	12.5	19.1	64.1	10.5
East Maui	7.9	2.9	0.0	2.4	12.8	73.7

Table 11 covers the change in shelter costs expected by Maui households to result from their next move. Realistically, more than 48 percent of current owners and 68 percent of current renters expect to be paying more than their current shelter cost of an owners unit. About 40 percent of the present renter group expects to pay more for their next rental unit.

Table 11
Preferred Changes in Shelter Cost for New Units, 1989

Intended tenancy for next housing unit	Total	Current Tenancy: Home Owners	Renters
Intend to buy:			
will pay at least $200 less	6.1	10.1	3.5
will pay about the same	18.3	23.7	14.6
will pay at least $250 more	59.5	47.6	67.5
not sure	16.1	18.6	14.3
Intend to rent:			
will pay at least $200 less	22.8	9.5	23.7
will pay about the same	30.8	21.2	31.4
will pay at least $250 more	40.4	69.3	38.7
not sure	5.9	.0	6.3
Base:	8,598	2,560	6,037

The surprise was that 70 percent of the current home owners who intend to move to a rental unit expect to pay more for their next unit. This is likely an artifact of the survey method. Units were classified as owned if someone in the household owned the unit. The respondent may not have been the owner, and wished to move out of the unit. It is likely that sharing members of the household would pay considerably more for their own units.

Preference for Owned Units

Based on survey data, it is possible to come to a fairly clear understanding of the type, size, location and cost of ownership housing units on Maui in the next five years. Table 12 summarizes the most important features for the island as a whole, and considerable detail is available in the appendix to this report. Table 12 is based on all householders who will move to new owned units in the next five years. It shows the percentage of respondents who preferred each characteristic. For items where more than one choice was allowed, the first choice and the total of all choices is shown[14]. In the last column, we have estimated the number of housing units that will be needed in the next five years[15]. The major findings of this analysis are summarized below:

TYPE OF UNIT: The first choice of more than 80 percent of those who will move to new units is for a single family detached dwelling unit. This has been the case for all studies we know of on Maui over the last two decades. The difference is that, given a second choice, about 52 percent of these households would be willing to move into multi-family units. This differs significantly from past surveys.

Also note that households who will move to owned units have an average of 2.1 motor vehicles per household, indicating a substantial need for parking at new units.

SIZE. Most (81%) of those who will move to owned units will be looking for two and three-bedrooms. The flexibility on this choice seems to be limited. There are a few who could back down to one or two bedroom units, but even among those, the second choice is likely to be for a larger unit rather than a smaller one.

LOCATION. The most preferred locations for owned units are West and Central Maui. Given a second choice, the preference for West Maui is a bit stronger, and interest in Up Country housing increases dramatically. This is a major change from the 1982 Maui Housing Study, which found Upcountry demand to be significantly higher, and West Maui demand to be much lower. About 34 percent of all the respondents had a second or third choice, and more than 50 percent were willing to consider an area outside of that in which they currently live.

14 For the multiple choice items, the percentages will not sum to 100 percent.

15 This is not the number of new or additional housing units needed. It represents the total number of units needed to facilitate the market if all household objectives are met. It includes units that would be vacated by these same households as they move out to a new home.

Table 12
Preferred Housing Characteristics, Owned Units

Preferred Characteristic	First Choice	All Choices	Estimated Units
Type of Unit			
single family dwelling	85.4	90.9	5,435
multi-family unit	10.1	62.3	641
other	4.5	4.5	288
Number Bedrooms			
one	3.3	10.9	209
two	32.7	63.0	2,064
three	49.8	78.9	3,143
four or more	14.2	31.0	1,048
Location			
West Maui	23.8	38.2	1,514
Central Maui	26.0	48.0	1,652
Kihei/Wailea	10.6	25.7	676
Upcountry	22.1	51.7	1,408
East Maui	8.9	15.0	564
Any Maui	3.4	6.4	214
Not Maui	2.0	3.6	129
Undecided	3.2	3.2	207
Expected Monthly Mortgage			
under $500		5.2	328
$500 to $799		9.8	621
$800 to $1,099		24.7	1,574
$1,100 to $1,399		17.6	1,112
$1,400 to $1,999		15.4	961
$2,000 or more		4.7	301
don't know		22.7	1,448
Expected Down Payment			
under $5,000		8.3	530
$5,000 to $9,999		8.4	538
$10,000 to $29,999		32.1	2,045
$30,000 to $59,999		14.1	899
$60,000 or more		17.6	1,117
don't know		19.4	1,234
Access to Special Financing			
have access		24.0	1,530
may have access		8.4	533
no access		67.6	4,302

Recalling that there is significant interest in staying in the current part of the island, and that most of the housing is now in Central Maui, we can reach some important conclusions for ownership units. First, preference for West Maui has grown over the past seven years, perhaps in response to new housing or employment opportunities there, or perhaps in response to the lack of development in the Upcountry area. Second, although preference for region of the island is always stated, it is clear that relatively large numbers of new owners will consider more than one location in their decision. Thus, the fact that someone does not strongly prefer an area does not preclude their buying in that area.

COST. The median expected monthly mortgage payment for owned units across Maui was $1,068. Median payments differed for individual areas, but that may have been in response to different sizes or types of units rather than the area itself. The mortgage estimates also showed that about five percent of those who intend to move to new owned units have a relatively unrealistic idea of housing costs--expecting to pay less than $500 per month for mortgage, insurance and taxes. On the other hand, nearly ten percent of the group expected to be paying $2,000 or more for monthly shelter costs.

FINANCING: About a quarter of the households that will be moving to new owned units in the next five years have some access to special financial programs such as VA, FHA, etc. Most of them have a relatively realistic idea of the financial responsibility involved, as indicated by the fact that the majority (57.3%) expect that they will be making down payments in excess of $20,000.

We will return to the question of financing in a later section of this report that describes the qualifications of expectant home buyers. In the meantime, it appears that prospective buyers have a fairly realistic idea about the types and values of homes in the Maui market.

Preference for Rented Units.

About 27 percent of all those who will be moving in the next five years will be moving to rental units. Most of them are currently living in rental housing, and most will be moving within the next two years. Table 13 summarizes the preferred type, size, location and cost of rental units they will need. Additional detail is available in the appendix. Table 13 covers householders who will move to rental units in the next five years. Again, it shows preferences for each characteristic. For items where more than one choice was allowed, the first choice and the total of all choices is shown[16]. In the last column, we have estimated the number of housing units that will be needed in the next five years[17]. The major findings are briefly summarized after Table 14.

16 For the multiple choice items, the percentages will not sum to 100 percent

17 This is not the number of new or additional housing units needed. It represents the total number of units needed to facilitate the market if all household objectives are met. It includes units that would be vacated by these same households as they move out to a new home

Table 13
Preferred Housing Characteristics, Rented Units

Preferred Characteristic	First Choice	All Choices	Estimated Units
Type of Unit			
single family dwelling	67.9	78.3	1,581
multi-family unit	25.1	54.8	587
other	7.0	10.3	164
Number Bedrooms			
one	17.7	35.5	416
two	44.9	72.9	1,032
three	32.8	57.3	750
four or more	6.2	12.5	146
Furnished or Unfurnished			
unfurnished		46.4	1,087
partially furnished		11.6	271
furnished		33.1	777
not sure		8.9	208
Location			
West Maui	26.2	56.2	614
Central Maui	25.2	46.1	591
Kihei/Wailea	16.4	24.8	383
Upcountry	19.8	40.5	463
East Maui	4.9	11.5	116
Any Maui	2.0	6.3	48
Not Maui	1.7	1.8	43
Undecided	3.7	3.7	86
Expected Monthly Rent			
under $500		10.6	247
$500 to $799		38.9	912
$800 to $1,099		33.1	775
$1,100 to $1,399		5.7	133
$1,400 to $1,999		5.0	117
$2,000 or more		.9	21
don't know		5.9	137

TYPE OF UNIT: The first choice of most renters is for a single family detached dwelling unit. Compared to those who will move to owned units, there is an even larger probability that the second choice included a multi-family unit. Nearly 64 percent of prospective renters would be willing to consider a multi-family unit. About a third will need a furnished rental unit. Households who will move to rental units have an average of 1.3 motor vehicles per household, indicating a substantial need for parking at new units.

SIZE: Compared to buyers, the renters will be looking for slightly smaller units. The majority (76%) are still looking for two and three-bedrooms, but 18 percent will want efficiency or one-bedroom apartments. Flexibility is substantial but within a smaller range of options than for owned units. About 84 percent of these respondents had a second choice, and it was usually for a smaller unit than originally stated.

LOCATION: Preferences for location were very similar to those for owned units, with the exception that preference for West Maui and Kihei areas, where larger numbers of rental units exist, was greater. The most preferred locations for owned units were West and Central Maui. Very few renters would choose East Maui. Nearly all of those who did were from East Maui, and most wanted units in Hana itself. Given a second choice, the preference for West Maui is a bit stronger. About 93 percent of all the respondents had a second or third choice, and about 40 percent were willing to consider an area outside of that in which they currently live.

COST: The median expected monthly rent payment for Maui was $782. Median payments differed for each area, in what appears to be a reflection of prevailing rents in 1989. Only 10.6 percent of prospective renters expected to pay less than $500 per month for rent, and less than 15 percent were expecting to pay more than $1,100 per month. The range of expected rental prices was relatively small.

Finally, we should add a comment about households that are currently occupying rental units without payment of cash rent. They make up about four percent of all Maui households. The average household size for the group is about 1.7 persons, and they are not likely to be overcrowded. Many more of them intended to move in the next five years, and the grand majority intend to move to rental units.

ISSUES

The survey covered several issues of immediate importance to the planners and developers who sponsored the study. Those issues are discussed in this section of the report.

Cost

The cost of housing has increased dramatically over the past nine years. In 1980, the median value of a home on Maui was $106,400[18]. By 1989, that figure was up to $196,990, an increase of over 85 percent. Monthly mortgage costs went from $392 in 1980 to $794 in 1989. Rental cost went from $298 per month to $669, for a nine-year increase of almost 125 percent.

The overall effect of the increased housing cost was to foster expectations for even higher housing costs in the future. The average household intending to move to an owned unit in the next five years is

18 US Department of Commerce, Bureau of the Census. 1980 Census of Housing, Detailed Housing Characteristics, Hawaii. HC80-1-B13, Tables 98-100

expecting to put $25,000 down and pay $1,100 per month for mortgage, taxes and insurance. Renters expect to pay a median monthly rent of $690.

Rising costs have not decreased demand, and this study suggests that there is considerable pent-up demand for housing at present. Home sharing, doubling-up and crowding are all at relatively high levels. Overall, the number of units needed to fulfill the expectations for both rental and owned units rose from just over 6,000 in 1982 to 8,700 in 1989.

Qualification

It was not expected that every household that reported their intention to move to an owned unit in the next five years would be qualified to enter the market with standard financing. The survey included several items that can be used to identify the extent to which prospective owners might be qualified to purchase property either at market value or with some government assistance. Table 15 summarizes those items for current renters and current home owners.

We leave the final evaluation of these elements up to the individual reader. The specific variables included in Table 15 were designed to measure individual elements of the qualification procedure for different purposes. The rationale for each is outlined briefly below:

Home Value: The value of the current housing unit (if owned) is a measure of the extent to which homeowners may have sufficient equity to purchase a new unit. Home values are universally high on Maui, indicating excellent potential for qualification by this measure. Only 12.2 percent of current homeowners felt that their present homes were worth less than $100,000.

Length of Residence: This measure is also related to the real estate equity that may be available for purchasing a new unit. About 47 percent of all current homeowners ready to buy have been in their present units less than three years.

Current Shelter Cost: This is an indicator of present ability to handle certain shelter costs. The median shelter cost for homeowners is $1,051 and for renters is $743. Renters, however, were much more likely to have current shelter costs less than $500 per month.

Expected Mortgage: This element measures the extent to which the prospective buyers have a reasonable expectation for the cost of home ownership. The median expected payments were $1,355 for owners and $1,171 for renters. Persons who expected to pay less than $500 per month are unlikely to be successful in today's housing market. Persons expecting to pay between $500 and $1,100 per month would clearly require some assistance in securing an appropriate unit.

Expected Down: Households expecting to pay less than $5,000 down for their new homes would be unlikely to find suitable housing or financing. Those who are thinking of paying between $5,000 and $20,000 may be able to secure housing with some assistance.

Income: Household income would probably have to exceed $20,000 for home ownership even with public assistance. Incomes between $20,000 and $40,000 may qualify under certain public assistance programs.

Savings: Family savings is a rough indicator of liquid assets other than real estate controlled by the prospective home buyer. Savings in excess of $20,000 would be useful in clearing down payment and closing costs for a new unit.

Other: About 24 percent of all homeowners have some access to special financing programs, indicating that they may qualify for ownership with lesser assets than for commercial financing. Those who are currently receiving public assistance are less likely to qualify for ownership. Finally, the years until the next move is useful because those interested in home ownership are likely to be using the time to improve their financial position.

Table 14
Financial Qualification Indicators for Prospective Home Buyers

Preferred Characteristic	Current Owners	Current Renters	Total Prospective Units
Total Buyers	895	1,334	2,343
Current Unit Value			
median estimated value	$213,940	—	$213,940
percent less than $100,000	12.2%	—	12.2%
Length of residence in unit			
Median years	3.9	2.0	2.5
Percent less than three years	47.6%	72.0%	62.1%
Current monthly mortgage/rent			
Median payment	$1,051	$647	$743
Percent less than $500	12.8%	29.4%	22.7%
Expected monthly mortgage payment			
Median monthly payment	$1,358	$1,084	$1,171
Percent less than $500	6.8%	5.1%	6.0%
Percent $500 to $1,000	28.5%	48.9%	38.8%
Expected down payment			
Median dollars	$37,930	$19,650	$24,670
Percent less than $5,000	9.0%	9.6%	9.4%
Current annual household income			
Median income	$47,160	$33,540	$37,160
Percent less than $20,000	9.4%	20.0%	15.4%
Percent $20,000 to $40,000	21.2%	48.2%	39.0%
Family savings			
Percent less than $20,000	60.9%	78.3%	71.1%
Other			
Have access to special financing	21.9%	26.5%	24.1%
Received public assistance	.0%	3.1%	2.1%
Years before next move (median)	1.5	.5	.9

Across the top, it looks as if very many of the current home owners would be qualified for market units. The only surprising finding in the survey data was that more than 47.6 percent of this group had been in their current units for more than three years.

Fewer prospective home buyers who are currently renting are likely to be qualified. Their current shelter costs are lower, and between 40 and 45 percent of them will not be qualified for market-level housing units.[19] Perhaps as much as ten percent may not be able to buy a home at all. This is important to developers because nearly 60 percent of the owned units to be purchased over the next five years would be bought by current renters. It is important to the potential buyers because only 60 percent of them will be able to realize their expectation for home ownership.

Table 15
Profile of Buyers by Expected Down Payment Amount

Characteristic	Total	Less than $5,000	$5,000 $19,999	$20,000 $49,999	$50,000 or more	Don't Know
Current owners	2,858	7.0%	13.4%	27.5%	31.3%	20.8%
Current renters	3,624	8.0%	33.8%	30.7%	9.8%	17.7%
Family savings						
Less than $20,000	4,068	8.2	30.1	30.4	10.4	20.9
Access to special financing	1,530	6.1	34.9	27.0	15.6	14.6
Annual household income						
Less than $20,000	840	27.3	34.1	16.6	8.9	13.2
$20,000 to $39,999	1,980	6.8	27.3	33.9	12.2	19.9
$40,000 or more	2,308	5.4	20.3	32.3	30.6	18.0
Have rental income	1,142	11.6	9.2	37.2	27.2	14.8
Receive public assistance	131	54.3	18.9	6.9	0.0	29.9
BASE:	6,434	520	1,633	1,812	1,135	1,234

One final point must be made here. The item asking about expected down payment was worded such that respondents were telling us what they expected to pay. That had already told us that they would be moving to an owned unit in the next five years. The item did not suggest, however, that all those who expected to pay a given amount were currently qualified to do so. Table 15 shows the financial profile of

19 That is, 46 percent expect to pay between $500 and $1,100 per month for their mortgage. 41 percent expect to pay between $5,000 and $20,000 for their down payment, and 46 percent have household incomes between $20,000 and $40,000 per year.

prospective homeowners who expected to pay certain amounts as down payments for their new homes. The results suggest that the majority of the down payment information is consistent with the current financial status of the survey respondents.

West Maui Region

A disproportionate interest is currently being shown for housing located in the West Maui region. Housing planners and developers are interested in the area and current plans suggest that the majority of new units scheduled for the turn of the decade are expected to be built there. Not the least of these planned developments is the major, mixed income development planned by the Housing Finance and Development Corporation, which led to the initiation of this project. Certain items in the surveys were developed specifically to investigate preferences for housing in West Maui and are covered in this section of the report.

Preference for West Maui

Across Maui, 24.5 percent of all those planning to move chose West Maui as their first choice for the new location. The region was the first choice of more potential movers than any other region except Central Maui (25.1%). It was also the region that was most likely to have been selected as a first choice among current residents of the region. But as a second choice, Upcountry Maui was definitely the leader, and it was overall the most popular location on the island. West Maui would be considered as a site for a new home by 41.4 percent of all potential movers.

Asked specifically if they would be willing to consider a housing unit in West Maui, 45 percent said they would be willing to consider the site, and an additional 11.4 percent said it would depend on the types of units available.[20]

Mixed Income Development

There was also some concern that certain buyers or renters might be unwilling to live in a mixed income housing development. Asked if they would like to live in a mixed income development, 55.2 percent of all potential movers answered affirmatively, and an additional 15.6 percent said it would depend on the units and the price. Willingness to live in a mixed income development was particularly high among residents of West Maui (76.9%), and lowest among current residents of the Kihei/Wailea area (41.9%).

20 See Table B-13 in the appendix for detail

Employment

Most Maui residents work relatively near where they live. Among the primary wage earners for all households on Maui in 1989, 64.2 percent worked in the same area in which they lived. In West Maui, the figure was higher (91.1%) than in other areas of the island. Almost two-thirds of primary wage earners (65.4%) worked either in Central or West Maui, and there was a relatively strong pattern of Kihei and Upcountry Maui wage earners commuting to Central Maui.

To see if employment might be a draw for housing in West Maui, all respondents were asked if they would like to change jobs and work in West Maui.[21] Among wage earners living outside of West Maui, 41 percent replied that they would be willing to change jobs. Among those who would be willing, 77 percent said that they would be willing to move if a job was available, 78 percent originally said that they would be willing to live in West Maui. It appears that employment in West Maui might draw an additional 2.7 percent, or about 240 unit owners, to that area.

21 If you could get a job in West Maui, that was as good or better than the one you have now, would you want to change jobs?

APPENDIX

METHOD

The Maui Housing Study, 1989, as a telephone interview surveys of a large sample of households on the Island of Maui. The basic design of the study was presented to all members of the funding consortium for their approval. We are indebted to the members for their assistance in fine tuning the design.

SURVEY INSTRUMENT

The survey instrument was developed in consultation with the members of the funding consortium. The initial draft of the survey instrument was prepared by SMS Research & Marketing Services based on preliminary discussions with the consortium. That draft was submitted to all members for their comments and recommendations. A second draft was prepared including some changes to fit the needs of individual members of the consortium. That draft was also sent our for approval, and a final draft of the survey instrument was prepared.

A pretest of 25 households on Maui was conducted using the instrument prepared as described above. Several changes were made as a result of the pretest--mostly involving formatting or minor wording changes. The resulting survey instrument was used to conduct the interviews covered in this report. A copy is appended.

SAMPLING

The population for this study was adult residents of Maui. The sampling method was Random Digit Dialing (RDD). RDD samples have become the standard in telephone research. The method produces simple random samples that provide optimum precision, and allow for inclusion of unlisted phone numbers and numbers that have been assigned or reassigned since the latest telephone directory was issued.

The sample selection method was disproportionate across the five survey regions of Maui[22], with simple random sampling within regions. The resulting sample was therefore representative of the number of working telephone numbers in each telephone exchange on the Island of Maui at the time the survey was conducted. Table M-1 shows the sample design and statistics for the survey by region.

Table M-1
Sample Statistics, Maui Housing Study, 1989

AREA	1989 Household	Sample Size	Sample Fraction	SRS Error	Wtd. Error	Sample Weight
ISLAND OF MAUI	26,863	1,262	4.7%	2.69	2.79	---
WEST MAUI	6,285	302	4.8%	5.50	5.50	20.7417
CENTRAL	8,695	311	3.6%	5.46	5.46	27.9582
KIHEI/WAILEA	3,680	293	8.0%	5.49	5.49	12.5597
UPCOUNTRY	5,602	256	4.6%	5.98	5.98	21.8828
EAST MAUI	2,591	100	3.8%	9.61	9.61	26.1700

22 See Map in Figure 1 of the text

The total survey error, weighted for disproportionate sampling, was plus-or-minus 2.8 percentage points at the 95 percent confidence level. That is well below the industry standard of ±5.0 percentage points. For each region, sample errors were about ± 5.5 points, with the exception of East Maui, where the smaller sample size produced an estimated error level of about nine points. That means that internal analysis of data for the East Maui region will not be accurate enough for rigorous planning analysis.

The total sample size was 1,262. Weighting the data was required by the disproportionate sample design. The weights are shown in Table M-1, and all data in this report have been weighted using those weights. The weighting was done to replicate the characteristics of the population of Maui. In addition, the results will be expandable to the entire population and can be used in the development of housing alternatives and strategies for the future.

SELECTION AND TRAINING OF INTERVIEWERS

SMS Research was responsible for selection, training, and supervision of interviewers assigned to this project. Regardless of interviewer background or experience, all interviewers were trained for this project. Training sessions included: general instruction in the conduct of telephone surveys; the use of sampling and project control procedures; a question-by-question training on the survey instrument; a question-and-answer session to insure interviewers have all problems handled before beginning the survey and practice interviews.

DATA COLLECTION

All interviews were conducted from the SMS Honolulu Calling Center. This provided for 100 percent monitoring of all calls, using both personal observation and electronic monitoring. All calls were placed between the hours of 5:00 and 9:00 pm on weekdays and 9:00 am to 9:00 pm on weekends. A two call-back procedure was employed. Calls that did not result in contacts were rescheduled for at least two additional attempts to contact the household. Failed contact attempts that occurred on weekdays were scheduled for at least one call-back on weekends, and those that occurred on weekends were scheduled for call backs on weekdays.

EDITING AND CODING

Completed survey forms were edited by the Calling Center supervisor for completeness and contingency pattern observance. Instruments were then passed to the professional editing staff who checked them for internal logic and other possible errors. Any open-ended items were assigned numeric codes for processing, and a final check was applied.

DATA PROCESSING

Following editing and coding procedures, the information was entered to machine-readable format using key-to-disk software with edit-on-entry capabilities. The resulting computer files were then submitted to special data editing and cleaning programs prepared by SMS Research & Marketing Services. These programs were used to identify and correct any data errors which may have passed through the quality control procedures to this point. The clean files became the basis for all analysis.

DATA TABULATIONS

Table B1
Housing Characteristics for Home Owners

Characteristic	Total	West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
		Area of Residence				
How many people live in household?						
1	10.6	9.9	11.9	13.0	8.2	10.1
2	28.8	33.0	23.8	36.9	29.3	23.2
3	18.9	21.1	16.4	18.8	20.7	18.2
4	18.8	16.8	21.5	17.1	19.5	15.2
5	9.7	5.6	11.9	7.8	12.5	9.1
6 or more	12.6	12.9	13.5	6.1	9.8	24.2
refused	.5	.7	1.0	.3	0	.0
How many are under 18 years?						
none	46.8	57.5	40.9	52.2	46.0	34.8
1	18.6	17.6	17.9	19.6	20.9	16.9
2	20.0	15.0	25.5	20.0	18.3	18.0
3	8.7	6.6	9.1	5.1	9.8	14.6
4	3.3	1.1	4.0	2.4	3.4	7.9
5 or more	2.0	1.6	1.8	4	1.3	6.7
refused	.8	.4	.7	.4	.4	1.1
How many families share housing unit?						
none	2.6	5.9	1.5	3.1	9	1.1
1	83.7	70.3	87.6	87.1	87.7	89.9
2	9.4	15.8	8.0	7.5	7.7	4.5
3 or more	3.8	7.7	2.2	2.4	3.0	3.4
don't know	.6	.4	.7	.0	.9	1.1
How many people in unit are not related to you?						
none	84.8	72.2	91.6	85.5	87.2	86.5
1	8.8	15.8	4.4	9.8	7.7	7.9
2	3.3	7.0	1.5	4.7	1.7	2.2
3 or more	3.1	5.1	2.6	.0	3.4	3.4
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)

Table B2
Current Housing Characteristics

Characteristic	Total	West Maui	Central Maui	Kihei	Up Country	East Maui
		Area of Residence				
Rent or own housing unit						
own or in process of buying	55.6	45.5	59.2	57.0	62.5	51.5
rent for cash	39.9	50.8	37.3	41.3	33.2	34.3
occupied without cash payment	4.2	3.3	2.9	1.7	4.3	14.1
refused	.3	.3	.6	.0	.0	.0
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)
Number of rooms in housing unit						
1	.2	3	.0	.0	.4	.0
2	1.9	2.6	2.6	2.4	.8	.0
3	5.2	7.9	4.8	6.1	2.3	5.1
4	12.2	15.5	11.9	14.7	6.2	14.1
5	18.2	20.1	16.4	15.4	17.6	25.3
6	20.0	19.6	23.6	13.3	19.5	26.3
7	16.0	16.2	13.2	18.4	20.7	11.1
8	11.0	7.6	10.3	12.6	14.8	11.1
9	6.1	4.6	6.4	9.2	6.2	4.0
10 or more	8.2	5.0	10.3	7.8	11.3	3.0
don't know	.2	.3	.3	.0	.0	.0
Mean	6.3	5.8	6.4	6.4	6.8	5.9
Median	6.0	6.0	6.0	6.0	7.0	6.0
Length of residence in housing unit						
less than one year	16.2	24.1	11.3	23.5	15.2	5.1
one to three years	27.0	31.4	24.4	28.3	25.0	27.3
four to five years	9.2	11.2	6.8	11.3	10.9	6.1
six to ten years	14.7	13.2	13.2	18.4	16.0	15.2
more than ten years	32.4	19.8	43.1	18.1	32.8	46.5
don't know, refused	.5	.3	1.3	.3	.0	0
Previous place of residence						
lived here all of my life	2.7	3.3	2.9	1.0	2.0	5.1
another housing unit in this same town	47.3	55.1	50.8	44.0	33.6	50.5
other unit this island, other town	24.4	15.2	22.8	23.9	40.2	18.2
on Oahu	7.8	6.6	10.3	4.1	7.0	9.1
on another island	3.2	1.7	4.8	1.7	3.1	4.0
in another state	11.4	14.2	3.2	23.9	12.9	11.1
in another country	2.2	3.3	2.9	1.0	.8	2.0
refused	1.0	.7	2.3	.3	4	.0
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)

Table B3
Housing Characteristics for Home Owners

Characteristic	Total	West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
		Area of Residence				
Purchase unit as leasehold or fee						
leasehold	6.3	13.8	4.9	7.8	3.1	2.0
fee simple	85.7	77.5	87.0	88.6	90.6	80.4
don't know, refused	8.0	8.7	8.2	3.6	6.3	17.6
Current market price						
$20,000 but less than $75,000	1.8	2.2	2.2	1.2	.6	3.9
$75,000 but less than $100,000	5.2	7.2	5.4	1.8	5.0	5.9
$100,000 but less than $125,000	5.1	4.3	5.4	6.6	2.5	9.8
$125,000 but less than $150,000	4.5	2.9	3.8	4.8	6.9	3.9
$150,000 but less than $175,000	8.9	10.1	12.0	6.0	6.9	3.9
$175,000 but less than $200,000	11.0	13.0	12.0	13.2	8.8	5.9
$200,000 but less than $250,000	12.5	7.2	12.0	19.8	15.0	7.8
$250,000 but less than $300,000	6.9	8.7	6.0	9.6	6.3	3.9
$300,000 but less than $400,000	6.8	7.2	8.7	5.4	6.9	0
$400,000 or more	7.7	10.1	2.7	12.6	8.8	11.8
don't know, refused	29.6	26.8	29.9	19.2	32.5	43.1
Median	$196,990	$193,770	$188,050	217,420	$210,380	$179,270
Total monthly payment for housing						
less than $200	3.0	1.4	2.7	.6	5.0	5.9
$200 but less than $500	12.4	9.4	12.5	14.4	9.4	23.5
$500 but less than $800	16.0	18.8	20.7	10.2	14.4	5.9
$800 but less than $1,100	9.7	10.1	7.6	18.0	11.3	0
$1,100 but less than $1,400	10.4	8.0	9.2	16.2	12.5	5.9
$1,400 but less than $2,000	7.4	11.6	5.4	9.0	8.8	0
$2,000 or more	3.4	8.7	1.6	4.2	2.5	.0
already paid for, or mortgage paid up	24.7	23.2	23.9	14.4	26.3	43.1
don't know, refused	12.9	8.7	16.3	13.2	10.0	15.7
Median	$794	$928	$712	$984	$883	$387
Usual monthly utilities payments						
less than $50	4.6	5.8	5.4	4.8	1.3	7.8
$50 but less than $100	31.8	25.4	27.7	25.7	42.5	43.1
$100 but less than $150	27.3	24.6	32.1	24.6	28.8	15.7
$150 but less than $200	15.1	12.3	16.3	17.4	15.6	11.8
$200 but less than $250	6.4	8.7	6.0	9.0	4.4	3.9
$250 or more	5.6	9.4	3.3	7.8	3.1	9.8
included in mortgage	1.6	1.4	2.2	4.2	.0	.0
don't know, refused	7.4	12.3	7.1	6.6	4.4	7.8
Median	$116	$124	$119	$128	$107	$93
Base	(14,940)	(2,862)	(5,144)	(2,097)	(3,501)	(1,335)

Table B4
Housing Characteristics for Rental Units

Characteristic	Total	West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
		Area of Residence				
Monthly rent						
less than $200	5.0	3.6	7.7	1.7	2.4	11.8
$200 but less than $500	28.3	20.0	41.0	16.5	23.5	44.1
$500 but less than $800	34.5	30.9	41.0	36.4	38.8	11.8
$800 but less than $1,100	17.4	28.5	4.3	23.1	21.2	5.9
$1,100 but less than $1,400	5.3	8.5	.9	11.6	4.7	.0
$1,400 but less than $2,000	2.3	3.6	.0	4.1	3.5	0
$2,000 or more	.8	1.2	.0	.0	2.4	0
don't know, refused	6.3	3.6	5.1	6.6	3.5	26.5
Median	$669	$803	$496	$782	$742	$406
Combined monthly utilities payments						
less than $50	11.6	11.0	17.9	6.6	8.2	5.9
$50 but less than $100	35.3	35.1	32.5	37.2	37.6	38.2
$100 but less than $150	19.2	14.9	17.1	20.7	27.1	23.5
$150 but less than $200	8.1	6.5	10.3	7.4	11.8	0
$200 but less than $250	1.9	1.9	1.7	.8	2.4	2.9
$250 or more	3.1	1.3	2.6	1.7	7.1	5.9
included in rent	15.5	24.0	12.0	19.0	5.9	11.8
don't know, refused	5.3	5.2	6.0	6.6	.0	11.8
Median	$101	$94	$101	$116	$116	$108
Receive government rental assistance						
yes	6.6	3.2	11.1	5.0	4.7	8.8
no	92.4	96.8	87.2	95.0	95.3	85.3
don't know, refused	1.0	.0	1.7	.0	.0	5.9
Furnished or unfurnished						
furnished	30.0	44.0	19.5	40.5	13.5	35.4
partially furnished	16.7	16.9	23.4	13.5	14.6	4.2
unfurnished	52.3	39.2	54.7	46.0	70.8	58.3
refused	1.1	.0	2.3	.0	1.0	2.1
Base	(11,961)	(3,443)	(3,579)	(1,583)	(2,101)	(1,256)

Table B5
Quality of Maui Housing Units

Characteristic	Total	Area of Residence: West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
Unit is too small	24.0	29.0	19.0	23.4	24.0	22.2
More privacy	16.0	18.3	17.9	15.3	14.7	.0
Lot is too small	11.1	9.2	13.1	8.9	13.3	11.1
Unit is too old	8.6	6.1	8.3	8.9	10.7	16.7
Unit is too expensive	7.3	10.7	2.4	9.7	5.3	11.1
Dislike location	7.5	9.2	7.1	11.3	4.0	.0
Quieter neighborhood	6.6	7.6	3.6	4.0	12.0	5.6
Better maintenance and management	6.4	3.1	9.5	8.9	4.0	11.1
Rather own than rent	5.8	3.8	3.6	5.6	9.3	16.7
Not satisfied with type of residence	4.3	3.8	7.1	.8	5.3	.0
Move to residential area	4.1	4.6	2.4	7.3	4.0	0
Better parking facilities	4.0	8.4	2.4	4.0	0	0
Better traffic routes	2.7	4.6	.0	5.6	1.3	0
Air conditioning	2.2	3.8	1.2	4.0	.0	.0
Better plumbing	1.4	1.5	1.2	.8	2.7	0
Recreation facilities	1.0	2.3	.0	.0	0	5.6
Laundry facilities provided	.6	.8	1.2	0	0	0
nothing, satisfied as is	16.0	8.4	17.9	20.2	20.0	22.2
other	11.0	11.5	13.1	9.7	6.7	16.7
don't know, refused	2.4	3.8	3.6	1.6	.0	.0
Base	(8,735)	(2,717)	(2,348)	(1,557)	(1,641)	(471)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years. Percentages sum to more than 100 because of multiple responses. The actual wording of the question was: "What would you say you dislike most about your current housing unit--things you'd like to change if you moved to another home?"

Table B6
Intention to Move to a New Housing Unit
By Area of Current Residence

Characteristic	Total	Location of Current Residence: West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui
Plan to move in next 12 months						
yes	15.2	21.5	12.2	21.2	12.5	7.1
no	76.0	71.3	78.5	69.3	78.5	82.8
not sure	8.6	7.3	8.7	9.6	8.6	10.1
no response	.3	0	.6	.0	.4	0
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)
Number of years before you might be moving						
two years	10.9	16.0	7.3	16.0	9.4	8.7
three years	5.2	7.1	4.4	4.3	5.8	3.3
four or five years	5.7	7.1	6.2	6.5	5.4	1.1
six to ten years	4.8	3.8	4.0	4.8	7.1	4.3
more than ten years	3.1	4.2	2.6	3.9	3.6	1.1
will not move	43.8	32.8	46.5	30.7	48.2	64.1
don't know	25.8	27.7	27.8	33.8	20.5	16.3
no response	.8	1.3	1.1	.0	.0	1.1
Base	(22,780)	(4,937)	(7,633)	(2,901)	(4,902)	(2,408)
Buying or renting next unit						
buying	70.7	65.7	69.8	70.2	78.2	78.9
renting	26.0	29.9	26.7	29.8	17.9	15.8
not sure	2.7	4.4	1.2	.0	3.8	5.3
refused	.6	.0	2.3	.0	.0	0
Base	(9,035)	(2,862)	(2,411)	(1,557)	(1,707)	(497)

Table B7
Intention to Move to a New Housing Unit
By Preferred Location of New Unit

Characteristic	Total	West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui	Other[2]
		Preferred Area for New Home[1]					
Plan to move in next 12 months							
yes	45.1	48.1	40.9	51.7	38.0	53.2	48.6
no	46.5	46.2	48.2	43.5	53.3	35.7	40.8
not sure	8.4	5.6	11.0	4.7	8.7	11.1	10.6
Base	(9,035)	(2,212)	(2,271)	(1,059)	(1,871)	(706)	(917)
Number of years before you might be moving							
two years	50.0	54.2	36.6	52.2	55.1	59.2	56.5
three years	23.7	24.1	30.6	17.2	18.8	22.5	23.2
four or five years	26.3	21.7	32.8	30.6	26.1	18.4	20.3
Base	(4,963)	(1,147)	(1,343)	(511)	(1,160)	(330)	(471)
Buying or renting next unit							
buying	70.7	68.5	73.7	63.8	75.2	79.9	60.0
renting	26.0	27.8	26.3	36.2	24.8	16.4	19.2
not sure	2.7	3.6	.0	.0	.0	3.7	14.7
refused	.6	.0	.0	.0	.0	.0	6.1
Base	(9,035)	(2,212)	(2,271)	(1,059)	(1,871)	(706)	(917)

[1] First choice for area respondent preferred to move

[2] Includes people with no choice, those who would move anywhere on Maui and those who would move to another island or to the mainland US

Table B8
Some Preferred Characteristics of New Housing Units

Characteristic	Total	West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui	Other[2]
		Preferred Area for New Home[1]					
First choice for type of housing unit							
separate house	79.6	72.2	86.0	77.2	86.7	96.9	56.7
duplex or townhouse	5.2	11.3	4.7	5.89	1.1	.0	3.0
apartment or condominium	8.9	14.6	9	16.9	6.3	0	17.7
doesn't really matter	.7	.9	.0	0	1.2	.0	2.3
other	2.2	.9	4.7	.0	2.1	3.1	1.4
not sure, refused	3.4	.0	3.7	.0	2.7	.0	18.9
First choice for number of bedrooms							
one	7.1	12.8	2.5	9.1	4.7	2.9	10.9
two	34.2	32.5	30.0	40.0	40.1	32.0	37.8
three	44.5	43.5	52.0	42.6	42.2	52.8	29.1
four	9.0	9.4	10.4	7.1	10.8	6.2	4.8
five	2.5	.9	3.4	1.2	.7	6.0	6.6
six	.4	.0	.6	.0	0	0	2.3
not sure, doesn't matter	1.7	.9	1.2	.0	1.5	.0	8.5
Second choice for type of housing							
separate house	6.8	11.8	2.4	13.1	4.8	.0	7.4
duplex or townhouse	36.0	39.7	39.2	36.7	29.7	31.9	34.2
apartment or condominium	22.5	24.1	21.6	30.1	16.5	25.6	22.3
doesn't really matter	.7	.0	.0	.0	1.2	.0	4.5
no second choice	24.2	18.8	21.7	16.6	36.6	39.5	14.9
other	2.7	.9	4.9	2.4	3.7	2.9	0
not sure, refused	7.1	4.7	10.1	1.2	7.5	0	16.7
Second choice for number of bedrooms							
one	10.0	11.8	7.7	13.3	10.	7.4	9.5
two	30.0	34.7	33.3	24.9	22.9	35.7	26.4
three	27.9	23.4	31.8	35.0	27.6	24.6	24.1
four	12.7	10.3	16.1	10.9	13.9	20.1	4.5
five	1.3	1.9	.0	.0	4.1	.0	0
six	.2	.0	.0	.0	.0	.0	2.4
no second choice	15.2	14.1	10.0	14.6	21.4	12.2	21.5
not sure, refused	2.5	3.8	1.2	1.2	.0	.0	11.5
Base	(9,035)	(2,212)	(2,271)	(1,059)	(1,871)	(706)	(917)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years.

[1] First choice for area respondent preferred to move

[2] Includes people with no choice, those who would move anywhere on Maui, and those who would move to another island or to the mainland US

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Table B9
Preferred Characteristics of New Owned Units

Characteristic	Total	Preferred Area for New Home[1]: West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui	Other[2]
Expected monthly mortgage payment (including property taxes and insurance)							
less than $200	1.8	0	0	1.9	3.5	3.9	5.1
$200 but less than $500	3.4	1.4	.0	5.6	5.0	8.3	7.4
$500 but less than $800	9.7	6.8	11.2	10.9	3.4	27.1	9.8
$800 but less than $1,100	24.6	32.8	22.8	14.9	22.7	18.5	30.7
$1,100 but less than $1,400	17.8	15.1	21.6	20.9	19.2	19.3	5.1
$1,400 but less than $2,000	15.3	17.8	19.6	12.4	16.2	6.1	6.3
$2,000 or more	4.7	8.0	4.1	5.8	5.6	.0	4.6
mortgage paid	9.3	9.0	10.7	13.0	13.4	.0	0
don't know, refused	13.4	11.0	9.9	14.9	10.9	16.8	31.2
Expected down payment							
none	3.8	.0	4.8	.0	3.1	8.5	12.4
less than $5,000	4.5	4.1	5.0	6.0	5.4	4.6	0
$5,000 but less than $10,000	8.4	9.6	11.3	3.7	3.1	7.6	16.6
$10,000 but less than $15,000	9.4	3.6	9.6	14.2	10.4	17.8	8.3
$15,000 but less than $20,000	8.0	12.8	8.0	5.6	7.5	4.6	2.3
$20,000 but less than $30,000	14.6	16.9	10.4	15.3	20.0	6.1	14.6
$30,000 but less than $50,000	14.1	15.9	19.7	10.5	15.1	7.8	0
$50,000 or more	17.9	17.8	14.2	18.6	24.5	17.6	12.3
don't know, refused	19.3	19.3	17.0	26.0	10.9	25.4	33.5
Access to special financing							
have access	23.9	24.7	23.4	35.8	22.0	17.6	20.4
will use conventional	67.5	66.0	64.9	56.8	75.6	73.9	65.6
don't know, think so	8.3	9.2	11.7	5.6	2.4	8.5	13.9
refused	.2	0	0	1.9	0	0	0
Base	(6,392)	(1,514)	(1,680)	(675)	(1,408)	(564)	(551)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years, and who plan to buy their next housing unit

[1] First choice for area respondent preferred to move

[2] Includes people with no choice, those who would move anywhere on Maui, and those who would move to another island or to the mainland US

Table B10
Preferred Characteristics of New Rented Units

Characteristic	Total	Preferred Area for New Home[1]: West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui	Other[2]
Looking for furnished or unfurnished							
unfurnished	46.4	30.4	47.9	48.7	62.9	36.8	55.0
partially furnished	11.6	10.1	18.9	16.4	4.7	0	7.1
furnished	33.1	49.3	23.7	31.6	22.9	63.2	18.9
don't know, refused	8.9	10.1	9.5	3.3	9.4	.0	18.9
Expected monthly rental payment							
$200 but less than $500	10.6	8.8	18.9	3.3	10.1	0	12.4
$500 but less than $800	38.9	33.8	61.2	19.7	34.8	63.2	18.9
$800 but less than $1,100	33.1	27.0	15.1	49.9	45.6	36.8	42.5
$1,100 but less than $1,400	5.7	6.8	0	18.5	0	0	11.8
$1,400 but less than $2,000	5.0	10.1	.0	8.7	4.7	.0	0
$2,000 or more	.9	3.4	.0	.0	.0	.0	0
don't know, refused	5.0	6.8	4.7	.0	4.7	.0	14.3
Base	(2,343)	(614)	(591)	(383)	(463)	(116)	(176)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years, and who plan to rent their next housing unit

[1] First choice for area respondent preferred to move

[2] Includes people with no choice, those who would move anywhere on Maui, and those who would move to another island or to the mainland US

Table B11
Housing Issues by Location of Current Residence

Characteristic	Total	Area of Residence: West Maui	Central Maui	Kihei	Up Country	East Maui
If there were a new development in West Maui, would you like to live in that area?						
yes	45.0	80.2	33.3	33.1	20.0	27.8
not sure, depends	11.4	13.0	9.5	8.1	13.3	16.7
no	43.3	6.1	57.1	58.9	66.7	55.6
refused	.2	.8	.0	0	.0	.0
If there were a mixed income housing subdivision - with some market housing and some assisted rental or elderly housing, would you like to live there?						
yes	55.2	67.9	56.0	41.9	45.3	55.6
not sure, depends	15.6	13.7	15.5	18.5	16.0	16.7
no	29.0	17.6	28.6	39.5	38.7	27.8
refused	.2	.8	.0	.0	.0	0
If you could get a job in West Maui that was as good or better than the one you have now, would you want to change jobs?						
yes	34.2	39.7	41.7	27.4	22.7	27.8
maybe	9.3	9.9	6.0	13.7	6.7	16.7
no or not likely	51.5	42.0	47.6	54.0	69.3	55.6
already work in West Maui	4.4	7.6	3.6	4.8	1.3	0
refused	.6	.8	1.2	.0	.0	0
Base	(8,735)	(2,717)	(2,348)	(1,557)	(1,641)	(471)
If you did have a job in West Maui, would you want to live in West Maui?						
yes	79.3	86.5	74.3	85.3	64.7	80.0
not sure, depends	3.8	3.8	.0	5.9	5.9	20.0
no	12.9	3.8	20.0	8.8	29.4	0
already live in West Maui	3.0	5.8	2.9	0	.0	0
refused	.9	.0	2.9	0	.0	0
Base	(2,987)	(1,079)	(979)	(427)	(372)	(131)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years

Table B12
Housing Issues by Preferred Location of New Unit

Characteristic	Total	Preferred Area for New Home[1]: West Maui	Central Maui	Kihei/ Wailea	Up Country	East Maui	Other[2]
If there were a new development in West Maui, would you like to live in that area?							
yes	45.0	81.8	35.3	45.8	24.7	22.7	39.9
not sure, depends	11.4	13.7	9.6	10.3	13.5	10.8	7.6
no	43.3	4.5	55.1	43.9	61.9	66.5	49.6
refused	.2	.0	0	.0	0	0	2.9
If there were a mixed income housing subdivision - with some market housing and some assisted rental or elderly housinl, would you like to live there?							
yes	55.2	72.1	52.7	51.0	44.8	53.0	48.0
not sure, depends	15.6	12.7	17.6	15.0	19.7	13.2	11.1
no	29.0	15.2	29.7	34.0	35.5	33.8	38.1
refused	.2	.0	.0	.0	.0	.0	2.9
If you could get a job in West Maui that was as good or better than the one you have now, would you want to change jobs?							
yes	34.2	38.4	37.2	38.1	27.2	21.0	37.2
maybe	9.3	10.0	7.9	11.5	6.9	16.4	8.0
no or not likely	51.5	41.0	50.4	45.7	64.0	62.6	51.9
already work in West Maui	4.4	9.7	3.4	4.7	1.8	0	2.9
refused	.6	1.0	1.2	.0	.0	.0	0
Base	(8,735)	(2,129)	(2,271)	(1,059)	(1,871)	(680)	(726)
If you did have a job in West Maui would you want to live in West Maui?							
yes	79.3	92.4	71.8	80.6	69.2	66.4	87.7
not sure, depends	3.8	0	0	3.1	8.4	18.3	12.3
no	12.9	2.5	22.5	16.3	17.0	15.3	0
already live in West Maui	3.0	5.1	2.5	0	5.5	0	0
refused	.9	0	3.3	.0	0	0	0
Base	(2,987)	(817)	(844)	(403)	(509)	(143)	(270)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years.

1 First choice for area respondent preferred to move

2 Includes people with no choice, those who would move anywhere on Maui and those who would move to another island or to the mainland US

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Table B13
Preferred Location of New Unit by Location of Current Residence

Preferred Location of New Unit (First Choice only)	Total	Area of Residence: West Maui	Central Maui	Kihei	Up Country	East Maui
West Maui in general	5.9	17.5	.0	8	1.3	0
Lahaina	8.3	24.1	2.3	8	0	0
Napili	4.4	13.9	.0	.0	.0	.0
Ka'anapali	2.1	5.8	.0	.0	1.3	0
Kapalua	2.0	5.8	.0	.8	.0	.0
Kahana	1.1	3.6	0	.0	.0	.0
Honokawai	.5	1.5	.0	0	.0	.0
other West Maui	.2	.7	.0	0	0	0
Central Maui in general	4.4	.0	14.9	8	1.3	0
Wailuku	10.3	3.6	26.4	4.0	3.8	10.5
Kahului	9.3	.7	29.9	1.6	3.8	0
Wailuku Heights	8	7	1.1	1.6	0	0
Sprecklesville	.2	.7	.0	0	.0	.0
other Central Maui	.1	.0	.0	8	0	0
Kihei area in general	.3	.0	0	1.6	.0	.0
Kihei	10.7	2.2	3.4	52.4	0	0
Wailea	.6	.0	.0	3.2	.0	0
Maalaea	.2	7	.0	.0	.0	0
Upcountry Maui in general	6.4	7	3.4	4.8	23.1	.0
Kula	9.7	1.5	8.0	8.1	26.9	10.5
Makawao	2.0	2.2	.0	8	6.4	0
Pukalani	1.6	7	1.1	8	5.1	0
other Upcountry Maui	1.0	7	0	1.6	2.6	0
East Maui in general	.8	.7	.0	.0	1.3	5.3
Haiku	3.1	1.5	.0	2.4	11.5	.0
Hana	3.1	.7	.0	.0	0	52.6
other East Maui	.9	.0	0	.0	0	15.8
Hawaii in general	.4	0	1.1	8	0	0
Oahu	1.3	1.5	2.3	0	1.3	0
Big Island	1.2	.0	0	8	3.8	5.3
Kauai	.3	.0	.0	1.6	0	0
Molokai	.2	.7	.0	.0	.0	0
Mainland in general	.9	7	0	2.4	1.3	0
California, other West Coast	.2	0	0	1.6	0	0
other Mainland	.7	1.5	0	1.6	0	0
any Maui	5	7	.0	0	1.3	0
other	1.2	1.5	1.1	2.4	0	0
don't know	3.2	2.9	4.6	1.6	3.8	0
Base	(9,035)	(2,842)	(2,432)	(1,557)	(1,707)	(497)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years

Table B14
Preferred Location of New Unit by Location of Current Residence

Preferred Location of New Unit (Other Choices)	Total	Area of Residence: West Maui	Central Maui	Kihei	Up Country	East Maui
West Maui in general	7.0	19.7	0	3.2	1.3	0
Lahaina	12.8	32.1	4.6	5.6	2.6	0
Napili	9.0	27.7	.0	.0	1.3	0
Kapalua	4.2	12.4	.0	1.6	.0	0
Kahana	2.9	8.8	.0	8	0	0
Ka'anapali	2.8	7.3	.0	1.6	1.3	0
Honokawai	2.3	7.3	.0	0	.0	0
Olowalu	.1	0	.0	8	.0	0
other West Maui	.2	.7	.0	0	.0	0
Central Maui in general	7.0	4.4	17.2	1.6	3.8	0
Wailuku	17.6	6.6	44.8	11.3	5.1	10.5
Kahului	16.1	1.5	48.3	9.7	5.1	0
Wailuku Heights	1.8	1.5	3.4	2.4	.0	0
Waikapu	1.5	0	4.6	1.6	0	0
Waihee	.9	.0	2.3	0	1.3	0
Sprecklesville	.2	.7	.0	.0	0	0
other Central Maui	.7	.7	1.1	8	0	0
Kihei area in general	.4	.0	.0	2.4	.0	0
Kihei	19.6	8.8	17.2	58.9	7.7	10.5
Wailea	3.7	3.6	1.1	9.7	1.3	5.3
Maalaea	.4	.7	.0	.8	.0	.0
other Kihei area	.5	.7	.0	1.6	.0	0
Upcountry Maui in general	13.6	8.8	13.8	10.5	28.2	0
Kula	18.9	11.7	13.8	15.3	41.0	21.1
Makawao	8.1	2.9	6.9	8.1	19.2	5.3
Pukalani	6.7	1.5	10.3	4.0	12.8	5.3
Ulupalakua	.6	.7	.0	8	1.3	0
other Upcountry Maui	1.0	.7	.0	1.6	2.6	0
East Maui in general	.9	.7	.0	8	1.3	5.3
Haiku	7.3	2.9	2.3	6.5	21.8	10.5
Hana	4.1	1.5	.0	8	0	63.2
Paia	.9	.7	1.1	.8	1.3	0
other East Maui	.9	.0	.0	0	0	15.8
Base	(9,035)	(2,842)	(2,432)	(1,557)	(1,707)	(497)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years. Percentages sum to more than 100 because of multiple responses.

Table B14 (Continued)
Preferred Location of New Unit by Location of Current Residence

Preferred Location of New Unit (Other Choices)	Total	Area of Residence: West Maui	Central Maui	Kihei	Up Country	East Maui
Hawaii in general	1	0	0	.8	0	.0
Big Island	3.0	.7	.0	2.4	7.7	15.8
Oahu	2.9	4.4	4.6	0	1.3	0
Molokai	.7	2.2	.0	0	.0	0
Kauai	.3	.0	.0	1.6	0	.0
Mainland in general	.9	.7	0	2.4	1.3	0
California	.7	0	0	2.4	0	5.3
West Coast	.7	.7	1.1	.8	0	0
other Mainland	.7	1.5	.0	1.6	0	0
any Maui	.9	.7	1.1	.8	1.3	0
foreign country	.4	.7	.0	.8	.0	0
US Territory	.1	0	.0	.8	0	0
no choice	.1	0	0	.8	0	0
other	2.6	2.9	2.3	3.2	2.6	0
don't know, refused	3.2	2.9	4.6	1.6	3.8	0
Base	(9,035)	(2,842)	(2,432)	(1,557)	(1,707)	(497)

Table is based on those who will be moving to another housing unit in the next twelve months, or might move to another housing unit in the next five years. Percentages sum to more than 100 because of multiple responses.

Table B15
Employment Characteristics by Location of Current Residence

Characteristic	West Total	Area of Residence: Central Maui	Maui	Up Kihei	East Country	Maui
How many people in household are employed right now?						
none	11.5	7.3	15.1	12.3	9.0	14.1
1	25.5	20.8	22.8	30.4	27.7	34.3
2	43.8	44.6	42.1	45.1	48.0	36.4
3 or more	19.2	27.4	19.9	12.3	15.2	15.2
In what industry is the primary wage earner employed?						
Visitor Industry	18.6	37.6	10.9	22.2	7.0	18.2
Service	15.4	10.9	19.0	14.0	16.8	13.1
Construction	14.7	8.3	14.5	19.1	18.0	18.2
Government	6.9	3.3	8.7	5.1	7.0	12.1
Retail trade	5.4	7.6	4.5	5.8	6.2	1.0
Other agriculture	3.8	2.0	1.9	1.7	7.4	10.1
Banking, real estate, insurance	3.7	5.6	3.2	4.4	3.1	1.0
Sugar	2.7	3.6	4.5	1.0	1.2	0
Transportation	1.9	2.0	2.3	1.4	2.7	0
Communication and utilities	1.9	1.0	2.6	1.4	3.1	0
other manufacturing	1.3	.3	1.0	2.0	2.3	1.0
Food processing	1.2	1.7	1.0	.3	2.3	0
Wholesale trade	1.0	.3	1.3	2.4	.4	1.0
not employed	1.8	1.3	2.9	1.0	1.2	2.0
other	6.9	4.6	6.1	5.5	10.9	8.1
retired	10.8	6.9	14.1	11.6	8.6	12.1
refused	1.9	3.0	1.6	1.0	1.6	2.0
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)

Table B15 (Continued)
Employment Characteristics by Location of Current Residence

Characteristic	West Total	Central Maui	Maui	Up Kihei	East Country	Maui
		Area of Residence				
West Maui in general	8.7	29.0	2.4	3.2	1.8	1.2
Lahaina	12.7	34.9	9.1	5.1	3.1	0
Ka'anapali	5.4	19.0	1.2	3.2	0	0
Napili	3	1.1	.0	0	0	0
Honokawai	.5	1.9	.0	.0	.0	0
Kapalua	2.0	5.2	1.2	.4	4	2.4
Central Maui in general	5.1	.4	8.3	1.6	10.1	0
Wailuku	12.7	2.2	26.9	10.7	10.1	2.4
Kahului	15.7	2.2	26.5	14.2	22.0	2.4
Waikapu	.3	.0	.8	.4	.0	.0
other Central Maui	1.7	.4	4.3	.4	9	0
Kihei area in general	.1	0	.0	.4	.0	0
Kihei	8.2	.4	7.5	35.2	4.0	1.2
Maalaea	.3	0	.4	4	4	0
Wailea	3.2	7	3.2	13.0	1.3	0
other Kihei area	.6	.0	.8	1.6	4	0
Upcountry Maui in general	2.8	.0	.0	.0	12.8	.0
Kula	1.0	.0	.4	.4	4.0	.0
Ulupalakua	.2	0	.0	.0	.9	0
Makawao	1.8	.0	.4	1.2	7.0	0
Pukalani	.2	0	0	0	9	0
other Upcountry Maui	4	0	.0	4	1.8	0
East Maui in general	7	0	8	4	9	2.4
Paia	.7	4	4	4	2.2	0
Haiku	1.4	0	.8	.4	4.4	1.2
Hana	7.1	0	0	0	0	74.7
other East Maui	1.2	.0	.0	.4	4	10.8
any Maui	3.8	1.5	2.4	5.9	8.8	0
Oahu	.1	.0	.4	.0	.0	.0
US Territory	.1	.4	.0	.0	.0	.0
other	.8	.0	1.6	.8	.4	1.2
refused	.4	4	.4	0	8	0
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)

Table B16
Demographic Characteristics by Location of Current Residence

Characteristic	West Total	Central Maui	Maui	Up Kihei	East Country	Maui
		Area of Residence				
Years of residence on Maui						
less than one	4.1	6.9	1.3	8.2	3.9	1.0
one to five years	17.1	27.1	10.0	28.7	12.5	10.1
six to ten years	14.4	18.8	10.9	16.4	15.2	11.1
eleven to twenty years	19.7	16.8	18.0	27.0	23.0	15.2
more than 20, less than lifetime	14.8	12.5	19.9	8.9	11.3	19.2
lifetime	28.0	16.5	36.7	9.9	33.2	41.4
refused	1.8	1.3	3.2	1.0	.8	2.0
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)
Had a job before moving to Maui or had to find one						
already had a job	33.0	33.6	32.0	29.8	39.3	24.3
got job after arrival	55.6	59.2	53.6	53.6	53.6	59.5
retired, or not working then	10.5	6.6	12.8	15.3	7.1	16.2
refused	.8	.5	1.6	1.3	0	0
Base	(14,855)	(4,376)	(3,495)	(2,952)	(3,064)	(968)
Number of motor vehicles in household						
none	3.3	2.6	4.2	2.4	1.6	7.1
1	27.1	31.2	22.5	31.1	22.3	38.4
2	39.9	33.5	39.9	44.4	45.7	34.3
3	17.0	19.2	19.6	12.3	16.4	11.1
4	5.7	6.4	5.5	3.8	7.4	4.0
5 or more	4.5	3.9	5.1	4.3	5.6	2.0
don't know, refused	2.6	3.4	3.2	1.7	1.2	3.0
Ethnic background						
Korean	.6	.3	1.0	.0	.8	0
Caucasian	42.3	50.5	19.9	64.5	56.2	35.4
Chinese	.5	1.0	.0	.3	.4	1.0
Filipino	12.0	15.8	18.3	10.2	4.3	1.0
Hawaiian, part Hawaiian	20.6	12.2	22.2	8.5	18.7	56.6
Japanese	15.5	12.2	29.3	6.1	10.5	1.0
mixed, not Hawaiian	4.2	2.3	4.8	4.8	5.5	3.0
Black	3	3	6	3	0	0
other	3.0	3.6	2.9	4.4	2.3	1.0
don't know, refused	1.1	1.7	1.0	7	1.2	1.0
Sex of respondent						
Male	41.5	42.6	36.3	46.8	44.1	43.4
Female	58.5	57.4	63.7	53.2	55.9	56.6
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)

Table B16 (Continued)
Demographic Characteristics by Location of Current Residence

Characteristic	Total	Area of Residence: West Maui	Central Maui	Up Kihei	East Country	Maui
Total Annual Household Income						
less than $10,000	5.2	2.3	5.8	4.8	3.9	14.1
$10,000 but less than $20,000	11.8	12.5	12.5	8.9	10.5	14.1
$20,000 but less than $30,000	13.0	11.2	15.1	12.3	11.7	14.1
$30,000 but less than $40,000	13.5	14.5	12.2	15.0	15.2	9.1
$40,000 but less than $50,000	8.4	11.2	6.4	10.6	9.8	2.0
$50,000 but less than $75,000	9.1	8.3	8.4	9.6	11.3	8.1
$75,000 or more	6.0	6.6	3.9	7.5	8.6	4.0
don't know, refused	33.0	33.3	35.7	31.4	28.9	34.3
Family savings						
less than $20,000	58.6	60.7	53.7	53.2	62.1	69.7
more than $20,000	22.5	23.4	21.9	26.6	23.0	15.2
don't know, refused	18.9	15.8	24.4	20.1	14.8	15.2
Sources of income						
commissions, salary, wages	80.3	86.5	76.8	78.6	82.0	74.7
retirement pension	20.4	16.5	26.4	17.7	14.1	27.3
social security	24.3	16.8	31.5	19.5	20.3	33.3
public assistance from government or private agencies	3.8	2.3	3.5	2.4	5.5	7.1
rental income	14.3	10.9	14.8	17.1	17.6	10.1
other	12.2	8.3	10.3	17.1	16.8	11.1
Base	(26,853)	(6,285)	(8,695)	(3,680)	(5,602)	(2,591)

SURVEY INSTRUMENT

Name: ______	No. ___
Date: ______	Date: ___
Pau: ______	______
Start: ______	______
Total: ______	______

MAUI COUNTY HOUSING
(2352)
SMS Research & Marketing Services, Inc.
September 7, 1989
FINAL

Phone:	______
Sequence No:	______
Contact No:	1 2 3 4 5
West Cent Kihei Up East	

Hello. I'm ______ with SMS Research & Marketing Services, a Hawaii research company. We are conducting a survey about housing in Maui County. The results will be used to plan for housing needs in your area. Are you the head of the household? IF NO, ASK: May I speak to the head of the household? (SPEAK TO EITHER THE HEAD OR SPOUSE OF THE HEAD. IF NEITHER ARE AVAILABLE SPEAK TO ANY ADULT RESIDENT OF THE HOUSEHOLD. CIRCLE PERSON INTERVIEWED)

head 1
spouse 2
other 3

1. Are you a resident of Maui?

yes [CONTINUE] 1
no [THANK & TERMINATE & TALLY] 2

I'd like to ask you some questions about the housing unit you live in right now.

2. How many rooms are there in your housing unit?

Number of rooms [ ][ ]

3. Do you own or rent this housing unit?

Own or in process of buying 1
Rent for cash [GO TO Q.8] 2
Occupied without cash payment 3
REFUSED/DON'T KNOW 9
→ GO TO Q.11

IF OWN OR IN PROCESS OF BUYING, ASK:

4. Did you purchase this unit as leasehold or fee simple property?

Leasehold 1
Fee simple 2
DON'T KNOW/REFUSED 9

5. How much do you think this unit would sell for on today's market?

[DO NOT READ LIST]

$20,000 but less than $75,000 01
$75,000 but less than $100,000 02
$100,000 but less than $125,000 03
$125,000 but less than $150,000 04
$150,000 but less than $175,000 05
$175,000 but less than $200,000 06
$200,000 but less than $250,000 07
$250,000 but less than $300,000 08
$300,000 but less than $400,000 09
$400,000 or more 10
REFUSED/DON'T KNOW 99

6. What is your total monthly payment for this housing unit -- including your mortgage, lease, any maintenance fees, taxes, and insurance?
[READ LIST]
[INCLUDE UTILITIES ONLY IF RESPONDENT PAYS AS PART OF MORTGAGE PAYMENT]

less than $200 1
$200 but less than $500 2
$500 but less than $800 3
$800 but less than $1100 4
$1100 but less than $1,400 5
$1,400 but less than $2,000 6
$2,000 or more 7
Already paid for, or mortgage paid up 8
DON'T KNOW/REFUSED 9

7. How much are your usual monthly utilities payments -- including electricity, gas, and water?

[READ LIST]

[GO TO Q.12]

less than $50 1
$50 but less than $100 2
$100 but less than $150 3
$150 but less than $200 4
$200 but less than $250 5
$250 or more 6
Included in mortgage 7
DON'T KNOW/REFUSED 9

IF RENTING FOR CASH RENT, ASK:

8. How much is your monthly rent--not including gas, electricity or water payments? Is it....? [READ LIST]
NOTES

less than $200 1
$200 but less than $500 2
$500 but less than $800 3
$800 but less than $1100 4
$1100 but less than $1400 5
$1400 but less than $2000 6
$2,000 or more 7
DON'T KNOW/REFUSED 9

9. Are you combined monthly utilities payments usually...

[READ LIST]

less than $50 1
$50 but less than $100 2
$100 but less than $150 3
$150 but less than $200 4
$200 but less than $250 5
$250 or more 6
Included in rent 7
DON'T KNOW/REFUSED 9

10. Do you receive any rental assistance of any kind from the government?

yes 1
no 2
DON'T KNOW/REFUSED 9

11. Is this a furnished or unfurnished unit?

furnished 1
partially furnished 2
unfurnished 3
REFUSED 9

12. How long have you lived in this housing unit?

Less than one year 1
One to three years 2
Four to five years 3
Six to ten years 4
More than ten years 5
DON'T KNOW/REFUSED 9

13. Where did you live before you moved to this housing unit?

[WRITE IN--DO NOT CODE]

______

Lived here all of my life 1
Another housing unit in this same town 2
Other unit this island, other town 3
On Oahu 4
On another island 5
In another state 6
In another country 7
DON'T KNOW/REFUSED 9

OK, now I'd like to ask you about your housing plans for the next few years. First of all,

14. Do you think that you and your family will be moving to another housing unit in the next twelve months?

Yes 1
No 2
Not sure 3
NO RESPONSE 9
→ GO TO Q.16

15. How many years do you think it might be before you and your family would move to another housing unit?

Two years 1
Three years 2
Four or five years 3
Six to ten years 4
More than ten years 5
Don't Know 6
Will not move 7
NO RESPONSE 9
→ GO TO Q. 30

16. Given your family housing needs, will you be looking for a separate house, duplex or town house, or an apartment? [PROBE: What would be your second choice?]

		CHOICE NO.
Separate house	1	1
Duplex or townhouse	2	2
Apartment or condominium	3	3
Doesn't really matter	4	4
No second choice		7
<-Other (SPECIFY)	8	8
DON'T KNOW/REFUSED	9	9

17. How many bedrooms will you be looking for? [PROBE: And what would be your second choice?]

One	1	1
Two	2	2
Three	3	3
Four	4	4
Five	5	5
Six	6	6
No second choice		7
DON'T KNOW/REFUSED	9	9

18. In what area or areas would you like to live? [PROBE: "Any place else?]

1st: ______ First Choice ....

2nd: ______ Second Choice ....

3rd: ______ Third Choice ....

[TAKE UP TO THREE. WRITE RESPONSES VERBATIM, DO NOT CODE. WRITE "None" IF NO CHOICE.]

19. When you do move, do you think you will be buying or renting your next housing unit? [MORE LIKELY TO BUY OR TO RENT?]

Buying [GO TO Q.20]	1
Renting [GO TO Q 23]	2
Not Sure [PROBE: GO TO 30]	3
REFUSED [GO TO Q.30]	9

IF BUYING THE NEXT HOUSING UNIT, ASK:

20. About how much would you expect to pay each month for mortgage payment, property taxes, and insurance for the kind of unit you need?

[DO NOT READ LIST]

less than $200	1
$200 but less than $500	2
$500 but less than $800	3
$800 but less than $1100	4
$1100 but less than $1400	5
$1400 but less than $1700	6
$1700 but less than $2000	7
$2000 or more	8
DON'T KNOW/REFUSED	9

21. About how much do you expect to pay for a down payment on this unit? [DO NOT READ]

None	1
less than $5,000	2
$5,000 but less than $10,000	3
$10,000 but less than $15,000	4
$15,000 but less than $20,000	5
$20,000 but less than $30,000	6
$30,000 but less than $50,000	7
$50,000 or more	8
DON'T KNOW/REFUSED	9

22. Do you have any access to special financing arrangements like Veteran's benefits, FHA, or government employees loans, or would you be using conventional financing?

Have access to special financing	1
Will use conventional financing	2
Don't know, think so	3
REFUSED	9

[THEN GO TO Q.25]

IF WILL BE RENTING:

23. Will you be looking for a furnished or an unfurnished unit?

unfurnished	1
partially furnished	2
furnished	3
DON'T KNOW/REFUSED	9

24. About how much do you expect the monthly rent to be for the kind of unit you need?

[DO NOT READ LIST]

less than $200	1
$200 but less than $500	2
$500 but less than $800	3
$800 but less than $1100	4
$1100 but less than $1400	5
$1400 but less than $1700	6
$1700 but less than $2000	7
$2000 or more	8
DON'T KNOW/REFUSED	9

25. What would you say you dislike most about your current housing unit--things you'd like to change if you moved to another home? [PROBE]

OFFICE USE

Now, I'd like to get your opinions on some ideas about providing more affordable housing.

26. If there were a new, affordable housing development in West Maui, would you like to live in that area?

yes	1
not sure, depends	2
no	3
refused	9

27. If there were a mixed income housing subdivision--with some market housing and some assisted rental or elderly housing, would you like to live there?

yes	1
not sure, depends	2
no	3
refused	9

28. If you could get a job in West Maui that was as good or better than the one you have now, would you want to change jobs?

yes	1
maybe	2
no or not likely	3
already work in West Maui	4
refused	9

-> GO TO Q.30

29. If you did have a job in West Maui, would you want to live in West Maui?

yes	1
not sure/depends	2
no	3
already live in West Maui	4
refused	9

Good. Now I just need to ask a few questions about your household for statistical purposes:

30. Including yourself, how many persons live in this household? No. of persons

31. How many people in your household are children less than 18 years old? No. of persons

32. How many families share this housing unit? No. families

33. How many people in this housing unit are NOT related to you? [BY BIRTH, MARRIAGE OR ADOPTION] No. persons

34. What is your ethnic background?

Korean	01
Caucasian	02
Chinese	03
Filipino	04
Hawaiian/part Hawaiian	05
Japanese	06
mixed/not Hawaiian	07
Black	08
<--OTHER [SPECIFY]	97
DON'T KNOW/REFUSED	99

35. How many adults in your household are employed right now? No. of persons

36. In what industry is the primary wage earner of your household employed right now? [DO NOT READ LIST]

[WRITE BELOW IF UNSURE ABOUT CODING.]

- sugar 01
- other agriculture 02
- visitor industry 03
- construction 04
- food processing 05
- other manufacturing 06
- communication and utilities 07
- retail trade 08
- wholesale trade 09
- banking, real estate, insurance 10
- services 11
- transportation 12
- government 13
- other (SPECIFY AT LEFT) 14
- not employed 18
- retired 19
- refused, not sure 20

→ GO TO Q.38

37. In what area of Maui is the primary wage earner of your household employed?

____

Code for Area [ ][ ]

38. How many years have you lived on the island of Maui?

- Less than one 1
- one to five years 2
- six to ten years 3
- eleven to twenty years 4
- more than 20, less than lifetime 5
- lifetime 6
- refused 9

→ GO TO Q.40

39. When you moved to Maui, did you already have a job, or did you find a job after you arrived?

- already had a job 1
- got job after arrival 2
- retired, or not working then 3
- REFUSED 9

40. And what was the total 1988 income, before taxes, of all the people in your household? Was it....

- Less than $10,000 1
- $10,000 but less than $20,000 2
- $20,000 but less than $30,000 3
- $30,000 but less than $40,000 4
- $40,000 but less than $50,000 5
- $50,000 but less than $75,000 6
- $75,000 or more 7
- DON'T KNOW/REFUSED 9

41. Is the total amount of your family savings less than $20,000 or more than $20,000? [NOT COUNTING REAL ESTATE]

- Less than $20,000 1
- More than $20,000 2
- DON'T KNOW/REFUSED 9

42. Does your family get any of its income from these sources: (READ LIST)

	Yes	No	D.K./ Refused
Commissions, salary and wages	1	2	9
Retirement pension	1	2	9
Social security	1	2	9
Public assistance from government or private agencies	1	2	9
Rental income	1	2	9
Any other sources of income	1	2	9

43. How many motor vehicles (cars or trucks) are owned by members of your household? [ ][ ]

THANK YOU FOR PARTICIPATING IN OUR SURVEY!

44. INTERVIEWER, RECORD DO NOT ASK: Gender of respondent:

- male 1
- female 2

SUPERVISOR ID

EDITOR ID

KEYPUNCH ID

QUALITY CODE

APPENDIX B
FISCAL IMPACTS

FISCAL IMPACTS

METHODOLOGY

This section describes the projected additional revenues and costs which will accrue to the State of Hawaii and County of Maui. To assess the impact of this project, estimates of the incremental revenues and costs were made and charged to the project in order to calculate the revenue-cost ratio. The approach employed in conducting the revenue and cost analysis included:

- Identification of the kinds of revenue and cost elements to consider.
- Estimation of the dollar amount that would be associated with each revenue and cost element.
- Comparison of the discounted present value of the various revenue and cost totals.

The objective of this analysis was to determine whether the additional government revenues generated as a result of this project would be sufficient to offset the additional costs incurred.

PARAMETERS

Timing of Revenue and Cost Flows

The timing of the various revenue and cost flows were based upon the Lahaina Master Plan, various public documents, telephone conversations with Maui County personnel and others. The assumptions for supporting the revenue and cost flows are described later in this section.

REVENUE AND COST VARIABLE SELECTION AND ESTIMATION

Only those variables which were expected to produce a significant impact on the State of Hawaii and County of Maui revenues and costs were selected for study. The County would realize its revenues in the form of real property taxes from the residential units, commercial property and golf course. The State of Hawaii will realize the majority of its tax revenues from the 4% general excise tax on the development of the market priced homes, golf course and commercial property, and the operations of the golf course and commercial property. Since the project will also provide new jobs and income for corporations, the State would also receive additional income taxes. The revenues and cost estimates were distributed over a twenty year period for the years 1991 to 2010.

Based on the Lahaina Master Plan, it is assumed that most of the families who will reside in the proposed project are current residents of the Lahaina area. Therefore, any increase in services to Lahaina will largely be due to general population growth

rather than the project. The County suggested that only the additional per capita costs associated with police, fire and human services be computed. Costs for State and County highway services, sanitation services and public utilities were not included since these services are typically funded through user fees and taxes. It was assumed that revenues from the user fees and taxes will match future costs.

REVENUE AND COST VARIABLES

This section provides details on the various variables which were used to estimate the financial impacts on public revenues and costs. Each revenue and cost variable is described along with the rationale for its inclusion, estimation procedure and critical assumptions that were made. Exhibit I presents the revenue and cost analysis.

Public Revenue Variables

General Excise Tax Revenue -- Development

This variable reflects the revenue that would occur from the development activities. Only the construction cost of the residential units for sale at market prices, the golf course, the commercial center, and the churches/child care centers would be subject to the 4% general excise tax. Using the authority provided in Chapter 201E-205, the Housing Finance and Development Corporation (HFDC) will certify the developer for General Excise Tax (G.E.T.) exemption on all affordable housing units. Using the same authority provided in the Statutes, the HFDC would also exempt the developer from the G.E.T. on all infrastructure costs.

The construction costs for the market-priced residential units, commercial center and golf course were estimated and assessed the 4% tax rate.

General Excise Tax Revenue -- Operations

The golf course operations and the various businesses operating within the proposed commercial center will be assessed general excise taxes under the Hawaii Revised Statutes. All businesses were assumed to engage in transactions which would be taxed at the 4% rate.

The golf course revenue would principally come from green fees, pro shop sales, snackbar sales and driving range charges. It was estimated that revenues generated from these sources would be approximately $45 per round. The golf course was estimated to accomodate 76,500 rounds per year for an annual gross income of $3,442,500. The 4% G.E.T. rate was applied to all gross revenues.

Gross revenues for the commercial center were based on an estimated $231 per net leasable sq. ft. The commercial center was estimated to have 60,000 net leasable space. All revenues were assumed be taxed at the 4% G.E.T. rate.

The churches/child care centers were assumed to be non-profit organizations which would be exempt from the G.E.T. It was further assumed that the rental projects would be developed in accordance with the HFDC Rental Housing System so that the rents would be exempt from the G.E.T.

General Excise Tax Revenues - Personal Consumption Expenditures

It was assumed that the development project, commercial center, golf course and new elementary school would create new jobs for the community. These new jobs would result in additional income that would be used to purchase various goods and services which would be subject to the 4% G.E.T.

The G.E.T. for these additional personal consumption expenditures was calculated by estimating the net take-home pay for the "average" family. Net take-home pay was calculated by using gross pay less payroll taxes. Gross pay was based on the 1989 Maui median income for the type of work adjusted to 1990 dollars. Payroll taxes were estimated at 20% of gross pay. From this net take-home pay, it was assumed that 60% of this amount would be spent on consumable goods, excluding mortgage/rental expenditures. This consumable goods amount was used as the base figure to calculate the gross excise tax revenue per family/household.

Corporate Income Tax - Operations

It was assumed that all businesses developing the residential units, commercial center and golf course would be corporations. The net income from the proposed housing development and other operations would be subject to corporate income tax under the Hawaii Revised Statutes, Chapter 235. Specifically, the taxable income would be assessed at a rate of 6.4% under HRS 235-761(a).

The income subject to State income tax for the housing development was based on the estimated profit per housing unit. The net income on the commercial center and golf course were based on assumed profit margins of 4% of gross sales from the commercial center and 20% of gross sales from the golf course. The taxable income was then subject to the 6.4% tax rate.

Personal Income Tax

This variable represents the estimated income tax attributed to the income earned by the employees hired by the elementary school, the golf course and businesses located in the commercial center. Using the gross income as estimates for family incomes and an average of $5,028 in exemptions per family/household, the taxable income of the "average" household was estimated. The income tax was then computed assuming all employees would file a married and joint return.

Real Property Tax

The 3,160 for-sale units and 153 premium lots will yield additional real property tax to the County of Maui. The rental projects consisting of 587 units will be exempt from real property tax. It was assumed that all for-sale dwelling units will be fee simple. It was further assumed that 2,212 units will be owner-occupied by Hawaii residents who would all apply for their homeowner's exemption of $20,000. The

remaining 948 units will be owned by non-residents who would not qualify for a homeowner's exemption. The average unit sales prices were used as the assessment value and taxed at $4.75 for each $1,000 value of property and land.

Since the golf course is assumed to be operated by a for-profit corporation, the real property taxes were calculated using the current tax rate of $4.75 per $1,000 value of property and land. Calculation of real property tax during the construction period is based on the County's recent experience with other golf course developments and is calculated at $35,000 per acre plus development costs during that period. The County's current "benchmark" of $70,000 per acre was used to determine the valuation of the golf course once the golf course is operational.

The commercial property assessment was based on the cost of land and improvements and construction. The total value was then assessed at $6.00 per $1,000 value of property and land.

Public Cost Variables

Additional expenditures of public resources were calculated for the Lahaina project based primarily on current per capita expenditure levels adjusted to 1990 constant dollars.

Cost of Education

The proposed change or shift in population will increase public education costs for teachers and schools. It was assumed that the project would require a new elementary school and additional positions would be required to meet the increased student population at the intermediate and high school levels. It is estimated an additional 74 positions will be needed to meet this increase. These new positions were assumed to be added consistent with the population increase at the project.

Discussion with the Department of Education's Facilities and Support Services Branch indicated that the existing elementary schools on Maui are near or at maximum capacity. Therefore, the increase in population will require the development of a new elementary school, once the student population is 250 students over the maximum capacity (approximately 850-950 students per school). The new school is estimated to be required in year 1995.

$15 million was used as an estimate for the new school building and equipment costs. This estimate would satisfy the broad requirements established by DOE's Facilities and Support Services Branch.

Cost of Police Services

This variable was calculated using the 1989 expenditures from the County of Maui Details for the County Budget for the Fiscal Year 1990 adjusted to 1990 constant dollars. These expenditures included personnel costs and related materials and services to support the police. These expenditures were distributed among the estimated 5,042 Lahaina households to determine the average cost per Lahaina household. The average per capita cost was then applied to the incremental increase in the project population. It was assumed that 70% of the new homes would be purchased by current Lahaina residents. The remaining 30% would be the incremental increase in population.

<u>Cost of Fire Services</u>

To estimate the cost of the incremental fire service cost, selected 1989 expenditures from the <u>County of Maui Details for the County Budget for the Fiscal Year 1990</u>, and adjusted to 1990 constant dollars,were used and distributed among the 5,042 Lahaina households to determine the average cost per Lahaina household. The average per capita cost was then applied to the incremental increase in project population.

<u>Cost of Human Concerns</u>

Human concerns include a variety of services for youths, seniors, and immigrants. The total 1989 Human Concerns expenditures were adjusted to 1990 constant dollars allocated among all Maui households to determine the average household cost. This average per capita cost was then applied to the incremental increase in population at the Lahaina project.

RESULTS OF ANALYSIS

For the Lahaina project, a revenue-cost ratio of 1.2 to 1.0 was attained. This indicates that an additional $1.20 in public revenue benefits would accrue to either the State of Hawaii or the County of Maui for every dollar of public cost caused by the proposed development. This would provide a financial gain to the State and County should this project be implemented. As a standard for comparison in its civil projects, the U.S. Army Corps of Engineers recommends proceeding with a project if there is unity (1.0 to 1.0) or greater. The summary of the present value analysis is presented in Exhibit I.

In addition to the revenue benefits, the State of Hawaii and the County of Maui would receive other benefits which cannot be easily quantified. These intangible benefits to the Lahaina community include:

- Providing affordable for-sale housing for Hawaii residents who would otherwise not be able to purchase their own homes.
- Addressing the high demand for all types of housing in the Lahaina area by both Lahaina residents and workers in the hotel industry.
- Providing a well-planned aesthetic community with sufficient parks, open space, and landscaping.

EXHIBIT I

Summary of Analysis

PUBLIC AND OTHER REVENUES	
General Excise Tax	$20,664,270
Corporate Income Tax	2,523,488
Personal Income Tax	4,054,552
Real Property Taxes	40,968,584
Total Tax Revenues	68,210,894
PUBLIC COSTS	
Education - Salaries	29,469,484
Education - New School	15,000,000
Police	9,021,161
Fire	3,582,302
Human Concerns	1,113,076
Total Public Costs	58,186,023
NET PUBLIC BENEFIT	$10,024,871
Revenue Cost Ratio	1.2

APPENDIX C
SOILS STUDY

SOILS STUDY

LAHAINA MASTER PLANNED PROJECT

LAHAINA, MAUI, HAWAII

TMK: 4-5-21:

for

PBR HAWAII

W.O. 89-1860
September 29, 1989

EH ERNEST K. HIRATA & ASSOCIATES, INC.

SOILS STUDY

LAHAINA MASTER PLANNED PROJECT

LAHAINA, MAUI, HAWAII

TMK: 4-5-21:

INTRODUCTION

This report presents the results of our soils engineering study for the Lahaina Master Planned Project. This study was performed in support of your preparation of the Master Plan, EIS and Design Guidelines for the HFDC project. The scope of our work was limited to providing geotechnical information on the project area, and presenting our opinions regarding their impact on building foundations, site grading, and possible adverse conditions which may affect development of the site.

This study included a review of available soils information pertinent to the project site. The sources of information included the Soil Survey, prepared by the U.S. Department of Agriculture, Soil Conservation Service, as well as our past projects in the area.

SITE CONDITIONS

The project site covers approximately 1,120 acres of land, north of Lahaina, Maui. The approximate location of the project site is shown on the enclosed Location Map, Plate 1.
The site is situated east, or mauka, of Honoapiilani Highway. The Lahaina Civic Center and

Wahikuli Subdivision border the property on the west, with Kelawea Subdivision and Princess Nahienaena Elementary School situated to the south. Kahoma Stream extends along a portion of the southeast property line.

The site slopes downward in a westerly direction, from approximate elevation +800 at the northeast corner, to about +10 along Honoapiilani Highway. Most of the area slopes at about 10 percent, slightly steeper in the upper sections.

Several gullies extend downslope in the central portion of the site. The Wahikuli and Crater Reservoirs are located in the southeast section of the site, along with a small air strip used by helicopters and small planes. The remainder of the parcel is used to cultivate sugar cane. Irrigation ditches and cane haul roads are located throughout the site.

PROJECT CONSIDERATIONS

Preliminary plans for the project area include 3,900 residential units. School, church and park/recreational facilities are also planned throughout the site. The future Lahaina Bypass Highway will bisect the property in a northwest-southeast alignment. The main roadways supporting the proposed development will intersect with the highway extension.

SOIL CONDITIONS

The project area is located at the base of the West Maui Mountains. Alluvial fans cover the areas near the mouths of streams. However most of the site is covered by residual soil derived from basic igneous rock.

The Soil Survey, prepared by the U.S. Department of Agriculture, Soil Conservation Service, identifies the soils in the project area as Wahikuli and Lahaina Silty Clays. A map taken from the Soil Survey is presented on Plate 2.

The predominant soil is Wahikuli Silty Clay. The silty clay is fine textured, and dark reddish brown in color. The soil has been influenced to some extent by volcanic ash from local cinder cones. Weathered gravel and cobbles are mixed with the soil in most areas. Basalt can underlie the Wahikuli Silty Clay at relatively shallow depths.

The soils in the northeast section of the site were identified as Lahaina Silty Clay. The soil is also dark reddish brown in color, and underlain by weathered basalt.

Exploratory borings for previous projects in the area generally confirm the Soil Survey. Borings drilled at approximate elevation +250 along the same slopes further north encountered weathered rock at depths of about 5 feet, and hard basalt at approximately 20 feet. The transition from silty clay to weathered rock, and from weathered rock to hard basalt was gradual, and difficult to determine from test borings.

Borings drilled closer to Honoapiilani Highway usually encountered thicker layers of silty clay. In areas closer to the shoreline, the silty clay can be underlain by sandy material.

The silty clay encountered in our past projects were relatively stiff, and exhibited high shear strength and low compressibility characteristics. This was particularly true at the higher elevations. Laboratory testing on the silty clay indicated only slight to moderate expansion potentials, both in remolded and in situ sample testing.

Seepage or perched water was not encountered in borings drilled at higher elevations.

DISCUSSION

Based on our research and past experience in the project area, we believe that the subsurface soil conditions should not adversely affect development of the site. Most of the development is located in the upper slopes, where relatively good soil conditions have been encountered.

Building Foundations

We expect that development will be limited to low and mid-rise buildings. Preliminary planning may reflect the use of conventional shallow foundations for support of these structures. Residences will probably be supported on spread footings and thickened slab type foundations.

The silty clays are generally in a stiff condition, and as a result, excessive settlement due to building loads, as well as fill placement, is not expected.

Expansive Soils

The soils covering the project area generally exhibit low to moderate expansion potentials. Additional site preparation work due to expansive soils is therefore not expected.

Groundwater

We believe that groundwater or seepage conditions will not affect development of the site. Groundwater should not be encountered except in low-lying areas adjacent to Honoapiilani Highway. Our past borings drilled on the higher slopes did not encounter seepage or perched water.

However, we understand that the bottom of the Crater Reservoir is not tightly sealed, and tends to leak water. Seepage conditions may exist in the areas directly downhill of the reservoir.

Site Grading

Most of the project area presently slopes at about a 10 percent gradient. As a result, we believe that site grading will be designed to maintain existing grades as much as possible. Deep cuts and fills may occur in isolated areas.

As stated earlier, the onsite silty clays are generally low to moderately expansive. Preliminary plans may be based on reusing the soils in compacted fills. Planning should also assume cut and fill slopes at 2:1 (horizontal to vertical) gradients. Steeper cuts slopes may be acceptable in areas, depending on the depth to weathered rock and basalt.

Limitations

Our professional services were performed, findings obtained, and opinions derived in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions. This warranty is in lieu of all other warranties expressed or implied.

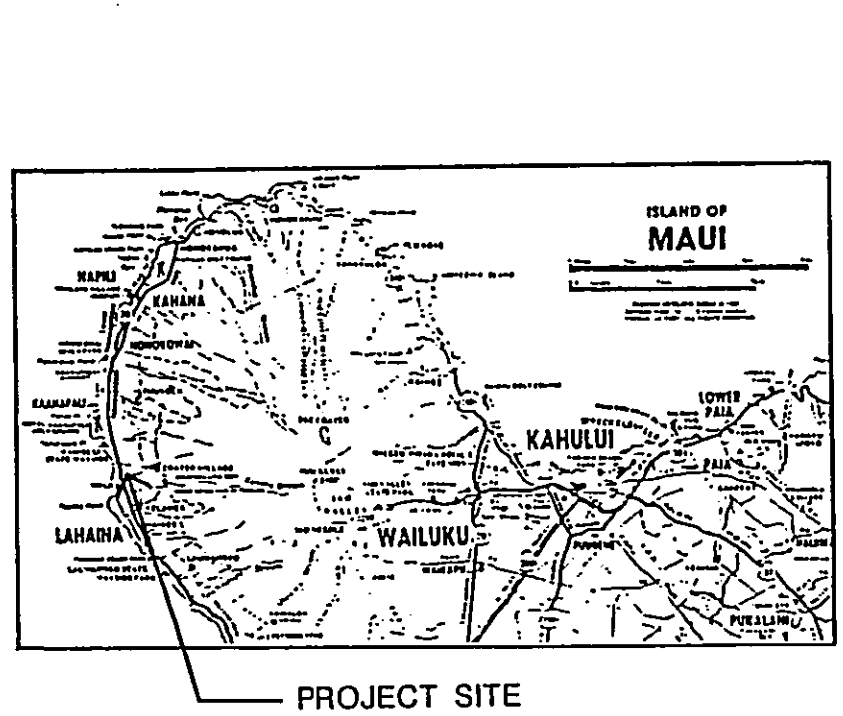
PAUL S. MORIMOTO
REGISTERED PROFESSIONAL ENGINEER
No. 5229
HAWAII, U.S.A.

Respectfully submitted,

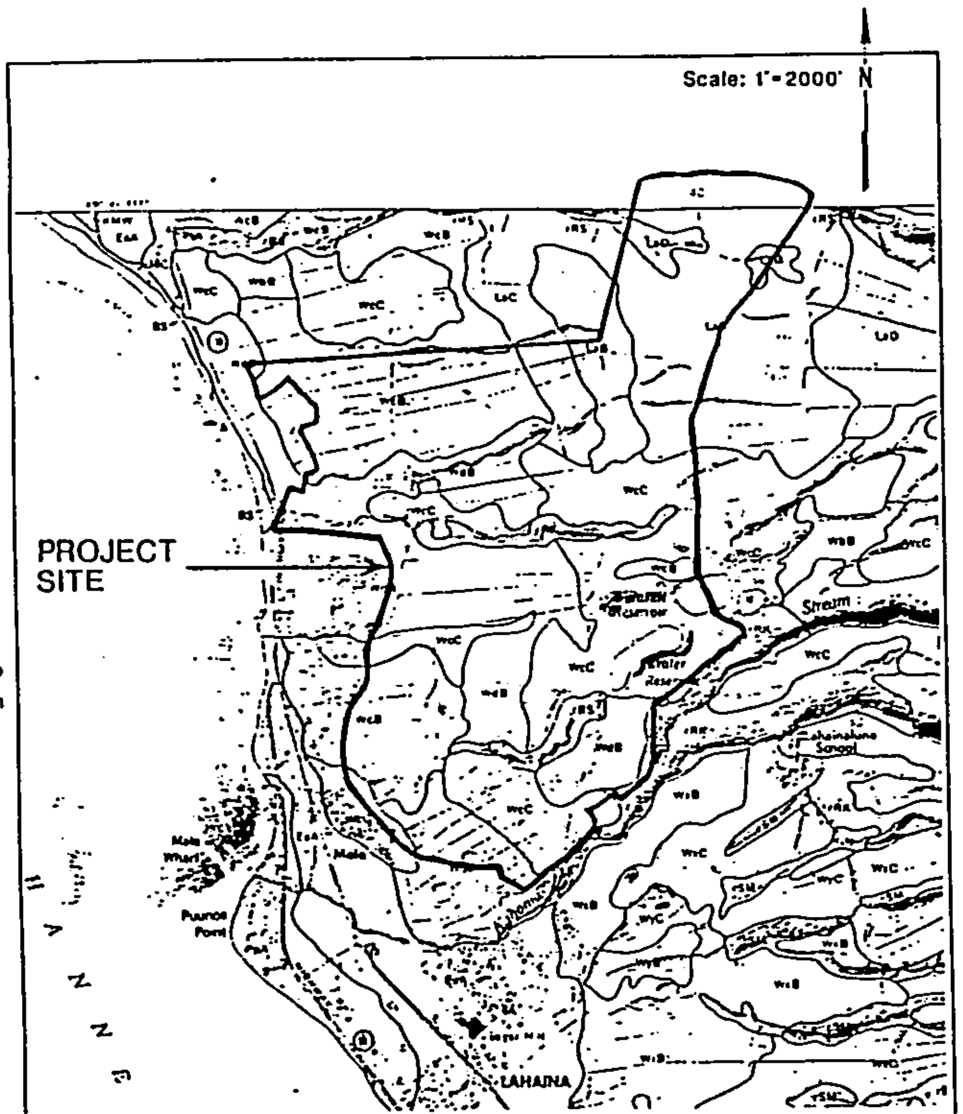
Ernest K. Hirata & Associates, Inc.

Paul S. Morimoto

Paul S. Morimoto, P.E.



W.O. 89-1860	Lahaina Master Planned Project
ERNEST K. HIRATA & ASSOCIATES, INC.	LOCATION MAP Plate 1



Reference: Soil Survey

W.O. 89-1860	Lahaina Master Planned Project
ERNEST K. HIRATA & ASSOCIATES, INC.	SITE PLAN Plate 2

APPENDIX D
LAHAINA MASTER PLAN: IMPACT ON AGRICULTURE

LAHAINA MASTER PLAN:
Impact on Agriculture

LAHAINA MASTER PLAN:
Impact on Agriculture

PREPARED FOR:
Hawaii Finance and Development Corporation

PREPARED BY:
Decision Analysts Hawaii, Inc.

November 1989

CONTENTS

TABLES

EXECUTIVE SUMMARY

The implementation of the Lahaina Master Plan would result in the urbanization of approximately 1,120 acres of sugarcane lands which are currently under cultivation by Pioneer Mill Company, Ltd. (PMCo), a subsidiary of Amfac/JMB Hawaii (Amfac).

IMPACT ON PMCO

The 1,120-acre HFDC project would affect about 16.2 percent of PMCo sugarcane land. However, about 45 acres of land containing infrastructure that is critical to PMCo would remain undeveloped. Assuming that PMCo operations will be affected in proportion to the 16.2 percent reduction in its sugarcane land, then its decrease in production would amount to an estimated 7,700 tons of raw sugar, nearly 2,600 tons of molasses, and about 1.2 million kWh of electricity. Furthermore, export earnings could drop by about $3 million, and employment could (but is not expected to) drop by about 50 jobs. Also, water requirements would decrease by about 16.5 mgd. Actual impacts, however, could deviate from the above. In particular, it is unlikely that employment would be impacted in direct proportion to the reduction in acreage since many specialized mill and field jobs would have to remain.

The HFDC project would decrease PMCo's acreage from 6,922 acres in 1987, to about 5,800 acres. If other projects which have been proposed in the past resurface and eventually gain approval, then the size of the plantation could be reduced to less than 5,000 acres. Assuming that U.S. sugar prices will continue to be high enough to justify continued sugar operations in Hawaii, an important question is whether the Lahaina Master Plan—combined with other planned and proposed projects--would eventually cause the closing of PMCo by reducing sugarcane acreage sufficiently to reduce economies of scale and/or by contributing to a scattered, and therefore inefficient, plantation rather than a more compact and efficient one. The issue is of particular concern because PMCo is already Hawaii's smallest sugar operation, and the proposed development would result in the withdrawal of considerable acreage near the center of the plantation. The small size of the plantation reflects not only limited land and past urbanization of PMCo lands, but also a limited water supply which precludes a large plantation.

In recent years, PMCo has been a break-even operation even though the plantation enjoys favorable growing conditions. Its high cost of production is due partially to its small size. A further reduction in the size of the plantation could increase the difficulty of maintaining "break-even" profitability. Nevertheless, in 1986, Amfac announced that PMCo would be reduced to about 4,000 acres which could be irrigated entirely with ditch water with no expensive pumping of groundwater required. These plans have since been revised in favor of a 6,000-acre plantation.

Provided that losses by PMCo can be avoided or can be kept at a relatively modest level, it is expected that Amfac will continue the PMCo operation because the lush greenery provided by the sugar fields is regarded as a major asset to West Maui and, in particular, to Amfac's Kaanapali Resort and property sales. Nevertheless, the HFDC project would increase the difficulty of managing a shrinking plantation.

In the longer term, the future of PMCo becomes increasingly uncertain given the outlook for flat or declining sugar prices and costs for labor, materials and supplies which characteristically increase with inflation. Furthermore, continued development of the West Maui visitor industry will increase the pressures to urbanize additional PMCo lands in order to meet the demand for housing. When, and if, PMCo closes—due to low sugar prices and/or because the plantation becomes too small for profitable operations—the economic loss would be equivalent to that of a small 230-room hotel, with some sugarcane workers suffering social disruption, but nearly all workers being able to eventually find other employment within the growing West Maui economy. An additional concern would be the problem of providing an attractive green backdrop to West Maui. Candidate land uses would include housing having a strong emphasis on greenery, golf courses, pineapple cultivation for some of the land, possibly diversified agriculture for some land, and pastureland for the remainder.

IMPACT ON THE GROWTH OF DIVERSIFIED AGRICULTURE

The development of the Lahaina Master Plan on sugarcane acreage would not change the amount of land *currently* available for diversified agriculture; but it would preclude the *future* use of the affected lands for diversified agriculture. However, it is extremely doubtful that the project would adversely affect the *Statewide* growth of diversified agriculture. There are four reasons for this assessment: (1) an extensive amount of agricultural land and water in the State has been freed from sugar and pineapple production due to past plantation closings and reductions in operations—over 100,000 acres including announced reduction plans—and most of this land has favorable soil ratings and remains available for diversified-agriculture activities; (2) given the existence of unprofitable sugar operations, a very real possibility exists that additional land and water will be freed from sugar production; (3) some—if not most—of the sugar operations would make their lands available for profitable replacement crops to the extent that such crops are available; and (4) when compared to the available supply, a very small amount of land and water is required to grow proven and promising diversified-agriculture crops in order to achieve a realistic level of Statewide food and animal-feed self-sufficiency, and to increase exports. In other words, the limiting factor is not the *land supply*, but rather the *market demand* for those crops that can be *grown profitably* in Hawaii. The proposed Lahaina Master Plan involves far too little land to affect this conclusion.

Although the HFDC project would not adversely affect the Statewide growth of diversified agriculture, it could affect the growth of diversified agriculture in West Maui if the lands were made available for diversified agriculture. However, it should be noted that: (1) none of the crops that are suited to the climatic conditions of West Maui require locational characteristics unique to West Maui; (2) farmers in West Maui are at a competitive disadvantage compared to farmers elsewhere in the state because of high land and labor costs in West Maui and long trucking distance to shipping terminals; (3) limited water supplies preclude the development of freshwater aquaculture; (4) proximity to homes and resort activities preclude livestock operations because of odors, dust, and fly problems; and (5) to date, Amfac has been unsuccessful in its search for a profitable replacement crop for sugar in West Maui.

In addition to having to compete against other farmers throughout the State, farmers in West Maui would have to compete against other activities for the limited supply of land, water, and labor. Strong demands exist for these limited resources, and market prices are high. From the perspective of a farm operation, high costs for land, water, and labor make it difficult to achieve and maintain profitability. From the broader societal and economic perspective, high prices for urban land indicate that at least some land in low-value agricultural uses should be reallocated to high-value urban uses, such as housing. Furthermore, any marginal amount of West Maui land which may be freed from sugar production is too valuable to place in a low-value use such as most (but not all) diversified agriculture crops. Thus the conversion of a small amount of sugarcane land to diversified agriculture would be justified only if the new crop were of high value and could be grown only in West Maui. Otherwise, the limited conversion of sugarcane acreage to diversified agriculture would represent a misallocation of the valuable and scarce land and water resources, thereby contributing to higher housing costs which would more than negate any economic benefit derived from putting the land in a low-value use such as most diversified agricultural crops.

CONSISTENCY WITH STATE PLAN AND LAHAINA COMMUNITY PLAN

In certain regards, the HFDC project would be inconsistent with State and County *agricultural* policies: potentially with respect to the continued viability of the sugar industry in West Maui, and with respect to protecting prime agricultural lands from development and encouraging the growth of diversified agriculture in West Maui. On the other hand, the project would not adversely affect any existing diversified agricultural activities, nor would it adversely affect the *Statewide* growth of diversified agriculture.

To a limited extent, the project would conform to the Lahaina Community Plan, which calls for urbanization to the east and north of the civic center complex, and around Crater Reservoir. However, the project would urbanize some lands which the Lahaina Community Plan would leave in agriculture.

From a broader perspective, it should be noted that West Maui enjoys a very healthy economy which is driven by the visitor industry, and any risk that the HFDC project may pose to agriculture would translate into a very small risk to the economy as a whole. Also, State and County policies that support affordable housing conflict with those policies which support agriculture and, given the severity of the housing situation in West Maui and the economic health of the region, the State and County policies regarding affordable housing would appear to override the agricultural policies.

LAHAINA MASTER PLAN: IMPACT ON AGRICULTURE

BACKGROUND

The Lahaina Master Plan encompasses an area of approximately 1,120 acres of land in West Maui. The property, which would be used primarily for housing, is adjacent to Lahaina, mauka of the Lahaina Civic Center and Wahikuli subdivision area, and north of the existing Kelawea Subdivision and Lahaina Luna High School. The goal of the Lahaina Master Plan is to create a well-planned residential community having a high level of amenities and services that would be available to residents of all income levels.

Currently, the land is in sugarcane under cultivation by Pioneer Mill Company, Ltd. (PMCo), a subsidiary of Amfac/JMB (Amfac). The impacts of the HFDC project on PMCo operations and on the potential growth of diversified agriculture are summarized in this report.

SOIL QUALITY OF AFFECTED SUGARCANE ACREAGE

The affected acreage consists primarily of eight soil types:

LaB	Lahaina silty clay, 3 to 7 percent slope.
LaC	Lahaina silty clay, 7 to 15 percent slope.
LaD	Lahaina silty clay, 15 to 25 percent slope.
rRK	Rock land.
rRS	Rough broken and stony land.
WcB	Wahikuli stony silty clay, 3 to 7 percent slope.
WcC	Wahikuli stony silty clay, 7 to 15 percent slope.
WdB	Wahikuli very stony silty clay, 3 to 7 percent slope.

For each soil type, Table 1 shows the approximate acreage, possible agricultural uses, and two soil ratings (explained below). The predominate soil types-- LaC, WcB, WcC, and WdB -- comprise about 88 percent of the Master Plan area. Suitable agricultural activities associated with most of the affected soil types are primarily sugarcane, with about 19 percent of the land suitable for pineapple and truck crops (soil types LaB and LaC).

The soils within the Master Plan area have been rated in terms of four classification systems commonly used in Hawaii: (1) Land Capability Grouping, (2) Agricultural Lands of Importance to the State of Hawaii, (3) Overall Productivity Rating, and (4) Proposed Land Evaluation and Site Assessment. These classification systems are discussed below.

(1) *Land Capability Grouping by the United States Department of Agriculture Soil Conservation Service (SCS).*

This classification system rates soils according to eight levels, ranging from the highest classification level, I, to the lowest level, VIII. Assuming that the land is irrigated for all soil types except rRk and rRs (which are rocky and stony), these ratings are shown in Table 1. Soil types LaB and WcB—which cover about 23 percent of the proposed project—have land capability ratings of IIe. The II indicates that the soil has moderate limitations that reduce the choice of plants that can be grown successfully, or indicates that moderate conservation practices are required. The subclassification "e" indicates a risk of erosion. Soil types LaC and WcC comprise about 42 percent of the Master Plan area, and have land capability ratings of IIIe, which indicates that the soils have severe limitations that reduce the options on

Table 1.— LAHAINA MASTER PLAN
SOIL TYPES, AGRICULTURAL USES, AND LESA AND SCS RATINGS

Soil Type	Acreage	Agricultural Uses	SCS Rating[1]	LESA Rating
LaB	39	Sugar, Pineapple, Truck Crops, Pasture	IIe	90
LaC	177	Sugar, Pineapple, Truck Crops, Pasture	IIIe	82
LaD	19	Sugar	IVe	66
rRK	11	Pasture	VIIs	18
rRS	60	Pasture	VIIs	18
WcB	222	Sugar	IIe	82
WcC	290	Sugar	IIIe	74
WdB	302	Sugar	IVs	51

1. Assuming all soils are irrigated except rRK and rRS which are not irrigated.

Source: U.S. Department of Agriculture, Soil Conservation Service, *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii*, August 1972.

plants, require special conservation practices, or both. Soil types LaD and WdB have land capability ratings of IVe and IVs, respectively, which indicates that the soils have very severe limitations that reduce the choice of plants, require very careful management practices, or both. The "s" represents problems of stoniness. Soil types rRk and rRS, which cover about 6 percent of the project area, are rated VIIs, which indicates that the soils and landforms have limitations that preclude their use for commercial plant production.

(2) *Agricultural Lands of Importance in the State of Hawaii (ALISH), by the SCS, University of Hawaii (UH) College of Tropical Agriculture and Human Resources, and the State of Hawaii, Department of Agriculture.*

This system classifies lands into three categories: (a) prime agricultural land which is land that is best-suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment; (b) unique agricultural land which is non-prime agricultural land that is currently used for the production of specific high-value crops; and (c) other agricultural land which is non-prime and non-unique agricultural land that is of importance to the production of crops. Approximately 68 percent of the lands in the proposed development area are rated as "prime" agricultural lands, and 26 percent of the lands are rated as important to the production of crops.

(3) *Overall Productivity Rating, by the UH Land Study Bureau (LSB).*

This classification rates soils according to five levels, with "A" representing the class of highest productivity and "E" the lowest. About 16 percent of the Master Plan lands have soils rated "A," 40 percent rated "B," 33 percent rated "C," and 11 percent rated "E." None of the soils are rated "D."

(4) *Proposed Land Evaluation and Site Assessment (LESA) System, by the State of Hawaii Land Evaluation and Site Assessment Commission*

Based on soil quality, locational attributes, improvements, nearby activities, and land-use plans, this proposed classification system would designate a sufficient amount of the better agricultural lands to meet projected agricultural goals. If the LESA classification approach were applied to the proposed site, 94 percent of the designated lands (all but soil types rRk and rRs) would be termed "important agricultural lands" (IAL), which would include all lands having a rating of 51 or above, out of a possible total of 100. The ratings for each soil type are shown in Table 1. However, the designation could be changed if an overriding public benefit were demonstrated.

Based on the various soils surveys, approximately two-thirds of the site is comprised of good soils.

IMPACT ON PMCO[1]

Background Information

Production and Export Earnings

PMCo, which was founded in 1860, is the smallest sugar operation in the State. In 1987, PMCo produced 47,621 tons of raw sugar and 15,984 tons of molasses, earning the plantation about $16.4 million. In addition, it sold 7.6 million kWh of electric power to Maui Electric Co.

The 1987 production of 47,621 tons of sugar compares with 41,256 tons in 1981 when the plantation had considerably more land under cultivation (see the next subsection).

Land Area, Ownership and Property Taxes

In 1987, PMCo cultivated 6,922 acres of sugarcane lands, on which it paid $88,000 in property taxes. A portion of the land farmed by PMCo is owned in fee by Amfac, and a portion is leased, principally from the State of Hawaii and Bishop Estate. The leases expire in 1994 and 2000, respectively. The land area encompassed by the Lahaina Master Plan is State-owned land.

The size of the plantation in 1987 was 1,464 acres less than its 1981 size of 8,386 acres. The reduction reflects loss of land to urbanization as well as requirements to compensate for loss of water to other activities (see the next subsection).

Water

Because of its location on the hot leeward side of West Maui, PMCo uses considerable water for the drip irrigation of its fields, while some fields near the mill are watered with furrow irrigation using mill tailwaters. In 1987, PMCo used an average of 64 million gallons per day (mgd) of groundwater and 38 mgd of ditch water for a total of 102 mgd of water use, and an average of 14,735 gallons per day per acre. For comparison, domestic water provided by the Maui Department of Water Supply averaged only 22 mgd in 1987[2], and per-acre usage for single-family homes (at 5 units per acre) averages about 2,130 gallons per day.

The availability of water has been a major problem at PMCo due to its history of having its high-elevation ditch water diverted for resort and other urban uses in West Maui. These diversions have been made by Amfac for the Kaanapali Beach Resort, Maui Land and Pineapple (ML&P) for its Kapalua development, and the County of Maui. The water diverted by Amfac has since been returned to PMCo after new wells were developed. High-elevation ditch water is valued because it does not require expensive pumping and, after being used to irrigate fields, it percolates down to mix with and reduce the salinity of the groundwater. During droughts,

1. Unless otherwise noted, the material in this section has been provided by Amfac.
2. Department of Business and Economic Development, *Data Book, 1987*, p. 155.

the resulting water shortages and high salinity adversely affect PMCo yields. A reduction in the size of PMCo and a corresponding decrease in water requirements have reduced the water problems.

Employment

Field, mill, and management employment at PMCo in 1987 was 324 workers. Indirect employment dependent upon PMCo is estimated to be 366 jobs,[3] for a total of 690 jobs, or about 1.5 percent of Maui County jobs. Payroll for PMCo totaled $7.1 million.

The 1987 employment was 23 percent below the 1981 figure of 422 workers. The decrease reflects significant productivity increases and cost savings.

As with other agricultural activities on Maui, PMCo has had problems retaining workers because of the job opportunities provided by a large and growing visitor industry. This industry and its supporting activities offer many jobs having higher pay, greater security, greater career potential, and better working conditions than those offered by the sugar industry.

Growing Conditions and Yields

PMCo benefits from favorable conditions for growing sugarcane, including good soil quality, favorable terrain, and a leeward island location having many sunny days. In 1987, average sugar yields at PMCo were slightly higher than the average for the State: 12.68 tons per acre for PMCo, versus a Statewide average of 12.32 tons per acre.[4] However, 1988 yields increased to 14.22 tons per acre.

These yields reflect a significant increase in productivity over that in 1981 when yields averaged only 9.99 tons per acre. The increase in yields reflect a better water balance, conversion to drip irrigation, improved varieties of cane, improved farming practices, etc.

Profitability

Even though PMCo benefits from favorable growing conditions and, in recent years, major improvements in yields and labor productivity, historically, the plantation has been a high-cost producer, and is currently breaking even. The problem is its small size and the corresponding lack of economies of scale.

Amfac Plans for PMCo

In 1986, Amfac announced that PMCo would be reduced in size to about 4,000 acres which could be irrigated entirely with ditch water with no expensive pumping of groundwater. In addition, the work force was to be reduced to 200 employees who would be trained to handle

3. Multiplier of 1.13, based on the State Economic Model.
4. Hawaiian Sugar Planters' Association, *Hawaiian Sugar Manual, 1988*.

different jobs to improve operating efficiencies. These plans have since been revised in favor of a 6,000-acre plantation.

Even though PMCo is only a break-even operation, Amfac has been willing to continue operations so long as any losses remain modest. This is because the lush greenery provided by PMCo is regarded as a major asset to West Maui and, in particular, to Amfac's Kaanapali Resort and property sales.

In the meantime, Amfac has been exploring a variety of crops which could profitably replace sugar and provide the desired greenery. Crops which have recently or are currently being explored included macadamia nuts, coffee, tea, and cocoa. However, a profitable replacement crop to sugar has yet to be identified for West Maui.

Outlook for Sugar Prices

The survival of PMCo will depend greatly on the price of sugar. In the world market, the average price of sugar is expected to remain well below the production costs for all countries, because most sugar is traded in controlled and/or subsidized markets, where surplus sugar is dumped onto the world market for sale at a loss. Dramatic price increases have occurred, however, following a 6- to 9-year cycle, with prices increasing when world production falls short of consumption. However, a number of fundamental developments have taken place in sugar and in related industries over the past two decades which appear to have altered the pattern of sugar prices, thereby reducing peak prices and extending the periods of low prices. These changes include: the decline or stagnation of sugar consumption in some developed countries; market inroads made by the liquid sweetener high-fructose corn syrup (HFCS); the availability of substantial sugar reserves in the form of sugarcane now devoted to ethanol production; major gains in sugarbeet production in several European countries which were traditionally cane sugar importers; and the appearance of the European Economic Community (ECC) as a major exporter of refined sugar.[5]

In the United States, Federal legislation protects sugar from the low world prices by imposing import quotas, tariffs, and import fees. However, U.S. sugar prices are managed so that they remain fairly low in order to prevent an acceleration in the growth of competing sweeteners, and to maintain public support for the program. Under the U.S. Food Security Act, which runs to late 1990, the target price for sugar is 18 cents per pound, with no adjustments for inflation.

The competing sweetener of major concern has been HFCS. It is as sweet, or sweeter, than regular sugar, costs less to produce, sells for less, is more profitable, is very similar to liquid sugar, can be substituted readily in many applications, and is easier and cheaper to

5. James B. Brown, *The International Sugar Industry, Developments and Prospects*.

CORRECTION

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

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handle. It has experienced a rapid growth in sales at the expense of regular sugar sales. However, HFCS has captured nearly all of the liquid-sweetener market so that its continued growth will depend on the market acceptance of Crystar, the crystalline version of HFCS. In addition, the new low-calorie sweetener aspartame, sold under the brand name "Equal," is capturing market share and putting additional downward pressure on U.S. sugar prices.

Regarding the short-term outlook for sugar legislation, it should be noted that, because of the advent of HFCS, many corn states (HFCS is produced from corn) have joined the sugar and sweetener coalition, making it larger and stronger than in the past. The considered expectation among sugar experts and lobbyists is that sugar will continue to be included in the U.S. Food Security Act, but that the price-support level will remain unchanged with no adjustment for inflation. Even though this is expected, there is a risk that efforts by sugar users and consumer groups to exclude sugar from the U.S. Food Security Act, or to significantly reduce the support price, will be successful.

Another and more serious threat to U.S. sugar price supports is the negotiations on the General Agreement on Tariffs and Trade (GATT). A GATT panel has found that the U.S. limits on sugar imports violate international trade rules. In order to comply with GATT, the U.S. sugar program may require a major restructuring, allowing a higher volume of imports, and probably resulting in lower U.S. sugar prices. Furthermore, any GATT Agreement would be subject to an accept-or-reject decision by the U.S. Senate, without opportunity for modification. If accepted, GATT would supersede U.S. sugar legislation, with the 1991/1992 crop being the first one affected.

In the longer term, the major concern is the introduction of a number of new sweeteners for which the target market is that portion of the sweetener market still held by regular sugar. Included are such sweeteners as Crystar (crystalline HFCS), high-temperature aspartame, super aspartame, sunette, sucralose, alitame, talin, and stevioside. Some of the sweeteners have recently won approval for human consumption in the United States, and others are in the process of obtaining approvals. If at least one of these new sweeteners achieves significant market success, then the downward pressure on sugar prices will increase.

In order to survive decreasing sugar prices, PMCo will have to decrease its production costs accordingly.

Urbanization Pressures on PMCo

Because of its location abutting Lahaina and Kaanapali Resort, and its proximity to other resort development in West Maui, PMCo lands are subject to very strong urbanization pressure for housing and other urban uses. This pressure is indicated by the 1979-to-1987 reduction of PMCo's fields by 1,854 acres, most of which resulted from urbanization. This reduction reflects Amfac's expansion of Kaanapali and development of resort and employee housing, the

County's development of employee housing, and various other housing and commercial developments.

PMCo is experiencing further urban pressures from various plans to urbanize additional sugarcane lands. Amfac plans further expansion of Kaanapali, the development of employee housing at Wainee, and the eventual development of a residential community at Olowalu.

In 1978, the Bishop Estate solicited proposals for developing a housing project near Lahaina Luna School on 400 acres of Bishop Estate land which is leased to PMCo. The proposal was withdrawn, however, after opposition was expressed by the County government. Although the Bishop Estate has retained this plan for housing, the proposal is not being pursued.

Finally, the subject HFDC project would remove about 1,120 acres of sugarcane in order to meet community housing needs.

Direct Impacts of the Lahaina Master Plan on PMCo

The 1,120-acre HFDC project would affect about 16.2 percent of PMCo's sugarcane land. However, about 45 acres of land containing infrastructure that is critical to PMCo—a reservoir, an airstrip, and an irrigation ditch—would remain undeveloped. A proposed golf course would buffer homes from the noise and dust of trucks using a cane haul road which passes through the property.

Assuming that PMCo operations will be affected in proportion to the 16.2-percent reduction in its sugarcane land, then its decrease in production would amount to an estimated 7,700 tons of raw sugar, nearly 2,600 tons of molasses, and about 1.2 million kWh of electricity. Furthermore, export earnings could drop by about $3 million, and employment could (but is not expected to) drop by about 50 jobs. Also, water requirements would decrease by about 16.5 mgd.

Actual impacts, however, could deviate from the above. In particular, it is unlikely that employment would be impacted in direct proportion to the reduction in acreage since many specialized mill and field jobs would have to remain.

Outlook For PMCo

The continued survival of PMCo will depend on a number of factors. One of the most important of which will be continued Federal price supports for sugar that are sufficiently high to justify continued operations, and continued success in reducing production costs. PMCo's success in increasing its yields and downsizing the plantation to compensate for lands lost to urbanization will also be important. The agricultural quality of the lands which remain, and the form of the plantation will also be a concern. In general, the preferred contraction in the plantation is from the periphery inward because this would result in a compact plantation and high-quality lands: a more compact plantation reduces trucking and other costs, while higher-quality lands contribute to higher yields. Even though some PMCo lands are owned in fee, continued sugar operations also will depend on PMCo's success in negotiating favorable lease terms with the State in 1994, and Bishop Estate in 2000.

The HFDC project would decrease PMCo's acreage from 6,922 acres in 1987, to about 5,800 acres. Based on additional urbanization envisioned in the Lahaina Community Plan, acreage could be reduced to about 5,500 acres by the year 2000. And if other projects which have been proposed in the past resurface and eventually gain approval, then the size of the plantation could drop to less than 5,000 acres, which would result in a very small plantation. Furthermore, the proposed development would withdraw considerable acreage near the center of the plantation. This reduction in the size of the plantation could increase the difficulty of maintaining PMCo's "break-even" profitability.

As mentioned previously, however, it is expected that Amfac will continue its PMCo operation so long as losses by PMCo can be avoided or kept at a relatively low level. This is because the lush greenery provided by PMCo is regarded as a major asset to West Maui and, in particular, to Amfac's Kaanapali Resort and property sales.

In the longer term, the future of PMCo becomes increasingly uncertain given an outlook for flat or declining sugar prices, and costs for labor, materials and supplies which characteristically increase with inflation. Furthermore, continued development of the visitor industry in West Maui will increase the pressures to urbanize additional PMCo lands in order to provide needed housing.

Economic Impact of Closing PMCo Operations

When and if PMCo closes—due to low sugar prices and/or because the plantation becomes too small for profitable operations—the resulting loss of jobs would be less than 324 direct jobs and 370 indirect jobs, with the actual number depending upon the reduced employment made possible by continuing increases in productivity. This would be the economic equivalent of losing a small 230-room hotel. Immediately following the mill closing, there would be considerable social disruption for a number of employees. But over the long term, most if not all sugar employees can be expected to find other employment if this should be required. However, some unskilled sugar workers and those having non-transferable skills may receive reduced pay when and if they are forced to find non-sugar jobs.

Following a plantation closing, considerable land would become available for other uses. The major problem, however, would become one of how to provide attractive greenery as a backdrop to West Maui. Candidate land uses would include residential developments having a strong emphasis on greenery, golf courses, pineapple cultivation for some of the land, possibly diversified agriculture for some land, and pastureland for the remainder.

IMPACT ON GROWTH OF DIVERSIFIED AGRICULTURE

Implementation of the Lahaina Master Plan would constitute a commitment of prime agricultural land to residential use. For the purposes of this discussion, prime agricultural land is loosely defined to mean any high-quality agricultural land capable of providing high yields for a variety of crops; it comprises about two-thirds of the lands currently cultivated land in the Master Plan area. Even though no existing diversified agricultural activities would be affected, this commitment raises the question of whether the HFDC project would hinder the future development of diversified agriculture. This issue is addressed below.

Suitability for Diversified Agriculture

West Maui enjoys year-round subtropical conditions which are excellent for cultivating those Hawaii crops which grow well in the warmer and dryer areas of Hawaii. Such crops include: *alfalfa, avocados, cucumbers, dry and green onions, Chinese peas, green peppers, pumpkin, Italian squash, sweet potatoes, tomatoes, watermelon, snap beans, bittermelon, sweet corn, seed corn, eggplant, ginger root, papaya, parsley, radishes, Oriental squash, tangerines, flowers and nursery products, sorghum, and feed grain.* On the other hand, the area is unsuitable for crops which require cool and/or moist conditions commonly found at higher elevations, such as Kula, or on the wet windward side of the island.

Fresh-water aquaculture is another possibility for the area. However, after many attempts, fresh-water aquaculture has failed to produce a record of profitability. Furthermore, fresh-water aquaculture requires enormous amounts of water—about 36,000 gallons per acre per day. This compares to less than 15,000 gallons per acre per day for sugar. Given the limitations on PMCo's water supply, freshwater aquaculture would constitute an irresponsible activity in the Lahaina area as long as PMCo is an operating sugar plantation. Finally, fresh-water aquaculture would not provide the attractive backdrop that sugar provides.

Brackish- and/or salt-water aquaculture are other possibilities which have a better record for profitability. However, seepage would risk damage to the freshwater supply in the area, and would preclude future use of the land for growing many crops and plants. Also, the ponds would not produce an attractive green backdrop.

Most *livestock operations* (such as a cattle feed lot, dairy operations, piggeries, and chicken operations) would be incompatible with the resort and housing areas near Lahaina, given odor, dust, fly and visual problems.

Although many of the above-listed crops and activities are agronomically suited to West Maui, none require locational characteristics unique to West Maui. Also, farmers in West Maui are at a competitive disadvantage compared to farmers elsewhere in the State because of high West Maui land and labor costs, and the long trucking distance to shipping terminals. As a result of these disadvantages, few crops and activities are likely to be profitable, and those which may be profitable generally require relatively little land (see below). Of particular significance, Amfac has been unsuccessful in its search for a profitable replacement crop for sugar in West Maui.

In addition to having to compete against other farmers throughout the State, farmers in West Maui would have to compete against other activities for the limited supply of land, water, and labor. Strong demands exist for these limited resources, and market prices are high. From the perspective of a farm operation, high costs for land, water, and labor make it difficult to achieve and maintain profitability. From the broader societal and economic perspective, high prices for urban land indicate that at least some land in low-value agricultural uses should be reallocated to high-value urban uses, such as housing. Furthermore, any marginal amount of West Maui land which may be freed from sugar production is too valuable to place in a low-value use such as most (but not all) diversified agriculture crops. Thus the conversion of a small amount of sugarcane land to diversified agriculture would be justified only if the new crop were of high value and could be grown only in West Maui. Otherwise, the limited conversion of sugarcane acreage to diversified agriculture would represent a misallocation of the valuable and scarce land and water resources, thereby contributing to higher housing costs which would more than negate any economic benefit derived from putting the land in a low-value use such as most diversified agricultural crops.

In summary, diversified agriculture offers little promise of economic development for West Maui. Furthermore, as discussed below, the limited successes which may occur would require little land.

Demand for Prime Agricultural Land

From a broader perspective, the proposed development would involve too little land to affect the Statewide growth of diversified agriculture. The most optimistic projections known to the consultant for the growth of diversified agriculture are those prepared by the Land Evaluation and Site Assessment (LESA) Commission. These projections—which are shown in Tables 2 and 3 for the State and Maui, respectively—were prepared in 1985. The projections represent an attempt to quantify the amount of agricultural land that will be required to (1) accommodate resident-plus-visitor population growth, (2) increase food and animal-feed self-sufficiency, and (3) increase crop exports.

Table 2.— LESA AGRICULTURAL ACREAGE REQUIREMENTS STATE OF HAWAII: 1983 AND 1995

Crop or Activity	1983	1995	Increase
Crops and Activities which Generally Do Not Require Prime Agricultural Lands			
Beef/cattle [1,2]	765,450	365,090	--
Livestock:			
Dairy	1,000	1,182	182
Eggs/Poultry	281	515	234
Swine	600	1,050	450
Subtotal for Livestock	1,881	2,747	866
Unique Crops:			
Aquaculture	500	4,500	4,000
Coffee	2,000	5,700	3,700
Flowers/Nursery	1,786	3,040	1,254
Papaya	2,120	11,850	9,730
Taro	400	527	127
Subtotal for Unique Crops	6,806	25,617	18,811
Macadamia Nuts	15,800	27,000	11,200
Crops and Activities which Generally Do Require Prime Agricultural Lands			
Plantation:			
Sugarcane [2,3]	194,300	177,700	-16,600
Pineapple	36,000	36,049	49
Subtotal for Plantation	230,300	213,749	-16,551
Other:			
Guava	965	1,400	435
Seed Corn	730	1,060	330
Bananas	1,100	2,200	1,100
Feed/Forage [2,4]	8,705	12,495	3,790
Fruits	635	1,156	521
Vegetables/Melons 5	4,340	7,022	2,682
Subtotal for Other Crops	16,475	25,333	8,858
Contingency [6]	--	29,500	29,500
TOTAL	1,036,712	689,036	--
TOTAL, Excluding Beef/Cattle	271,262	323,946	52,684

Table 2.— LESA AGRICULTURAL ACREAGE REQUIREMENTS
STATE OF HAWAII: 1983 AND 1995
(continued)

1. Includes marginal grazing and pasture lands. The 1983 figure includes arid zones and other areas having low carrying capacity, while the 1995 figure does not.
2. Often includes land in a holding operation awaiting discovery of profitable uses.
3. The decline in acreage primarily reflects the loss of Puna Sugar Co.
4. Includes some pastureland and 8,000 acres of guinea grass on Molokai.
5. Overstated in that the acreage figures are for harvested acres, rather than for the amount of land required (i.e., the acreage requirements for a crop harvested twice a year should be halved).
6. Based on 10% of all acreage other than that for beef/cattle. This contingency amounts to double counting in that the LESA projections are already high. Also, the contingency figure allows for an additional 17,770 acres for expansion of sugarcane, even though the sugar industry is expected to decline, not expand.

Table 3.— LESA AGRICULTURAL ACREAGE REQUIREMENTS,
COUNTY OF MAUI: 1983 AND 1995

Crop or Activity	1983	1995	Increase
Crops and Activities which Generally Do Not Require Prime Agricultural Lands			
Beef/cattle [1,2]	108,500	70,000	--
Livestock:			
Dairy	240	284	44
Eggs/Poultry	0	14	14
Swine	120	282	162
Subtotal for Livestock	360	580	220
Unique Crops:			
Aquaculture	15	120	105
Flowers/Nursery	274	440	166
Papaya	25	100	75
Taro/Watercress	0	39	39
Subtotal for Unique Crops	314	699	385
Macadamia Nuts	1,250	3,780	2,530
Crops and Activities which Generally Do Require Prime Agricultural Lands			
Plantation:			
Sugarcane [2]	47,400	45,700	-1,700
Pineapple	8,649	9,449	800
Subtotal for Plantation	56,049	55,149	-900
Other:			
Guava	0	242	242
Seed Corn	0	100	100
Bananas	80	176	96
Feed/Forage [2,3]	--	---	---
Fruits	25	44	19
Vegetables/Melons [4]	1,850	2,265	415
Subtotal for Other Crops	1,955	2,827	872
Contingency [5]	--	6,304	6,304
TOTAL	168,428	139,339	—
TOTAL, Excluding Beef/Cattle	59,928	69,339	9,411

Table 3.-- LESA AGRICULTURAL ACREAGE REQUIREMENTS, COUNTY OF MAUI: 1983 AND 1995 (continued)

1. Includes marginal grazing and pasture lands. The 1983 figure includes arid zones and other areas having low carrying capacity, while the 1995 figure does not.
2. Often includes land in a holding operation awaiting discovery of profitable uses.
3. Includes some pasture.
4. Overstated in that the acreage figures are for harvested acres, rather than for the amount of land required (i.e., the acreage requirements for a crop harvested twice a year should be halved).
5. Based on 10% of all acreage other than that for beef/cattle. This contingency amounts to double counting in that the LESA projections are already high. Also, the contingency figure allows for an additional 4,570 acres for expansion of sugarcane, even though the sugar industry is expected to decline somewhat.

As indicated, the LESA Commission projected in 1985 that an estimated 52,684 additional acres of land would be required Statewide to accommodate the increase in production for the 1983-to-1995 period. The corresponding figure for Maui is 9,411 acres. The crops and acreage requirements are categorized according to those which generally do not require prime agricultural land (although some crops may be grown profitably on prime agricultural land), those which generally do require prime agricultural land, plus a contingency of 10 percent of all acreage used for purposes other than beef and cattle production.

The relevant figures from Tables 2 and 3 are not the total figures, but the increase in the amount of prime agricultural land required to accommodate diversified agriculture: the increase is 8,858 acres for the State, and 872 acres for Maui. These increased requirements for prime agricultural land are surprisingly small. Nevertheless, the projected land requirements, as small as they are, are high in that diversified agriculture is growing more slowly than the LESA Commission projections. A more realistic estimate for the amount of prime agricultural land required to accommodate Statewide growth of diversified agriculture over the next two decades is probably closer to 1,500 acres.[6] Furthermore, land is being freed from plantation agriculture faster than it can be absorbed by other crops (discussed below).

If diversified agriculture is to require a large amount of prime agricultural land, then additional crops will have to be grown for the export market rather than for the small Hawaii market. However, the extreme difficulty of developing large export markets should be noted. For over a century, numerous and extensive crop searches and experiments have been conducted by many people and organizations, and have led to surprisingly few major long-term successes in Hawaii, thereby indicating the extreme difficulty in identifying new export crops and developing them into new and profitable industries. Furthermore, the difficulty in developing export markets is increasing because of increasing competition from other sugarcane-growing areas. Periodic low sugar prices have led nearly all sugarcane operators throughout the world to search for profitable replacement crops, particularly crops which can increase the level of earnings from exports. Thus far, few successes have materialized.

Supply of Prime Agricultural Land

Regarding the supply of land, an enormous and growing supply of prime agricultural land is available for diversified agriculture and other uses. Since 1968, over 90,000 acres of Hawaii's higher-quality agricultural land have been freed from sugar and pineapple production: over 63,000 acres of sugarcane and over 27,000 acres of pineapple have been freed from production.[7,9] On the Big Island, Hamakua Sugar Co., Inc. has announced that it will sell

6. Plasch, Bruce S., Peter Garrod, et. al., *An Economic Development Strategy and Implementation Program for Molokai.*
7. Hawaiian Sugar Planters' Association, *Hawaiian Sugar Manual 1988.*

10,000 acres of land in order to reduce its debt, and Ka'u Agribusiness has announced a 4,200-acre reduction in sugarcane acreage. Between 1979 and 1988, over 5,100 acres of land were taken out of sugar production on Maui, most of which was land used by Wailuku Ag that was converted to pineapple fields and macadamia nut orchards. On the nearby island of Moloka'i, 16,600 acres have been freed from pineapple operations, most of which remains available for diversified agriculture.

In the State as a whole, some of the land freed from sugar and pineapple production has or will be converted to urban, diversified agriculture, and aquaculture uses. After making allowances for the various conversions, uncommitted acreage which remains available for diversified agriculture and aquaculture amounts to many tens of thousands of acres. Much of this land is fallow, in pasture, or in some other low-productivity use. However, land for diversified agriculture is not as available on Maui as it is on the other islands.

The Statewide supply of prime agricultural land probably will increase given the very real possibility of future sugar plantation closings. A number of Hawaii's sugar plantations are unprofitable but remain in operation today only because they have lease and/or energy contracts which make closing too expensive. However, these contracts eventually will end.

Furthermore, a portion of the sugarcane land is in holding awaiting a discovery of profitable replacement activities; this land forms part of the supply of prime agricultural land available to profitable diversified agriculture crops.

Many of the lands in the State which have been freed, are to be freed, or can be freed from sugar and pineapple production have excellent agricultural qualities and climatic conditions, and are well-suited for a variety of crops. Also, water is available for most of these lands, especially those lands freed from sugar production.

Additional lands which have been made available for diversified agriculture are in government-sponsored agricultural parks throughout the State. Also, lands for agricultural activities which do not require prime agricultural land include pasture land, land for livestock operations, and "unique" lands as classified by ALISH (see page 3). Unique lands are not prime agricultural lands, but are important lands for certain crops, the principal examples are the coffee lands in Kona, and certain lava lands in Puna that are particularly well-suited for growing papaya. The supply of unique lands is quite large and is distinct from the supply of prime agricultural lands.

8. Hawaii Agricultural Statistics Service, *Statistics of Hawaiian Agriculture 1987*.
9. Robert C. Schmitt, *Historical Statistics of Hawaii*.

Availability of Land to Small-Scale Farmers

Even though considerable agricultural land exists, small agricultural parcels are seldom available to small-scale farmers under long-term leases because land-use regulations and the political environment make it unprofitable and too risky to the landowner to lease out small farm parcels. Agricultural use constitutes a low-value use of the land and, correspondingly, farmers pay relatively low lease rents. At the same time, in order to rent to small-scale farmers, landowners are required to subdivide the property. Applicable County subdivision regulations (designed for rural estates) require expensive electrical power, paved rather than gravel roads, and buried rather than surface water lines. The combination of low rents and expensive subdivision requirements makes it unprofitable for the landowner to subdivide land into small farms.

For example, rather than developing the State agricultural park in Kahuku, it would have been—as surprising as it may seem—less expensive for the State to give each farmer in the park $100,000[10]. In addition, there is the risk that when the leases expire, small-scale farmers will turn to the Legislature in an attempt to prevent landowners from raising lease rents, or to prevent landowners from evicting them in favor of a higher and more profitable use of the landowner's land—this often occurs in long-term leases for land on which small-scale farmers have built homes (e.g., Waihole-Waikane, Kona, Waianae, Kalama Valley). Such an economic environment favors leases to large-scale operators (including cooperatives consisting of many small-scale farmers), short-term and illegal leases of unsubdivided land, subdivision of the land into rural estates for sale to buyers who can afford the costs of the subdivision requirements, or leaving the land fallow.

In summary, the shortage of small parcels of land for farmers is a serious problem. Nevertheless, a vast Statewide supply of prime agricultural land does exist and is available for those profitable diversified agricultural activities that are large in scale, or for which the subdivision requirements are somehow circumvented.

Outlook for Diversified Agriculture

Based on the above analysis, ample prime agricultural land will be available to easily accommodate the Statewide requirements of diversified agriculture. This conclusion derives from the fact that a vast amount of prime agricultural land and water is available Statewide, having been freed from sugar and pineapple production in recent years; the very real possibility that additional sugarcane acreage and water will be freed, given the existence of unprofitable

10. This is based on 275 usable acres divided into 24 lots, a land cost to the State of $50 per acre per year; improvement costs of $3.5 million for developing the farm plots (electric power, roads, etc.); rents received from farmers of $300 per acre per year; an 8-percent discount rate based on State bonds; and a 30-year term for the bond and the lease.

sugar operations; the fact that some, if not most, of the sugar operations would make their lands available for profitable replacement crops; and, in contrast, the fact that land requirements for diversified agriculture are surprisingly modest. In other words, the limiting factor is not the *land supply*, but rather the *market demand* for those crops that can be *grown profitably* in Hawaii. The proposed Lahaina Master Plan involves far too little land to affect this conclusion. Therefore, the Lahaina Master Plan would not affect adversely the Statewide growth of diversified agriculture.

However, the HFDC project could affect where the growth of diversified agriculture occurs. For example, if the property were to be removed from sugar production and made available for diversified agriculture—but not for housing, commercial, or industrial use—and made available at rents which are heavily discounted from market rents, then some diversified agriculture could develop on the property. However, such development would be at the expense of diversified agriculture elsewhere in the State.

Consistency with Overseas Long-Term Trends

The increased availability of prime agricultural land in Hawaii compared to that of prior decades results from some very long-term and accelerating trends that are occurring throughout the United States, Europe, and many developed and developing market economies. For example, U.S. farmers are paid by the government not to farm their land. This has resulted in 30 million acres of agricultural land lying fallow in 1984.[11] In Europe, quotas are used to limit production. The principal agricultural problem has been overproduction, which has occurred as a result of the tremendous success of increasing yields, coupled with a slowing of the population growth rate. Because yields increase faster than population growth, resources must be freed from agriculture in order to restore balanced markets, and to increase income to the farmers who remain. Otherwise agricultural products glut the market; this is followed by low prices, a fall in farmers' income, and bankruptcies.

Furthermore, the export market has not been able to absorb the excess production, partly due to the agricultural successes achieved in many developing counties. For example, India once suffered from severe food shortages. With the introduction of modern agriculture, however, its farm industry has been transformed, making India self-sufficient and even an exporter of many foods it once had to import. Similar gains have been achieved throughout Asia and Central and South America.

Sugar is clearly part of this trend which, over the long term, shows supply increasing more quickly than demand. In fact, some of the newer sweeteners have the theoretical potential of causing the release of all the land in the world that is now planted in sugarcane and sugarbeets.

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11. Norman E. Borlaug and Christopher R. Dowswell, "World Revolution in Agriculture."

The major agricultural problem facing the United States and many other economies, therefore, is how to make the reduction in production an orderly one so as to minimize social problems. This is a problem that arises from the tremendous successes in agriculture production, and contrasts sharply with, and invalidates, the 200-year old prediction of Thomas Malthus that population will increase faster than the food supply.

CONSISTENCY WITH LAHAINA COMMUNITY PLAN AND STATE PLAN

In certain regards, the HFDC project would be inconsistent with State and County *agricultural* policies: potentially with respect to the continued viability of the sugar industry in West Maui, and with respect to protecting prime agricultural lands from development and encouraging the growth of diversified agriculture in West Maui (see Table 4). On the other hand, the project would not adversely affect any existing diversified agricultural activities, nor would it adversely affect the *Statewide* growth of diversified agriculture.

To a limited extent, the project would conform to the Lahaina Community Plan, which calls for urbanization to the east and north of the civic center complex, and around Crater Reservoir. However, the project would urbanize some lands which the Lahaina Community Plan would leave in agriculture.

From a broader perspective, it should be noted that West Maui enjoys a very healthy economy which is driven by the visitor industry, and any risk that the HFDC project may pose to agriculture would translate into a very small risk to the economy as a whole. Also, State and County policies that support affordable housing conflict with those policies which support agriculture and, given the severity of the housing situation in West Maui and the economic health of the region, the State and County policies regarding affordable housing would appear to override the agricultural policies.

Table 4.-- SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS

HAWAII STATE PLAN (Chapter 226, Hawaii Revised Statutes, as amended):

Section 226-7 Objectives and policies for the economy--agriculture.

(a) Planning for the State's economy with regard to agriculture shall be directed towards achievement of the following objectives:

(1) Continued viability in Hawaii's sugar and pineapple industries.

(2) Continued growth and development of diversified agriculture throughout the State.

(b) To achieve the agricultural objectives, it shall be the policy of the State to:

(6) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.

Section 226-103 Economic priority guidelines.

(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:

(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.

(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:

(1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.

Section 226-104 Population growth and land resources priority guidelines.

(b) Priority guidelines for regional growth distribution and land resource utilization:

(2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

Table 4.-- SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS (continued)

STATE AGRICULTURAL FUNCTIONAL PLAN (June 1985)
(Functional plans are guidelines for implementing the State Plan, and are not adopted by the State Legislature.)

B. Objective: Achievement of Productive Agricultural Use of Lands Most Suitable and Needed for Agriculture.

(5) Policy: Provide greater protection to agricultural lands in accordance with the Hawaii State Constitution.

(c) Implementing Action: Identify important agricultural lands to promote diversified agriculture, increased agricultural self-sufficiency, and assure the availability of agriculturally suitable lands.

(d) Implementing Action: Until standards and criteria to conserve and protect important agricultural lands are enacted by the Legislature, important agricultural lands should be classified in the State Agricultural District and zoned for agricultural use, except where, by the preponderance of the evidence presented, injustice or inequity will result or overriding public interest exists to provide such lands for other objectives of the Hawaii State plan.

Table 4.-- SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS (continued)

LAHAINA COMMUNITY PLAN, COUNTY OF MAUI (December 1983)

IV. MAJOR PROBLEMS & OPPORTUNITIES

A. Highest priority problems and issues:

- Viability of agricultural activities and preservation of the land resource base for a variety of agricultural activities, including sugar, pineapple, diversified agriculture, and aquaculture.

B. Second priority problems and issues:

- Water for domestic and agricultural uses.

V. PLANNING STANDARDS & PRINCIPLES

1. The Economic Base.

Establishing a stable economic base capable of providing sustaining employment opportunities for present and future residents was a strong concern. The (Lahaina Citizens Advisory) committee felt that it would be necessary not only to strengthen the present economic base, but to broaden it as well. In addition to supporting present agriculture, . . . the committee felt it wise to encourage other economic pursuits compatible with community desires and the region's environment. Desirable economic activities included diversification of agricultural pursuits such as diversified agriculture and aquaculture, . . .

The following planning standards and principles reflect these committee choices.

2. Protection of the Agricultural Land Base.

Plantation agriculture is an important economic activity which also provides most of the "green" backdrop important for the region's atmosphere and its marketability to visitors. Protection of these lands is considered critical to the viability of Lahaina's sugar industry and the livelihood of its employees.

VI. RECOMMENDATIONS

SOCIO-ECONOMIC ASPECTS

1. Economic Activity

a. **General.** Promote a diversified economic base which offers long-term employment to Lahaina residents, and maintains overall stability in economic activity and growth. Such a program should include the following components:

6) Agriculture.

Table 4.-- SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS (continued)

b. **Agriculture.** Provide for the preservation and enhancement of important agricultural lands for a variety of agricultural activities, including sugar cane, pineapple, diversified agriculture, and aquaculture. The importance of agriculture to the region's economic base, identity, and lifestyle should be recognized through the following programs and policies.

1) Maintain the land acreage required to sustain economically viable agricultural operations.

2) Prevent urbanization of important sugar cane lands to the greatest extent possible.

3) Encourage maintenance and development of water sources for agricultural activities which do not conflict with water needed for domestic use.

2. **Population**

d. Consistent with a policy of slow population growth, phase growth for the region with a limit of 2300 additional units in the first phase. Subsequent phases should be considered only if it is found that earlier phases cannot accommodate actual population increases. Growth should be phased as follows:

1) Phase I: (Short-term; first 5 years):
- Residential development around Crater Reservoir.
- Residential development adjacent to the Lahaina Civic Center.

2) Phase II: (Medium-term; 10 year growth, if more accommodation is needed):
- Contributions to the residential housing supply north of the Lahaina Civic Center.

3) Phase III: (Long-term; 20 year growth, if further accommodation is needed):
- Continued residential expansion north of the Lahaina Civic Center.

This pattern of residential growth assists in accomplishing the following objectives:

1) Minimization of urban intrusion into important agricultural lands.

PHYSICAL ASPECTS

2. **Land Use**

The following land use recommendations are illustrated on the Land Use plan presented as Exhibit E, page 17.

e. Revise State Urban District boundaries along the south and east edges of the civic center complex and north of the civic center complex for additional residential uses. These adjustments will allow for phased residential expansion.

APPENDIX E
BOTANICAL SURVEY

f. Create State Urban District boundaries for residential use . . . around Crater Reservoir. That action is consistent with the phased residential growth strategy outlined previously and will provide for the establishment of small-scale residential communities at historical plantation camp sites.

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BOTANICAL SURVEY

LAHAINA HFDC PROJECT

LAHAINA DISTRICT, ISLAND OF MAUI

by

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Prepared for: PBR HAWAII

September 1989

Table of Contents

BOTANICAL SURVEY
LAHAINA HFDC PROJECT
LAHAINA DISTRICT, ISLAND OF MAUI

INTRODUCTION

A well-planned residential community whose primary goal is to provide affordable housing is proposed for the site by the State of Hawaii Department of Housing Finance and Development (HFDC). The Lahaina HFDC project site consists of approximately 1,120 acres adjacent to Lahaina town on the island of Maui. It lies above (mauka of) the Lahaina Civic Center and Wahikuli residential area and north of the existing Kelawea subdivision and Lahainaluna High School.

The majority of the project site is presently under active sugar cane cultivation. Uncultivated areas occur in gulches and around a quarry and two reservoirs near Pu'u Laina.

Field studies to assess the botanical resources on the site were conducted in August 1989. The primary objectives of the field studies were to (1) describe the major vegetation types; (2) inventory the terrestrial, vascular plants; and (3) search for threatened and endangered species on the project site.

SURVEY METHODS

Prior to undertaking the field survey, a search was made of the pertinent literature to familiarize the principal investigator with other botanical studies conducted in the general area.

Topographic maps and recent aerial photographs were examined to determine access, terrain characteristics, vegetation patterns, and potential logistical and technical problems. Access onto most parts of the project site was provided by a number of unpaved cane haul roads which run through the site.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, exposure, etc. Plants which could not be positively identified in the field were collected for later determination in the herbarium and for comparison with the taxonomic literature. The species recorded are indicative of the season and environmental conditions under which the survey was conducted. A survey taken during the wetter rainy season (about November through January) would no doubt yield slight variations in the species list, especially of the weedy, annual taxa.

DESCRIPTION OF THE VEGETATION

Portions of the Lahaina HFDC project site have been included in the botanical surveys for the realignment of the Hono-A-Pi'ilani Highway, better known as the Lahaina Bypass Highway (Char 1986; Char 1988). In addition, the lands immediately adjacent to (north of) the project site have recently been surveyed (Char and Linney 1989) for AMFAC's proposed South Beach Mauka project. In all of these flora surveys, actively cultivated fields of sugar cane comprised the major vegetation type. Scrub vegetation, usually koa-haole shrubs and buffel grass, occurred on uncultivated areas while gulch and stream areas supported mixed forests of kiawe, 'opiuma and Java plum, and koa-haole thickets. No plants considered threatened or endangered by the federal and/or state governments were found during these surveys.

In this report, vegetation on the project site is described from three areas: (1) cane fields; (2) gulches; and (3) the reservoirs and quarry.

1. Cane Fields

The cane fields along with their network of cane haul roads and

and irrigation ditches covers the majority of the subject property. The cane fields occur on well-drained, deep soils of the Waiakoa-Keahua-Molokai association (Foote et al. 1972). The fast-growing sugar cane (Saccharum officinarum) tends to shade out other plants and the majority of the weedy species associated with cultivated, agricultural lands occurs along the margins of fields, cane haul roads, and irrigation ditches. Only the ubiquitous nut grass (Cyperus rotundus) has adapted well to growing under the dense cane. Among the most frequently observed weedy species found along cane fields are two grasses: swollen finger grass (Chloris barbata) and buffel grass (Cenchrus ciliaris). Other plants found occasionally include young koa-haole shrubs (Leucaena leucocephala), Canada fleabane (Conyza canadensis), hairy spurge (Chamaesyce hirta), pluchea (Pluchea symphytifolia), maile hohono (Ageratum conyzoides), virgate mimosa (Desmanthus virgatus), wild bittermelon (Momordica charantia), spider flower (Cleome gynandra), Bermuda grass (Cynodon dactylon), and little bell (Ipomoea triloba).

Piles of rocks and boulders are scattered through the fields. These support koa-haole scrub with a dense ground cover of buffel grass and swollen finger grass. Guinea grass (Panicum maximum) may be locally abundant on some rock piles.

Three major irrigation ditches and a number of smaller ditches traverse the property. These support more moisture-loving species such as honohono (Commelina diffusa), jungle rice (Echinochloa colona), and barnyard grass (Echinochloa crus-galli).

2. Gulch Vegetation

Two major gulches border the project site; Hahakea Gulch to the north and Kahoma Gulch to the south. A smaller gulch, running mauka-makai almost through the middle of the property and crossing the Civic Center, may be used for storm water detention for the proposed HFDC project. A few other small gullies are also found throughout the site.

Smaller gulches and gullies support primarily koa-haole scrub with a ground cover of Guinea grass. Along the wetter gulch bottoms California grass (Brachiaria mutica) may be abundant in places. Two vines of the morning-glory family, the moon flower (Ipomoea alba) and koali-'awania (Ipomoea indica), sometimes form a conspicuous tangle climbing over the koa-haole shrubs.

Larger gulches support koa-haole scrub and scatterd stands of trees which form a mixed forest, 20 to 30 ft. high. The trees are generally distributed along the gulch bottoms and include Java plum (Syzygium cumini), monkeypod (Samanea saman), 'opiuma (Pithecellobium dulce), kiawe (Prosopis pallida), and Siris tree (Albizia lebbeck). Buffel grass and Guinea grass are the most abundant ground cover plants, although, in places, 'ilima (Sida fallax), hairy merremia (Merremia aegyptia), lion's-ear (Leonotis nepetifolia), and hairy abutilon (Abutilon grandifolium) may be locally abundant.

3. Reservoir and Quarry Vegetation

Two reservoirs are found on the property. Crater Reservoir is wholly within the site while the Wahikuli Reservoir is located along the eastern boundary. A Java plum forest rings the shores of Crater Reservoir. The trees are dense and there is very little ground cover beneath; soil, litter, and rocks predominate. The Wahikuli Reservoir is lined with concrete and stone. Around its perimeter, vegetation consists of koa-haole scrub. In places where there is seepage and standing water, taro (Colocasia esculenta) has been planted. Also found in these wet spots are honohono, jungle rice, California grass, primrose willow (Ludwigia octovalvis), and leptochloa (Leptochloa uninervia).

Pu'u Laina is a cinder cone which has been quarried in several places. A koa-haole scrub with dense buffel grass typifies most of the vegetation on the pu'u. In places, Natal redtop (Rhynchelytrum repens) may dispalce the buffel grass. Scattered through the scrub are trees of kiawe, silk oak (Grevillea robusta), 'opiuma, and Java plum. Near an old village site by the Wahikuli Reservoir, several large old trees of monkeypod, avocado (Persea americana), and Siris tree are found.

The vertical walls of the quarry nearest the Pu'u Laina pump house are damp in places and it is not uncommon to find large patches of ferns such as hairy sword fern (Nephrolepis multiflora), pteris (Pteris vitata), gold fern (Pityrogramma calomelanos), maiden-hair fern (Adiantum raddianum), and laua'e (Phymatosorus scolopendria) clinging to the sides of the walls. Mosses and hornworts can also be found in these damp seeps. One plant of nehe, an endemic species, was found in this quarry.

DISCUSSION AND RECOMMENDATIONS

Vegetation on the Lahaina HFDC project site consists almost exclusively of actively cultivated sugar cane fields along with associated weedy species found alongside the cane haul roads, margins of fields, on rock piles, and beside irrigation ditches. Uncultivated portions of the site, as around the two reservoirs, the quarry, and in gulches, support largely koa-haole scrub and stands of trees. The majority of the plants occurring on the site are introduced or alien (see species checklist at end of report). Of a total of 88 species inventoried, 78 (88%) are introduced; 6 (7%) are native; and 4 (5%) are originally of Polynesian introduction. Among the native plants, one is endemic, i.e. native only to the Hawaiian Islands, and five are indigenous, i.e. native to the islands and elsewhere.

None of the native species are officially listed threatened or endangered species by the federal and/or state governments (U. S. Fish and Wildlife Service 1985; Herbst 1987); nor are any of them candidate or proposed for such status. The one endemic species, the nehe (Lipochaeta aff. lavarum), is found scattered to some-

times locally common in coastal habitats and dry forest areas of Moloka'i, Lana'i, Maui, Kaho'olawe, and Hawai'i (Wagner et al. in press).

There is little of botanical interest or concern on the project site as the majority of the site has been disturbed by agricultural activities. The proposed residential development should not have a significant negative impact on the total island populations of the species involved as they occur in similiar lowland situations throughout the islands.

Common areas such as parks could be landscaped with easy to grow, hardy, native lowland species such as wiliwili (Erythrina sandwicensis), nehe, 'alahe'e (Canthium odoratum), pa'u-o-Hi'i-'aka (Jacquemontia ovalifolia), 'ilima, native cotton or mao (Gossypium tomentosum), etc. These plants are adapted to the local environmental conditions and would require less water and maintenance.

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PLANT SPECIES CHECKLIST -- Lahaina HFDC Project

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of three groups: Ferns and Fern Allies, Monocots, and Dicots. Taxonomy and nomenclature of the Ferns and Fern Allies follow Lamoureux (1984); the flowering plants (Monocots and Dicots) are in accordance with Wagner _et al_. (in press). In most cases, common English and/or Hawaiian names given follow St. John (1973) or Porter (1972).

For each species, the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used:
   - E = endemic = native only to the Hawaiian Islands
   - I = indigenous = native to the islands and also to one or more other geographic area(s)
   - P = Polynesian = plants of early Polynesian introduction prior to Western contact (1778); not native
   - X = introduced or alien = all those plants brought to the islands intentionally or accidentally after Western contact; not native.
4. Presence (+) or absence (-) of a particular species within each of three vegetation types recognized on the project site (see text for discussion):
   - C = Cane Fields
   - G = Gulch Vegetation
   - R = Reservoir and Quarry Vegetation

Scientific Name	Common Name	Status	Vegetation Type C	G	R
FERNS AND FERN ALLIES					
ADIANTACEAE (Maiden-hair Fern Family)					
Adiantum raddianum Presl	maiden-hair fern	X	-	-	+
HEMIONITIDACEAE (Gold Fern Family)					
Pityrogramma calomelanos (L.) Link	gold fern	X	-	-	+
NEPHROLEPIDACEAE (Sword Fern Family)					
Nephrolepis multiflora (Roxb.) Jarrett ex Morton	hairy sword fern, kupukupu	X	-	-	+
POLYPODIACEAE (Common Fern Family)					
Phymatosorus scolopendria (Burm.) Pic.-Ser.	laua'e, lauwa'e	X	-	-	+
PSILOTACEAE (Psilotum Family)					
Psilotum nudum (L.) Beauv.	moa	I	-	-	+
PTERIDACEAE (Pteris Family)					
Pteris vittata L.	pteris	X	-	-	+
MONOCOTS					
ARACEAE (Philodendron Family)					
Colocasia esculenta (L.) Schott	taro, kalo	P	-	-	+
AGAVACEAE (Sisal Family)					
Furcraea foetida (L.) Haw.	Mauritius hemp	X	-	-	+
COMMELINACEAE (Spiderwort Family)					
Commelina benghalensis L.	hairy honohono	X	-	+	+
Commelina diffusa N. L. Burm.	honohono	X	+	+	+

Scientific Name	Common Name	Status	Vegetation Type C	G	R
CYPERACEAE (Sedge Family)					
Cyperus rotundus L.	nutgrass, nut sedge	X	+	-	+
MUSACEAE (Banana Family)					
Musa X paradisiaca L.	banana, maia	P	-	+	-
POACEAE (Grass Family)					
Brachiaria mutica (Forrsk.) Stapf	California grass	X	-	+	+
Brachiaria subquadripara (Trin.) Hitchc.		X	+	-	-
Cenchrus ciliaris L.	buffel grass	X	+	+	+
Cenchrus echinatus L.	common sandbur, 'ume 'alu	X	+	-	-
Chloris barbata (L.) Sw.	swollen finger grass, mau'ulei	X	+	+	+
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	+	+	+
Digitaria insularis (L.) Mez ex Ekman	sourgrass	X	-	+	+
Echinochloa colona (L.) Link	jungle rice	X	+	-	+
Echinochloa crus-galli (L.) P. Beauv.	barnyard rice	X	+	-	+
Eleusine indica (L.) Gaertn.	wire grass	X	+	-	-
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	lovegrass	X	-	+	+
Leptochloa uninervia (K. Presl.) Hitchc. & Chase	leptochloa	X	-	-	+
Melinis minutiflora P. Beauv.	molassesgrass	X	-	-	+
Panicum maximum Jacq.	Guinea grass	X	+	+	+
Paspalum dilatatum Poir.	Dallis grass	X	+	-	-
Pennisetum purpureum Schumach	elephant grass, Napier grass	X	-	+	+
Rhynchelytrum repens (Willd.) Hubb.	Natal redtop	X	+	+	+
Saccharum officinarum L.	sugar cane, ko	P	+	+	-
Setaria verticillata (L.) P. Beauv.	bristly foxtail	X	-	+	+

Scientific Name	Common Name	Status	Vegetation Type		
BUDDLEJACEAE (Butterfly Bush Family)					
Buddleia asiatica Lour.	[illegible]				
CACTACEAE (Cactus Family)					
Opuntia ficus-indica (L.) Mill.	panini, papipi				
CAPPARACEAE (Caper Family)					
Cleome gynandra L.	spider flower, honohina				
CONVOLVULACEAE (Morning-glory Family)					
Ipomoea alba L.	moon flower, koali-pehu				
Ipomoea indica (J. Burm.) Merr.	koali-'awahia				
Ipomoea obscura (L.) Ker-Gawl.	field bindweed				
Ipomoea triloba L.	little bell				
Merremia aegyptia (L.) Urban	hairy merremia, koali kua hulu				
CUCURBITACEAE (Gourd Family)					
Momordica charantia L.	wild bittermelon				
EUPHORBIACEAE (Spurge Family)					
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge				
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge				
Euphorbia heterophylla L.	[illegible]				
Ricinus communis L.	castor bean, koli				
FABACEAE (Pea Family)					
Albizia lebbeck (L.) Benth.	[illegible]				
Crotalaria pallida Aiton	[illegible]				
Desmanthus virgatus (L.) Willd.	[illegible]				
Desmodium [illegible] (Sw.) DC.	[illegible]				
Leucaena leucocephala (Lam.) de Wit	[illegible]				
Macroptilium lathyroides (L.) Urban	[illegible]				
[illegible]	[illegible]				
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	[illegible]				
Senna [illegible] (Lam.) Barn.	[illegible]				
LAMIACEAE (Mint Family)					
Leonotis nepetifolia (L.) R. Br.	[illegible]				

CORRECTION

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

Scientific Name	Common Name	Status	Vegetation Type C	G	R
DICOTS					
AMARANTHACEAE (Amaranth Family)					
Amaranthus spinosus L.	spiny amaranth, pakai kuku	X	+	+	-
APIACEAE (Carrot Family)					
Ciclospermum leptophyllum (Pers.) Sprague	fir-leaved celery	X	+	-	-
ASTERACEAE (Sunflower Family)					
Ageratum conyzoides L.	maile hohono	X	+	+	+
Bidens pilosa L.	Spanish needle, beggar's tick	X	+	+	+
Conyza canadensis (L.) Cronq.	Canada fleabane, ilioha	X	+	-	-
Eclipta alba (L.) Hassk.	false daisy	X	+	-	+
Emilia fosbergii Nicolson	Flora's paintbrush, red pualele	X	+	-	+
Lactuca serriola L.	wild lettuce	X	-	-	+
Lipochaeta aff. lavarum (Gaud.) DC	nehe	E	-	-	+
Galinsoga parviflora Cav.	galinsoga	X	-	-	+
Pluchea symphytifolia (Mill.) Gillis	pluchea	X	+	+	+
Sonchus oleraceus l.	sow thistle, pualele	X	+	+	+
Tridax procumbens L.	coat buttons	X	+	-	+
Xanthium saccharatum var. canadense (Mill.) Torr. & A. Gray	cocklebur	X	-	+	-
Zinnia peruviana (L.) L.	wild zinnia	X	-	-	+
BRASSICACEAE (Mustard Family)					
Lepidium virginicum L.	wild peppergrass	X	-	-	+
BUDDLEJACEAE (Butterfly Bush Family)					
Buddleia asiatica Lour.	dogtail, huelo 'ilio	X	+	+	-
CACTACEAE (Cactus Family)					
Opuntia ficus-indica (L.) Mill.	panini, papipi	X	-	-	+

Scientific Name	Common Name	Status	Vegetation Type C	G	R
CAPPARACEAE (Caper Family)					
Cleome gynandra L.	spider flower, honohina	X	+	-	-
CONVOLVULACEAE (Morning-glory Family)					
Ipomoea alba L.	moon flower, koali-pehu	X	-	+	+
Ipomoea indica (J. Burm.) Merr.	koali-'awania	I	-	+	+
Ipomoea obscura (L.) Ker-Gawl.	field bindweed	X	+	-	-
Ipomoea triloba L.	little bell	X	+	-	-
Merremia aegyptia (L.) Urban	hairy merremia, koali kua hulu	X?	+	+	+
CUCURBITACEAE (Gourd Family)					
Momordica charantia L.	wild bittermelon	X	+	+	+
EUPHORBIACEAE (Spurge Family)					
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge	X	+	+	+
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X	+	-	-
Euphorbia heterophylla L.		X	+	-	-
Ricinus communis L.	castor bean, koli	X	-	+	+
FABACEAE (Pea Family)					
Albizia lebbeck (L.) Benth.	Siris tree	X	-	+	+
Crotalaria pallida Aiton	rattlepod	X	+	+	+
Desmanthus virgatus (L.) Willd.	virgate mimosa	X	+	-	-
Desmodium tortuosum (Sw.) DC	Florida beggarweed	X	-	-	+
Leucaena leucocephala (Lam.) de Wit	koa-haole	X	+	+	+
Macroptilium lathyroides (L.) Urban	cow pea, wild bush bean	X	-	-	+
Pithecellobium dulce (Roxb.) Benth.	'opiuma	X	-	+	+
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe, algaroba	X	-	+	+
Samanea saman (Jacq.) Merr.	monkeypod	X	-	+	+
LAMIACEAE (Mint Family)					
Leonotis nepetifolia (L.) R. Br.	lion's-ear	X	+	+	+

Scientific Name	Common Name	Status	Vegetation Type C	G	R
LAURACEAE (Laurel Family)					
Persea americana Mill.	avocado, pear	X	-	-	+
MALVACEAE (Mallow Family)					
Abutilon gradifolium (Willd.) Sweet	hairy abutilon, mao	X	+	+	+
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X	-	+	+
Sida fallax Walp.	'ilima	I	-	+	+
Sida rhombifolia L.	Cuba jute	X	-	+	-
MYRTACEAE (Myrtle Family)					
Psidium guajava L.	guava, kuawa	X	-	+	+
Syzygium cumini (L.) Skeels	Java plum	X	+	+	+
ONAGRACEAE (Evening Primrose Family)					
Ludwigia octovalvis (Jacq.) Raven	primrose willow, kamole	P?	-	-	+
PASSIFLORACEAE (Passion Flower Family)					
Passiflora foetida L.	red-fruited passion flower, pohapoha	X	+	+	+
POLYGONACEAE (Buckwheat Family)					
Antigonon leptopus Hook. & Arnott	Mexican creeper, chain-of-hearts	X	-	-	+
PORTULACACEAE (Purslane Family)					
Portulaca oleracea L.	common purslane	X	+	+	+
Portulaca pilosa L.	'ihi	X	-	-	+
PROTEACEAE (Protea Family)					
Grevillea robusta A. Cunn. ex R. Br.	silk oak	X	-	-	+
SOLANACEAE (Nightshade Family)					
Lycopersicon pimpinellifolium (Jusl.) Mill.	wild tomato, currant tomato	X	-	-	+
Nicandra physaloides (L.) Gaertn.	apple-of-Peru	X	-	-	+
Solanum americanum Mill.	popolo	I?	+	-	-

Scientific Name	Common Name	Status	Vegetation Type C	G	R
STERCULIACEAE (Cocoa Family)					
Waltheria indica L.	'uhaloa, hi'aloa	I?	+	+	+
ZYGOPHYLLACEAE (Caltrop Family)					
Tribulus terrestris L.	puncture vine	X	+	-	-

APPENDIX G
PREDEVELOPMENT RECONNAISSANCE OF THE MARINE MACROBIOTA AND WATER QUALITY CONDITIONS AFFRONTING THE LAHAINA MASTER PLANNED PROJECT

PREDEVELOPMENT RECONNAISSANCE OF THE

MARINE MACROBIOTA AND WATER QUALITY

CONDITIONS AFFRONTING THE

LAHAINA MASTER PLANNED PROJECT

LAHAINA, MAUI

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EXECUTIVE SUMMARY

This study was undertaken to establish baseline conditions for the marine communities and water chemistry characteristics along a 2.6km section of coastline affronting a proposed development of 1100 acres at Lahaina, Maui. This development proposes to take the land out of sugar production and placing it into low and moderate income housing. Identified environmental concerns include the potential impact of changes in drainage on nearshore marine communities and water quality. Presently the project site is drained via three point sources of discharge to the shoreline; it is proposed that these remain but increase in volume capacity. Only one discharge (Kahoma Stream) was historically permanent until diversion of its waters occurred for agricultural and domestic use.

More than 195ha (480 acres) were examined in this study; this area extended from Mala Wharf on the south to an unnamed drain situated in Wahikuli State Wayside Park about 2.6km to the north and from the shoreline to the 20m isobath about 1km seaward. Three major biotopes or zones were defined in this area; the biotope of sand and Halimeda beds occupies about 85 percent of the study site and is situated offshore of the biotope of diverse high coral cover. The biotope of diverse high coral cover is located in a narrow band adjacent to shore affronting most of the study site. Along the northern extreme of the study site, the biotope of sand and low coral cover was identified.

In this area 12 stations were established to quantitatively sample pertinent water quality parameters and the marine macrobiota. The water chemistry studies show that groundwater emanates from the shoreline contributing to the elevation of certain dissolved nutrient species in the nearshore waters. Oceanic waters are low in these nutrients which results in gradients of nutrient concentrations with distance from shore. Despite these inputs, the waters affronting the project site are typical of well flushed, open coasts. Using the Department of Health "wet" water quality criteria which apply to this coastline, the concentrations of measured chemical parameters show that the quality of waters easily meet state standards during periods of no surface runoff with the exception of chlorophyll-a. High chlorophyll-a values are probably a response of high nutrient groundwater inputs to the system.

The biological studies found a rather depauperate fauna and flora in the biotope of sand and Halimeda beds. Interestingly, a green alga *Cladophora* sp. has very recently become very common in the offshore waters below depths of 6m and greater in the study site. In shallower water this alga appears primarily as unat-

tached thalli that have been rafted in by waves and currents. The abundance of this alga well offshore suggests that the mechanism(s) responsible for its success are not directly derived from inputs from land (as via runoff, etc.). It is suspected that this widespread "outbreak" of Cladophora may be a natural event. This algal bloom has also been reported from Puako on the West Hawaii coast, further suggesting a nautral event.

In shallower water adjacent to shore is found a diverse assemblage of fishes and corals; these occur in a rather narrow band affronting much of the shoreline. These communities are situated adjacent to shoreline point source discharges for storm water runoff. Major storm events occur about once every 6 years in the Lahaina area. Under present conditions of occasional storm water discharge (with sediment) and probable near-constant groundwater input, these communities have persisted and appear to be stable.

The proposed development will increase the potential for runoff volume but project design as well as the ongoing Corps of Engineers flood control project for Kahoma Stream should lessen the sediment load reaching the sea during periods of runoff. Barring any major storm event occurring when large areas of the project site are under construction and the soil exposed to erosion, the proposed development should not greatly impact nearshore marine communities by large increases in sedimentation.

INTRODUCTION

The Hawaii State Housing Finance Development Corporation (HFDC) is proposing to develop a planned residential community at Wahikuli, Lahaina, Maui on about 1,100 acres of land most of which is now in sugarcane production. This parcel lies to the east and mauka of the Lahaina Civic Center and when completed, will have approximately 3,900 units the majority of which will be in the affordable range. The project site lies mauka of Honoapiilani Highway; along much of the makai side of the highway is the shoreline. Thus, drainage and storm water runoff from the site directly enters the sea.

A consideration in the proposed development is the potential for impact with changes in the patterns of use and drainage to the marine communities and water quality of nearshore waters affronting the project site. Presently, much of the proposed site is in cane production. Sugar is also cultivated on the slopes above the project area. Along the north boundary of the project site is a small gully; storm water runoff from this gully crosses Honoapiilani Highway through a 48 inch culvert. The capacity of this culvert is estimated to be 70 cfs. Kahoma Stream serves as the southern boundary to the project site. Pioneer Mill Co. maintains two large irrigation reserviors at the southeast corner of the site adjacent to Kahoma Stream; these are part of the existing drainage system. Two additional gullies bisect the project site and these converge south of the Lahaina Civic Center where storm water runoff is conveyed across Honoapiilani Highway to the ocean via three 48 inch culverts. The estimated combined capacity of the triple culvert system is 210 cfs. Unemori Engineering, Inc. (1989) has determined that under conditions where 50 percent of the cane fields in the project site are in a harvested mode, the onsite runoff for a 100 year recurrence interval storm is 2,130 cfs. Offsite runoff from the mauka lands is calculated to be 1,778 cfs.

Although a number of studies have been carried out with respect to a variety of construction projects in the Lahaina area since the early 1960's (e.g., Lahaina seawall improvements, the Lahaina wastewater treatment plant, and the Kahoma Stream flood control project), there is a credible lack of quantitative information on the marine communities and water quality characteristics for the nearshore waters affronting Lahaina. Environmental Consultants, Inc (1976) presented information on the marine communities south of Lahaina for the possible development of a small-boat harhor; Brock and Norris (1987) described the marine communities in a small area offshore of Mala Wharf to be used in conjunction with a submarine dive tour operation and Brock (1987a, 1988a, 1988b) studied the nearshore area affronting Launiupoko for the potential development of a marina. None of these studies spatially or temporally overlap with the nearshore waters affronting the proposed HFDC development.

This study was undertaken (1) to provide quantitative baseline information on the marine communities and water quality characteristics in the area from Mala Wharf on the south to the unnamed 48 inch culvert approximately 2.6km to the north at Wahikuli and (2) to determine the potential for impact to these communities and nearshore waters with the proposed development. The most probable source of impacts would come through changes in the drainage system and thus storm water runoff to these nearshore waters.

MATERIALS AND METHODS

A. BENTHIC SURVEYS

The fieldwork which provided the database for this baseline study of the marine macrobiota offshore of the Lahaina project site was conducted on 27-28 September 1989. The area encompassed in this survey is given in Figure 1; it includes the nearshore region from the shore, seaward to approximately the 20m isobath over a kilometer from shore and is bordered by Mala Wharf on the south and an unnamed drain about 2.6km to the north at Wahikuli State Wayside Park.

The quantitative sampling of macrofauna of marine communities presents a number of problems; many of these are related to the scale on which one wishes to quantitatively enumerate organism abundance. Marine communities in the Lahaina region may be spatially defined in a range on the order of a few hundred square centimeters (such as the community residing in a *Pocillopora meandrina* coral head) to major biotopes covering many hectares. Recognizing this ecological characteristic, we designed a sampling program that attempted to delineate all major extant communities in the limits of the study area and to quantitatively describe these communities. Thus, a number of methods were used.

To obtain an overall perspective on the extent of the major communities or "zones" occurring in the study area, divers were slowly towed behind a skiff over most of the study site from shore seaward to the 20m isobath (the outer limits for this study). This exercise allowed the qualitative delineation of major biotopes based partially on large structural elements (e.g., amount of sand, hard substratum, fish abundance, coral coverage or dominant coral species). Within each of these a number of stations were established and quantitative studies were conducted, including visual enumeration of fish, counts along benthic transect lines and cover estimates in benthic quadrats. Besides these quantitative measures, a qualitative reconnaissance was made in the vicinity of each station by swimming and noting the presence of species not encountered in the transects. All assessments were carried out using SCUBA.

The location of stations were subjectively chosen as being representative of a given biotope and were also selected as to coincide with existing discharge points for storm water runoff from the hinterland. Immediately following site selection, a visual fish census was undertaken to estimate the abundance and biomass of fishes. These censuses were conducted over a 25 x 4m corridor and all fishes within this area to the water's surface were counted. Data collected included species, numbers of in-

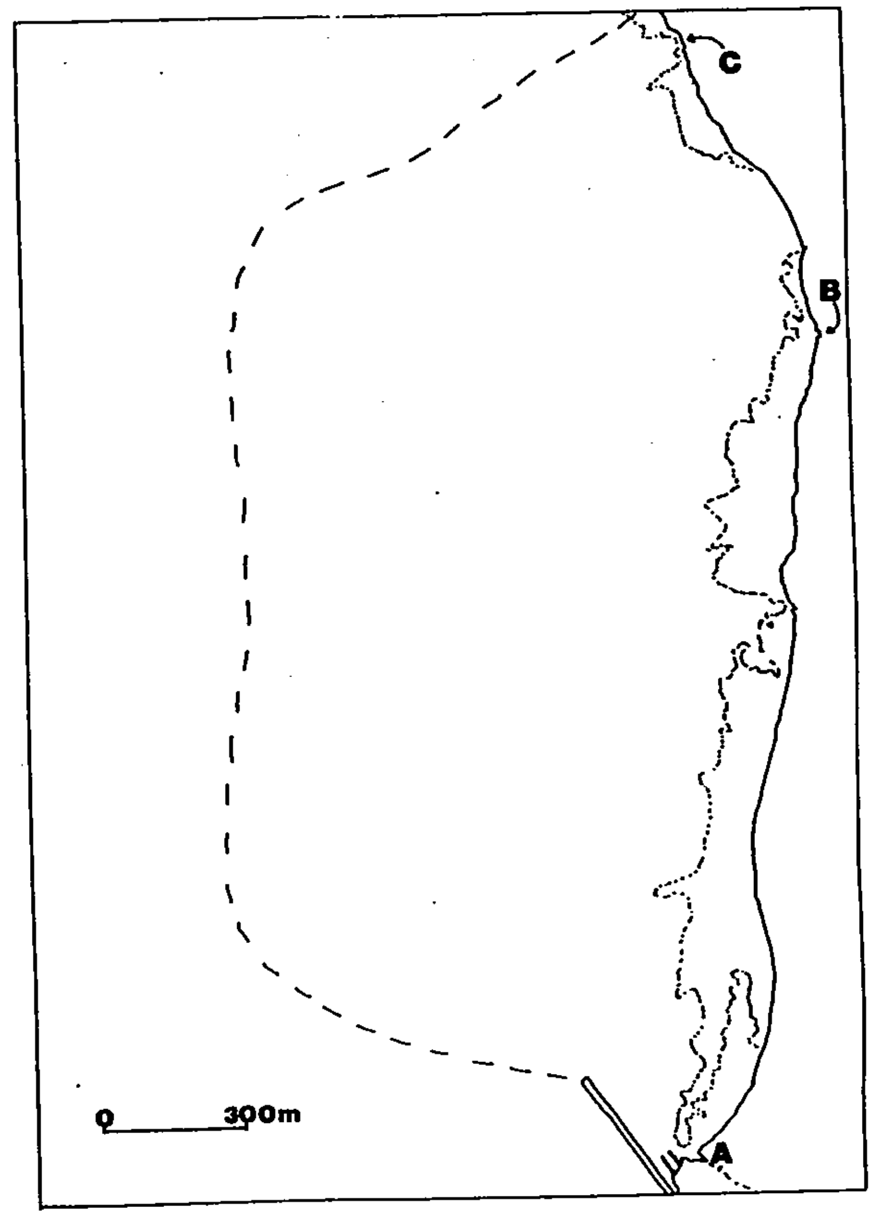

FIGURE 1. Line map of the shoreline area affronting the HFDC project site depicting the boundaries of the study area (dashed line). Shown also are the major point sources of discharge: A = Kahoma Stream, B = the triple 48 inch culvert just south of the Lahaina Civic Center and C = the single 48 inch culvert about 250m north of the Civic Center.

ice and subsequently frozen until analysis. Analyses for ammonium, nitrate + nitrite and orthophosphate were carried out using standard techniques; inorganic and total (after oxidation) nutrient analyses were determined using manual spectrophotometric techniques on a fiber optic colorimeter. All samples were collected and measured in triplicate; data are presented as means. The analytical procedures followed those as given in Standard Methods (1985) with modifications according to Stickland and Parsons (1972).

Turbidity samples were collected as unfiltered water and stored on ice in 250ml polyethylene bottles until measurements were made. Turbidity was measured on a Monitek Laboratory Nephelometer following the procedures as described in Standard Methods (1985). The instrument was calibrated as specified by the Environmental Protection Agency with standard formazin solutions prior to and after sample measurements. Prior to measurement, samples were throughly mixed to disperse particulate materials and measured in duplicate when all air bubbles disappeared.

Chlorophyll-a samples were collected by filtering known volumes of seawater through glass microfiber filters; filters were stored in acetone and the samples frozen until laboratory analyses were carried out. Laboratory procedures followed Standard Methods (1985) and pigments were extracted and determined fluorometrically. Salinity samples were collected in 250ml polyethylene bottles in the field, filled completely and capped tightly until measurement by tritration (EPA method 325.3) in the laboratory.

FIGURE 2. Line map of the shoreline area affronting the HFDC project site showing the locations of the the stations. Quantitative biological sampling was carried out at Station Numbers 1, 2, 3, 4, 5, 7, 8, 9 and 12; water chemistry sampling was done at the first 11 stations. Letters A, B and C show the locations of the 3 point sources of storm water discharge.

dividuals and their estimated lengths; these data were later converted to standing crop estimates using linear regression techniques. A single diver equipped with SCUBA, transect line, slate and pencil would enter the water, count and note all fishes in the prescribed area (method modified from Brock 1954). The 25m transect line was paid out as the census progressed, thereby avoiding any previous underwater activity in the area which could frighten wary fishes.

Fish abundance and diversity is often related to small-scale topographical relief over short linear distances. A long transect may bisect a number of topographical features (e.g., cross coral mounds, sand flats, and algal beds), thus sampling more than one community and obscuring distinctive features of individual communities. To alleviate this problem, a short transect (25m in length) has proven adequate in sampling many Hawaiian benthic communities (Brock and Norris 1989).

Besides frightening wary fishes, other problems with the visual census technique include the underestimation of cryptic species such as moray eels (family Muraenidae) and nocturnal species, e.g., squirrelfishes (family Holocentridae), aweoweos or bigeyes (family Priacanthidae), etc. This problem is compounded in areas of high relief and coral coverage affording numerous shelter sites. Species lists and abundance estimates are more accurate for areas of low relief, although some fishes with cryptic habits or protective coloration (e.g., the nohus, family Scorpaenidae; the flatfishes, family Bothidae) might still be missed. Obviously, the effectiveness of the visual census technique is reduced in turbid water and species of fishes which move quickly and/or are very numerous may be difficult to count and to estimate sizes. Additionally, bias related to the experience of the diver conducting counts should be considered in making any comparisons between surveys. In spite of these drawbacks, the visual census technique probably provides the most accurate non-destructive method available for the assessment of diurnally active fishes (Brock 1982).

After the assessment of fishes, an enumeration of epibenthic invertebrates (excluding corals) was undertaken using the same transect line as established for fishes. Exposed invertebrates usually greater than 2cm in some dimension (without disturbing the substratum) were censused in a 25 x 4m area. As with the fish census technique, this sampling methodology is quantitative for only a few invertebrate groups, e.g., some of the echinoderms and holothurians. Most coral reef invertebrates (other than corals) are cryptic or nocturnal in their habits making accurate assessment of them in areas of topographical complexity very difficult. This, coupled with the fact that the majority of these cryptic invertebrates are small, necessitates the use of methodologies that are beyond the scope of this survey (e.g., see Brock and Brock 1977). Recognizing constraints on time and the

scope of this survey, the invertebrate censusing technique used here attempted only to assess those few macroinvertebrate species that are diurnally exposed.

Exposed sessile benthic forms such as corals and macrothalloid algae were quantitatively surveyed by use of quadrats and the point-intersect method. The point-intersect technique only notes the species of organism or substratum type directly under a point. Along the previously set fish transect line, 50 such points were assessed (once every 50cm). These data have been converted to percentages. Quadrat sampling consisted of recording benthic organisms, algae and substratum type present as a percent cover in six one-meter square frames placed at five-meter intervals along the transect line established for fish censusing (at 0, 5, 10, 15, 20 and 25m).

If macrothalloid algae were encountered in the 1 x 1m quadrats or under one of the 50 points, they were quantitatively recorded as percent cover. Emphasis was placed on those species that are visually dominant and no attempt was made to quantitatively assess the multitude of microalgal species that constitute the "algal turf" so characteristic of many coral reef habitats.

During the course of the fieldwork, notes were taken on the number, size and location of green sea turtles seen within the study area. Additionally, records were kept on recreational use patterns as observed within the study area while carrying out other field studies. Further information on recreational use and the presence of green turtles was obtained by questioning knowledgeable people in the Lahaina area.

B. WATER CHEMISTRY STUDIES

Water quality parameters were measured at eight locations (Station numbers 1, 2, 3, 4, 5, 7, 8 and 9) both at the surface (actually, about 20cm below the surface) and at depth (approximately 1.5m from the seafloor). At three additional sites these parameters were measured at the surface only (Stations 6, 10 and 11). The locations of these stations are given in Figure 2. Water quality parameters that were evaluated are specific criteria designated for "open coastal waters" in Title 11, Chapter 54, Amended Administrative Rules for Water Quality Standards. These criteria include ammonia nitrogen, nitrate + nitrite nitrogen, total nitrogen, orthophosphate phosphorus, total phosphorus, chlorophyll-*a* and nephelometric turbidity. Also collected were samples for the non-specific criteria, salinity as well as the nutrient, silica at each station.

Water samples for nutrient analyses were taken in 125ml acid-washed polyethylene bottles. These samples were filtered through glass fiber filters in the field, immediately placed on

CORRECTION

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

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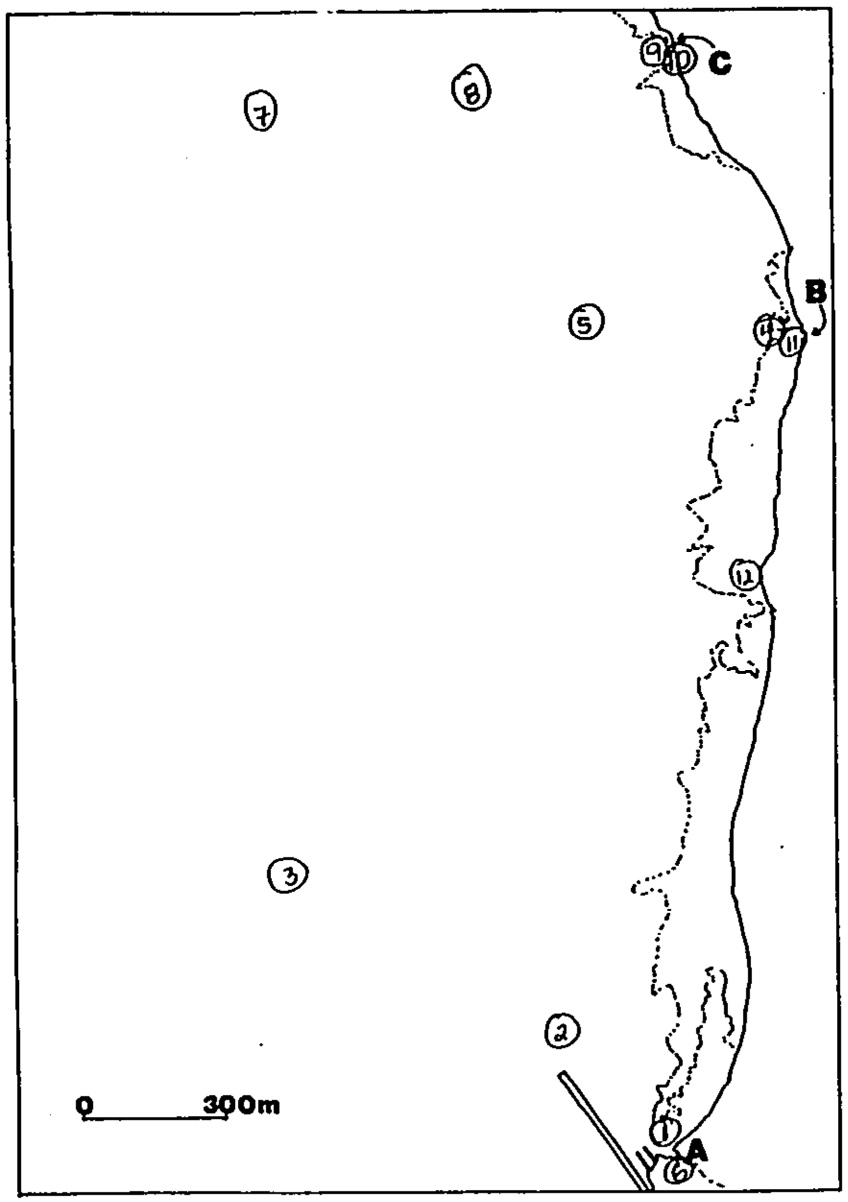


RESULTS

WATER CHEMISTRY

Six water quality parameters specified by the State Department of Health (DOH) Water Quality Standards were measured at the surface and approximately 1.5m from the bottom at each of 8 locations (Station numbers 1, 2, 3, 4, 5, 7, 8 and 9); at 3 additional sites (Station numbers 6, 10 and 11) these parameters were assessed at the surface only because of shallow water (less than 1.5m deep). The station locations are shown in Figure 2. The waters affronting the project site are classified as open coastal waters by the state (Chapter 11-54) and the standards for the measured parameters are given in Table 1 for comparative purposes.

Table 2 presents a synopsis of the water chemistry parameters measured in this study. There are several trends apparent in these data: (1) the concentrations of dissolved nutrients (orthophosphate, nitrate + nitrite and silicates) show an inverse relationship with distance from shore; (2) the concentration of these nutrients show a similar trend with respect to depth and (3) salinity displays an increase with distance from shore as well as with depth. Thus stations further from shore and deeper samples have lower nutrient concentrations than do stations near shore and from the surface. These gradients are related to the probable diffuse input of groundwater along the shoreline with relatively high concentrations of these nutrient species. Both silica and nitrates (NO_3+NO_2) usually exist in high concentration in groundwater owing to metabolism of organic material and mineral dissolution; these ions are in low concentration in open ocean waters and hence they (along with salinity) act as tracers for groundwater input into oceanic settings.

Because effluxing groundwater with little in the way of dissolved salts is less dense than seawater, the groundwater on entering the sea tends to lie on the surface until physical mixing occurs. This low salinity water high in nitrates and silicates is evident in the surface samples from Stations 4, 10 and 11. Station 4 was established about 25m from shore affronting the triple 48 inch culvert just south of the Lahaina Civic Center. Station 11 was at the same site but about 5m from the beach and Station 10 was about 3m offshore of the single 48 inch culvert. A comparison of the silicate and nitrate data from these and other more seaward stations show the mixing and uptake of these elements that occurs with distance from land. These declines with distance are shown for silicate, nitrate and orthophosphate in Figures 3, 4 and 5.

TABLE 1. Specific criteria specified by the Department of Health water quality standards for open coastal waters as amended in 1988.

Parameter	Geometric mean not to exceed the given value	Not to exceed the given value more than 10% of the time	Not to exceed the given value
Total Nitrogen (ug N/L)	150.00* 110.00**	250.00* 180.00**	350.00* 250.00**
Ammonia Nitrogen (ug NH_4-N/L)	3.50* 2.00**	8.50* 5.00**	15.00* 9.00**
Nitrate+Nitrite Nitrogen (ug[NO_3+NO_2]-N/L)	5.00* 3.50**	14.00* 10.00**	25.00* 20.00**
Total Phosphorus (ug P/L)	20.00* 16.00**	40.00* 30.00**	60.00* 45.00**
Chlorophyll-a (ug/L)	0.30* 0.15**	0.90* 0.50**	1.75* 1.00**
Turbidity (NTU)	0.50* 0.20**	1.25* 0.50**	2.00* 1.00**

* "Wet" criteria apply when the open coastal waters receive more than three million gallons per day of fresh water discharge per shoreline mile.

** "Dry" criteria apply when the open coastal waters receive less than three million gallons per day of fresh water discharge per shoreline mile.

Applicable to both "wet" and "dry" conditions:

Salinity - Shall not vary more than 10 percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

Orthophosphate was eliminated from the list of requirements in the revised 1988 document but because of its biological importance, it was measured in this study. The old "wet criteria was 7.00ug/L and "dry" standard was 5.00ug/L.

TABLE 2. Summary of the water quality parameters as measured at 10 sites in the study area. Surface samples are denoted with an "S" and bottom samples with a "B". In the body of the table concentrations of dissolved nutrients given in ug/L. Underlined geometric means are equal to or are in excess of Department of Health water quality standards. Table continued on next page.

Station	Nitrate N	Ammonia N	Total N	Ortho-P	Total P	Silicates
1-S	3.78	1.12	72.24	4.96	11.78	155.68
1-B	1.68	0.56	59.92	4.34	10.23	39.76
2-S	9.10	2.80	81.48	4.96	9.92	170.80
2-B	1.26	0	68.18	3.41	9.92	11.48
3-S	1.26	1.68	73.22	4.03	8.99	174.44
3-B	0.28	0.84	76.58	4.03	8.99	34.16
4-S	14.00	3.92	91.28	6.51	10.23	330.12
4-B	1.68	0	64.96	3.72	8.99	30.24
5-S	3.64	1.12	64.40	4.34	10.23	79.80
5-B	1.26	0.84	58.94	4.03	9.61	22.68
7-S	1.40	0.98	67.20	3.72	32.86	45.64
7-B	1.26	0	56.84	3.10	8.68	22.96
8-S	1.26	0.56	61.74	3.72	8.68	28.56
8-B	0.84	0	60.06	4.34	8.99	28.56
9-S	39.20	2.10	119.42	5.89	9.61	468.44
9-B	5.32	0.70	66.64	4.03	12.09	245.56
10-S	126.98	3.50	203.28	7.75	9.61	1148.28
11-S	44.38	1.82	106.54	8.06	8.68	879.76
GEOMETRIC MEANS	3.50	1.24	76.15	4.55	10.35	90.81

TABLE 2 CONTINUED ON FOLLOWING PAGE.

TABLE 2. Continued.

Station	Turbidity (NTU)	Chlorophyll-a (ug/L)	Salinity ($^{o}/oo$)
1-S	0.07	0.24	36.1
1-B	0.06	0.31	36.1
2-S	0.08	0.30	35.8
2-B	0.04	0.29	36.1
3-S	0.05	0.29	36.5
3-B	0.06	0.32	36.5
4-S	0.08	0.30	35.8
4-B	0.05	0.42	36.1
5-S	0.06	0.31	35.8
5-B	0.05	0.33	35.8
7-S	0.05	0.31	35.8
7-B	0.04	0.28	36.1
8-S	0.05	0.27	35.8
8-B	0.05	0.30	35.8
9-S	0.09	0.54	35.0
9-B	0.05	0.36	35.8
10-S	0.09	1.13	35.4
11-S	0.91	1.67	34.3
GEOMETRIC MEANS	0.07	0.37	35.8

FIGURE 3. Plot of silicate (Si) concentrations (in uM) against distance from shore for surface samples at 10 locations affronting the HFDC project site, Lahaina.

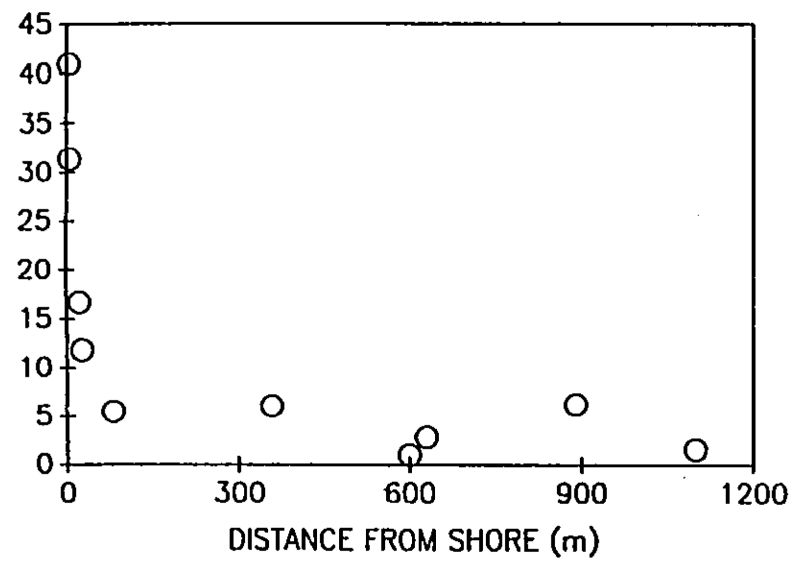


FIGURE 4. Plot of nitrate (NO_3+NO_2) nitrogen concentrations (in uM) against distance from shore for surface samples at 10 locations affronting the HFDC project site, Lahaina.

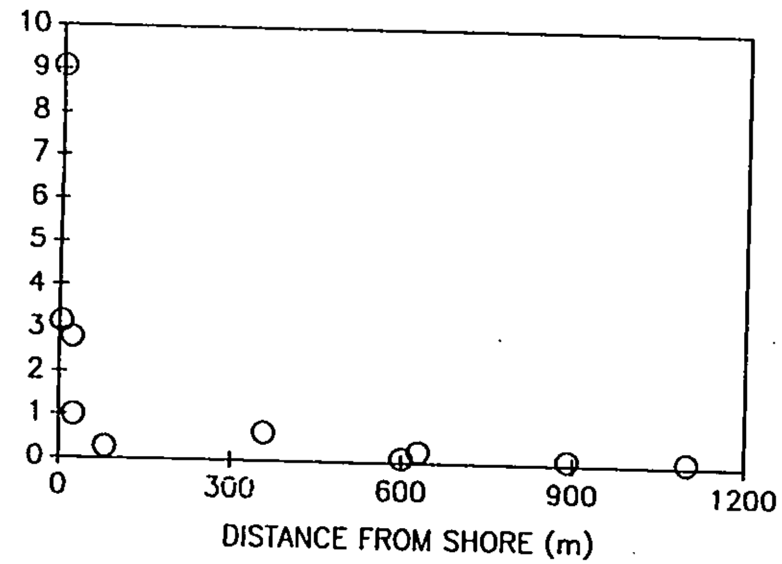
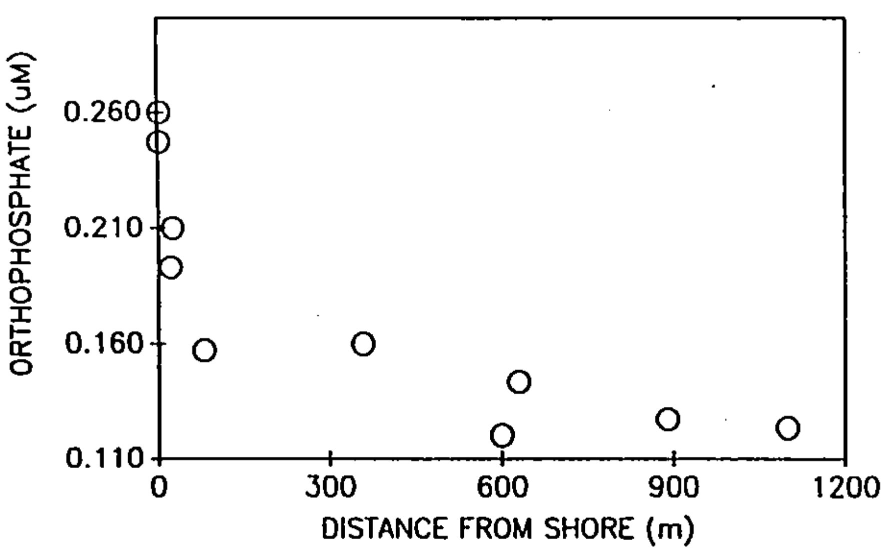


FIGURE 5. Plot of orthophosphate (PO_4) concentrations (in uM) against distance from shore for surface samples at 10 locations affronting the HFDC project site, Lahaina.

G-12



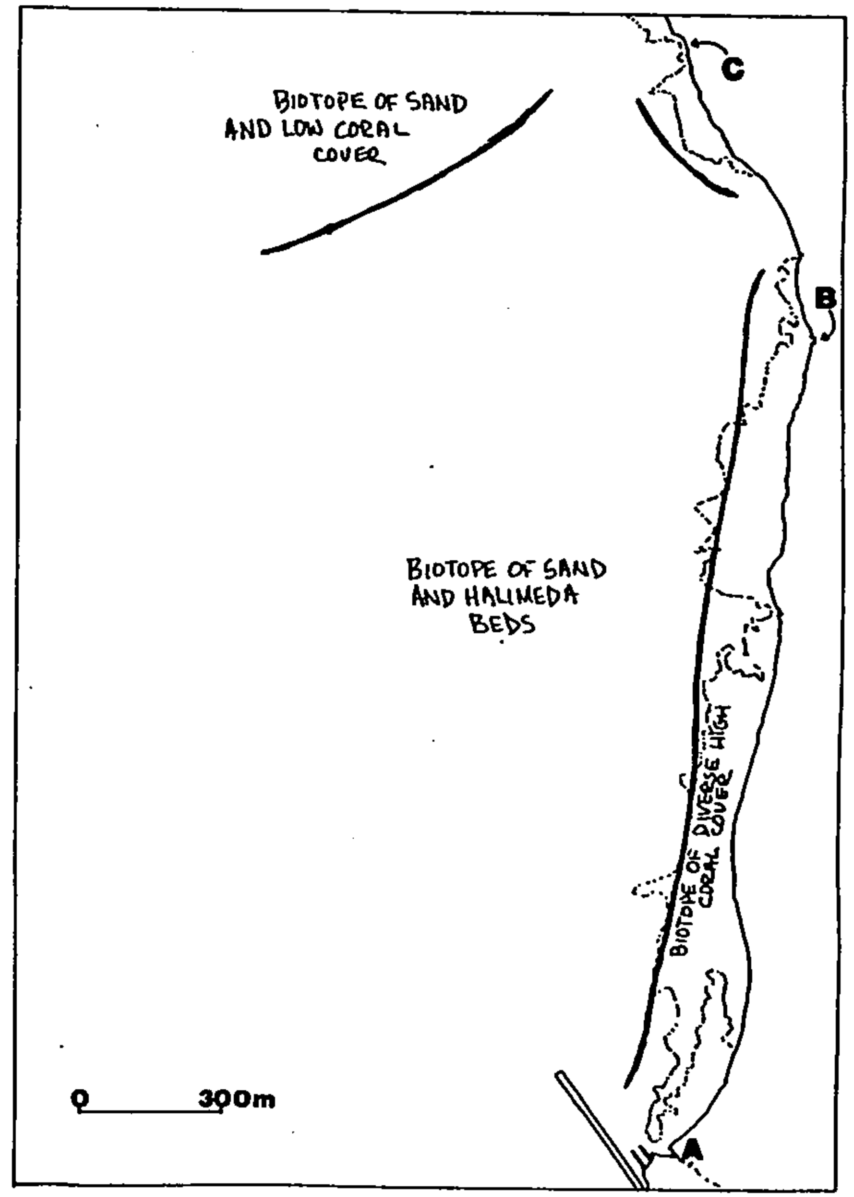
Due to diversion, Kahoma Stream in its lower reaches is intermittent and only flows following rain (the other two drains to the north are also intermittent and were similarly dry at the time of sampling). Presently the Corps of Engineers flood control project for Kahoma Stream is underway. At the seaward end of the project, a dam of boulders had been established to control possible flow of terrigenous material into the ocean following a rain. Behind the dam of boulders and soil was a brackish water pond about 25m in longest dimension and about 30cm in depth at the time of our field survey. This pool had a soft mud bottom (mud about 80cm deep), appeared to be stagnant and of low water quality. A sampling station was established in this pool to determine the chemical composition of the water. Concentrations of measured parameters (means) were as follows: nitrate nitrogen (NO_3+NO_2) = 0.42ug/L, ammonia nitrogen (NH_4) = 4.90ug/L, total nitrogen = 337.96ug/L, orthophosphate (PO_4) = 7.44ug/L, total phosphate = 32.86ug/L, silicate (Si) = 3,452.40ug/L, turbidity = 2.55 NTU, chlorophyll-a = 31.1ug/L and salinity = 15.2$_o$/oo. The ammonia nitrogen, total nitrogen, total phosphorus, chlorophyll-a and turbidity exceed state water quality standards. Station 6 was not included in the calculation of geometric means because it does not sample "open coastal water" and is not representative of anything but an isolated stagnant pool.

BIOLOGICAL

The qualitative reconnaissance to define major biotopes affronting the Lahaina Master Planned Project site extended from the shoreline to the 20m isobath more than a kilometer offshore and from Mala Wharf on the south to the unnamed drain approximately 2.6km to the north (Figure 1). In total more than 195ha (480 acres) were surveyed in this effort and three biotopes were recognized. The physical extent of each is shown in Figure 6. It should be noted that the boundaries of each zone are not sharp but rather grade from one to another; these are ecotones or zones of transition. Biotopes were delimited by physical characteristics including water depth, relative exposure to wave and current action, and the major structural components present in the benthic communities. The latter include the amount of sand, hard substratum, and vertical relief present as well as the biological attributes of relative coral coverage, fish abundance, and dominant species of the coral community. Biotopes were named for distinctive features of each as shown in Figure 6.

The biotope of diverse high coral cover parallels the shore and is adjacent to it, not extending for more than 200m from the beach. This biotope occurs as a near-continuous feature along the shoreline, occasionally broken by the continuation of sand from offshore areas to the shore where the latter forms small

FIGURE 6. Line map of the shoreline area affronting the HFDC project site showing the approximate boundaries of the three biotopes defined in this study. These biotopes are the biotope of diverse high coral cover which is adjacent to shore, the biotope of sand and Halimeda beds which lies offshore and the biotope of sand and low coral cover on the northern extreme of the project site. Also shown are the 3 point sources of storm water discharge (A, B and C).



beaches. The biotope of diverse high coral coverage is situated on a mix of basalt boulders and limestone bench that affronts much of the project site. A diverse, high coverage coral community occurs on this stable substratum; related to the cover afforded by the boulders and coral is a rich assemblage of fishes. Quantitative stations 1, 4, 9 and 12 sampled the communities in this biotope.

Seaward of the biotope of diverse high coral coverage is the biotope of sand and Halimeda beds. The biotope of sand and Halimeda beds continues seaward beyond the offshore boundary of this study; fully 85 percent of the study area is situated in the biotope of sand and Halimeda beds. As the name implies, this biotope is dominated by sand with beds of the alga, Halimeda opuntia. In some areas, these beds may cover a hectare or more, thus can be quite extensive. Quantitative station numbers 2, 3 and 5 sampled this biotope.

On the northern extreme of the study site is the biotope of sand and low coral cover. This biotope occurs from depths of 4 to greater than 20m (the outer limit of this study). The substratum in the biotope of sand and low coral cover is dominated by sand and rubble; occasional areas of emergent limestone occur on which are found a number of coral species with mean coverage less than 5 percent. Quantitative station numbers 7 and 8 sampled this biotope.

The quantitative stations were selected to be representative of a given biotope; they were also established to describe the extant water quality conditions and thus were placed to take advantage of possible gradients in water quality characteristics that might occur with the three identified point sources for runoff from the project site (i.e., Kahoma Stream, the triple 48 inch culvert just south of the Lahaina Civic Center, and the single 48 inch drain north of the Civic Center). The locations of all sampling sites are given in Figure 2 and the results of the biological inventory of these biotopes are presented below.

The Biotope of Sand and Halimeda Beds

The biotope of sand and Halimeda beds is present over more than 85 percent of the entire study site. Characteristic of this biotope is the presence of a sand substratum; Halimeda beds occur on scales of 10 x 20m to over a hectare in size. These beds are spaced from 10 to more than 100m apart. Much of this biotope is exposed to strong currents that move approximately parallel to shore and appear to reverse themselves with the change of tide. These currents may exceed speeds in excess of 0.5m/sec as measured on both 27 and 28 September 1989.

Halimeda opuntia is usually greater than 10cm in height and the spacing between individual plants may provide coverage from

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15 to 100 percent over scales of many square meters. In most areas, the Halimeda has as an epiphyte, Cladophora sp. either growing attached to it or just entangled in the branches. The water column at these more offshore stations is often filled with broken Cladophora sp. pieces (up to 30cm in length) drifting with the current; many of these loose peices must become entangled with the Halimeda opuntia.

There is little cover for fishes in the biotope of sand and Halimeda beds and few fishes are seen. Common species include juvenile malu and nabeta as well as two small wrasse species. Exposed macroinvertebrates other than echinoderms (e.g., here sea urchins) are not common. Macroinvertebrate species occasionally seen include the black sea urchin (Tripneustes gratilla) and the oak cone (Conus quercinus).

Three stations (Numbers 2, 3 and 5) sampled this biotope. Station 2 was situated about 80m northwest of the seaward end of Mala Wharf (about 160m seaward of Kahoma Stream mouth) in about 10m of water. Sand is the dominant substratum type and Halimeda opuntia covers about 30 percent of the substratum. Table 3 presents a summary of the benthic survey carried out at Station 2. No corals were encountered in the quadrat survey, rather 7 species of algae comprised an average cover of 35 percent. The most common species were Halimeda opuntia and Cladophora sp. Six macroinvertebrate species were censused in the 4 x 25m area; the most abundant were the green sea urchin (Echinometra mathaei) and the black sea urchin (Tripneustes gratilla). Five species of fishes (8 individuals) were censused and the most common was the wrasse (Cheilinus bimaculatus). The standing crop of fishes present at Station 2 was estimated to be 9g/m^2. The results of the fish census is presented in Appendix 1.

In the vicinity of Station 2 were seen the alga, Velonia ventricosa, corals (Porites lobata, P. compressa, Montipora verrucosa, Pavona varians and Pocillopora meandrina), the pearl osyter (Pinctada galtsoffi), shrimp (Saron marmoratus), polychaete (Loimia medusa), moa (Ostracion meleagris), 'upapalu (Apogon kallopterus), 'oili'uwi'uwi (Pervagor spilosoma), hover goby (Pterelotris heteropterus), pao'o kauila (Exallis brevis), hinalea lau'wili (Thalassoma duperrey), lau'ipala (Zebrasoma flavescens), kihikihi (Zanclus cornutus), malu (Parupeneus pleurostigma), moano (P. multifasciatus), wrasse (Pseudojuloides cerasinus), pili'koa (Cirrhitops fasciatus), cornet fish (Fistularia commersoni), butterfly fish (Heniochus acuminatus) and damselfishes (Chromis vanderbilti, Dascyllus albisella and Plectroglyphidodon johnstonianus). Most of the fishes and corals were found aggregated around a one-meter diameter colony of Porites lobata which is uncommon in this biotope.

Station 3 was established about 890m offshore of Kahoma Stream (610m seaward of Mala Wharf) in the biotope of sand and

TABLE 3. Summary of the benthic survey conducted at Station 2 approximately 358m offshore of Kahoma Stream mouth at Lahaina, Maui in the biotope of sand and Halimeda flats on 27 September 1989. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth from 10.4m; mean coral coverage is 0 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 0m	5m	10m	15m	20m	25m
Algae						
Cladophora sp.	4	2	17	24	14	19
Gracilaria bursapastoris	0.5			0.1		
Padina japonica		0.1				
Neomeris annulata				0.1	0.1	
Halimeda opuntia		0.1	27	38	33	30
Jania sp.					1	
Dictyota acutiloba				0.1		
Sand	33.5	66.8	47	33.7	44.9	46.5
Rubble	62	31	9	4	7	4.5

B. 50-Point Analysis

Species	Percent of the Total
Algae	
Cladophora sp.	8
Halimeda opuntia	16
Sand	50
Rubble	26

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mollusca	
Conus quercinus	1
Spondylus tenebrosus	2
Phylum Arthropoda	
Aniculus strigatus	1
Phylum Echinodermata	
Pseudoboletia indiana	1
Tripneustes gratilla	6
Echinometra mathaei	7

TABLE 3. Continued.

D. Fish Census (4 x 25m)

5 Species
8 Individuals

Halimeda beds at a depth of 21m. The substratum at this station is comprised of sand with large areas (several hundred square meters) of *Halimeda opuntia*; there was little other topographical relief present. The results of the benthic survey are presented in Table 4 and the fish census results are given in Appendix 1. No corals were encountered in the quadrat sampling and algae comprised a mean coverage of 72 percent. Dominant algal species were *Halimeda opuntia* and *Cladophora* sp. Few exposed macro-invertebrates were seen; amongst those were the egg cases of the sand dwelling polychaete, *Arenicola brasiliensis*. In the fish census, 5 species were encountered (12 individuals) and the most common was the wrasse, *Cheilinus bimaculatus*. The biomass of fishes present was estimated to be about $3g/m^2$. In the vicinity of Station 3 were seen the moano (*Parupeneus multifasciatus*) and the alga, *Neomeris annulata*.

Station 5 was established about 630m seaward of the triple 48 inch culvert situated just south of the Lahaina Civic Center in the biotope of sand and Halimeda beds at a depth of 9.8m. The substratum at this station is sand with beds of *Halimeda opuntia*; these beds range in size from 3 x 20m to well over 100 x 100m in extent. The spacing between the Halimeda patches ranges from 5 to 40m. Table 5 presents the results of the benthic survey conducted at Station 5. No corals were encountered either in the quadrat survey area or outside of it; likewise no fish were seen. The dominant species present was *Halimeda opuntia* which had a mean estimated cover of 24.5 percent. Macroinvertebrates encountered in the study area include the oak cone (*Conus quercinus*) and the he'e or octopus (*Octopus cynaea*). In the vicinity of Station 5 were seen colonies of the sponge (*Tethya* sp.), the auger shell (*Terebra maculata*) and the alga, *Liagora maxima*.

The Biotope of Sand and Low Coral Cover

The biotope of sand and low coral cover occurs along the northern boundary of the study site and on to some unknown distance to the north (outside of the boundary of this study). This biotope commences in shallow water (4m) and is a continuous feature to at least the 20m isobath. The substratum in the biotope of sand and low coral cover is dominated by sand and rubble; there are occasional areas of emergent hard substratum on which corals are seen. Common species of corals seen in this biotope include *Porites lobata*, *Pocillopora meandrina* and more infrequently, *Pocillopora eydouxi*. Common algae include the ubiquitous *Halimeda opuntia* and *Cladophora* sp. Where cover is sufficient a number of fish species may be encountered including the wrasse (*Cheilinus bimaculatus*), na'ena'e (*Acanthurus olivaceus*) and juvenile malu (*Parupeneus pleurostigma*). Two stations (numbers 7 and 8) sampled the biotope of sand and low coral cover.

Station 7 was established about 1.1km from shore affronting

TABLE 4. Summary of the benthic survey conducted at Station 3 approximately 890m offshore of Kahoma Stream mouth at Lahaina, Maui in the biotope of sand and Halimeda flats on 27 September 1989. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 20.7m; mean coral coverage is 0 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 0m	5m	10m	15m	20m	25m
Algae						
Halimeda opuntia	65	42	31	42	61	58
Cladophora sp.	14	18	25	12	30	33
Champia sp.		1				
Sand	21	39	44	46	9	9

B. 50-Point Analysis

Species	Percent of the Total
Algae	
Halimeda opuntia	35
Cladophora sp.	10
Sand	55

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Annelida	
Arenicola brasiliensis (egg cases)	3
Phylum Echinodermata	
Tripneustes gratilla	3

D. Fish Census (4 x 25m)

5 Species
12 Indviduals

TABLE 5. Summary of the benthic survey conducted at Station 5 approximately 630m offshore of the terminus of the triple 48 inch culvert just south of the Lahaina Civic Center at Lahaina, Maui in the biotope of sand and Halimeda flats on 27 September 1989. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 9.8m; mean coral coverage is 0 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 0m	5m	10m	15m	20m	25m
Algae						
Halimeda opuntia	40	28			51	28
Jania sp.	1	1.7			0.5	0.5
Topyplocladia glomerulata					0.25	0.25
Cladophora sp.	12	14			7	6
Sand	47	56.3	100	100	41.25	65.25

B. 50-Point Analysis

Species	Percent of the Total
Algae	
Halimeda opuntia	8
Sand	92

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mollusca	
Octopus cynaea	1
Conus quercinus	1

D. Fish Census (4 x 25m)

No Fish Encountered

the single 48 inch drain that is north of the Lahaina Civic Center (just south of Hanaka'o'o Beach and Point) at a depth of 17m. The substratum at this station is dominated by sand and rubble; corals are found on small (1 x 2m) areas of emergent limestone substratum. These areas of corals are spaced from 3 to 40m apart and the intervening sand and rubble substratum has little else present. Table 6 presents the results of the benthic survey conducted at Station 7. The quadrat survey found two coral species (*Porites lobata* and *Pocillopora meandrina*) with a mean coverage of 2.8 percent; three algal species had mean coverage of 0.8 percent. Only one macroinvertebrate species, the wana (*Echinothrix diadema*), was noted in the 4 x 25m census area but 16 species of fishes (30 individuals) were counted. The most common fish species were the na'ena'e (*Acanthurus olivaceus*), the damselfish (*Chromis vanderbilti*) and the angelfish (*Centropyge fisheri*). The biomass of fishes at Station 7 was estimated to be $36g/m^2$. The largest contributor to this standing crop were three large na'ena'e (comprising 38 percent of the total biomass).

In the vicinity of Station 7 were seen the corals *Montipora verrilli* and *Pocillopora eydouxi*, the soft coral (*Palythoa tuberculosa*), the hydroid (*Pennaria tiarella*), an unidentified red sponge (Porifera sp.), algae (*Neomeris annulata*, *Dictyota divaricata* and *Desmia hornemannii*), 'omaka (*Stethojulis balteata*), o'ili lepa (*Cantherhines sandwichiensis*) and moano (*Parupeneus multifasciatus*).

Station 8 also sampled the biotope of sand and low coral cover. This station was established about 600m offshore and affronting the single 48 inch drain situated north of the Lahaina Civic Center in 11m of water. The substratum at this station is rubble and sand with small patches of corals scattered over it. The small coral patches range from 1 to 5m in diameter and are spaced from 3 to 30m apart. Table 7 presents the results of the benthic survey conducted at Station 8. Six species of corals comprising a mean coverage of 2.9 percent were noted in the quadrat survey. The most common species are *Porites lobata*, *P. compressa* and *Pocillopora meandrina*. Five algal species were also noted and have a mean coverage of 12.4 percent. Most common algal species in the quadrat survey was an unidentified blue-green (Cyanophyte) mat, green-brown in color and slippery to the touch. This mat broke down and pieces drifted away with the current when the alga was handled. Also common in the area was the chlorophyte, *Cladophora* sp. The inventory of invertebrates in the 4 x 25m survey area noted 8 species; most abundant were three sea urchin species (*Echinothrix diadema*, *Tripneustes gratilla* and *Echinometra mathaei*). The fish census (Appendix 1) found 12 species (38 individuals); most common were the wrasse (*Pseudojuloides cerasinus*) and *Parapercis schauinslandi* (note no common name known). The estimated standing crop of fishes at Station 8 is $6g/m^2$ and a single pualu (*Acanthurus mata*) contributed 34 percent of the biomass seen at this station.

TABLE 6. Summary of the benthic survey conducted at Station 7 approximately 1.1km offshore of the terminus of the single 48 inch culvert approximately 260m north of the Lahaina Civic Center at Lahaina, Maui in the biotope of sand and low coral cover on 28 September 1989. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 16.8m; mean coral coverage is 2.8 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 0m	5m	10m	15m	20m	25m
Algae						
Halimeda opuntia	0.1					
Lyngbya majuscula	0.1					
Cladophora sp.			0.75	2		
Coral						
Porites lobata	0.1	3.5	9	3		0.1
Pocillopora meandrina	1					
Sand	83.7	70.5	66.25	81	44	95.9
Rubble	15	26	24	14		4

B. 50-Point Analysis

Species	Percent of the Total
Sand	64
Rubble	34
Hard Substratum	2

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Echinodermata	
Echinothrix diadema	2

D. Fish Census (4 x 25m)

16 Species
30 Individuals

TABLE 7. Summary of the benthic survey conducted at Station 8 approximately 600m offshore of the terminus of the single 48 inch culvert approximately 260m north of the Lahaina Civic Center at Lahaina, Maui in the biotope of sand and low coral cover on 28 September 1989. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth 10.7m; mean coral coverage is 2.9 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 0m	5m	10m	15m	20m	25m
Algae						
Padina japonica		0.1	1	1	1	
Grateloupia filicina		4				
Enteromorpha sp.				6	6	4
Cladophora sp.		12	4			
Unid. Cyanophyta sp.			31	4		
Corals						
Porites lobata		0.1		0.1	0.75	6
P. compressa						3
Pocillopora meandrina		2	2.5			1.25
Montipora flabellata						0.5
M. patula						0.75
Fungia scutaria						0.25
Sand	100	17.8	53.5	57.15	44.25	36.25
Rubble		64	8	31	48	48

B. 50-Point Analysis

Species	Percent of the Total
Algae	
Dictyota bartayresii	2
Cladophora sp.	2
Coral	
Porites lobata	8
Montipora verrucosa	2
Sand	44
Rubble	40
Hard Substratum	2

TABLE 7. Continued.

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Annelida	
Pharcardia striata	1
Phylum Arthropoda	
Dardanus punctulatus	1
Phylum Echinodermata	
Linckia diplax	1
Echinothrix diadema	2
E. calamaris	1
Tripneustes gratilla	2
Echinometra mathaei	2
Pseudoboletia indiana	1

D. Fish Census (4 x 25m)

12 Species
38 Individuals

In the vicinity of Station 8 were seen the corals (*Pavona varians* and *Pocillopora eydouxi*), the polychaete (*Loimia medusa*), rock osyter (*Spondylus tenebrosus*), slate-pencil sea urchin (*Heterocentrotus mammillatus*), humuhumu ele'ele (*Melichthys niger*), a'awa (*Bodianus bilunnatus*), kihikihi (*Zanclus cornutus*), 'o'opue hue (*Arothron meleagris*), maiko (*Acanthurus nigroris*), ala'ihi (*Adioryx xantherythrus*), 'upapalu (*Apogon kallopterus*), lau wiliwili (*Chaetodon miliaris*), kikakapu (*Chaetodon multicinctus* and *C. lunula*), angelfish (*Centropyge potteri*), o'ili'uwi'uwi (*Pervagor spilosoma*), puhi laumilo (*Gymnothorax undulatus*), alo'ilo'i (*Dascyllus albisella*), damsel fish (*Chromis hanui*), wrasse (*Pseudocheilinus octotaenia*) and hover goby (*Ptereleotris heteropterus*).

Throughout the biotope of sand and low coral cover a considerable amount of free-floating *Cladophora* was seen; much of this material had become entangled on anything projecting up from the substratum, including corals and particularly on *Pocillopora eydouxi* and *P. meandrina*. These corals appeared to be in poor health, having lost much of their zooxanthellae (symbiotic algae) where the *Cladophora* had become entangled on the coral. Knowledgeable divers report that the current "bloom" of *Cladophora* began two to three months ago; if it continues, it may have a large impact on corals of the genus *Pocillopora* in the areas offshore of Lahaina.

The Biotope of Diverse High Coral Cover

The biotope of diverse high coral cover occurs as a near continuous feature along much of the project site from shore to no more than 200m seaward. The substratum of this biotope is comprised primarily of basalt boulders and limestone bench on which a diverse assemblage of corals occur. The biotope is breached in places by a continuation of sand from offshore areas to the shore where it forms small beaches. Water depth in this biotope ranges from about 1 to 5m.

Shoreward of the biotope of diverse high coral cover is the intertidal region whose substratum is dominated by basalt boulders. On this emergent rock is a rich algal community comprised of *Pterocladia capillacea*, *Ulva fasciata*, *Ulva reticulata*, hulu'ilio (*Giffordia breviarticulata*), aki'aki (*Ahnfeltia concinna*), *Acanthophora spicifera*, *Coelothrix* sp., *Gelidiopsis scoparia*, huluhuluwaena (*Grateloupia filicina* and at least two species of *Hypnea*. Molluscs are common on the intertidal rocks; species seen include the pupipi (*Nerita picea*), cowries (*Cypraea caputserpentis*), chiton (*Acanthochiton* sp.), snail (*Littorina pintado*), drupe (*Drupa morum*) and *Siphonaria normalis*. Fishes occasionally seen perched on the intertidal rocks include the pao'o (*Entomacrodus marmoratus* and *Istiblennius zebra*). An important resource in the intertidal habitat affronting the project site are the locally well-developed stands of the alga, *Pterocladia capillacea* which is an important forage resource for the threatened green sea turtle (*Chelonia mydas*; Balazs 1980).

Station 1 was established about 80m offshore of the mouth of Kahoma stream in the biotope of diverse high coral cover at water depths from 1.8 to 3.6m. The substratum at this station is comprised of limestone and basalt boulders that form seaward projections of hard bottom oriented perpendicular to shore (in a seaward direction). These "fingers" of hard substratum are from 10 to 30m in length, 5 to 10m in width and are spaced from 3 to 15m apart with silty sand in the intervening areas. Because of the proximity of Kahoma Stream and the ongoing construction (drainage improvements), there is a layer of fine terrigenous material over much of the non-live coral substratum at this station.

Table 8 presents the results of the benthic survey conducted at Station 1. Six coral species were recorded and comprised a mean coverage of 32.8 percent. The invertebrate census noted four sea urchin species and the most common was the black sea urchin (*Tripneustes gratilla*). Twenty-seven species of fishes (126 individuals) were enumerated in the 4 x 25m census area. The most common fishes were the hinalea lauwili (*Thalassoma duperrey*), mamo (*Abudefduf abdominalis*) and damselfish (*Chromis vanderbilti*). The standing crop of fishes at Station 1 was estimated to be $32 g/m^2$; the three species above made up 25 percent of this biomass.

In the vicinity of Station 1 were seen the limu kohu (*Asparagopsis taxiformis*), the alga (*Amansia glomerata*), soft corals (*Palythoa tuberculosa* and *Anthelia edmondsoni*), corals (*Porites compressa*, *Leptastrea purpurea* and *Pocillopora damicornis*), sea cucumber (*Holothuria atra*) taou (*Lutjanus fulvus*), kikakapu (*Chaetodon lunula*) and 'opule (*Anampses cuvier*). It was noted that live corals continue from Station 1 towards the shore to within 12m of the mouth of Kahoma Stream where water depths range between 1 to 1.4m; shoreward of this, the hard substrate is covered with an algal mat dominated by *Amansia glomerata*.

Station 4 also sampled the biotope of diverse high coral cover. This station was established about 25m offshore and affronting the terminus of the triple 48 inch drain situated to the south of the Lahaina Civic Center in water from 3 to 3.6m in depth. The substratum at Station 4 is comprised of some water-worn basalt and some limestone. Hard substratum comprises about 40 percent of the bottom, the remainder being sand. These areas of hard substratum are from 2 x 5m to over 10 x 25m in size spaced from 3 to 20 apart.

A summary of the inventory of the benthic community at Station 4 is presented in Table 9. Five algal species were

TABLE 8. Summary of the benthic survey conducted at Station 1 approximately 80m offshore of Kahoma Stream mouth at Lahaina, Maui in the biotope of diverse high coral cover on 27 September 1989. Results of the $6 m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth from 1.8 to 3.6m; mean coral coverage is 32.8 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 0m	5m	10m	15m	20m	25m
Corals						
Porites lobata				2	21	9
P. evermanni					16	
Pocillopora meandrina				0.5	5	
Montipora verrucosa				11	49	15
M. verrilli				3		5
M. flabellata				38	5	17
Sand	88		30			36
Hard Substratum	12	100	70	45.5	4	18

B. 50-Point Analysis

Species	Percent of the Total
Corals	
Porites lobata	10
Montipora verrucosa	14
M. flabellata	6
M. verrilli	6
Sand	22
Hard Substratum	42

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Echinodermata	
Tripneustes gratilla	5
Heterocentrotus mammillatus	1
Echinothrix calamaris	1
Echinometra mathaei	2

TABLE 8. Continued.

D. Fish Census (4 x 25m)

27 Species
126 Individuals

TABLE 9. Summary of the benthic survey conducted at Station 4 approximately 25m offshore of the terminus of the triple 48 inch culvert just south of the Lahaina Civic Center at Lahaina, Maui in the biotope of diverse coral cover on 27 September 1989. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth from 3 to 3.6m; mean coral coverage is 4.7 percent (quadrat method).

A. Quadrat Survey

	Quadrat Number					
Species	0m	5m	10m	15m	20m	25m
Algae						
Hypnea musiformis		2				
Jania sp.				1		
Neomeris annulata				0.1		
Lyngbya majuscula				0.5		
Cladophora sp.		2		0.5	0.5	
Corals						
Porites lobata	0.1		6.5	3	4	3
Pocillopora meandrina	1.5		0.1			
Montipora verrucosa			2	1	0.5	
M. verrilli			1	1		
M. flabellata				4.5		
Sand	30.4	89	9	4	50	77
Hard Substratum	68	7	81.4	84.4	45	20

B. 50-Point Analysis

Species	Percent of the Total
Corals	
Porites lobata	12
Pocillopora meandrina	2
Sand	38
Hard Substratum	48

TABLE 9. Continued.

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Echinodermata	
Tripneustes gratilla	18
Echinothrix diadema	4
Echinometra mathaei	17

D. Fish Census (4 x 25m)

7 Species
8 Individuals

enumerated in the quadrat survey; these comprised a mean coverage of 1.1 percent and the most common was *Cladophora* sp. Five coral species in these same quadrats had a mean coverage of 4.7 percent and *Porites lobata* provided the greatest coverage. Three macroinvertebrate species were censused and the sea urchins (*Tripneustes gratilla* and *Echinometra mathaei*). The results of the fish census at Station 4 is given in Appendix 1. In total 7 species of fishes (8 individuals) were censused. The biomass of fishes was estimated to be $15g/m^2$; 93 percent of this biomass was contributed by two yellow papio (*Gnathodon speciosus*) that by chance swam through the area while the visual census was in progress.

In the vicinity of Station 4 were seen the algae (*Hypnea cervicornis*, *Colpomenia sinuosa* and *Amansia glomerata*), the hydroid (*Pennaria tiarella*), humuhumunukunukuapua'a (*Rhinecanthus rectangulatus*) and 'alo'ilo'i (*Dascyllus albisella*). Corals were seen to within 15m of the shoreline at this station.

Station 9 was established about 22m from the shoreline directly affronting the single 48 inch drain north of the Lahaina Civic Center in the biotope of diverse high coral cover at a depth from 1.5 to 2.4m. The substratum at this station is comprised of basalt boulders emergent from a sand bottom. Locally, the basalt comprises about 60 percent of the substratum but nearby are areas of sand on scales of 3 x 10m to 15 x 30m. Corals are restricted to the hard substrate areas and were found to within 15m of the shoreline.

Table 10 presents a summary of the benthic community survey carried out at Station 9. The quadrat survey found 10 species of corals comprising a mean coverage of 27.3 percent. The most common species are *Porites lobata* and *Montipora flabellata*. Seven macroinvertebrate species were censused; the most common were the sea urchins (*Echinometra mathaei* and *Heterocentrotus mammillatus*). Twenty-nine species of fishes were censused (149 individuals) and the standing crop was estimated to be $73g/m^2$. The most common fishes were the hinalea lauwili (*Thalassoma duperrey*), damselfish (*Chromis vanderbilti*), mamo (*Abudefduf abdominalis*) and the manini (*Acanthurus triostegus*). The largest contributors to the standing crop of fishes were the surgeonfishes (comprising 48 percent of the total), particularly na'ena'e (*Acanthurus olivaceus*), umaumalei (*Naso literatus*) and manini (*A. triostegus*).

In the vicinity of Station 9 were seen huli piliko'a (*Paracirrhites forsteri*), weke (*Mulliodes favolineatus*) and kumu (*Parupeneus porphyreus*). The emergent basalt boulders in the intertidal region were covered with the algae, *Pterocladia capillacea* and *Ulva fasciata*.

TABLE 10. Summary of the benthic survey conducted at Station 9 approximately 22m offshore of the terminus of the single 48 inch culvert approximately 260m north of the Lahaina Civic Center at Lahaina, Maui in the biotope of diverse coral cover on 28 September 1989. Results of the $6m^2$ quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth from 1.5 to 2.4m; mean coral coverage is 27.3 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 0m	5m	10m	15m	20m	25m
Algae						
Cladymenia pacifica	1					
Soft Coral						
Pennaria tiarella	1					
Palythoa tuberculosa					0.5	
Coral						
Porites lobata	18		16	14	19	13
P. compressa			6			
P. evermanni				2		
P. synarea convexa			2			
Pocillopora meandrina	4.5		4	8	1	
Montipora verrucosa	9		3	4	1.5	
M. flabellata	4		14	9	9	
M. verrilli				1.5		
Pavona varians					1	
Leptastrea purpurea			0.5			
Sand	6	83	3			22
Hard Substratum	56.5	17	51.5	61.5	68	65

B. 50-Point Analysis

Species	Percent of the Total
Coral	
Porites lobata	10
P. compressa	2
Pocillopora meandrina	4
Montipora verrucosa	2
M. flabellata	10
Leptastrea purpurea	2
Sand	36
Hard Substratum	34

TABLE 10. Continued.

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Arthropoda	
Stenopus hispidus	1
Phylum Echinodermata	
Echinometra mathaei	106
Heterocentrotus mammillatus	25
Echinothrix diadema	7
E. calamaris	3
Tripneustes gratilla	7
Holothuria atra	1

D. Fish Census (4 x 25m)

29 Species
149 Individuals

In an effort to characterize the benthic communities present in the biotope of diverse high coral coverage at some point away from the influence of freshwater discharge points (i.e., drains), a site about midway between the two extreme points of discharge (Kahoma Stream and the single 48 inch drain north of the Civic Center) was selected for study. Station 12 is located about 1.2km north of Kahoma Stream, approximately 18m offshore of small point (that directly affronts the County sewage pump station (SPS) No. 3; see Figure 2) in 2.1 to 3m of water. The substratum at Station 12 is comprised of basalt boulders and limestone forming a near-continuous pavement on which a diverse coral community has developed. The basalt boulders are from 1 to 3m in diameter and become more obvious on approaching the shoreline from the station.

Table 11 presents the results of the benthic survey conducted at Station 12. Eight species of corals were noted in the quadrat survey having a mean coverage of 30.9 percent. Important contributors to this coverage were Porites lobata, Montipora flabellata and M. patula. Eight macrinvertebrate species were encountered in the 4 x 25 census area; among these were two spiny lobsters (Panulirus penicillatus). Thirty-eight species of fishes (438 individuals) were censused in this area (Appendix 1). The most abundant fishes were a school of about 175 weke (Mulloides flavolineatus), a school of weke'ula (M. vanicolensis) and a small school of large kala (Naso unicornis). The standing crop of fishes was estimated to be 980g/m^2; the majority of this biomass was in the weke (45% of the total), the kala (18%) and the palani (13%).

In the vicinity of Station 12 were seen the kupipi (Abudefduf sordidus), moano kea (Parupeneus cyclostomus), a'awa (Bodianus bilunulatus), o'opu okala (Diodon holocanthus), keke (Arothron hispidus) and sharpback puffer (Canthigaster amboinensis). Corals extended to within 10m of the shore and were replaced by a algal mat dominated by Amansia glomerata and in the lower intertidal, by Pterocladia capillacea.

Four green sea turtles were sighted during the course of this study. The first was seen about 175m north of Station 1 in about 4m of water, 60m from the shoreline. This turtle was estimated to have a straight-line carapace length of 50cm. The second turtle (about 50cm carapace length) was encountered 230m south of Station 12 again about 70m from shore in 3m of water. The third turtle (estimated 50cm carapace length) was found about 100m north of Station 12, 35m from shore in 4m of water. These three turtles were in the biotope of diverse high coral cover which lies just seaward of potential forage resources in the intertidal and shallow subtidal (Pterocladia capillacea and Amansia glomerata). Additionally, the only potential resting habitat seen in this survey was found in the biotope of diverse high coral coverage. The last turtle was encountered in 12m of

TABLE 11. Summary of the benthic survey conducted at Station 12 approximately 1.2km north of Kahoma Stream mouth at Lahaina, Maui about 18m offshore in the biotope of diverse coral cover on 28 September 1989. Results of the 6m^2 quadrat sampling of the benthic community (expressed in percent cover) are given in Part A; a 50-point analysis is presented in Part B and counts of invertebrates in Part C. A short summary of the fish census is given in Part D. Water depth from 2.1 to 3m; mean coral coverage is 30.9 percent (quadrat method).

A. Quadrat Survey

Species	Quadrat Number 0m	5m	10m	15m	20m	25m
Coral						
Porites lobata	1	7	1.5	12	14	12
Pocillopora meandrina	1	3.5		4	4	
Montipora verrucosa	7.5	12	2	9		6
M. flabellata	3	5	6.5	6	21	8
M. patula				29	6	
M. verrilli			0.75			
Leptastrea purpurea				1		0.5
L. bottae					2	
Sand	3					
Hard Substratum	84.5	72.5	89.25	39	53	73.5

B. 50-Point Analysis

Species	Percent of the Total
Coral	
Porites lobata	8
Montipora verrucosa	2
M. patula	2
Sand	2
Hard Substratum	86

TABLE CONTINUED ON NEXT PAGE

TABLE 11. Continued.

C. Invertebrate Census (4 x 25m)

Species	Number
Phylum Mollusca	
Conus miliaris	1
Spondylus tenebrosus	1
Phylum Arthropoda	
Panulirus penicillatus	2
Phylum Echinodermata	
Echinothrix diadema	2
Tripneustes gratilla	7
Heterocentrotus mammillatus	1
Echinostrepus aciculatum	1
Linckia diplax	1

D. Fish Census (4 x 25m)

38 Species
438 Individuals

water over a sand bottom about 300m seaward of Mala Wharf in the biotope of sand and Halimeda beds. This turtle was estimated to be about 60cm in carapace length.

The area from Mala Wharf to the single 48 inch culvert about 2.6km to the north is not known as an area harboring many green turtles according to local divers. It is said that the best area to view green turtles nearby is offshore of the Hyatt Hotel at Hanaka'o'o Beach about 700m north of the northern boundary of the present study site. Time did not permit our inspection of this locality, but descriptions of it suggest that it is an area affording some cover and is probably being used as a resting site by the turtles. No firm estimate of numerical abundance of turtles at this location can be presently made, but conversations suggest no more than 3 to 8 turtles are present.

Little recreational use was noted in the study area during the field survey on 27-28 September 1989. A SCUBA/snorkel group was seen in the shallows offshore of the sand beach between the two parking areas at Wahikuli State Wayside Park. According to people interviewed, this area is popular among the SCUBA/snorkel tour operators for the convenience of parking and ease of water entry-exit. A jet-ski platform was operating on both survey days just to the north of the study area offshore of Hanaka'o'o Park. Some boat traffic (not counted here) was seen using the ramp at Mala Wharf and several swimmers including a spearfisherman were noted offshore of Wahikuli State Wayside Park.

DISCUSSION

WATER QUALITY STUDIES

During dry periods (at the time of the September 1989 sampling) the waters affronting the project site may be characterized as having a high clarity and a water chemistry typical of well-flushed, open coasts. Like many other nearshore Hawaiian marine systems (e.g., the West Hawaii coast), there is evidence of diffuse groundwater input along the shoreline; this lower salinity groundwater has high concentrations of nitrates and silicates. Because oceanic waters are low in these and other dissolved nutrient species, a concentration gradient is evident in the data. A similar gradient exists with respect to depth; in general, deep samples have lower nutrient concentrations than surface samples from a given location. The salinity data suggest the existence of these gradients but the concentrations of the measured dissolved nutrient species are a much more sensitive indicator of these gradients than are measurements of salinity.

The "composite" nutrient parameters of total nitrogen and total phosphorus yield the least information about water quality of the nutrient species measured in this study. The lack of definitive information from these parameters is the result of the makeup of these two composite species. Total phosphorus and nitrogen include a myriad of unspecified groups of dissolved organic materials, some of which are not found in groundwater and are of unknown biological function.

The geometric mean for the concentration of nitrate nitrogen was equal to the "dry" criteria as established by the Department of Health (DOH) water quality standards (i.e., 3.50ug/L). All other measured parameters were below the DOH "dry" criteria. The relatively high value for nitrate nitrogen is probably related to the diffuse groundwater inputs along the entire shoreline affronting the project site. The aquifer at Lahaina is highly permeable and groundwater flow is not impeded by caprock at the coast (Mink 1989). The flux of groundwater in the basal lens has been calculated to be between 4.5 to 5 mgd per mile of coastline (Mink 1989). If groundwater flows are this high, the applicable DOH water quality criteria that should be used are the standards for "wet" conditions. These apply when open coastal waters receive more than 3 mgd of groundwater discharge per shoreline mile. Applying the wet criteria, the nitrate nitrogen value not to be exceeded is 5.00ug/L and thus the quality of the waters affronting the project site easily meet state standards for an open coastal system with the exception of chlorophyll-a.

The geometric mean for chlorophyll-a (0.37ug/L) exceeds state DOH standards (0.30ug/L). The relatively high level of chlorophyll-a in the studfy area is probably a response to elevated dissolved nutrient input via groundwater discharge. Chlorophyll-a serves as a measure of phytoplankton abundance; high phytoplankton biomass may be an indicator of eutrophic conditions, which in this case, are brought on by the discharge of groundwater.

BIOLOGICAL STUDIES

Studies conducted on coral reefs in Hawaii and elsewhere have estimated fish standing crops to range from 20 to 200g per square meter (Brock 1954, Brock et al. 1979). This variation in standing crop appears to be related to the variation in the local topographical complexity of the substratum. Thus habitats with high structural complexity affording considerable shelter space usually harbor a greater estimated standing crop of coral reef fish; conversely, transects conducted in structurally simple habitats (e.g., sand flats) usually result in a lower estimated standing crop of fish (5 to 20g/m^2). Goldman and Talbot (1975) noted that the upper limit to fish biomass on coral reefs is about 200g/m^2. Ongoing studies (Brock and Norris 1989) suggest that with the manipulation (increasing) of habitat space or food resources (Brock 1987b), local fish standing crops may approach 2000g/m^2. Thus under certain circumstances, coral reefs may be able to support much larger standing crops of fishes than previously realized.

The high biomass estimate of fishes at Station 12 (980g/m^2) exceeds the usual maximum; 45 percent of this exceptional standing crop was due to the encounter of a large school of weke (*Mulloides flavolineatus*). Also encountered in large numbers were a school of kala (*Naso unicornis*) comprising 18 percent of the biomass and a school of palani (*Acanthurus dussumieri*) which contributed 12 percent to the standing crop of fishes present. Such encounters with large roving schools of fishes is unusual. If these fishes are removed from the biomass estimate for Station 12, the remaining standing crop is 245g/m^2, suggesting that at the time of sampling a diverse, high biomass fish community was present.

The standing crop of fishes met with at the other stations are typical for many Hawaiian localities. At stations over the sand and Halimeda beds, the biomass of fishes appears low (mean 4g/m^2) but not unusual for sand bottom habitats. Considering all stations together, the most important families of fishes by weight at were the surgeonfishes (family Acanthuridae, 22% of the total), the hinaleas or wrasses (family Labridae, 20%) and the goatfishes (family Mullidae, 11% of the total; see Table 12).

TABLE 12. Summary of the biomass estimates (in g/m^2) calculated from estimated individual fish lengths in the field for families of fishes that collectively contributed 95 percent or more to the standing crop of fishes at the stations quantitatively sampled in this study.

Family	Station Number 1	2	3	4	5	7	8	9	12	Family Mean %
Acanthuridae	33			3		38	38	48	38	22
Balistidae	13	90						11	1	13
Canthigasteridae	1	1					4			0.5
Carangidae				93						10
Cirrhitidae						2	6			0.9
Labridae	15	8	76	3		41	28	11	2	20
Lutjanidae									1	0.1
Mullidae	6		24			7	13	7	47	11
Muraenidae						15		5		2
Parapercidae		1					9			1
Pomacentridae	27							9		4
Scaridae								4	8	1
Total Station Percent	95	100	100	99	0	97	98	95	97	

Excluding the corals, the invertebrate censuses did not yield any unusual results; species common offshore of Lahaina are the same species one would commonly encounter elsewhere in the Hawaiian Islands in similar habitats. However, the diversity and coverage of corals in the biotope of diverse high coral cover is exceptional. In terms of coverage, the genus Montipora is very important in the biotope. The most common coral species in many shallow Hawaiian habitats are Porites lobata, P. compressa and Pocillopora meandrina; the Montipora species are usually less dominant. Members of the genus Montipora are known to be among the most tolerant of Hawaiian coral species to burial by heavy sedimentation (Maragos 1972). The Montipora species shed sediment by ciliary action as well as the production of mucous which lifts the offending sediment away from the coral polyps (Marshall and Orr 1931, Hubbard and Pocock 1972). This characteristic allows Montipora to occur in areas which are suboptimal to other corals because of sedimentation. Thus, the presence of four Montipora species in the biotope of diverse high coral coverage which is adjacent to the shoreline suggests that this biotope must be occasionally subjected to terrigenous inputs and storm water runoff.

Algal assemblages encountered in this study are typical for the Lahaina area; offshore, the beds of Halimeda opuntia found in this study similarly occur offshore of Launiupoko (south of Lahaina) as does the rich assemblage of algal species found in the intertidal of both sites (Brock 1987a, 1988a, 1988b). However, most unusual in the present study was the "outbreak" of the green, stringy algae, Cladophora sp. which was abundant in waters from 6m to the outer depth limits of this study. The Cladophora was very common in the biotope of sand and Halimeda beds, being frequently attached to (or hung up on) the Halimeda plants. In these deeper parts of the study site where the tidal currents are stronger, the water column was frequently cluttered with drifting pieces of this alga which ranged in size from 5cm to over 30cm in length. These pieces were floating with the current and would often become entangled with any object protruding from the bottom, thus corals were susceptible to entanglement. As noted above, numerous Pocillopora eydouxi colonies were seen (in the biotope of sand and low coral cover) with Cladophora entangled in them and most of these corals had lost zooxanthallae from their tissues which is indicative of stress.

Upon questioning, local divers reported that the "green, stringy algae" was abundant offshore of Lahaina, to the north at Napili and on the windward side at Kahalui at the time of our field work. The current "outbreak" of Cladophora was first noticed two to three months ago and there appears to be no sign of abatement. The same phenomenon is also occurring offshore of Puako on the west coast of Hawaii (personal communication with dive tour operators working the area on 3-4 October 1989). At Puako, divers report that the alga is similarly found abundantly at depths below 6m. Thus the "bloom" is not confined to just one island or to one area which suggests that the mechanism(s) responsible for triggering the event is a general one and not site specific.

The primary site of growth for this Cladophora species is not on the shallow reef flats but further offshore in slightly deeper water where mixing is better. Most of the Cladophora that was found on the shallow reef flats or on the beaches in this survey appears to have been rafted in by wave action and currents. The confinement of primary growth of Cladophora to more offshore areas suggests that the stimulus for growth is not land-derived (e.g., from pollution, etc. emanating from the shoreline), for if it were, we would expect the greatest growth to occur adjacent to land.

The explosive growth of this alga may be related to now undetermined long-term natural environmental fluctuations. If this is correct, the physical and biological conditions are presently appropriate to meet the ecological requirements for this species. Alternatively, this species of Cladophora may be a new to the Hawaiian Islands and like many introductions goes through an explosive growth phase before coming into equilibrium with the habitat. How long the current situation will continue is unknown but it could have detrimental impacts to the corals in the study site.

The results of the biological survey show that benthic and fish community development is greatest in the biotope of diverse high coral cover and least in the biotope of sand and Halimeda beds. The important quantitative measures (i.e., number of coral species and cover, number of fish species and biomass) made in these communities are summarized in Table 13; in all, the biotope of diverse high coral coverage has the greatest biological development. The biotope of diverse high coral cover has the only appreciable amount of hard and stable substratum which is a requisite for the success of corals. The hard substratum and coral development creates shelter which is necessary for fishes. If these assumptions are correct, it suggests that diversity in the benthic and fish communities resident to the study area is related first to the presence of appropriate hard substratum and to a lesser degree, to land derived inputs (i.e., runoff and silt). This conclusion is based on the fact that the greatest coral and fish community development occurs directly adjacent to the shoreline where the point sources for freshwater and terrigenous inputs are located.

The diversity of these nearshore communities has persisted under the present conditions of occasional storm water runoff from the sugar cane fields. Storm water runoff in the Lahaina area may turn the water to a muddy-red color that can persist for days to more than a week. Following the heavy rainfall of Novem-

TABLE 13. Summary of the quantitative biological observations made at 9 stations sampling three biotopes recognized in this study.

Biotope	Station No.	Depth (m)	No. Coral Spp.	Mean Cover (%)	No. Fish Spp.	Biomass (g/m^2)
Biotope of Diverse High Coral Cover	1	3	6	33	27	32
	4	3	5	5	7	15
	9	2	10	27	28	73
	12	3	8	31	38	980
Means		3	7	24	25	275
Biotope of Sand and Low Coral Cover	7	17	2	3	16	36
	8	11	6	3	12	6
Means		14	4	3	14	21
Biotope of Sand and Halimeda Beds	2	10	0	0	5	9
	3	21	0	0	5	3
	5	10	0	0	0	0
Means		14	0	0	3	4

ber 1988, the nearshore waters affronting the project site were turbid for more than a week (personal observation). Thus considerable time may elapse before the terrigenous material is advected out of the area. This is probably related to the tidal nature of the current systems offshore of Lahaina where a cell of water may just oscillate along the shore rather than disperse (Environmental Consultants, Inc. 1976). Indeed, some of the terrigenous material is incorporated into soft bottom, lending brownish hue to the sand in the study area.

A principal natural source of drainage for the Lahaina area is Kahoma Stream. The drainage basin for this stream encompasses about 13.7km^2 and a tributary, Kanaha, as well as Kahoma cross this terrain, extending 11.3km from their headwaters in the West Maui mountains to the sea. Kanaha Stream joins Kahoma Steam at about the 80m elevation. Kahoma Stream is perennial in the headwaters, but because of extensive diversions of the water for agricultural and domestic uses, there is no streamflow from the stream mouth at Mala Wharf to about 2.6km upstream, except during heavy rainfall. Thus the lower reaches of Kahoma Stream are intermittent in flow and serve as a simple discharge point during periods of storm water runoff.

Data from the Wahikuli guage (Station 364) shows that the annual mean rainfall to be 47cm (18.5 inches); fully 63 percent of this precipitation occurs in the months of December through March (Environment Impact Study Corp. 1980). The mean rainfall varies with location; in Lahaina it is about 35.5cm (14 inches) per year while at the summit of Puu Kukui (West Maui mountains) mauka of Lahaina, it is about 2.5m (100 inches) per year (U.S. Army Corps of Engineers 1973). However, detrimental impacts due to runoff occur with the occasional large storms. Since 1879 there have been at least 19 damaging floods in the Lahaina area. This translates into about one such event every 5.8 years. The greatest flood on record occurred in May 1960 when up to 55cm (21.7 inches) of rain fell over a 24 hour period in the upper Kahoma basin (U.S. Army Corps of Engineers 1973). The flood problem in this drainage basin results primarily from flash floods which occur during periods of intense rainfall of short duration. During these events, the steep terrain and stream slopes induce high velocity flows which transport boulders and debris downstream into the lowland areas and the sea.

Despite the severity of these events, the nearshore benthic communities have persisted. Sedimentation has been implicated as a major environmental problem for coral reefs. Increases in turbidity may decrease light levels resulting in a lowering of primary productivity. Perhaps a greater threat would be the simple burial of benthic communities that may occur with high sediment loading. Many benthic species including corals are capable of removing sediment settling on them but there are threshold levels of deposition where cleaning mechanisms may be

overwhelmed and the individual becomes buried. However the impact of sedimentation on Hawaiian reefs may be overstated. Dollar and Grigg (1981) studied the fate of benthic communities at French Frigate Shoals in the Northwest Hawaiian Islands following the accidental spill of 2000 tons of kaolin clay. These authors found after 2 weeks there was no damage to the reef corals and associated communities except where the organisms were actually buried by the clay deposits for a period of more than two weeks.

The proposed development will increase the potential for runoff as inferred from the study by Unemori Engineering, Inc. (1989). This study found that the single 48 inch culvert servicing the north part of the project site can handle and estimated 70 cfs but must be increased in size to handle 478 cfs (an increase in potential volume flow of almost 7 times). The triple culvert system can now handle approximately 210 cfs and the projected flow for this system will remain the same but the runoff from areas mauka of the project site will be diverted into Kahoma Stream (1,778 cfs) as will some (520 cfs) runoff from areas adjacent to the stream. To lessen the impact of storm water runoff, there are at least four retention basins proposed for the project (Unemori Engineering, Inc. 1989). These will be designed as part of the open space and will serve to absorb the peak surface runoff volumes and provide areas for sedimentation to occur before runoff moves down to the sea.

Once completed, the flood control project for Kahoma Stream should lessen the sediment load reaching the ocean than presently occurs (U.S. Army Corps of Engineers 1973). This will be accomplished by developing a debris basin well inland and closer to the sea, building a rock sill to trap smaller material that escapes from the mauka basin.

Thus, the development should increase the runoff volume but the sediment load reaching the sea should be less than presently occurs. This statement assumes that a major storm event does not occur while a considerable area has been cleared of vegetative cover for construction. Following project completion, the soil should be covered and/or planted such that generation of sediment from the project site reaching the sea will be less than occurs today.

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APPENDIX I. Results of the quantitative visual censuses conducted at nine locations offshore of Lahaina, Maui on 27-28 September 1989. Each entry in the body of the table represents the total number of individuals of each species seen; totals are presented at the foot of the table along with an estimate of the standing crop (g/m^2) of fishes present at each location. Note that no fishes were censused at Station 5.

Family and Species	Station Number 1	2	3	4	5	7	8	9	12
ACANTHURIDAE									
Acanthurus olivaceus						3		11	12
A. nigroris									3
A. nigrofuscus	5			1				5	21
A. triostegus	2							9	3
A. dussumeri	17							7	21
A. mata	2						1		
A. leucoparieus								1	2
A. xanthopterus	3						2	4	
Ctenochaetus strigosus	5							1	
Naso literatus	1							4	6
N. unicornis	1						2		36
Zebrasoma flavescens	1								
APOGONIDAE									
Apogon maculiferus						4			
BALISTIDAE									
Melichthys niger									4
Rhinecanthus rectangulus	1	2						2	1
BLENNIDAE									
Exallis brevis	2								
CANTHIGASTERIDAE									
Canthigaster jactator	2	1		1			3	1	2
CARANGIDAE									
Gnathodon speciosus				2					
CHAETODONTIDAE									
Chaetodon auriga									1
C. fremblii								1	
C. lunula								2	1
C. quadrimaculatus									1
C. multicinctus									2
C. miliaris	3								3
C. ornatissimus									1
Forcipiger flavissimus									2

APPENDIX 1. Continued.

Family and Species	Station Number 1	2	3	4	5	7	8	9	12
CIRRHITIDAE									
Paracirrhitus forsteri						1	1		1
Cirrhitops fasciatus						1		1	
FISTULARIIDAE									
Fistularia commersoni							1	1	1
GOBIIDAE									
Ptereleotris heteropterus						1			
KYPHOSIDAE									
Kyphosus bigibbus									1
LABRIDAE									
Anampses chrysocephalus									1
Bodianus bilunulatus						1			
Cheilinus bimacula		3	5	1		4	4		
Thalassoma fuscum								1	1
T. duperrey	7			1				22	22
T. ballieui									1
Stethojulis balteata	5	1						3	6
Halichoeres ornatissimus	1								
Macropharyngodon geoffroy	1								
Coris venusta	1			1					
Gomphosus varius	1								
Pseudojuloides cerasinus			3			4	13		
Cheilo inermis			1						
Xyrichthys niveilatus			1						
LUTJANIDAE									
Lutjanus fulvus									20
MONACANTHIDAE									
Pervagor spilosoma						1			
Cantherhines sandwichiensis	1								
MULLIDAE									
Mulloides flavolineatus									175
M. vanicolensis								9	57
Parupeneus multifasciatus	3						3	3	1
P. pleurostigma			2			1	1		
P. porphyreus									1

APPENDIX 1. Continued.

Family and Species	Station Number 1	2	3	4	5	7	8	9	12
MURAENIDAE									
Gymnothorax eurostrus								1	
G. meleagris						1			
OSTRACIONTIDAE									
Ostracion meleagris						1			2
PARAPERCIDAE									
Parapercis schauinslandi		1				1	6		
POMACANTHIDAE									
Centropyge fisheri						2			
C. potteri									
POMACENTRIDAE									
Chromis vanderbilti	22					3	1	28	
Dascyllus albisella	8							3	
Plectroglyphidodon imparipennis								1	
P. johnstonianus	3					1		5	
Stegastes fasciolatus	7							7	4
Abudefduf abdominalis	20							13	12
SCARIDAE									
Scarus sordidus								1	
S. rubroviolaceus									2
S. psittacus								1	
Calotomus carolinus									1
SPARIDAE									
Monotaxis grandoculis									1
SYNODONTIDAE									
Synodus binotatus				1					
TETRAODONTIDAE									
Arothron meleagris									

APPENDIX 1. Continued.

Family and Species	Station Number 1	2	3	4	5	7	8	9	12
ZANCLIDAE									
Zanclus cornutus	1							1	6
TOTAL NUMBER OF SPECIES	27	5	5	7	0	16	12	29	38
TOTAL NUMBER OF INDIVIDUALS	126	8	12	8	0	30	38	149	438
ESTIMATED BIOMASS (G/M^2)	32	9	3	15	0	36	6	73	980

REPORT ADDENDUM

PREDEVELOPMENT WATER QUALITY CONDITIONS

AFFRONTING THE LAHAINA MASTER PLANNED PROJECT

LAHAINA, MAUI

FOLLOWING HEAVY RAINFALL

Prepared For:

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30 January 1990

INTRODUCTION

The water quality studies for the nearshore marine waters affronting the Lahaina Master Planned Project called for sampling under a normal "dry" period as well as following a major rainfall event. The first sampling of water quality parameters was carried out on 27-28 September 1989 under normal dry weather conditions. The rationale for sampling water quality parameters following a major rainfall is to provide information on the impact of runoff prior to any construction. Under the usual dry conditions that exist at Lahaina, existing drains are intermittent and only flow during or just after periods of rainfall. As noted in the first report, the perennial headwaters of Kahoma Stream have been diverted for agricultural and domestic uses and there is no regular stream flow in the final 2.6km of its length before entering the sea. Thus there is little surface water runoff unless heavy rains occur.

On 9 December 1989 858mm (3.38 inches) of rain fell in the Lahaina area. No rain fell on the three days prior to or after the 9 December deluge. This event represented the first major rainfall since the September survey and provided the opportunity to assess the impact of runoff. Accordingly, sampling was conducted on 12 December 1989.

The approximate 100 acres of land that comprise the Hawaii State Housing Finance Development Corporation (HFDC) project site lie mauka of Honoapiilani Highway in Lahaina, Maui. Drainage and storm water runoff from this site enters the sea via two areas of culvert and on the south side of the site, Kahoma Stream. Along the north boundary of the project site is a small gully; storm water runoff from this gully crosses the highway and into the sea through a single 48 inch culvert. Further south, two gullies converge adjacent to the Civic Center where a triple 48 inch culvert system carries strom runoff across the highway and into the ocean. All of these systems are usually dry and convey storm water runoff during heavy rains.

MATERIALS AND METHODS

Identical methods and equipment were used in the sampling effort of 12 December as were used in the September survey. The same sites were sampled thus the methods and site map are not reproduced here; the reader should refer to the previous report for this information. Additionally, in the December survey measurements of oxygen and pH were made in the field. Oxygen was measured using a YSI Model 58 meter and pH was determined using a Cole-Parmer digisense millivolt meter.

RESULTS

Water quality parameters specified by the State Department of Health (DOH) Water Quality Standards were measured at the surface and approximately 1.5m from the bottom at each of 8 locations (Station numbers 1, 2, 3, 4, 5, 7, 8 and 9); at 3 additional sites (Station numbers 6, 10 and 11) these parameters were assessed at the surface only because of shallow water (less than 1.5m deep). The waters affronting the project site are classified as open coastal waters by the state (Chapter 11-54) and the standards for the measured parameters are given in Table 1 for comparative purposes.

Table 2 presents a synopsis of the water chemistry parameters measured in September 1989 under dry conditions. The results of the 12 December 1989 measurements of these same parameters as well as for oxygen, temperature and pH collected under wet conditions are presented in Table 3.

Despite the fact that one sample period occurred under dry conditions and the other under a period of runoff, there are several trends common to and apparent in these data. These commonalities and trends include (1) the concentrations of dissolved nutrients (orthophosphate, nitrate + nitrite and silicates) show an inverse relationship with distance from shore; (2) the concentration of these nutrients show a similar trend with respect to depth and (3) salinity displays an increase with distance from shore as well as with depth. Thus stations further from shore and deeper samples have lower nutrient concentrations than do stations near shore and from the surface. These gradients are related to the probable diffuse input of groundwater along the shoreline with relatively high concentrations of these nutrient species. This apparently occurs under both wet or dry conditions but is more pronounced following active surface runoff as would be expected. Both silica and nitrates (NO_3+NO_2) usually exist in high concentration in groundwater owing to metabolism of organic material and mineral dissolution; these ions are in low concentration in open ocean waters and hence they (along with salinity) act as tracers for groundwater input into oceanic settings.

Because effluxing groundwater with little in the way of dissolved salts is less dense than seawater, the groundwater on entering the sea tends to lie on the surface until physical mixing occurs. This low salinity water high in nitrates and silicates is evident in the surface samples taken adjacent to shore (Stations 1, 4, 10 and 11). Station 1 was established 80m offshore and affronting the mouth of Kahoma stream; in the September sample period (dry conditions) there was no evidence of a salinity depression at this location. Station 4 was located about 25m from shore affronting the triple 48 inch culvert just south of

TABLE 1. Specific criteria specified by the Department of Health water quality standards for open coastal waters as amended in 1988.

Parameter	Geometric mean not to exceed the given value	Not to exceed the given value more than 10% of the time	Not to exceed the given value
Total Nitrogen (ug N/L)	150.00* 110.00**	250.00* 180.00**	350.00* 250.00**
Ammonia Nitrogen (ug NH_4-N/L)	3.50* 2.00**	8.50* 5.00**	15.00* 9.00**
Nitrate+Nitrite Nitrogen (ug[NO_3+NO_2]-N/L)	5.00* 3.50**	14.00* 10.00**	25.00* 20.00**
Total Phosphorus (ug P/L)	20.00* 16.00**	40.00* 30.00**	60.00* 45.00**
Chlorophyll-a (ug/L)	0.30* 0.15**	0.90* 0.50**	1.75* 1.00**
Turbidity (NTU)	0.50* 0.20**	1.25* 0.50**	2.00* 1.00**

* "Wet" criteria apply when the open coastal waters receive more than three million gallons per day of fresh water discharge per shoreline mile.

** "Dry" criteria apply when the open coastal waters receive less than three million gallons per day of fresh water discharge per shoreline mile.

Applicable to both "wet" and "dry" conditions:

Salinity - Shall not vary more than 10 percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

Orthophosphate was eliminated from the list of requirements in the revised 1988 document but because of its biological importance, it was measured in this study. The old "wet criteria was 7.00ug/L and "dry" standard was 5.00ug/L.

TABLE 2. Summary of the water quality parameters as measured at 10 sites in the study area on 27-28 September 1989. Surface samples are denoted with an "S" and bottom samples with a "B". In the body of the table concentrations of dissolved nutrients given in ug/L. Geometric means for each parameter are presented at the foot of the table. Underlined geometric means are equal to or are in excess of Department of Health water quality standards. Table continued on next page.

Station	Nitrate N	Ammonia N	Total N	Ortho-P	Total P	Silicates
1-S	3.78	1.12	72.24	4.96	11.78	155.68
1-B	1.68	0.56	59.92	4.34	10.23	39.76
2-S	9.10	2.80	81.48	4.96	9.92	170.80
2-B	1.26	0	68.18	3.41	9.92	11.48
3-S	1.26	1.68	73.22	4.03	8.99	174.44
3-B	0.28	0.84	76.58	4.03	8.99	34.16
4-S	14.00	3.92	91.28	6.51	10.23	330.12
4-B	1.68	0	64.96	3.72	8.99	30.24
5-S	3.64	1.12	64.40	4.34	10.23	79.80
5-B	1.26	0.84	58.94	4.03	9.61	22.68
7-S	1.40	0.98	67.20	3.72	32.86	45.64
7-B	1.26	0	56.84	3.10	8.68	22.96
8-S	1.26	0.56	61.74	3.72	8.68	28.56
8-B	0.84	0	60.06	4.34	8.99	28.56
9-S	39.20	2.10	119.42	5.89	9.61	468.44
9-B	5.32	0.70	66.64	4.03	12.09	245.56
10-S	126.98	3.50	203.28	7.75	9.61	1148.28
11-S	44.38	1.82	106.54	8.06	8.68	879.76
GEOMETRIC MEANS	<u>3.50</u>	1.24	76.15	4.55	10.35	90.81

TABLE 2 CONTINUED ON FOLLOWING PAGE.

TABLE 2. Continued.

Station	Turbidity (NTU)	Chlorophyll-a (ug/L)	Salinity (°/oo)
1-S	0.07	0.24	36.1
1-B	0.06	0.31	36.1
2-S	0.08	0.30	35.8
2-B	0.04	0.29	36.1
3-S	0.05	0.29	36.5
3-B	0.06	0.32	36.5
4-S	0.08	0.30	35.8
4-B	0.05	0.42	36.1
5-S	0.06	0.31	35.8
5-B	0.05	0.33	35.8
7-S	0.05	0.31	35.8
7-B	0.04	0.28	36.1
8-S	0.05	0.27	35.8
8-B	0.06	0.30	35.8
9-S	0.09	0.54	36.0
9-B	0.05	0.36	35.8
10-S	0.09	1.13	35.4
11-S	0.91	1.67	34.3
GEOMETRIC MEANS	0.07	<u>0.37</u>	35.8

TABLE 3. Summary of the water quality parameters as measured at 10 sites in the study area on 12 December 1989. Surface samples are denoted with an "S" and bottom samples with a "B". In the body of the table concentrations of dissolved nutrients given in ug/L. Geometric means for each parameter are presented at the foot of the table. Underlined geometric means are equal to or are in excess of Department of Health water quality standards. Table continued on next page.

Station	Nitrate N	Ammonia N	Total N	Ortho-P	Total P	Silicates
1-S	56.98	6.49	130.90	7.75	12.71	439.32
1-B	40.46	7.61	114.24	8.06	13.95	382.20
2-S	2.61	0.76	97.44	4.34	13.95	74.20
2-B	2.38	0	63.70	3.41	8.99	211.12
3-S	3.50	0	63.42	4.34	10.54	108.36
3-B	3.36	0.70	89.04	7.44	12.09	22.96
4-S	106.40	2.10	176.40	8.99	14.26	1232.56
4-B	5.04	1.12	81.06	4.03	9.92	62.72
5-S	2.38	1.73	80.50	4.03	9.92	22.96
5-B	2.38	3.08	72.80	4.03	9.61	22.96
7-S	2.94	0.98	95.76	4.65	11.16	68.60
7-B	2.38	0.70	81.06	4.03	9.92	165.48
8-S	2.38	0.98	78.82	4.34	8.68	34.16
8-B	2.38	1.54	84.56	4.65	9.92	62.72
9-S	50.21	3.55	134.26	8.37	13.95	741.72
9-B	7.42	3.08	89.46	5.58	10.85	125.44
10-S	46.62	3.64	142.94	8.68	15.50	525.00
11-S	76.58	3.03	148.96	9.61	13.33	964.32
GEOMETRIC MEANS	8.18	1.80	97.03	5.56	11.45	137.42

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TABLE 3. Continued.

Station	Turbidity (NTU)	Chl-a (ug/L)	Salinity (°/oo)	Oxygen (% Sat)	Temp. (°C)	pH
1-S	1.76	0.93	31.5	100	25.9	8.0
1-B	2.50	0.99	32.1	100	25.1	8.1
2-S	0.17	0.60	32.0	101	26.0	8.1
2-B	0.16	0.53	32.5	101	26.0	8.1
3-S	0.19	0.48	32.2	100	26.0	8.1
3-B	0.12	0.63	33.5	100	26.0	8.1
4-S	0.35	0.56	31.0	101	26.0	8.1
4-B	0.26	0.69	33.0	100	26.0	8.1
5-S	0.09	0.34	34.0	100	26.0	8.1
5-B	0.10	0.56	35.0	100	26.0	8.1
7-S	0.12	0.46	32.3	100	25.9	8.1
7-B	0.15	0.54	35.0	99	25.9	8.0
8-S	0.17	0.51	33.0	100	26.0	8.1
8-B	0.21	0.50	35.0	100	26.0	8.1
9-S	0.34	0.69	32.0	101	26.0	8.1
9-B	0.39	1.30	32.5	100	25.9	8.0
10-S	0.31	1.20	31.0	101	25.9	8.1
11-S	0.54	0.92	31.2	101	25.9	8.1
GEOMETRIC MEANS	0.26	0.65	32.7	100	26.0	8.1

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CORRECTION

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

TABLE 3. Summary of the water quality parameters as measured at 10 sites in the study area on 12 December 1989. Surface samples are denoted with an "S" and bottom samples with a "B". In the body of the table concentrations of dissolved nutrients given in ug/L. Geometric means for each parameter are presented at the foot of the table. Underlined geometric means are equal to or are in excess of Department of Health water quality standards. Table continued on next page.

Station	Nitrate N	Ammonia N	Total N	Ortho-P	Total P	Silicates
1-S	56.98	6.49	130.90	7.75	12.71	439.32
1-B	40.46	7.61	114.24	8.06	13.95	382.20
2-S	2.61	0.75	97.44	4.34	13.95	74.20
2-B	2.38	0	63.70	3.41	8.99	211.12
3-S	3.50	0	63.42	4.34	10.54	108.36
3-B	3.36	0.70	89.04	7.44	12.09	22.96
4-S	106.40	2.10	176.40	8.99	14.26	1232.56
4-B	5.04	1.12	81.06	4.03	9.92	62.72
5-S	2.38	1.73	80.50	4.03	9.92	22.96
5-B	2.38	3.08	72.80	4.03	9.61	22.96
7-S	2.94	0.98	95.76	4.65	11.16	68.60
7-B	2.38	0.70	81.06	4.03	9.92	165.48
8-S	2.38	0.98	78.82	4.34	8.68	34.16
8-B	2.38	1.54	84.56	4.65	9.92	62.72
9-S	50.21	3.55	134.26	8.37	13.95	741.72
9-B	7.42	3.08	89.46	5.58	10.85	125.44
10-S	45.62	3.64	142.94	8.68	15.50	525.00
11-S	76.58	3.03	148.96	9.61	13.33	964.32
GEOMETRIC MEANS	<u>8.18</u>	1.80	97.03	5.56	11.45	137.42

TABLE 3. Continued.

Station	Turbidity (NTU)	Chl-a (ug/L)	Salinity (°/oo)	Oxygen (% Sat)	Temp. (°C)	pH
1-S	1.76	0.93	31.5	100	25.9	8.0
1-B	2.50	0.99	32.1	100	26.1	8.1
2-S	0.17	0.60	32.0	101	26.0	8.1
2-B	0.16	0.53	32.5	101	26.0	8.1
3-S	0.19	0.48	32.2	100	26.0	8.1
3-B	0.12	0.63	33.5	100	26.0	8.1
4-S	0.35	0.56	31.0	101	26.0	8.1
4-B	0.26	0.69	33.0	100	26.0	8.1
5-S	0.09	0.34	34.0	100	26.0	8.1
5-B	0.10	0.56	35.0	100	26.0	8.1
7-S	0.12	0.46	32.3	100	25.9	8.1
7-B	0.15	0.54	35.0	99	25.9	8.0
8-S	0.17	0.51	33.0	100	26.0	8.1
8-B	0.21	0.50	35.0	100	26.0	8.1
9-S	0.34	0.69	32.0	101	26.0	8.1
9-B	0.39	1.30	32.5	100	25.9	8.0
10-S	0.31	1.20	31.0	101	25.9	8.1
11-S	0.54	0.92	31.2	101	25.9	8.1
GEOMETRIC MEANS	<u>0.26</u>	<u>0.65</u>	32.7	100	26.0	8.1

the Lahaina Civic Center. Station 11 was at the same site but about 5m from the beach and Station 10 was about 3m offshore of the single 48 inch culvert. A comparison of the silicate and nitrate data from these and other more seaward stations show the mixing and uptake of these elements that occurs with distance from land. These declines with distance from shore are shown for silicate, nitrate and orthophosphate in Figures 1, 2 and 3.

Perhaps the most evident differences lies between the measured parameters of the two surveys. In all cases the geometric means for every parameter other than salinity are greater under wet conditions (Tables 2 and 3). In the September survey nitrate nitrogen and chlorophyll-a exceeded the state standards; the wet conditions in December exacerbated this and turbidity also exceeded the state standards.

The two drains and Kahoma Stream are intermittent and only have surface runoff following heavy rainfall. The Corps of Engineers flood control project for Kahoma Stream has been underway through the period of this study. At the mouth of Kahoma Stream a dam of boulders was constructed prior to our sampling to control the possible flow of terrigenous material into the ocean following rain. In September behind the dam of boulders and soil was a brackish water pool about 25m in longest dimension and about 30cm in depth. This pool had a soft mud bottom and appeared to be stagnant and of low water quality. In the December survey the pool appeared much the same but the dam of mud had broken down and a low flow of water was moving seaward. The concentrations of nutrients, turbidity and chlorophyll-a are given in Table 4. In the September survey ammonia nitrogen, total nitrogen, total phosphorus, turbidity and chlorophyll-a exceeded state water quality standards for open coastal waters; in December nitrate nitrogen, ammonia nitrogen, total nitrogen, turbidity and chlorophyll-a again exceeded these standards. Station 6 was not included in the calculation of geometric means because it did not sample "open coastal water" and is not representative of anything but an isolated stagnant pool.

DISCUSSION

The waters affronting the project site may be characterized as having a high clarity and a water chemistry typical of well-flushed, open coasts. However like many other nearshore Hawaiian marine systems, there is evidence of diffuse groundwater input along the shoreline (similar to the West Hawaii coast) as well as surface water runoff following heavy rainfall (as is commonly seen on parts of Kauai, Oahu and Maui). Freshwater input results in lower salinities and groundwater has high concentrations of nitrates and silicates. Because oceanic waters are low in these and other dissolved nutrient species, a concentration gradient is

FIGURE 1. Plot of silicate (Si) concentrations (in uM) against distance from shore for surface samples at 10 locations affronting the HFDC project site, Lahaina under dry weather conditions in September 1989 and wet conditions in December 1989.

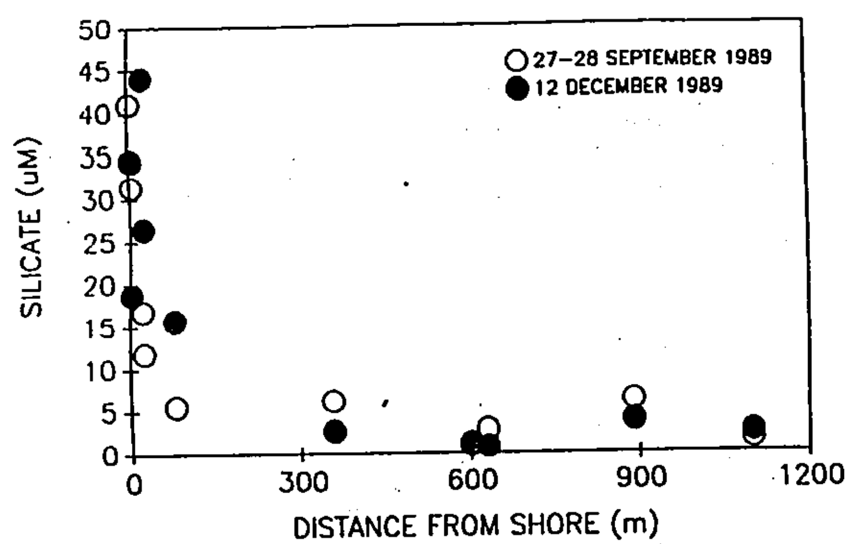

FIGURE 2. Plot of nitrate nitrogen (NO_2 + NO_3) concentrations (in uM) against distance from shore for surface samples at 10 locations affronting the HFDC project site, Lahaina under dry weather conditions in September 1989 and wet condtions in December 1989.

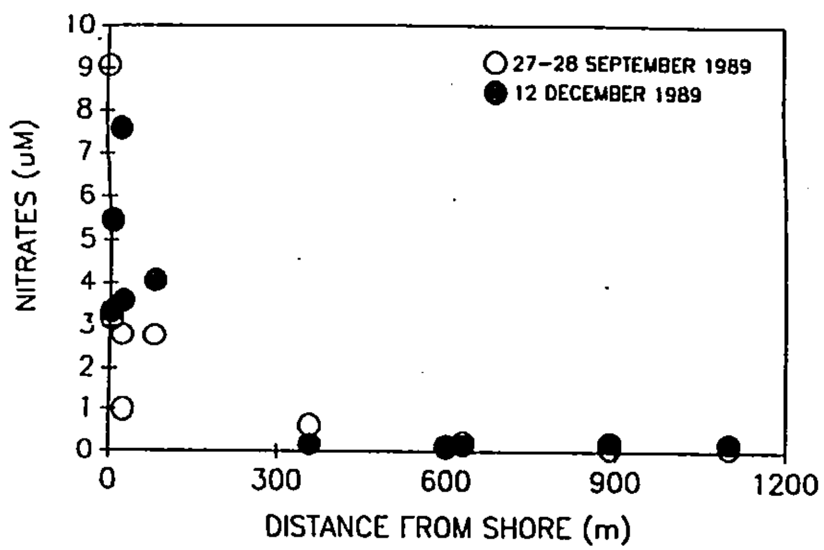

FIGURE 3. Plot of orthophosphate (PO_4) concentrations (in uM) against distance from shore for surface samples at 10 locations affronting the HFDC project site, Lahaina under dry weather conditions in September 1989 and wet condtions in December 1989.

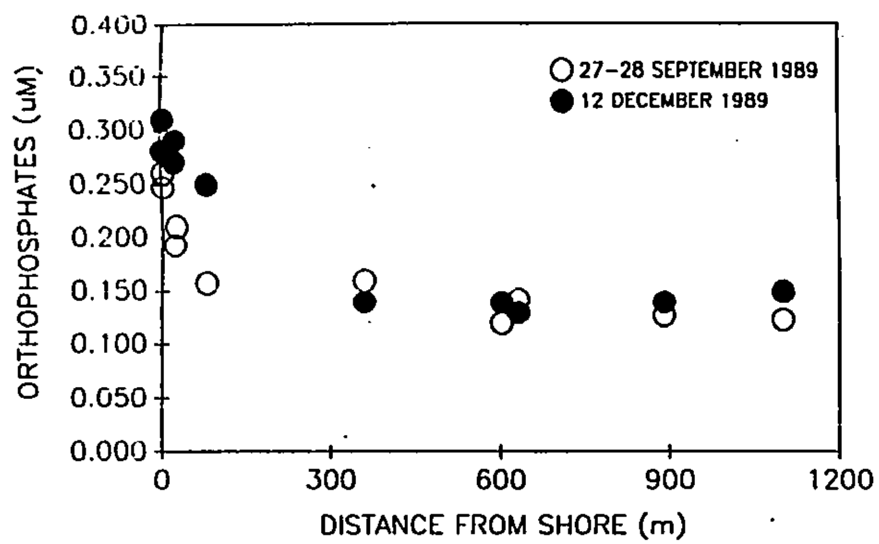

TABLE 4. Summary of the water quality parameters measured at Station 6 at the mouth of Kahoma Stream in September 1989 under dry conditions and in December 1989 following rainfall and surface water runoff in the stream. Measured concentrations of the dissolved nutrients are given in the body of the table in ug/L unless otherwise noted.

Parameter	September 1989	December 1989
Nitrate Nitrogen	0.42	43.82
Ammonia Nitrogen	4.90	2.10
Total Nitrogen	337.96	162.96
Orthophosphate	7.44	8.06
Total Phosphorus	32.86	13.33
Silicate	3452.40	1209.69
Turbidity (NTU)	2.55	2.20
Chlorophyll-a	31.1	3.6

evident in the data. A similar gradient exists with respect to depth; in general, deep samples have lower nutrient concentrations than surface samples from a given location. The salinity data suggest the existence of these gradients but the concentrations of the measured dissolved nutrient species are a much more sensitive indicator of these gradients than are measurements of salinity; this is related to the sensitivity of the equipment.

The "composite" nutrient parameters of total nitrogen and total phosphorus yield the least information about water quality of the nutrient species measured in this study. The lack of definitive information from these parameters is the result of the makeup of these two composite species. Total phosphorus and nitrogen include a myriad of unspecified groups of dissolved organic materials, some of which are not found in groundwater and are of unknown biological function.

The geometric mean for the concentration of nitrate nitrogen was equal to the "dry" criteria as established by the Department of Health (DOH) water quality standards (i.e., 3.50ug/L) in the September survey. All other measured parameters were below the DOH "dry" criteria for this sampling period. The relatively high value for nitrate nitrogen was probably related to the diffuse groundwater inputs along the entire shoreline affronting the project site. The aquifer at Lahaina is highly permeable and groundwater flow is not impeded by caprock at the coast (Mink 1989). The flux of groundwater in the basal lens has been calculated to be between 4.5 to 5 mgd per mile of coastline (Mink 1989). If groundwater flows are this high, the applicable DOH water quality criteria that should be used are the standards for "wet" conditions. These apply when open coastal waters receive more than 3 mgd of groundwater discharge per shoreline mile. Applying the wet criteria, the nitrate nitrogen value not to be exceeded is 5.00ug/L and thus the quality of the waters affronting the project site easily met state standards for an open coastal system in September. However, following the heavy rainfall and runoff in December, the geometric mean for nitrate nitrogen exceeded the water quality criteria for wet conditions (by 3ug/L) and turbidity was above permissible dry criteria levels.

The parameter that exceeded wet and dry DOH criteria on both surveys was chlorophyll-a. As noted in the first report, the relatively high level of chlorophyll-a in the study area is probably a response to elevated dissolved inorganic nutrient input via grounwater discharge. Chlorophyll-a serves as a measure of phytoplankton abundance; high phytoplankton biomass may be an indicator of eutrophic conditions, which in this case is probably a response to the discharge of groundwater.

The study of water chemistry characteristics affronting the project site suggest that some of the DOH water quality standards

are exceeded under the usual dry conditions that occur in Lahaina. With heavy rains, nearshore water quality decreases as noted in the December data; however, these impacts are temporary. As stated in the previous report, damaging flash flooding has occurred on 19 occasions since 1879 in Lahaina (U.S. Army Corps of Engineers 1973) which translates into one event about every 5.8 years. Despite the severity of these events, the nearshore benthic communities have persisted which attests to the transitory nature of impacts of lower water quality.

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APPENDIX F
FIELD SURVEY OF THE AVIFAUNA AND FERAL MAMMALS

FIELD SURVEY OF THE AVIFAUNA AND FERAL MAMMALS FOR THE LAHAIKA HFDC MASTER PLAN, MAUI

Prepared for
Phillips Brandt Reddick & Associates
Hawaii

by

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28 August 1989

FIELD SURVEY OF THE AVIFAUNA AND FERAL MAMMALS FOR THE LAHAINA HFDC MASTER PLAN, MAUI

INTRODUCTION

The purpose of this report is to summarize the findings of a three day (21-23 August 1989) bird and mammal field survey conducted at the site of a proposed HFDC development project at Lahaina, Maui (Fig.1). Also included are references to pertinent literature and unpublished reports of faunal surveys in adjacent or similar habitat. Finally, the report discusses some possible changes that might occur in the faunal community following the proposed development.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on the property or may likely occur given the type of habitats available.

2- Provide some baseline data on the relative abundance of each species.

3- Assess the possible changes in the faunal communities that might occur as a result of habitat alteration following the proposed development. In the event that special or critical habitat resources exist on the property identify these sites and make recommendations regarding their protection or what mitigating measures should be considered.

GENERAL SITE DESCRIPTION

The project-site is located at Lahaina, Maui (see Fig.1). The majority of the property is in cultivated sugar cane. All stages of cultivation are present from recently plowed fields to young and mature cane. Gulches, ditches, reservoirs and a small cindercone, Puu Laina, provide a more diversified array of habitats for wildlife. The dominant plants in these areas include: Java Plum (Syzygium cumini), Kiawe (Prosopis pallida), Koa Haole (Leucaena latisiliqua), Mango (Mangifera indica), Banyan (Ficus sp.) and Monkeypod Tree (Samanea saman) along with a host of other exotic plants. The native Wiliwili Tree (Erythrina sandwicensis) can also be found in the gulches.

Weather during the field survey was variable with cool clear mornings and variable cloudy/clear afternoons. Light to moderate rain showers occurred on 21 August. Winds were from the east at 10-20 mph.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. Attention was also paid to the presence of tracks and scats as indicators of bird and mammal activity. A total of 22 census stations (Fig.1) were established and eight minute counts were made of all birds seen or heard at these stations. These counts provide the basis for the population

estimates given in this report. Between these count stations additional observations of birds were also kept. Census (count) stations were more concentrated in regions of diversified vegetation and dispersed in the uniform cane field habitat. Faunal surveys of birds in similar habitat elsewhere on Maui were consulted in order to acquire a more complete picture of the bird activity typical in this type of habitat on Maui (Bruner 1986, 1988a, 1989).

Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution.

Scientific names used herein follow those given in the most recent American Ornithologist's Union Checklist (A.O.U. 1983), Hawaii's Birds (Hawaii Audubon Society 1984), A Field Guide to the Birds of Hawaii and the Tropical Pacific (Pratt et al. 1987), Mammal Species of the World (Honacki et al. 1982), List and Summary of the Flowering Plants in the Hawaiian Islands(St. John 1972).

RESULTS AND DISCUSSION

Resident Endemic (Native) Birds:

No endemic birds were recorded during the actual survey. The Short-eared Owl or Pueo (Asio flammeus sandwichensis) might occasionally be found at this site as they forage over open lowlands as well as at higher elevation. This species is common elsewhere on Maui, especially in Haleakala National Park (Hawaii Audubon Society 1984). The only other likely endemic species that may occur occasionally on the property are Black-necked Stilt (Himantopus mexicanus knudseni) and American Coot (Fulica americana alai). They may forage at the reservoirs or in flooded fields. Stilt and coot are opportunistic and can quickly respond to ephemeral resources. Shallenberger (1977) reports one Black-necked Stilt from "Wahikuli mudflat".

Resident Indigenous (Native) Birds:

The Black-crowned Night Heron or Aku'u (Nycticorax nycticorax) was the only indigenous species found on the property. A total of 25 Aku'u were observed foraging along ditches and around the reservoirs on the property. This species is the only native waterbird that is not endangered. In fact their statewide population has grown dramatically in recent years due to the growth of the aquaculture industry. Shallenberger (1977) also records night heron from Crater and Wahikuli (Waihukuli) reservoirs.

Migratory Indigenous (Native) Birds:

Pacific Golden Plover (Pluvialis fulva) -
Plovers prefer open areas for foraging such as exposed intertidal habitats, plowed fields and lawns. A total of 13 plover were recorded during the field survey.. These birds were observed on the plowed sugar cane field, along haul cane roads, flying over the

property and beside ditches. Johnson et al. (1981) and Bruner (1983) have shown plover are extremely site-faithful on their wintering grounds (returning each day to the same spot and maintaining this behavior throughout their life time). Plover also establish foraging territories which they defend vigorously. Such behavior makes it possible to acquire a fairly good estimate of the abundance of plover in any one area. These populations likewise remain relatively stable over many years.(Johnson et al. 1989).

Wandering Tattler (Heteroscelus incanus) -
Tattler are often found on rocky coastlines and along streams (Berger 1972, Pratt et al. 1987). One Tattler was observed along Wahikuli ditch. This species is usually solitary, however, no data are yet available that would indicate whether or not they are site-faithful on their wintering grounds as are Pacific Golden Plover.

The only other migratory shorebird species that probably occurs on the property, although not recorded on this survey is the Ruddy Turnstone (Arenaria interpres). Turnstone usually occur in small flocks and forage in fields as well as in the intertidal zone. Shallenberger (1977) reports that migratory ducks "visit the reservoirs in winter months".

Seabirds:

No seabirds were recorded on the property. Successful seabird colonies on the main Hawaiian Islands are relatively uncommon due to heavy predator pressure from introduced mammals and vandalism by humans. Some species such as Newell's Shearwater (Puffinus newelli) nest in upland forest habitat while Wedge-tailed Shearwaters (Puffinus pacificus) nest in burrows in coastal habitat. No seabirds would be expected to nest on this Lahaina Property. Great Frigatebird (Fregata minor) drink fresh water and therefore utilize ponds and reservoirs. It would not be unreasonable to assume that this species might occasionally be seen at Crater or Wahikuli reservoirs.

Exotic (Introduced) Birds:

A total of 12 species of exotic birds were recorded during the field survey. Table One shows the relative abundance of these species. The most numerous during the three day survey were Common Myna (Acridotheres tristis), Japanese White-eye (Zosterops japonicus), and Zebra Dove (Geopelia striata). Gray Francolin (Francolinus pondicerianus) were common at this site as they were on adjacent lands (Bruner 1988a, 1988b). The metal building adjacent to Wahikuli reservoir is a roosting site for over 200 Common Myna.

Five species recorded in similar habitat elsewhere on Maui (Hawaii Audubon Society 1984, Pratt et al. 1987, Bruner, 1986, 1988a, 1988b, 1989) were not seen on this survey but potentially could occur on the property: Red-crested Cardinal (Paroaria coronata), Northern Mockingbird (Mimus polyglottos), Cattle Egret (Bubulcus ibis), Ring-necked Pheasant (Phasianus colchicus) and Melodious Laughing-thrush (Garrulax canorus).

Feral Mammals:

Feral cats were seen during the survey. One Roof Rat (Rattus rattus) was also observed. A total of eight Small Indian Mongoose (Herpestes auropunctatus) were seen over the course of the three survey days. Without a trapping program it is difficult to conclude much about the relative abundance of rats, mice, cats and mongoose on this property, however, it is likely that their numbers are not dramatically different from what one would find elsewhere on Maui in similar habitat.

Records of the endemic and endangered Hawaiian Hoary Bat (Lasiurus cinerus semotus) are sketchy but the species has been recorded on Maui (Tomich 1986). Little is known of their natural history, distribution and ecological requirements. No bats were recorded on this project site despite nighttime observations.

CONCLUSION AND RECOMMENDATIONS

A brief survey can at best provide a limited perspective of the wildlife present in any given area. Not all species will likely be observed and information on their use of the site must be sketched together from brief observations and the available literature. The number of species and the relative abundance of each species may vary throughout the year due to available resources and reproductive success. Species which are migratory will quite obviously be a part of the ecological picture only at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the ecosystem (Williams 1987). Thus only long term studies can provide the insights necessary to acquire a definitive perspective of the bird and mammal populations in a particular area. However, when brief studies are coupled with data gathered from other similar habitats the value of the conclusions which are drawn is significantly increased.

In terms of broad conclusions related to bird and mammal activity on the project site the following are offered:.

1- The present environment at the project site provides a fairly limited range of habitats which are utilized by the typical array of exotic birds one would expect at this elevation and in this type of environment on Maui. The absence of Red-crested Cardinal was a little unexpected given the results of an earlier survey on an adjoining property (Bruner 1988a, 1988b). The proposed development will effectively convert what is now a largely monoculture habitat of cultivated sugar cane to a more diversified residential parkland habitat. House Sparrows (<u>Passer domesticus</u>) and House Finch (<u>Carpodacus mexicanus</u>) will undoubtedly increase in abundance when this site becomes more urban.

2- Migrant species particularly Pacific Golden Plover are usually benefited by the kind of development that creates open spaces such as large lawns. Bruner (1983) has shown that most plover will establish winter territories in the first year of their

life and return each year to reoccupy these exact same territories. The present habitat of sugar cane fields serve only as temporary foraging sites when the fields are plowed. Permanent open space like parks and golf courses would result in plover establishing territories and a more fixed size to the plover population on the property.

3- The Crater and Wahikuli Reservoirs and their surrounding vegetation are important foraging, resting and nesting areas for birds on this property. The native Black-crowned Night Heron rely upon these reservoirs for food resources and the large trees which surround Crater Reservoir are important roosting and resting areas. Where possible these reservoirs and their immediate vegetation should be maintained. Crater Reservoir and Puu Laina provide not only valuable habitat for birds but should be thought of as natural assets that could best enhance the proposed development if they were kept in a park status.

TABLE 1

Relative abundance of exotic birds recorded at the Lahaina property proposed for an HFDC Project, Maui.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*
Barn Owl	*Tyto alba*	R = 1
Gray Francolin	*Francolinus pondicerianus*	C = 6
Spotted Dove	*Streptopelia chinensis*	C = 7
Zebra Dove	*Geopelia striata*	A = 14
Rock Dove	*Columba livia*	R = 3
Common Myna	*Acridotheres tristis*	A = 19
Japanese White-eye	*Zosterops japonica*	A = 21
Northern Cardinal	*Cardinalis cardinalis*	U = 4
House Sparrow	*Passer domesticus*	U = 4
House Finch	*Carpodacus mexicanus*	A = 10
Nutmeg Mannikin	*Lonchura punctulata*	C = 9
Warbling Silverbill	*Lonchura malabarica*	R = 3

* (see page 12 for key to symbols)

-11-

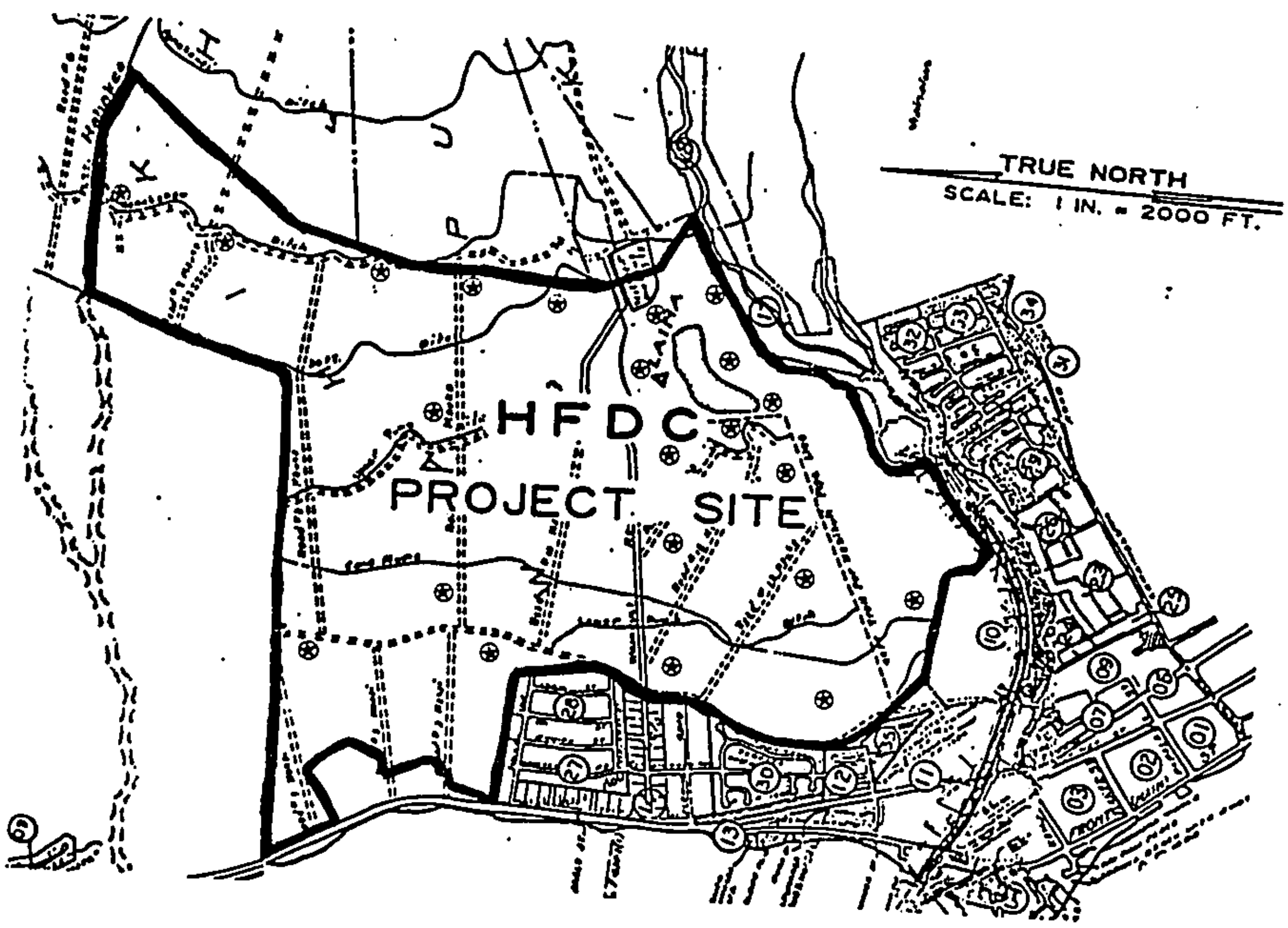

Fig. 1. Proposed project site with eight minute count (census) stations indicated by a star within a circle.

-10-

CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY

SEE FRAME(S)

IMMEDIATELY FOLLOWING

TABLE 1

Relative abundance of exotic birds recorded at the Lahaina property proposed for an HFDC Project, Maui.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*
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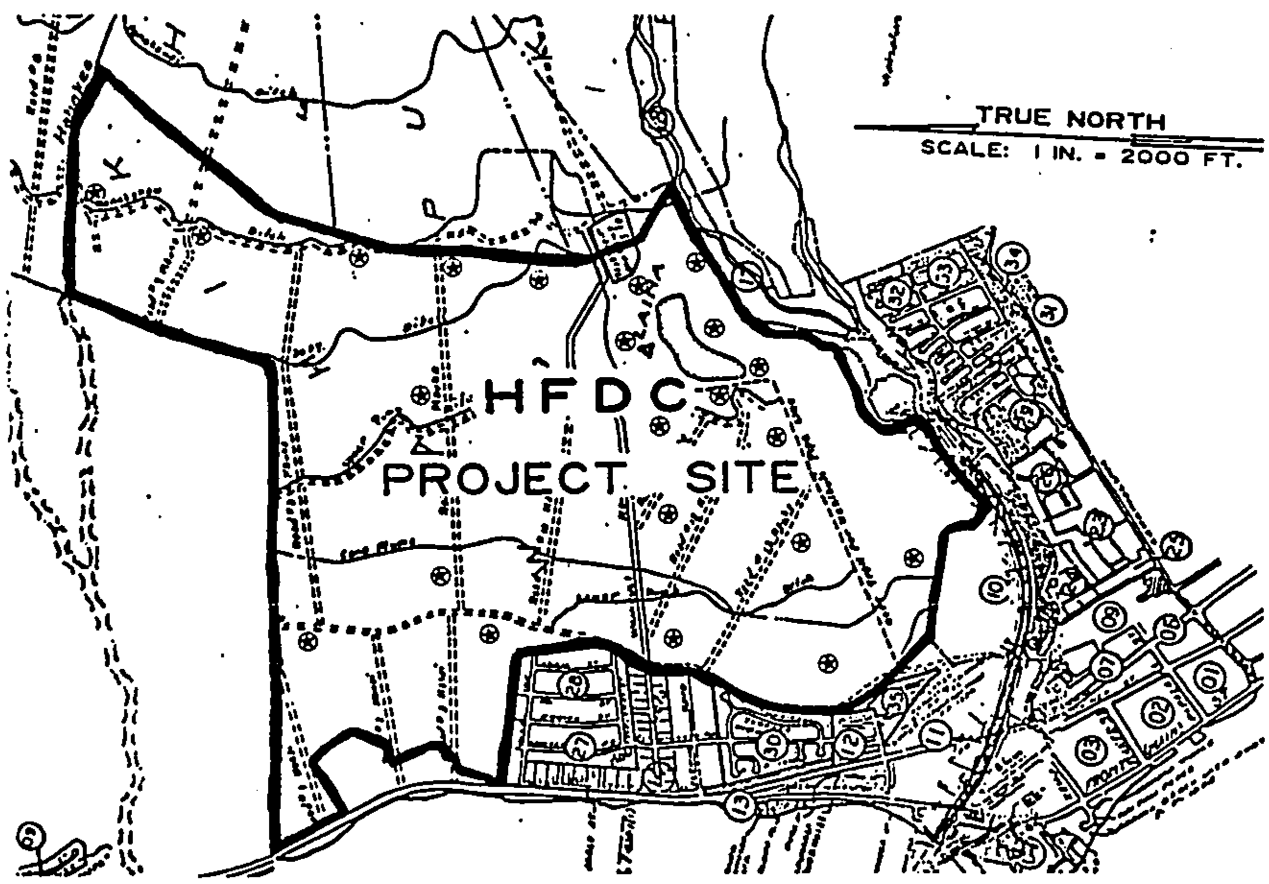

Fig. 1. Proposed project site with eight minute count (census) stations indicated by a star within a circle.

KEY TO TABLE 1

Relative abundance = Determined by frequency on eight minute counts in appropriate habitat. Number which follows is average of all counts for that species in appropriate habitat.

A = abundant (ave. 10+)

C = common (ave. 5-10)

U = uncommon (ave. less than 5)

R = recorded (number which follows is total individuals seen during the field survey)

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APPENDIX H
ARCHAEOLOGICAL INVENTORY SURVEY

Report 653-100689

Archaeological Inventory Survey
Lahaina Master Planned Project Site

Land of Wahikuli
Lahaina District, Island of Maui

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Report 653-100689

Archaeological Inventory Survey
Lahaina Master Planned Project Site

Land of Wahikuli
Lahaina District, Island of Maui

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SUMMARY

At the request of Mr. Michael B. Terry of PBR Hawaii, for their client, the Housing Finance and Development Corporation (HFDC) - State of Hawaii, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the c. 1,200-acre Lahaina Master Planned Project Site, situated in the Land of Wahikuli, Lahaina District, Island of Maui. In conjunction with the survey, PHRI also examined a short section of the proposed Alternative C Honoapiilani Highway Corridor. The basic objective of the survey was to provide information appropriate to and sufficient for the preparation of an Environmental Impact Statement (EIS) to be prepared in conjunction with a Land Use Boundary Amendment petition to be submitted to the State Land Use Commission.

The survey was conducted August 28-September 10, 1989, under the overall supervision of Associate Senior Archaeologist Dr. Peter M. Jensen and Supervisory Archaeologist Mr. Alan T. Walker. During the survey, 12 sites containing 44 component features were identified. Of the 12 sites, one had been previously identified and partially recorded (SIHP Site 1203), with the remaining 11 sites representing newly identified resources. Ranging in physical condition from poor to excellent, the identified sites included both single as well as multiple components, and displayed a range of feature types, including overhangs/caves, platforms, walled enclosures, petroglyphs, graves, agricultural terraces, and a single historic agricultural access road alignment. Tentatively identified functional types included habitation, agriculture (both prehistoric as well as historic), ceremonial/religious activities, probable burial, recreation, and some sites of probable indeterminate function.

Six of the 12 identified sites are assessed as significant solely for information content. No further work is recommended for one of these six sites (Site 2487); for the remaining five sites, further work in the form of vegetation clearing, detailed archaeological recording, and further refinement of the evaluations of subsurface components is recommended. The remaining six of the total 12 sites are assessed as significant for information content, and are provisionally evaluated as being good examples of site types. These sites include one complex in Hahakea Gulch which contains relatively well-preserved habitation features (Site 2480), the two site complexes identified within the two branches of Kahoma Stream (Site 2483 located within the south branch of the stream [also known as Kanaha Stream], and previously recorded Site 1203 located within the north branch), and two well constructed walled enclosures located within the general vicinity of Puu Laina (Sites 2485 and 2488). For these five sites, further work in the form of vegetation clearing and further data collection (i.e., detailed recording, surface collections, and limited excavations), would be followed by a decision as to whether preservation "as is," or preservation with some level of interpretive development, is appropriate. This determination would be based on functional interpretations, dating results, and evaluation of nearby areas for similar preserved examples. The last site (Site 2486) is assessed as significant for information content, and also as potentially culturally significant (if the site contains a burial).

CONTENTS

ILLUSTRATIONS

TABLES

INTRODUCTION

BACKGROUND

At the request of Mr. Michael B. Terry of PBR Hawaii, for their client, the Housing Finance and Development Corporation (HFDC) - State of Hawaii, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of the c. 1,200-acre Lahaina Master Planned Project Site, situated in the Land of Wahikuli, Lahaina District, Island of Maui. In conjunction with the survey, PHRI also examined a short section of the proposed Alternative C Honoapiilani Highway Corridor. The basic objective of the survey was to provide information appropriate to and sufficient for the preparation of an Environmental Impact Statement (EIS) to be prepared in conjunction with a Land Use Boundary Amendment petition to be submitted to the State Land Use Commission.

The survey was conducted August 28-September 10, 1989, under the overall supervision of Associate Senior Archaeologist Dr. Peter M. Jensen and Supervisory Archaeologist Mr. Alan T. Walker. Assistance was provided by Field Archaeologists Bea Burgett, Charlene Gross, and Jenny O'Claray. Approximately 200 man-hours of labor were expended conducting the survey field work.

The present report comprises the Final report of the current project. The report includes a scope of work, a description of the project area, a review of previous archaeological investigations within the immediate project vicinity, and a discussion of the field methods and procedures utilized. The report concludes with site descriptions, site significance evaluations, and recommended treatments for all recorded resources.

SCOPE OF WORK

The basic purpose of the inventory survey was to identify—to discover and locate on available maps—all sites and features of potential archaeological significance present within the specified project area. An inventory survey constitutes an initial level of archaeological investigation. It is extensive rather than intensive in scope, and is conducted basically to determine the presence or absence of archaeological resources. This level of survey indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. It permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for any subsequent mitigation work as might be necessary or appropriate. Such mitigation work could include further data collection involving detailed recording of sites and features, and limited excavations; and possibly subsequent data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research potential, interpretive qualities, and/or cultural values.

In consideration of the above, the basic objectives of the present survey were fourfold: (a) to identify (find and locate) all sites and site complexes present within the project area; (b) to evaluate the potential general significance of all identified archaeological remains; (c) to determine the possible impacts of proposed development upon the identified remains; and (d) to define the general scope of any subsequent further data collection and/or other mitigation work that might be necessary or appropriate.

Based on a review of readily available background literature, basic familiarity with the general project area, PHRI's extensive familiarity with the current requirements of pertinent review authorities, and discussions with Agnes Estioko-Griffin of Hawaii State Department of Land and Natural Resources-Historic Sites Section/State Historic Preservation Office (DLNR-HSS/SHPO), the following specific tasks were determined to constitute an adequate and appropriate scope of work for the proposed inventory survey:

1. Conduct archaeological and historical documentary background research involving review and evaluation of readily available archaeological and historical literature, historic documents and records, and cartographic sources relevant to the immediate project area;

2. Conduct a 100% coverage, low-level (30-50 ft altitude) aerial reconnaissance survey (helicopter) of the entire project area, with special emphasis on (a) identification of (1) any sites (both new and previously recorded) with surface structural remains and (2) areas devoid of sites (e.g., mechanically altered lands under past/current cultivation and pasture), and (b) locational plotting of sites and areas on aerial photos and/or topographic maps;

3. Conduct a variable coverage (partial to 100%), variable intensity ground surface survey of the entire project area, with (a) relatively higher intensity coverage being given any non-cultivated and otherwise minimally modified lands, and (b) relatively lower intensity coverage to lands extensively modified by historic period and/or recent cultivation;

4. Conduct limited subsurface testing of selected locations and identified sites within the project area, by means of mechanical backhoe and/or hand-tools, (a) to determine the presence or absence of potentially significant buried cultural features or deposits, and (b) to recover samples of portable remains (artifacts and/or midden) and materials suitable for dating; and

5. Analyze background and field data, and prepare appropriate reports.

The inventory survey was carried out in accordance with the standards for inventory-level survey recommended by the Hawaii State Department of Land and Natural Resources-Historic Sites Section/State Historic Preservation Office (DLNR-HSS/SHPO). These standards are currently being used by Maui County Planning Department as guidelines for the review and evaluation of archaeological inventory survey reports submitted in conjunction with various development permit applications. The standards are also utilized by the State Land Use Commission in evaluating boundary amendment petitions.

The significance of all archaeological remains identified within the project area were to be assessed in terms of (a) the National Register criteria contained in the Code of Federal Regulations (36 CFR Part 60), and (b) the criteria for evaluation of traditional cultural values prepared by the national Advisory Council on Historic Preservation. DLNR-HSS/SHPO uses these criteria to evaluate eligibility for both the Hawaii State and the U.S. National Register of Historic Places.

PROJECT AREA DESCRIPTION

The project area consists of approximately 1,200 ac in the Land of Wahikuli, Lahaina District, Island of Maui (Figure 1). The project area is bounded on the west by Wahikuli and Waikuli Terrace Parks and by Lahaina Civic and Recreation Center property, on the north by the Wahikuli ahupua'a boundary line and by the center of Hahakea Gulch, and around the east and south perimeters by the Wahikuli ahupua'a boundary line. While a portion of Hahakea Gulch defines the northern margin of the project area, and segments of the high ground above Kahoma Stream define the southern margins of the parcel, the remainder of the land is dissected by only a single gulch which descends westward to the Pacific Ocean from the lower reaches of the West Maui Mountains. A short section of proposed Alternative C Honoapiilani Highway corridor, where the corridor exits the Lahaina Master Planned Project site and crosses Kahoma Stream, was also incorporated into the area examined for cultural resources.

Virtually all of the project area has been and/or is currently being intensively cultivated for sugarcane and pineapple. Most of the cultural features currently visible on the surface of the parcel relate to this essentially modern agricultural activity, and include graded access and major cane haul roads, major and minor irrigation ditches, irrigation reservoirs and small ponds, and a short section of the historic Pioneer Mill Railroad Route (in current use as a tourist attraction). That both historic and contemporary cultivation have involved deep plowing and extensive surface modifications and substantial disturbance to subsurface deposits is attested by the presence of massive field clearing debris piles, particularly within the southwestern portion of the project area. According to Foote et al. (1972: Sheet 93), the project area incorporates at least two major soil classifications, including Pulehu silt loam and Ewa silty clay loam (Foote et al. 1972:29, 116). Annual rainfall in the project area is estimated to be about 15-20 inches (Armstrong 1973:56). The available water supply, combined with the deep rich soils, was more than adequate to support dense stands of native vegetation in early historic and prehistoric times. However, the extensive agricultural activities within the area have resulted in removal of virtually all of this cover and its replacement with sugarcane (Saccharum officinarum L.). Small pockets of relatively undisturbed terrain containing stands of native and introduced species comprise only about 10-12% of the project area and occur primarily restricted to the steep-sided, non-arable gulches associated with Kahoma Stream, Hahakea Gulch, and the unnamed gulch dissecting the approximate center of the project area. Additional undisturbed lands occur at Puu Laina, and between Puu Laina and Kahoma Stream within the southern portion of the project area.

PREVIOUS ARCHAEOLOGICAL WORK

Although formal archaeological survey work was initiated relatively early on Maui (e.g., Emory 1921; Walker n.d. [1930]), the island's prehistoric resources remains much less intensively studied than the resources for either Hawaii or Oahu. Emory's early work on Maui involved an inventory of archaeological sites located in Haleakala Crater, and is not directly relevant to the present project area. Winslow Walker's Bishop Museum-commissioned study involved a partial assessment and inventory of larger sites and heiau around the island. Immediately southwest of the

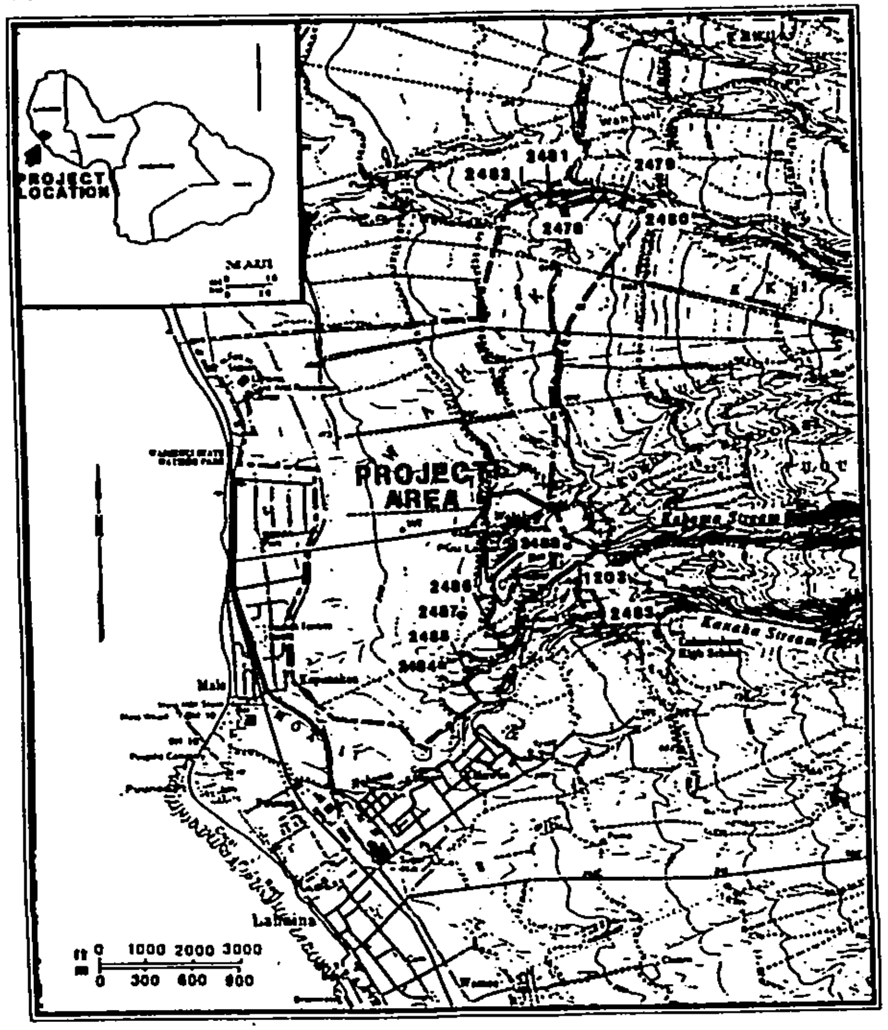

Figure 1. **PROJECT AREA AND SITE LOCATION MAP**
LAHAINA MASTER PLANNED PROJECT SITE
Land of Wahikuli, Lahaina District
Island of Maui
Project 89-653 *October 1989*

present project area, Walker references information from Thrum concerning several heiau remnants (Walker's Sites 7, 8, 9, and 10). However, all of these features had been completely, or nearly completely destroyed by the time that Walker conducted his survey field work (n.d.). Walker had also identified a heiau site (Walker's Site 11) immediately west of the present project area and to the north of Mala Wharf, which he described as a "large heiau for human sacrifice..." Again, however, by 1930 only a "...few fragments of walls remain[ed]." Walker identified no additional sites either along the coast or inland for a distance of at least two miles north of the northern perimeter of the present project area. Walker does not even mention the existence of the Alaloa ("Long Road") through the project area. Although major segments of this putative 16th century alignment remain intact around the island, according to Handy and Handy (1972:490-491) "...it was formerly clearly visible across the West Maui golf links, but was obliterated in the Lahaina area and beyond by the cultivation of cane and pineapple."

Maui archaeology was largely ignored during the 1950s, at a time when research being undertaken elsewhere was establishing important local and regional artifact chronologies and frameworks for categorizing major Hawaiian site-types. Some productive research was undertaken on East Maui during the 1960s (Soehren 1963, Pearson 1970), and Chapman's intensive settlement pattern survey and excavation work in Kahikinui contained island-wide implications for prehistoric patterns of settlement and land use (Chapman and Kirch 1979).

In West Maui, a small brick building called the "birth place" of King Kamehameha I located near the center of the Lahaina National Landmark, was evaluated, stabilized, and prepared for public display during the mid-1960s (Frederickson and Frederickson 1965). For the most part, however, relatively little research was undertaken within West Maui during this period.

During the succeeding decade and through the 1980s, West Maui finally began to receive increased attention, as the pace of urbanization and resort development demanded intensive contracted survey and excavation projects, a number of which have been undertaken within the immediate project vicinity. Proposed flood control improvements for Kahoma Stream, portions of which mark the eastern and southern perimeter of the present project area, had been conducted on the south side of the stream during the 1970s (Connolly 1974, Hommon 1973, Ahlo and Morgenstein 1980). Development of the nearby Mala Wharf Boat Launch Ramp had likewise been accompanied by several archaeological studies, including those by Sinoto (1975), Davis (1974), and Hammatt (1978). The latter projects identified numerous human burials, principally historic period in age, in the sand berm situated inland of the Mala Wharf and immediately west of the southernmost portion of the present project area. Also identified south of Kahoma Stream was an historic earth oven, or imu, and a ditch which Hammatt (1978) believed may have connected the well-documented Alamihi Fishpond to Kahoma Stream to the north (cf. Joerger and Kaschko 1979).

Additional subsurface reconnaissance surveys were undertaken within the immediate vicinity of the Alamihi Fishpond and the Mala Wharf by PHRI. One of these projects (PHRI 374) was undertaken in January of 1988 and involved excavation of 19 backhoe trenches, recording of stratigraphic information, and evaluating subsurface components for the presence of cultural materials and features. The program yielded a total of 33 glass bottles, 24 of which were dated to the period just prior to and immediately following the turn of the century (Haun 1988:16). In addition, age determinations involving both volcanic glass and radiocarbon samples yielded evidence of prehistoric use and occupation of the area between AD 1260 and 1640 (Haun 1988:17). The extensive disturbance documented in the backhoe trench profiles did not warrant preservation of specific cultural features or artifact concentrations, although monitoring was recommended as appropriate in view of the potential for encountering additional in situ cultural materials during construction. A second similar but smaller-scale project was conducted by PHRI (PHRI 397) in March of 1988, involving a small commercial lot located immediately south of the Mala Wharf Road and within the general vicinity of the south side of the Alamihi Fishpond. Based on the negative findings of both the background documentary research and the subsurface reconnaissance testing (eight backhoe trenches were excavated), provisional archaeological clearance for the proposed future development of the lot was recommended (Jensen 1988).

A thorough review of present project area maps and site locational information for the several previously identified resources at and around the mouth of Kahoma Stream, as discussed above, indicates that none of these previously recorded sites or features is located within the present project area, nor will any be affected by the proposed undertaking as presently planned.

Further inland, however, additional cultural resources have recently been relocated along Kahoma Stream near the southeast corner of the present project area. Originally recorded in April of 1974, SIHP Site 1203, known as the Kahoma Complex and consisting of 38 petroglyphs and a rockshelter, was relocated by Barrera in conjunction with his literature search and field survey of Alternative C of the proposed Honoapiilani Highway realignment between Lahaina and Honokawai (Barrera 1989:9). In reexamining this previously recorded site, Barrera also discovered additional agricultural features, including at least three terraces and a possible irrigation ditch on the alluvial floodplain on the south side of Kahoma Stream. On the basis of his conclusion that the site likely retains potentially significant information value, Barrera recommended that project effects be further evaluated in the event that direct impacts cannot be avoided. Following submission of Barrera's report, the State Historic Preservation Officer concluded that basic identification and evaluation of the resource (Step 1 of the 106 Process compliance) had not been adequately completed. One of the objectives of the present project was, therefore, to complete this work for the previously identified resources (i.e., Site 1203) located within that portion of road Alignment C which crosses Kahoma Stream.

Immediately southeast of the project area at Wainee Village near Lahaina, Hommon surveyed several hundred acres, although no intact cultural resources were encountered (Hommon 1982a).

North of the present project area, and during the early 1970s, Kirch documented intermittent marine exploitation at several small sites at Hawea Point for the period post-dating c. AD 1500 (Kirch 1973b). During this same period, the Archaeological Research Center of Hawaii (ARCH) undertook intensive survey of several hundred acres in conjunction with proposed realignment of the Honoapiilani Highway corridor through Kaanapali, between Honokawai and Alaeloa ahupua'a (Griffin and Lovelace 1977). Only four sites were encountered, including two walls, a trail, and a small midden deposit. The latter feature was further evaluated and eventually yielded radiocarbon dates confirming occupation for several centuries prior to western contact. Subsequent work within the same general vicinity produced similar results; during his survey of the North Beach Mauka and South Beach Mauka project areas (involving c. 240 acres), Hommon identified only three sites, including a single agricultural complex and two short wall segments. Hommon's findings, and the earlier work by Griffin and Lovelace, clearly highlighted the extensive surface disturbance to which much of West Maui has been subjected by both resort development as well as historic and contemporary agricultural activities. Despite these findings, however, monitoring of construction work along the beachfront at the site of the Kaanapali Alii Condominiums did confirm the presence of prehistoric burials (Dobyns and Allen-Wheeler 1982), a discovery which later resulted in similar recommendations for other such coastal development areas.

Besides the work by Kirch, Hommon, Dobyns and Allen-Wheeler, and Griffin and Lovelace (cited above), additional studies have been undertaken north of Lahaina and the present project area. Immediately northwest of the present parcel, PHRI conducted surface reconnaissance survey of the Sheraton Maui Master Plan Site in the Lands of Honokawai and Hanakaoo, Lahaina District. The archaeological team discovered virtually all of the project area to be fully developed with hotel structures, parking lots, driveways, and landscaping. The only unaltered portions of the project area were the barren coastal flats and the exposed faces of the old cinder cone at the point. No surface indications of cultural material were encountered during the examination of these areas, and conditional archaeological clearance was recommended for additional development of the Sheraton property at this location (Rosendahl, M.L.K. 1986).

In 1986, Barrera (1986) conducted an archaeological reconnaissance survey of the North Beach project area in conjunction with additional proposed developments at Kaanapali. No surface structures were identified during the survey, which concluded with a recommendation for subsurface reconnaissance of the sand dune area (Barrera 1986:3-4) in view of the previous findings by Dobyns and Allen-Wheeler (1982). The recommended dune reconnaissance (subsurface coring) was undertaken the succeeding year by PHRI (PHRI 321) (Rosendahl 1987), but failed to identify any subsurface prehistoric cultural deposits or human skeletal remains. Fragments of glass and metal were present in approximately 20% of the cores, although most of this material was recovered from upper strata and was determined to be of recent vintage. The generally negative findings were interpreted as evidence that there had been little to no prehistoric use of the area, or that such evidence was simply no longer present.

The subsurface coring of the dune did result in the identification of a single surface feature, consisting of an L-shaped wall without associated cultural deposits. Based on these findings, archaeological clearance was recommended for the proposed Kaanapali Resort expansions on the condition that initial ground disturbing activities along the shoreline be accompanied by archaeological monitoring. A monitoring plan was subsequently prepared and approved by the DLNR-HSS/SHPO and the Army Corps of Engineers (PHRI 345) (Rosendahl 1987).

Still further north, a proposal by the U.S. Department of Agriculture, Soil Conservation Service to establish a desilting basin at Kahana was accompanied by a program of subsurface archaeological reconnaissance (PHRI 128) (Walker

and Rosendahl 1985). The program was undertaken in order to evaluate possible subsurface accumulations of cultural material at several previously recorded prehistoric sites (Kaschko 1974). Detailed recording and test excavations had already been undertaken at several of these sites by the Bishop Museum (Komori 1983), whose findings suggested the possibility that additional significant cultural material may remain buried within the vicinity, and that this material reflected historic-era cattle ranching operations in the area. The PHRI evaluation suggested, on the other hand, that the project area sites represent an inland portion of the agricultural component of the traditional Hawaiian land use system, with historic period re-use of the area following initial displacement of Native Hawaiians which accompanied the introduction of commercial sugar cane and pineapple cultivation (Walker and Rosendahl 1985:22).

Finally, significant cultural deposits have been located at the proposed Kapalua Hotel Development Site in the Land of Honokahua, Lahaina District. Situated at Honokahua Bay, evidence of prehistoric burials within the project area was first noted and recorded by Kirch in 1973 during a reconnaissance survey for Kapalua Resort (Kirch 1973a). The burial site was subsequently listed with five other prehistoric sites within the Honokahua Archaeological District (SIHP Site 1342). In early 1986, vegetation grubbing associated with initial clearing for access roads required for engineering studies exposed five areas of disturbed skeletal material. Subsurface survey conducted in the spring of 1986 documented intensive use of the area as a cemetery, as well as previously unrecorded cultural features (including buried midden) within the project area (PHRI 246) (Donham 1986). Following additional surface and subsurface evaluations, mitigation data recovery field work was initiated in March of 1987 and continued more or less uninterrupted through late December of 1988. Interim reports (Donham 1989) document a complex, multi-component burial site with indications of initial use of at least some project area features as early as AD 600 (Donham 1989).

Collectively, the various studies discussed above document the presence within West Maui of a variety of significant and potentially significant prehistoric and historic-era cultural resources. However, only a single prehistoric site, containing habitation and agricultural features as well as petroglyphs, has been recorded within the present project area (SIHP Site 1203, the "Kahoma Complex").

On the other hand, previous archaeological work has also documented that much of the land located to the north of Lahaina has been extensively disturbed by historic and contemporary cane and pineapple cultivation. As a consequence of this disturbance, archaeological surveys of even relatively large parcels have occasionally failed to identify any resources at all. Based on these previous results, after reviewing aerial photographs and other project area maps, and in consideration of the fact that nearly 90% of the parcel has been subjected to intensive agricultural development, it was considered likely that relatively few intact cultural properties would be encountered within the present project area.

LIMITED HISTORICAL DOCUMENTARY RESEARCH

by Helen Wong Smith, B.A.

The ahupua'a of Wahikuli (lit. "noisy place") has been overshadowed during historic times by its much-visited neighbor just to the south, Lahaina. As a result, relatively little is available in terms of sources referring specifically to Wahikuli. For this reason, references to Lahaina have been substituted here, since it is nearby and thus closely associated with Wahikuli.

Inez Ashdown (personal notes) claims that Lahaina was originally Laha'aina, literally meaning "land [of] prophesy," deriving from the ancient alii prophets who made their predictions there. Another interpretation of the name is "cruel sun"; as noted by Albert Pierce Taylor, "[a] thin-haired chief who lived at Kauaula Valley, while going to and fro without a hat, felt annoyed at the effects of the scorching rays of the sun. He looked up and gazed into the heavens and cursed at the sun thus: 'He keu hoi keia o kala haina!' ('What an unmerciful sun!')" (Taylor 1928:36).

Another old variant name for Lahaina, attributed to a number of sources, is Lele (literally, "jump"). According to Ashdown, "The surf of U-o at Lele was even more important to ali'i...than others such as Ka-lehua-wehe at Waikiki" (personal notes).

Traditional References and Legends

Kamakau tells of a burial site north of the project area. His description suggests that people from Wahikuli were buried there:

> Waiuli...is a deep pit where the corpses of the common people were thrown (he lua meki ho'olei kupapa'u ia no na maka'ainana). It is directly mauka of Honokohau, Honolua, and Honokahua, and for those from Lahaina to Kahakuloa, it was the common burial place (ho'oilina kupapa'u). The body of anyone from those places who had died on Molokai was brought back to that place. (Kamakau 1964:39)

Following are two legends which are associated with the Lahaina area, the first from Kamakau, and the second from Beckwith.

> This is the main reason why the people of Maui worshipped sharks—in order to be saved from being eaten by a shark when they went fishing. At...Lahaina...a fisherman was in danger of being devoured by a shark when he went out fishing with a dip net ('upena 'aki'iki'i), or fishing for octopus with a lure (lawai'a lu'uhe'e), or setting traps for hinalea fish (ho'olu'ulu'u hinalea), or diving with a scoop net...or whichever kind of fishing a man would be doing alone. It would be better to stay ashore, but the fisherman craves fish to eat, and so might be devoured by a shark. Hence the people of that island worshiped sharks. Most of the people of that land do not eat shark even to this day; those who do are malihini—the kama'aina are afraid to eat shark (Kamakau 1964:78).

> There was a famous mo'o (lizard) goddess named Kihawahine who lived at Lahaina. A chiefess who worshipped her there died and was given the name Kihawahine. The one-time chiefess became confused with the more ancient mo'o to whom she was dedicated. Kihawahine was one of the deities venerated by Kamehameha the Great, who set her image in a heiau. Presumably the image was in the form of a giant reptile. The image was dressed "in deep saffron, yellow or light yellow on a patterned tapa cloth" (yellow was the color identified with mo'o; the patterned tapa perhaps suggestive of the patterns on a lizard skin). "In her name [Kamehameha] carried his conquest over the islands.... Ulumaheihei Hoapili, who later became an active friend of the missionaries and a leader in establishing the Christian church, was her keeper (kahu)" (Beckwith 1940:125-126).

Fornander (1917-19) describes nearby Kekaa in a reference that also mentions Wahikuli:

> Kekaa was the capital of Maui when Kakaalaneo was reigning over West Maui....Many houses were constructed and people cultivated a great deal of potatoes, bananas, sugar cane, and things of a like nature. I have been told that the country from Kekaa to Hahakea and Wahikuli—that country now covered by cactus, in a northwesterly direction from Lahaina—was all cultivated. This chief (Kakaalaneo) also planted bread fruit and kukui trees down at Lahaina. Some of these trees southwest of the Lahaina fort, were called the bread fruit of Kauheana (Fornander, vol. 5:540-541).

Interpolating Fornander, Handy concludes that there was "continuous cultivation on the coastal region along the northwest coast" of Maui. He goes on with his own description of the area:

> On the south side of western Maui the flat coastal plain all the way from Kihei and Maalaea to Honokahua, in old Hawaiian times, must have supported many fishing settlements and isolated fishermen's houses, where sweet potatoes were grown in the sandy soil or red lepo near the shore. For fishing, this coast is the most favorable on Maui, and, although a considerable amount of taro was grown, I think it is reasonable to suppose that the large fishing population which presumably inhabited this leeward coast ate more sweet potatoes than taro with their fish. Almost no sweet potatoes are planted in this section now, however, which is partly due to the displacement of Hawaiians by Orientals on the industrialized sugar and pineapple plantations (Handy 1940:159).

Handy later presented the following summary of this important region:

> Lahaina District was a favorable place for the high chiefs of Maui and their entourage for a number of reasons: the abundance of food from both land and sea; its equable climate and its attractiveness as a place of residence; it had probably the largest concentration of population, with its adjoining areas of habitation; easy communication with the other heavily populated areas of eastern and northeastern West Maui and with the people living on the western, southwestern and southern slope of Haleakala; and its propinquity to Lanai and Molokai... All this area, like that around and above Lahaina, is now sugar-cane land....Lahaina's main taro lands, on the lower slopes running up to the west side of Pu'u Kukui, were watered by two large streams, Kanaha and Kahoma, which run far back into deep valleys whose sides were too precipitous for terracing. (1972:492)

Early Historic References

Menzies, the naturalist and surgeon on board HMS <u>Discovery</u> during Captain George Vancouver's 1793 tour, made these observations of the Lahaina coast and the village:

> ...[We] soon entered the verge of the woods where we observed the rugged banks of a large rivulet that came out of the chasm cultivated and watered with great neatness and industry. Even the shelving cliffs of rock were planted with esculent roots, banked in and watered by aqueducts from the rivulet with as much art as if their level had been taken by the most ingenious engineer....

> March 17...to see the village of Lahaina, which we found scattered along shore on a low tract of land that was neatly divided into little fields and laid out in the highest state of cultivation and improvement by being planted in the most regulated manner with the different esculent roots and useful vegetables of the country, and watered at pleasure by aqueducts that ran here and there along the banks intersecting the fields, and in this manner branching through the greatest part of the plantation (Menzies 1920:105,112).

J. Arago, who visited Hawaii with Captain Louis de Freycinet in 1819, was impressed with the area as well:

> The environs of Lahaina are like a garden. It would be difficult to find a soil more fertile, or a people who can turn it to greater advantage;...various sorts of vegetables and plants...amongst which we distinguish the Caribee-cabbage, named here taro; double rows of banana, bread-fruit, cocoa-nut, palma-christi, and the paper-mulberry trees...

> The space cultivated by the natives of Lahaina is about three leagues [9 miles] in length, and one in its greatest breadth. Beyond this all is dry and barren; everything recalls the image of desolation (IN Handy 1972).

Rev. C.S. Stewart visited Hawaii twice, first as a missionary in 1823 assigned to the station at Lahaina, then as Chaplain of the U.S. Frigate <u>Vincennes</u>. His diary entry for May 31, 1823 reads:

> The settlement is far more beautiful than any place we have yet seen on the Islands. The entire district stretching nearly three miles along the seaside, is covered with luxuriant groves, not only of the coconut, the only tree we have before seen except on the tops of the mountains, but also of the breadfruit and of the kou...while the banana plant, kapa and sugar-cane are abundant, and extend almost to the beach, on which a fine surf constantly rolls (Taylor 1928:42).

Another Stewart entry reads:

> ...The breadfruit trees stand as thickly as those of a regularly planted orchard, and beneath them are kalo patches and fishponds, 20 or 30 yards square, filled with stagnant water, and interspersed with kapa trees, groves of banana, rows of the sugar cane, and bunches of the potato and melon....It scarcely ever rains, not oftener, we are told, than half a dozen times during the year, and the land is watered entirely by conducting streams, which rush from the mountains, by artificial courses, on every plantation. Each farmer has a right, established by custom, to the water every fifth day (Taylor 1928:43).

The <u>Pacific Commercial Advertiser</u> (February 12, 1857) devoted itself to the port of Lahaina. The following excerpt reports on the population as well as the agriculture:

> ...Fruits are generally abundant. The grape seems to luxuriate in the rich soil, and the sunny, clear weather of Lahaina.... Figs, bananas and melons are produced in abundance, and pumpkins enough for all New England to make pies for a general Thanksgiving....

> In riding through [a] "Tropic road"...we counted twenty varieties of trees and shrubs growing by the road side, and presenting within a mile's ride, as fine specimens of tropical productions as any similar drive to be found on the Islands.

> The population of Lahaina is estimated at fifteen hundred, the foreign part of which will not probably exceed one to two hundred. The causes that have been at work depopulating the islands have likewise tended to reduce the numbers here. "Years ago there was a hut under every breadfruit tree," was the statement of an old man who has seen the four Kamehamehas as the rulers of the land. So far as local diseases, we are singularly free. The climate is unequaled; the mild, sea breezes temper the heat of the day, and the cool breeze of the night makes sleeping a luxury to be enjoyed.

Finally, the <u>Maui News</u> (2-3-1926) provided the following narrative of a 1926 trip on horseback, in an article entitled "Historic Lahaina":

> The road during the rest of the journey to Lahaina [rider is departing the Hookokau area, North of

Wahikuli] is first-class. For a great part of the way the traveler can indulge in a brisk canter whenever he chooses. It skirts the sea beach very closely, running, in some places, within eight or ten feet of high water mark. Beyond this part, all the way into Lahaina, it lies further from the sea, but is equally good for riding.

...The large number of mango, bread fruit, tamarind, and other trees, with innumerable bananas, which are growing in all parts of the town and around it, give the place a most picturesque appearance. The luxuriance with which these trees grow here I have not seen equalled at any other place in the Kingdom. Mr. Turton's sugar plantation also is quite near to the town. Sugar cane is planted here wherever land can be obtained, a proof how rich the soil is....It [Lahaina] has suffered from the advance of other places, and also, in common with all the formerly populous parts of the Kingdom, from the lamentable depopulation, which is the most striking feature in the history of the islands since they became known to European nations. It has, I believe, experienced of late some revival, but its prospects are by no means so good as those of many other Hawaiian towns, which, under the influence of what is now the staple industry of the Kingdom, sugar growing, are making rapid strides in advance. -*George Cummings, clerk in the Office of the County Auditor.*

A survey of Maui sites was conducted by Winslow Walker in 1929. He lists one site for the Wahikuli ahupua'a:

Halulukoakoa Heiau, Mala Region

Location: S.E. corner of a cocoanut grove at Mala, just north of Kapunakea Camp. It lies in the ahupuaa of Wahikuli according to Thrum.

Description: A large heiau for human sacrifice of which but few fragments of walls remain. There is some coral to be found in their construction, but most of the stone has been removed for rock ballast on the railroad. The site has been further cleared and levelled to make a playground, and what remains has been used for a dump of debris of every kind, and the whole is heavily overgrown with kiawe bushes.

Remarks: Informant J. Kahahana is said to know of some legends connected with this heiau (1929:114).

Land Commission Awards

Testimony given in support of Land Commission Awards (LCA) is often used to shed light on land uses for a particular area. The Indices to Land Commission Awards lists only two awards for the ahupua'a of Wahikuli: LCA 477-F to P. Keliipio for 1 acre, 2 roods, 3 rods, and LCA 7724 to Poholapu for 12 acres. Keliipio's parcel is listed as a house lot alongside Kaanapali Road and Chandler's land (Alexander map Aug. 20, 1851). Poholapu's parcel, which was bounded by Kahoma Stream on the Olowalu side, was cultivated in taro (Hawaii State Archives, Native Testimony). A large percentage of Wahikuli was Crown Land. The Index of Kamehameha Deeds shows that 2,194 acres were leased from Kamehameha III to Kamehameha V on March 1, 1854 for the amount of $250 per annum (State Survey Office, Personal Communication). Kamehameha V had title of the ahupua'a of Hanakao'o, the northern neighbor of Wahikuli, and tried his hand at sugar cultivation (see Pioneer Mill Co. in this report).

A 1913 map by W. E. Wall (Reg. #2569) depicts another LCA, #5483:2 to Kaeo, as well as Grant 1891 to D. Baldwin. The map also reveals that 14,797 acres were devoted to cane land, and 221 acres to pasture land. This cane cultivation was under the management of Pioneer Mill Company.

Pioneer Mill Co.

Lahaina was the setting of some of the earliest sugar enterprises in Hawaii. In 1849 Judge A.W. Parsons operated a sugar mill here. This mill, along with 1,000 acres of land, was sold to O.H. Gulick at auction. Henry Dickenson, a Lahaina store owner, began a plantation in 1859, and the success of his Lahaina Sugar Co. encouraged the establishment the following year of a second plantation, Pioneer Mill Co. It was founded by three partners: James Campbell, a carpenter who later became Hawai'i's first millionaire, Henry Turton, and James Dunbar, on lands deeded to them by Benjamin Pitman. In 1863, Lahaina Sugar Co. went bankrupt and sold out to Pioneer Mill Co. (HRHP Site Form 50-03-1598, and Conde 1973:252). Another plantation, formed by Lot Kamehameha and others in 1870, was also bought out by Pioneer Mill Co. a few years later (HRHP Site Form 50-03-1598). The firm of Walker & Allen appears to have been the plantation agency in the early years, but in 1877 H. Hackfeld replaced them as agents (Conde 1973:252). An 1883 evaluation of plantations represented by H. Hackfeld lists Pioneer Mill Co. assets at $500,000 (Simpich 1974).

A section of Pioneer Mill's railroad ran through the project area. The main line extended north from the mill, which is several blocks from the center of Lahaina Village, to a point north of the town of Puukolii in Hanakaoo, five miles distant and, at the north end, about 350 feet above the sea (Conde 1975:169). The Pacific Commercial Advertiser reported on the construction of the railway on Oct. 23, 1882:

> Turton's railroad to Kaanapali is making rapid progress. The grading is finished for over two miles out from the mill, and the track is laid on same for nearly the whole distance. Mr. Johnstone, the civil and every other kind of engineer, has management of the whole thing, and is making things hum along the route — he expects to be hauling cane [to] Kaanapali by January next...
>
> Formerly the cane was brought to Lahaina at the rate of twenty cart loads a day — the carts would come into Lahaina in the morning and return in the afternoon to load up for the next day's trip. It took from six to eight bullocks to a cart, a driver for each team, and a luna to go back and forth with them. Now however, 120 loads will be hauled by steam in a day and it will require but the engineer, and say two trainmen on the cars — the wear and tear and loss of cattle and mules on the Kaanapali route was more than running expenses and wear and tear on the railroad will be.

The Hawaiian Gazette added to this on November 29, 1882:

> Mr. Turton's railroad to Honokowai has made good progress; the grading is now substantially completed and three miles of track are laid. About one mile has been heavy grading along a rocky tract, where a large amount of dynamite has been used. The whole length of the permanent track is four and one half miles; width of track 31 inches, steel rails. There will be some 5000 feet more movable track in addition. One and one quarter miles of railway will be laid from the mill to the south end of Lahaina. The whole cost of the railway and other plant will not exceed $30,000. This will dispense with about $20,000 invested in carts and teams, heretofore employed in conveying cane to the mill.

Pioneer Mill Co. reorganized in 1900. The prospectus for the change is interesting, as it designates the land areas comprising the plantation property:

> Lahaina - 1,000 acres of land on the flat and outside of small kuleanas, the land is fee simple.
> Launiupoko - 2,900 acres of fee simple land, lying between Lahaina and Olowalu.
> Wahikuli - A tract of Government land of 5,000 acres, under lease for eighteen years, lies between Lahaina and Kaanapali.
> Kaanapali - Some 3,600 acres at various levels, fee simple land, beyond Wahikuli. (The area also comprises streams at Kahumu, Lahainaluna, Kawaulu and Launiupoko.)

The extent of sugar cultivation is noted in the Hawaii Sugar Manual:

> The cane fields of the estate have a sea frontage of ten miles, and while cultivated to 1 1/2 miles average depth in some sections raising of cane is followed so far back as two and one half miles as the farthest reach up the slopes of the West Maui mountains.
>
> The bulk of the crop is raised on lands that range from 10 feet to 700 feet elevation above sea level; the highest being cultivated at 1500 feet (IN Conde 1973:254).

Beginning in 1929, the company's Annual Report lists equipment retirements, signalling the decline of the railroad. The 1933 report lists "Railroads & Bridges—1,020 linear feet of 26 lb. rail, acquired in 1920 was retired in 1933." The 1934 report notes "1 Velocipede track-car, acquired 1921, retired 1934." Starting in 1943, the company experimented with loading harvested cane into trucks using grab loaders. The 1946 report reveals that by that year, serious consideration was being given to abandoning the railroad and harvesting exclusively by trucks. The final rail report appeared in 1953: "Change in operation—...All cane will be hauled by truck on a time shift basis...All railroad tracks were taken up, sorted and subsequently sold to a mainland buyer. Most of the railroad equipment was sold to various purchasers. The mill yard was graded, dressed with cinders and a direct cane dumping arrangement was built." (Conde 1973:254).

An article in the Maui News reports that a large number of ties were purchased by ranchers for use as fence posts, and that portable track iron, all of the old rails, and old rail switches, frogs, fishplates angle bars and spikes were sold to the Purdy Co. of San Francisco.

The renaissance of the railway began when A.W. McKelvey received capital from Taylor A."Tap" Pryor to construct the "Lahaina, Kaanapali & Railroad" in 1968. The new railway began several blocks from the center of Lahaina, north of Pioneer Mill, on the old railroad grade, alongside cane haul dirt roads. New tracks were laid, and a trestle was built at the cost of $15,000 near the golf course to offer a panoramic view of Kaanapali. In 1973 the operation was sold to Willis B. Kyle who hired R.D. Ranger to run the line (Conde 1975:169).

Wahikuli State Wayside Park, makai of the project area, is described in The Beaches of Maui County:

> Wahikuli means "noisy place" and is an alternate name of the ahupua'a of Mala which includes this park. Wahikuli State Wayside Park is one of the most popular beach parks in West Maui. It is usually crowded with picnickers, swimmers, and sunbathers, especially on weekends and holidays. Wahikuli's popularity is undoubtedly due to its size, its good swimming conditions, its excellent facilities, and its proximity to Lahaina....Almost the entire shoreline is lined with a retaining wall composed of large boulders (Clark 1989:60).

FIELD METHODS AND PROCEDURES

Survey field work was conducted August 28 through September 10, 1989, under the supervision of PHRI Associate Senior Archaeologist Dr. Peter M. Jensen and Supervisory Archaeologist Mr. Alan T. Walker, assisted by PHRI Field Archaeologists Bea Burgett, Charlene Gross and Jenny O'Claray.

Inventory Survey

Aerial Coverage - A 100% coverage, low-level (30-50 ft altitude) aerial reconnaissance survey (helicopter) of the entire project area was completed on Tuesday, August 28, 1989. The helicopter contained a driver and two survey crew members equipped with project area maps and aerial photographs. The objective of the aerial coverage was to attempt to identify and locate/plot (a) any sites (both new and previously recorded) with surface structural remains, and (b) areas devoid of sites (e.g., mechanically altered lands under cultivation).

Pedestrian Coverage - The pedestrian survey was initiated within the southeastern portion of the project area, along a portion of the proposed Honoapiilani Highway's Alternate C alignment. Previous survey work along this 300 ft-wide corridor had indicated the presence of recorded site HRHP 1203; the on-foot re-examination of this area was designed to determine whether or not additional cultural materials remained unrecorded within Kahoma Stream gulch, and to complete detailed recording and preliminary evaluation of the known cultural resources.

The pedestrian inspection of this segment of proposed highway corridor involved the three-person survey crew walking systematic transects parallel with the long axis of the corridor, maintaining transect spacing at c. 20 m intervals. The area inspected began at the point at which the corridor exits the project area parcel, proceeded southerly across Kahoma Stream, and terminated on the stream's south side below the vertical cliffs which abut the stream on its south side.

Similar coverage was given to that portion of the Hahakea Gulch located within the northeast corner of the project area, and along the unnamed gulch which proceeds east-west through the approximate center of the project area and which dissects the parcel into north and south halves. Within all of these gulch/stream beds, survey centerlines were defined as the stream bottom, and the survey crew then examined the gulch/stream margins by means of survey transects spaced approximately 10 meters apart. The outside margins of the gulches were defined as the point at which disturbed agricultural (cane) lands were encountered. Similar transect coverage was given the undisturbed lands located within the southernmost portion of the project area, between Puu Laina and the northern margins of the high ground above Kahoma Stream.

Recording

Detailed recording was completed for all sites encountered, and included site and feature dimensions, delineation of surface and subsurface midden deposits where present, and preparation of scaled maps and drawings of individual features. Sites were described on standard PHRI site and feature record forms, and distinctive features were mapped to scale and were photographed using 35 mm black-and-white film (PHRI Temp. Roll Nos. 653-1,2).

Once identified and recorded, the locations of all archaeological sites and features were determined using a combination of aerial photographs and metric tape and compass, and the locations were then plotted onto a master project area map and the aerial photograph. Each recorded site and/or the primary feature within each site complex was marked with pink-and-blue flagging tape, as well as an aluminum tag bearing the site number, date, the letters "PHRI," and the PHRI project number (89-653). PHRI temporary site numbers (prefixed by "T-") were assigned to all previously unrecorded sites located within the project area; subsequently, T-sites were assigned permanent SIHP

all previously unrecorded sites located within the project area; subsequently, T-sites were assigned permanent SIHP site numbers as follows: T-1 (2478), T-2 (2479), T-3 (2480), T-4 (2481), T-5 (2482), T-6 (2483), T-7 (2484), T-8 (2485), T-9 (2486), T-10 (2487), and T-11 (2488).

Evaluation of Subsurface Components

During the current project, subsurface testing by way of controlled excavations was to be undertaken, if deemed necessary, to adequately evaluate potential site significance. In the case of the present site, however, it was possible to adequately determine potential significance solely on the basis of surface observations, and no further testing was necessary.

Limited subsurface testing in the project area by means of mechanical backhoe had also been considered a possibility in order to determine the presence or absence of potentially significant buried cultural features or deposits. Such testing would have been undertaken within areas containing surface indications of the potential presence of such material; however, no such areas were identified during either the aerial or pedestrian survey.

FINDINGS

A total of 12 sites containing 44 component features was identified within the present project area. Of the 12 sites, one had been previously identified and partially recorded (SIHP Site 1203), with the remaining 11 sites representing newly identified resources. Ranging in physical condition from poor to excellent, the identified sites included both single as well as multiple components, and displayed a range of feature types, including overhangs/caves, platforms, walled enclosures, petroglyphs, graves, agricultural terraces, and a single historic agricultural access road alignment. Tentatively identified functional types included habitation, agriculture (both prehistoric as well as historic), ceremonial/religious activities, probable burial, recreation, and some sites of probable indeterminate function.

Table 1 summarizes the distribution of the 44 features among the 12 identified sites. In addition, Table 1 includes site designations, deleted site numbers, calculations of the percentage of feature types represented within the project area, and appropriate totals. Under "Petroglyphs," a number appears in parentheses next to the number "1"; the parenthetical reference represents the number of individual petroglyph figures (N=38) observed by Barrera during his initial recording of this site. Regardless of the number of individual petroglyphs represented, however, each occurrence of such elements at a particular site was to be counted as a single feature representation at that site.

SITE DESCRIPTIONS

Site 2478 - Agricultural Terrace (1)

Site 2478 is located c. 15 m south, and approximately the same distance downslope from (north of) the upper margins of Hahakea Gulch. The site consists of a single, but disarticulated rock wall alignment believed to represent remnant agricultural terracing within the area. The feature extends for a total distance of 11 m east-west (parallel with the the stream through the bottom of the gulch), and was constructed by crudely piling or stacking local basalt cobbles and boulders from 3-5 courses to produce a finished wall width ranging from 0.40 to 1.10 m, and from 2-4 courses high to produce an average wall height of 0.65 m. No additional rock or other features, and no portable artifacts or midden remains, were observed within the immediate or general vicinity.

Site 2479 - Agricultural Terrace (2)

Site 2479 is located approximately 20 m south of Hahakea Gulch, and consists of two parallel rock walls separated from one another by a distance of c. 1 m. Constructed from loosely stacked cobbles and boulders, both features average 0.65 m in height and range from about 0.30 to nearly 1.0 m in width, and in this regard closely resemble the short segment of wall/terrace recorded as Site 2478. The segment of wall located closest to Hahakea Gulch consists of two disarticular segments, one of which measures 2.5 m in length, with the second measuring 6.5 m in length. The second wall, consisting of three disarticular segments, measures c. 22 m in overall length. As with Sites 2478, -4, and -5, both of these two wall segments appear to represent prehistoric agricultural terracing. No additional evidence of prehistoric use or activity was observed within the immediate or general vicinity of these two wall/terrace features.

Site 2480 - Walled Enclosures (2)

Site 2480, located several meters south of (back from) Hahakea Gulch, consists of two contiguous walled enclosures, generally well-constructed and perhaps representing small prehistoric habitation areas (they closely resemble known prehistoric remains) (Figure 2). Aligned east-west and paralleling the stream course, these two features extend approximately 23 meters east-west by 4-9 meters north-south. The eastern (upstream) end of the complex has been designated Feature B, and consists of an enclosed terraced area (presumably utilized for habitation) which extends 7.5 m east-west by 2 m north-south (i.e., "deep"). This area represents "enclosed" space which has been created by constructing a rubble wall along the feature's downslope side, piling local cobbles and boulders from 5-10 courses high and from 3-6 courses thick. Feature A, located at the western (downstream) end of the complex, consists of a generally similar but larger enclosed terrace area, measuring nearly 9 meters square. Near the center of this terrace are several (9-12) large basalt boulders, at least some of which may identify the location of an earlier fire hearth. Adjacent to the north side of Feature A is a small paved area, accessible from the interior of Feature A, measuring 3.75 m by 2.2 m. Feature B also exhibits a small paved area adjacent to its north side (measuring approximately 2 m in diameter), although this sub-feature is not easily accessible

Table 1. SUMMARY OF SITES AND FEATURES.

Field Site #	Notes Comments	SIHP Site #	Feature Type: Ovrhng/ Caves	Platform	Walled Encl.	Petro-glyphs	Grave Marker	Agri. Terrace	Hist. Ag. Road	Total At Site
Project 89-653										
HFDC Project Area, Inventory Survey										
SIHP No.										
2478	Hahakea Gulch		-	-	-	-	-	1	-	1
2479	Hahakea Gulch		-	-	-	-	-	2	-	2
2480	Hahakea Gulch		-	-	2	-	-	-	-	2
2481	Hahakea Gulch		-	-	-	-	-	2	-	2
2482	Hahakea Gulch		-	-	-	-	-	1	-	1
2483	So. Brnch Kahoma St.		-	-	1	-	-	8	-	9
2484	Near ag. air strip		-	-	1	-	-	-	-	1
2485	Near ag. air strip		-	-	1	-	-	-	-	1
2486	Near ag. air strip		-	1	-	-	13	-	-	14
2487	Near Puu Laina		-	-	-	-	-	-	1	1
2488	North of Puu Laina		-	-	1	-	-	-	-	1
-12	Deleted -- contemp. rd.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
50-03-1203	No. Brnch Kahoma St.		1	-	1	1 (38)	-	6	-	9
Total Fea. Type Represented			1	1	7	1	13	20	1	44
Fea. Type as % of Total			2%	2%	16%	2%	30%	46%	2%	100%

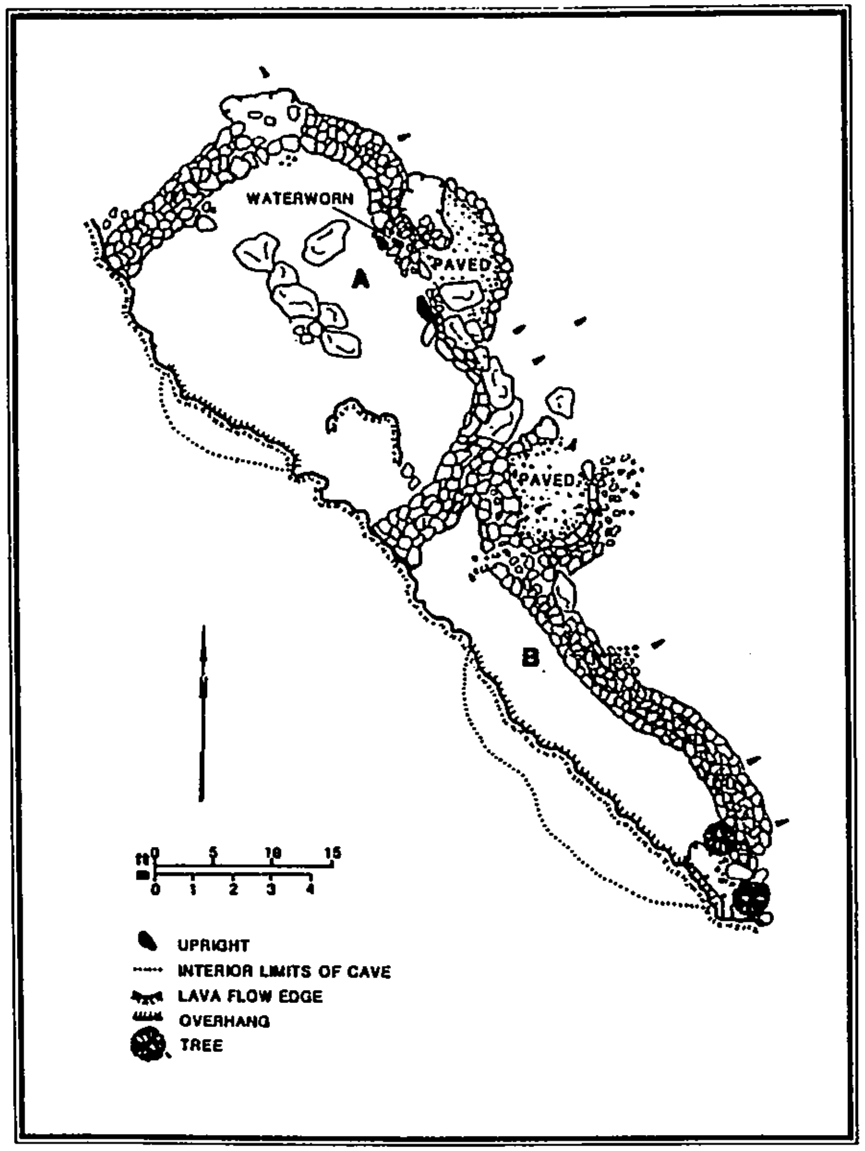

Figure 2. SITE 2480

from the interior of Feature B. Additional short segments of wall (i.e., "protrusions") appear to articulate with these primary feature walls and may represent remnant agricultural terraces.

Site 2481 - Agricultural Terrace (2)

Site 2481 ranges from between approximately 5 and 40 m south of Hahakea Gulch, and consists of two segments of rock wall constructed from loosely stacked cobbles and boulders. Both features average 1.10 m in height and range from about 0.6 to nearly 1.5 m in width, and in this regard closely resemble the walls/terraces recorded as Sites 2478 and 2479. Feature A wall/terrace at Site 2481 extends for a total distance of 85 m east-west, generally paralleling the stream course through the center of Hahakea Gulch, except at the wall's eastern (upstream) end where the final 20 m of the feature was realigned roughly perpendicular to the stream course. Feature B consists of three short, parallel segments of wall located immediately south of (above) Feature A, each of which measures approximately 5 m in length. No additional evidence of prehistoric use or activity was observed within the immediate or general vicinity of these two wall/terrace features, although the possibility exists that additional cultural materials (including perhaps both features as well as portable artifacts) remain concealed by dense vegetation within the immediate vicinity.

Site 2482 - Agricultural Terrace (1)

Site 2482 is located between about 5 and 15 m south of Hahakea Gulch. The site consists of a single, but disarticulated rock wall alignment, virtually identical to that recorded as Site 2478 and, as with Site 2478, also believed to represent remnant agricultural terracing. The 2482 feature extends for a total distance of 110 m east-west above and on the south side of (generally parallel with) the stream bed which proceeds through the approximate center of Hahakea Gulch. Constructed by piling and stacking large water-worn cobbles and boulders from 1-4 courses, the wall ranges from 0.60 to 1.40 m high and from 0.60 to 1.0 m wide. No additional rock or other features, and no portable artifacts or midden remains, were observed within the immediate or general vicinity, although it is possible that additional cultural materials or small terraced areas remain concealed by dense vegetation within the immediate vicinity of the recorded feature.

Site 2483 - Walled Enclosure (1), Segments of Agricultural Terraces (8)

Site 2483 consists of a complex of agricultural (8) and related habitation (1) features located on the north side of the south branch of Kahoma Stream (also known as Kanaha Stream), along the route of the Alternative C alignment of the proposed Hoonapiilani Road Corridor. The complex was apparently not observed during previous archaeological reconnaissance within this area, although it occupies most of the area of the proposed road corridor where that corridor crosses Kahoma Stream. Extending c. 210 m east-west (parallel with the Stream) by c. 150 m north-south (perpendicular to the Stream), the single walled enclosure (Feature A, presumed habitation area) is approximately centrally located among the 8 linear wall segments (all of which have been tentatively identified as remnant agricultural terraces).

Feature A consists of a well-constructed walled enclosure created by stacking waterworn boulders which average 30-40 cm in diameter. The enclosure is likely prehistoric as it closely resembles known prehistoric remains. The south (Kahoma Stream) side of the enclosure has been formally faced and rises a maximum of 2.5 m above the ground surface; the north (cliff) side of the enclosure has been blended into the moderate slope of the side of the gulch which descends to Kahoma Stream, but generally rises c. 0.75 m above the surrounding ground surface. The enclosed space encompasses approximately 20 square meters, although the west end of the wall forming the enclosure extends another c. 15 m to the west, thus forming an additional segment of agricultural terrace. Small quantities of marine shell midden, and two fragmentary fire-fractured cobbles, were observed on the surface of this area, indicating probable use of the feature for habitation purposes.

Features B-I represent linear wall segments, ranging in length from 4.5 to 25 meters, and averaging about 12 m in length. All of these appear to have been constructed to retain soil on their uphill sides, and thus to have functioned as agricultural features. No additional terraced or enclosed habitation areas, and no concentrations of portable artifacts or midden remains, were observed in association with any of these 8 linear wall segments, although such cultural elements may remain concealed by dense vegetation within this section of Kahoma Stream's gulch.

Site 2484 - Walled Enclosure, or L-Shaped Wall

Site 2484 represents a partial rock enclosure, or an L-shaped wall, located on the south-facing, gently sloping land above Kahoma Stream gulch, near the western end of the existing agricultural airstrip west of "Crater Reservoir" (see Figure 1). Extending 23.4 m north-south, the primary segment of wall was constructed by stacking basalt boulders from 4-5 courses to achieve a maximum wall height of 0.75

m and a wall width which ranges from 0.80 to 1.10 m. The southern end of this segment of wall has largely collapsed, but a second intact wall segment proceeds westerly from this point for an additional 11.5 m. It could not be determined whether the remainder of an "enclosure" exists within this area, with the walls having collapsed or been bulldozed, or whether the L-shape of the existing feature represents the entire original configuration. Additional vegetation clearing and detailed recording will be necessary in order to accurately map and refine the evaluation of feature "type" and function. However, no obvious concentrations of portable artifacts or other rock features exist within the immediate vicinity of this feature, which has thus only been tentatively identified as a possible habitation area.

Site 2485 - Walled Enclosure

Site 2485, located on the south-facing, gently sloping land above Kahoma Stream gulch and southwest of the western end of the existing agricultural airstrip west of "Crater Reservoir" (see Figure 1), represents a rock enclosure which has been tentatively identified as a probable prehistoric habitation area (the enclosure closely resembles known prehistoric remains) (Figure 3). Well constructed rock walls enclose a rectangular space which extends approximately 20 m north-south by 24 m east-west. Constructed on relatively flat ground, wall height is a fairly consistent 1.5 m around the entire periphery of the feature, except in areas which segments have collapsed. The thickness of the wall ranges from 0.90 to 1.80 m, with the thickest sections occurring at the feature's corners. The perimeter wall has been penetrated by a constructed opening at only one location—near the center of the feature's north wall.

Although no portable artifacts or other cultural deposits (i.e., midden) were observed during the present inventory survey field work, such material may remain concealed by dense grass and other surface vegetation, and/or may occur as part of a subsurface component at this site. In order to evaluate this possibility and adequately determine feature function, additional vegetation clearing, coupled with detailed recording and data collection, will be necessary at this site.

Site 2486 - Large Formal Cairn/Marker (1), Mounds (probable graves/grave markers)(13)

This site is located within the southeastern portion of the project area, on the ridge above and on the north side of Kahoma Stream and c. 200 m southwest of Puu Laina. The site occupies gently sloping land and consists of at least fourteen separate features distributed over an oval-shaped area measuring approximately 35 by 40 m (Figure 4). The most prominent of the features (Feature A) is located on the southwestern edge of the feature group, and represents a well-constructed circular cairn constructed of large field cobbles with rubble fill measuring 3 m in diameter at the base. Boulders were stacked from 6 to 7 courses in order to achieve a maximum height of 1.7 m above the current ground surface. The outside edge (perimeter) of the feature has been formally faced, while a depression has been created within the top-central portion of the cairn by removing rubble fill to a maximum depth of 0.8 m. Overall, the feature is well-preserved and does not appear to have been disturbed or otherwise modified in post-historic era times.

Scattered in a semi-arc to the north of Feature A are 13 additional rock features, at least 12 of which appear clearly to identify graves. One of these 13 features (Feature E) represents a well-constructed platform with faced sides, elevated above the ground by c. 0.75 m, and containing two separate compartments (combined measurement of the two compartments is 2.5 m X 3.1 m). A lower and smaller terrace (measuring 2.1 m X 2.8 m) has been constructed adjacent to the southwest side of the primary platform. Feature E may represent two contiguous but separate features which individually are quite similar to the other 12 isolated examples which appear to represent graves/grave markers, although the function/ implications of the smaller "terrace" at Feature E is unknown and has not been duplicated at any of the other examples.

The remaining 12 features range from low, flat-topped to ridged rectangular platforms, to mounded, trapezoidal to oval features of generally similar overall dimensions. In at least two instances, these features were located adjacent to preexisting examples, and boulders and cobbles were removed (i.e., "robbed") from the latter during construction of the more recent examples. Comparative dimensional information for the 14 features at this site is provided in Table 2, below.

The relative position and orientation of the 14 features has been preserved in the site map, reproduced in this report as Figure 5. Although two relatively large walled enclosures were also identified within the general vicinity of Site 2486 (see discussion above for Sites 2484 and 2485), there is no clear evidence of association among these various components, all of which were therefore recorded as separate sites.

Site 2487 - Historic Agricultural Access Road

Site 2487 represents a linear road bed alignment which extends for a total distance of c. 270 meters along the gently sloping land immediately west of Crater Reservoir (see Figure 1). The surface of the road is flat, 3.5 m in width,

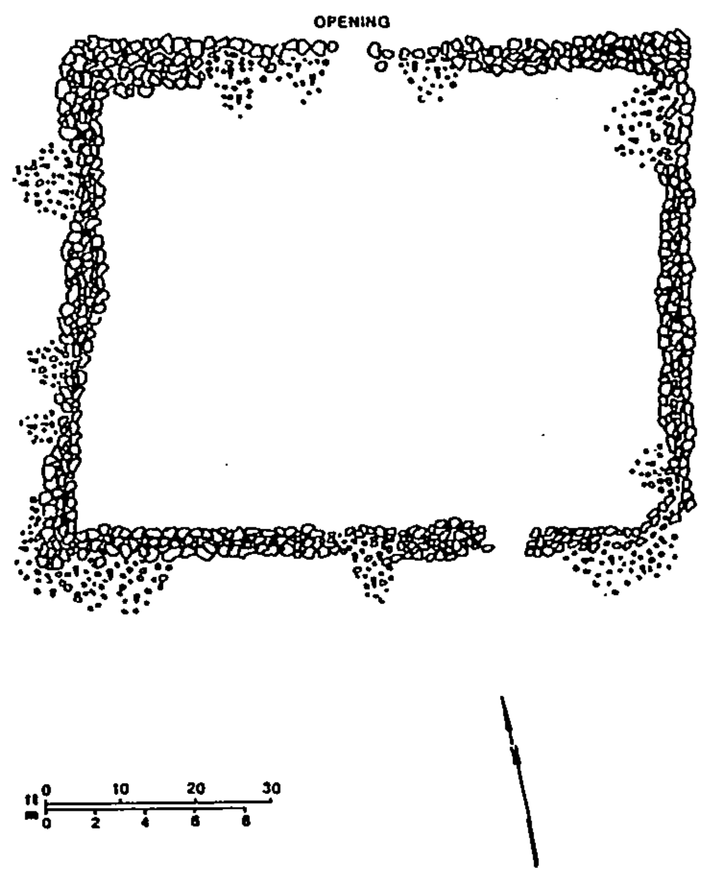

Figure 3. SITE 2485

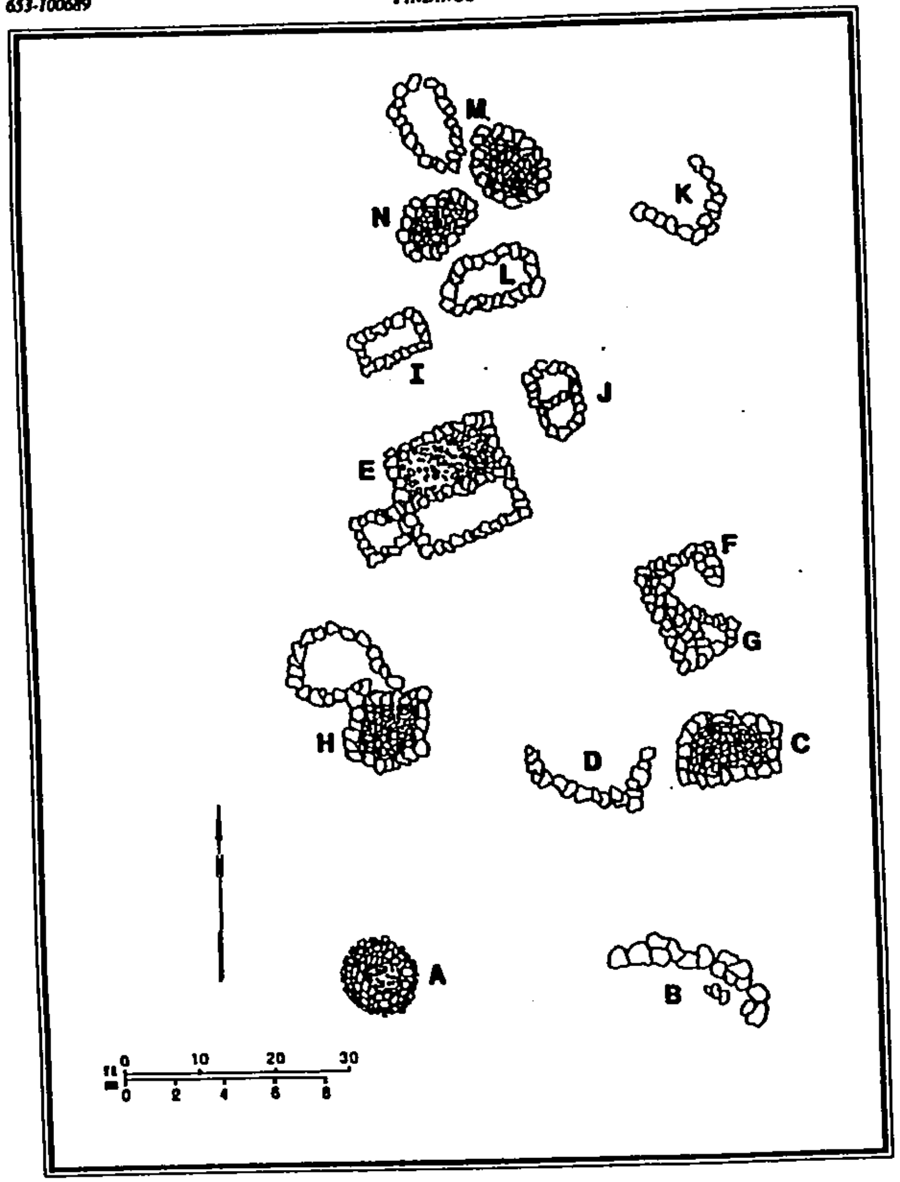

Figure 4. SITE 2486

Table 2.

COMPARATIVE DIMENSIONS OF SITE 2486 FEATURES

Feature Designation	Length (m)	Width (m)	Height* (m)	Comments
A	3.00 (diameter)		1.70 m	Large circular cairn /marker/shrine
B	6.50	1.00	0.50	Probable 1-2 graves
C	3.00	1.90	0.75	Probable grave
D	5.00	5.00	0.60	Probable grave
E	3.50	3.10	0.75	Probable 1-2 graves; possible ceremonial feature
F	2.00	1.40	0.60	Probable grave
G	3.60	1.80	0.75	Probable grave
H	6.00	2.70	0.40	Probable 1-2 graves
I	2.60	1.60	0.40	Probable grave
J	2.50	1.70	0.50	Probable grave
K	3.90	2.50	0.35	Probable grave
L	4.30	2.00	0.35	Probable grave
M	5.10	2.70	0.40	Probable grave, through possible linear feature only
N	2.30	2.10	0.20	Probable grave

* Maximum above current ground surface.

with an underlay of gravel and a downhill side buttressed with cemented stones (4-5 courses high). A "toe" ditch, or drainage channel, has been excavated and partially rock-lined adjacent to the uphill side of the road, and three drains (concrete culverts) were placed at strategic locations along the 270 m remnant section. The road was presumably constructed in conjunction with early agricultural activities, probably between about 1910-1920; it may have been abandoned when heavier equipment, requiring stronger roadbeds and culverts, was introduced by the Pioneer Mill operation for sugarcane and pineapple hauling and field preparations. No early historic dumps or other potentially significant artifact concentrations were observed along the alignment, although numerous more recent and contemporary dumping piles have been established. In fact, the road now appears to serve no other purpose than to provide access to these dumping areas. In addition to household trash, numerous 1950s-1960s era automobiles and automobile parts have also been dumped along segments of this road.

In the absence of significant or potentially significant artifact concentrations, the roadway itself is not considered to retain potentially significant information values. The present site locational information and site record documents are thus considered adequate mitigation of any potential project effects which may accompany the proposed development within the project area.

Site 2488 - Walled Enclosure

Site 2488, located immediately east of Crater Reservoir and southeast of Puu Laina (see Figure 1), represents a rock enclosure which has been tentatively identified as a probable prehistoric habitation area (the enclosure closely resembles known prehistoric remains)(Figure 5). Well constructed rock walls enclose a rectangular space which measures 5.0 by 8.0 meters (interior dimensions). Constructed on relatively flat ground, wall height is a fairly consistent 1.0 m around the entire periphery of the feature, except along partially collapsed sections of wall which occur principally along the south and west sides. The thickness of the perimeter wall ranges from 1.0 to 1.5 m, with the thickest sections occurring along the feature's north wall which also contains the only opening into the feature's interior.

Although no portable artifacts or other cultural deposits (i.e., midden) were observed during the present inventory survey, such material probably remains concealed by dense grass and other surface vegetation growing within and adjacent to the enclosure, and may also occur as part of a subsurface component at this site. In order to evaluate this possibility and adequately determine feature function, additional vegetation clearing, coupled with detailed recording and data collection, will be necessary at this site.

SIHP Site 1203 - Kahoma Complex

Originally recorded in 1974, this site was recently reevaluated in conjunction with ongoing studies associated with the proposed Honoapiilani Alternate C Road Alignment Corridor (Barrera 1989). Barrera's recent work was based on "...a literature search and archaeological reconnaissance survey..." (Barrera 1989:2). The field reconnaissance resulted in relocating the 38 petroglyphs and the rockshelter originally identified as the site, as well as identifying additional unrecorded agricultural features at the point where Alternative C crosses the north branch of Kahoma Stream. At this locale, Barrera identified, but did not record, "...at least three terraces and a possible irrigation ditch on the alluvial floodplain on the south side of the [north branch of the] stream" (Barrera 1989:9). Barrera recommended that since the site was potentially eligible for the National Register, "...that the Department of Transportation continue following the procedures of Section 106..." However, Step 1 of the process, which involves identifying and preliminary evaluation of potentially eligible properties, was not completed as no site record documents were prepared for the newly identified cultural materials, and no statements or conclusions were offered concerning those attributes of the identified property which might render it eligible for inclusion on the Register. As a consequence, PHRI was requested to reevaluate the property, complete site record documents, provide basic locational information, identify those qualities which might render the property eligible for inclusion on the Register or which might otherwise render the site significant, and determine whether or not additional cultural resources might still remain unrecorded along the proposed highway corridor through Kahoma Stream.

As indicated above, Highway Alternative C crosses two branches of Kahoma Stream, one which can be identified as the northern branch, and the second as the southern branch. Site 1203 is located on the south side of the north branch within, and extending both east and west of, the proposed alignment. Features A (ag. terracing), B (raised and faced habitation terrace), C (ag. terracing), D (ag. terracing) and E (small habitation cave), represent a series of interrelated agricultural and habitation features located along the interface of the floodplain and the cliff face on the south side of the north branch of Kahoma Stream (see Figure 6, showing Features A-E). The cave exhibits a cultural deposit, as evidenced by an octopus lure of cowry observed on the surface, fragments of marine shell midden in pockets on the surface, and several fire-fractured cobbles observed

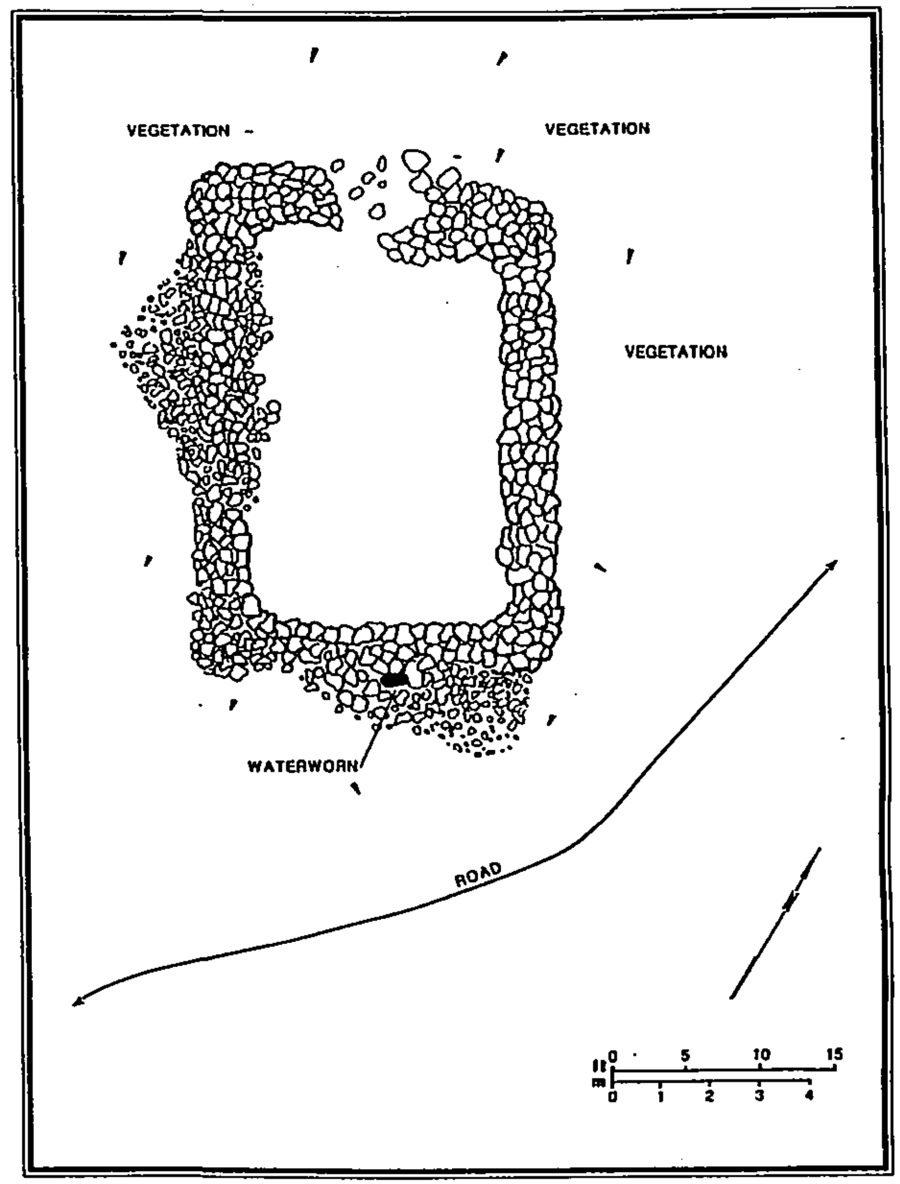

Figure 5. SITE 2488

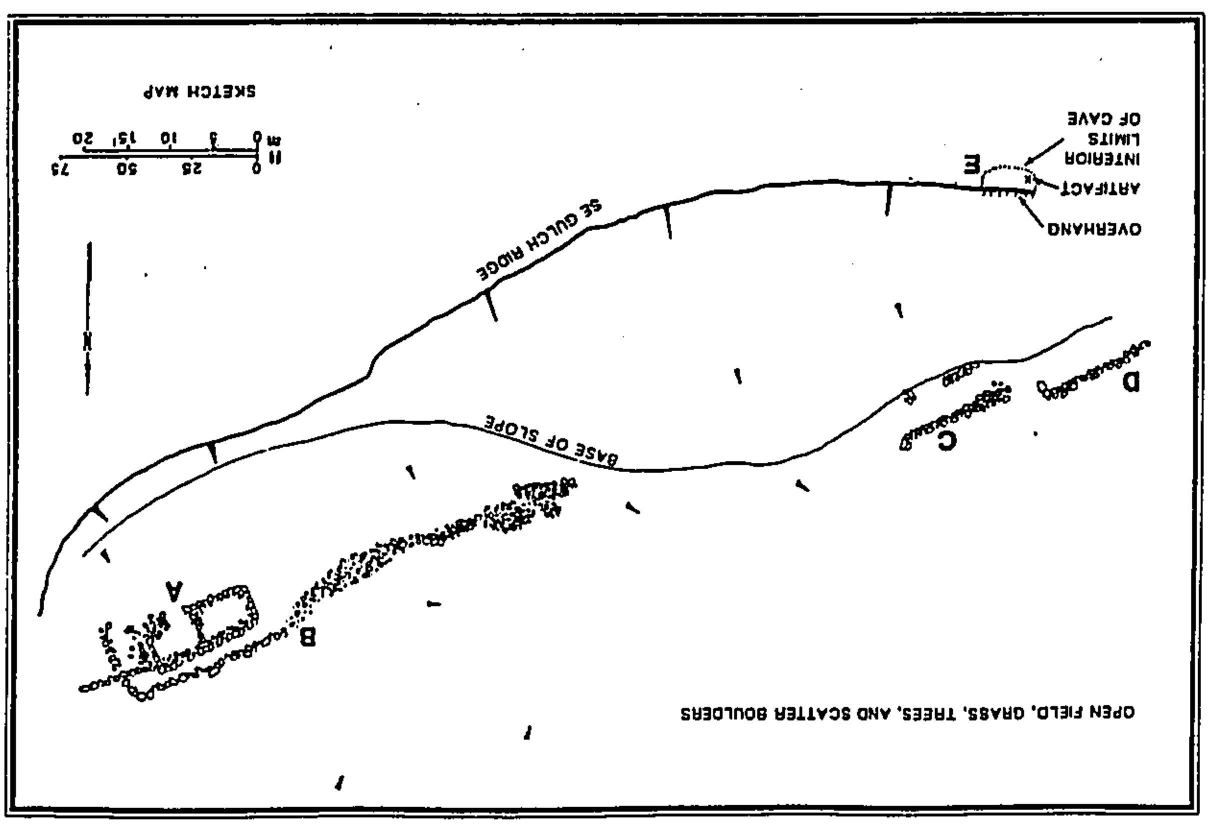

Figure 6. SITE 1203, FEATURES A-E.

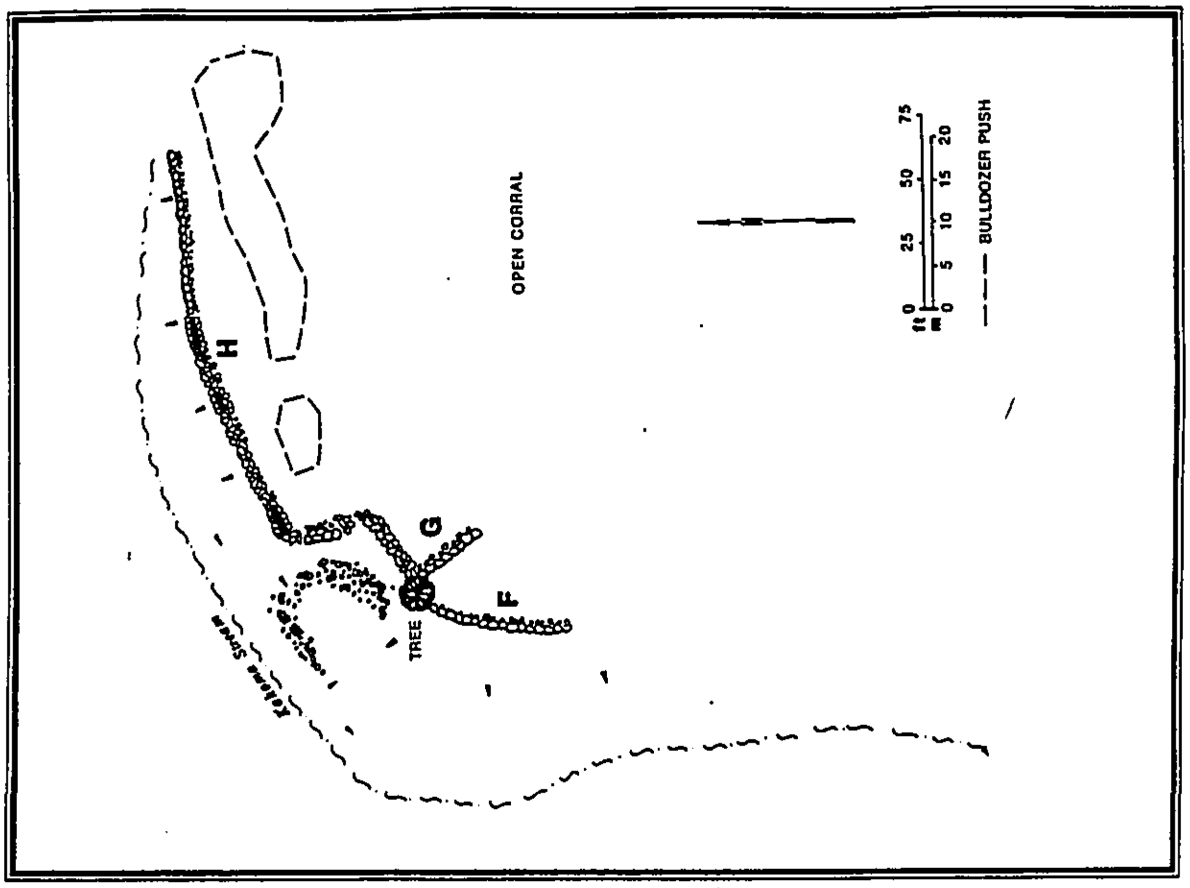

Figure 7. SITE 1203, FEATURES F-H.

on the surface as well as in backdirt piles resulting from rodent burrowing both within and in front of the small cave. The feature measures approximately 3.0 m in width, and averages about 1.75 m in depth (front to back) and is 1.10 m in height. The other habitation feature on this (south) side of the stream consists of Feature B terrace, constructed of field stones ranging from 10-40 cm in diameter stacked 3-6 courses high. The north wall of the terrace has been formally faced but is partially collapsed. The south edge of the feature has been blended into the slope of the cliff face above. Small quantities of habitation debris, including marine shell midden, were observed on the surface of this presumed habitation feature. Features A, C, and E represent short segments of what have been tentatively identified as agricultural terracing, consisting of linear rock wall alignments averaging about 0.9 m in height and 1.0 m in width, constructed from moderate to small-sized cobbles stacked from 3 to 6 courses high and wide.

Adjacent to the south side of the north branch of Kahoma Stream, on the opposite side of the floodplain and at a point c. 45.0 m north of Features A-E, are Features F (ag. terracing), G (terracing, possible habitation area in association), and H (ag. terracing) which, combined, extend for a total distance of c. 80 m. adjacent to the Stream (see Figure 7: Features F, G, and H). The 38 petroglyph figures originally described for this site and photographed by Barrera could not be relocated during the present project and are believed to be located outside of the Alternative C alignment corridor as depicted on project area maps.

Overall, the Kahoma Complex documents prehistoric agricultural activities within the area, suggesting that numerous additional habitation and agricultural features probably also existed in the lower reaches of this Stream prior to the extensive vegetation and other clearing activities which accompanied agricultural development of adjacent fields, and flood control projects along the Stream course itself. Despite these disturbances elsewhere, recoverable dating samples may exist at habitation Features B (habitation terrace), E (habitation cave), and G (possible habitation area). If such materials are present in association with additional evidence of prehistoric use/occupation, the Kahoma Complex would clearly retain information values important to local and regional prehistory, and would thus qualify for inclusion on the National Register under Criterion D. As well, the site assumes added potential significance in consideration of the presence of petroglyphs (potential cultural value) and in consideration of the extensive losses elsewhere along Kahoma Stream of similar types of sites.

Upon completion of the recording of the cultural resources at Site 1203, the survey crew undertook survey sweeps along the south branch of Kahoma Stream (Kanaha Stream), an area which had also been previously evaluated. Although Barrera (1989) does not report cultural resources from this area, the present field survey identified a number of cultural features within this area, including extensive agricultural terracing and an associated habitation complex consisting of a well-preserved and well-constructed walled enclosure. These features were recorded as Site 2483 (see discussion above).

DISCUSSION

Sites 2478 through 2482 all represent agricultural features, in at least one case, associated with habitation features located within that portion of Hahakea Gulch which dissects the northern portion of the present project area. All were preserved because they were located on the steep margins, or near the bottom, of the gulch, outside the area of historic and contemporary pineapple and sugarcane cultivation. It is obvious that numerous additional examples of such features at one time existed higher on the margins of the gulch. Destruction of such prehistoric features appears to have been extensive within the immediate and general project area.

Sites 2478, 2479, 2481, and 2482 appear to consist exclusively of segments of more extensive agricultural terracing systems.

CONCLUSION

DISCUSSION

Despite the extensive disturbances to which the project area has been subjected by past agricultural and other activities, a number of sites still exist intact within the project area, although both the range of feature types and functions represented are relatively narrow.

As noted in Table 1, agricultural terraces are by far the most prominent features represented within the project area, comprising 20 (c. 46%) of the total of 44 components recorded. This feature type was identified at all five Hahakea Gulch sites and at both of the site complexes recorded within Kahoma Stream gulch. In all cases, preservation of these features is clearly related to their location on the steep margins, or near the bottom, of the two major gulches which remain within the project parcel, areas which were unsuited for pineapple or sugarcane cultivation. It seems safe to conclude, therefore, that numerous additional examples may at one time have existed higher on the margins of both of these gulches and probably elsewhere within the general project area.

Graves/grave markers represent the next most prominent feature type encountered, although this representation is somewhat misleading in that the feature type occurs at only one (Site 2486) of the twelve recorded sites. Walled enclosures are actually more prominent within the project area, at least in terms of the number of sites containing such components. Seven of the 44 components recorded, or about 16% of the total, represent walled enclosures which in turn are believed to represent habitation on a semi-permanent to permanent basis. While four sites within the project area contain only agricultural terracing (2478, 2479, 2481, and 2482), three additional sites which contain terraces also contain small habitation areas in the form of walled enclosures (Sites 2480, 2483, and 1203). An additional three sites contain walled enclosures in the absence of associated terracing or other prehistoric features (Sites 2484, 2485, and 2488). These latter three sites occur in generally open terrain on the slopes above and away from the gulches, and appear to have been preserved because of their proximity to other natural features (i.e., Puu Laina and Crater Lake) which themselves were unsuited to agricultural or other developments. As with agricultural terraces, it is possible to conclude that additional examples of habitation enclosures may once have existed at numerous locales within the overall project area, but that many such features were subsequently destroyed in conjunction with agricultural developments.

The remaining feature types within the project area are all represented by single examples only, and include a small habitation cave and a single petroglyph component (containing 38 individual figures) (both located at Site 1203), and one platform feature associated with the 13 graves (at Site 2486).

Cultural deposits observed at the seven surface habitation features (walled enclosures) and the single small cave at Site 1203 appear to consist predominantly of light surface scatters of marine shell fragments with occasional prehistoric artifact types. However, at one or more of these sites, subsurface accumulations of cultural material may turn out to be quite substantial. For both the habitation cave as well as the surface habitation features, a predominantly prehistoric to possibly early historic/protohistoric age is indicated on the basis of observations of surface-occurring artifacts and midden debris. The petroglyphs described for Site -1203 (the "Kahoma Complex") are also presumably prehistoric in age, although associations of such features with specific other features (caves or surface features) cannot always be assumed or easily established.

Conspicuously absent from the present project area are major platforms or heiau features, and prehistoric-era trails. Proposed additional research (vegetation clearing in particular) at some of the gulch sites may reveal examples of the latter, although it is likely that the early historic agricultural clearing destroyed all of the large platforms or heiau sites which may once have existed. Such features are believed most likely to have occurred along the western margins of the present project area, at the confluence of gulch streams with the Pacific Ocean.

EVALUATIONS

Significance categories used in the evaluation process for the present project area sites follow definitions derived from the National Register criteria for evaluation, as outlined in the Code of Federal Regulations (36 CFR Part 60). The Hawaii State Historic Preservation Office also employs these criteria for evaluating cultural resources. Sites determined here to be potentially significant for information content (Category A, Table 3) are assessed under Criterion D, which defines significant resources as those which "have yielded, or may be likely to yield, information important in prehistory or history" (36 CFR Sec. 60.4). Sites determined to be potentially significant as excellent examples of site types (Category B, Table 3) are assessed under Criterion C, which defines significant resources as those which "embody the distinctive characteristics of a type, period, or method of construction,...or that represent a significant and distinguishable entity whose components may lack individual distinction" (36 CFR Sec. 60.4).

Sites determined to be (potentially) culturally significant (Category C) are assessed under guidelines prepared by the Advisory Council on Historic Preservation (ACHP), entitled "Guidelines for Consideration of Traditional Cultural Values in Historic Preservation Review" (Draft Report, August 1985) (ACHP 1985). Cultural value is defined in the guidelines as "...the contribution made by an historic property to an ongoing society or cultural system. A traditional cultural value is a cultural value that has historical depth" (1985:1). The guidelines specify that, "A property need not have been in consistent use since antiquity by a cultural system in order to have traditional cultural value" (1985:7). Both religious and nonreligious cultural values are specified, and examples include burial sites, loci of traditional economic activities, and loci that are symbolic of a group's identity or history (1985:11).

To further facilitate client management decisions regarding the subsequent treatment of resources, the general significance of all archaeological remains identified during the present survey were evaluated in terms of potential scientific research, interpretive, and/or cultural values (PHRI Cultural Resource Management [CRM] value modes, which are derived from the above federal criteria). Scientific research value refers to the potential of archaeological resources for producing information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. Interpretive value refers to the potential of archaeological resources for public education and recreation. Cultural value, within the framework for significance evaluation used here, refers to the potential of archaeological resources for the preservation and promotion of cultural and ethnic identity and values.

Information Content

In evaluating information content (Category A) (scientific research value), all of the sites located within the project area were examined in light of potential research issues identified during background research. These issues revolve around general questions of chronology, settlement, and exploitative patterns, site and assemblage variability, material culture and technology, diet and economy, and socio-religious patterns.

Chronology - Determining the period of use for sites within the project area is contingent upon recovery and assay of datable materials, such as volcanic glass and charcoal. The habitation features at several sites are believed to represent the features most likely to contain such material and deposits, and include Sites 2480, 2483, 2484, 2485, 2486, 2488, and -1203.

Settlement and Exploitative Patterns, Site and Assemblage Variability, Material Culture and Technology, and Diet and Economy - Further evaluation of these research domains requires intact deposits of artifacts and associated midden. Again, sites which are considered to contain specialized samples suitable for dating are also believed to contain variable quantities of midden, portable artifacts and/or buried/concealed features, and include Sites 2480, 2483, 2484, 2485, 2486, 2488, and -1203. Any such information for the present project area is particularly significant in view of the substantial losses to cultural resources which have accompanied extensive agricultural development of the area. In addition, such materials taken on added significance in view of several new analytical approaches currently available for analyzing dating and other special cultural deposits. Collectively, these considerations justify additional data collection at and further refinement of the evaluations of these sites, if intact preservation of the resources cannot be ensured.

Socio-Religious Patterns - A number of research questions have been addressed utilizing the numerous burials and burial remains which have been recovered from Anaehoomalu, Waikoloa, and Kalahuipuaa on Hawaii Island, and Kapalua in West Maui. The data which may be available at Site 2486 could provide useful additional information in support of ongoing research involving the Kapalua remains. In the present case (Site 2486), the remains would be recovered, evaluated and properly reinterred, only in the event that project impacts to the site could not be avoided and only after preparation of a State and County-approved Burial Treatment Plan.

Not only the human remains, but the Site 2486 platform or shrine may provide additional insight into prehistoric socio-religious patterns within the area. As well, the Site 1203 petroglyphs may also possess some religious significance or cultural value, a determination which should be made, in part, on the basis of input solicited from interested and knowledgeable individuals from the local area.

Table 3.

SUMMARY OF GENERAL SIGNIFICANCE ASSESSMENTS AND RECOMMENDED GENERAL TREATMENTS

Site	Significance Category				Recommended Treatment			
Number	A	X	B	C	FDC	NFW	PID	PAI
2478	+	-	-	-	+	-	-	-
2479	+	-	-	-	+	-	-	-
2481	+	-	-	-	+	-	-	-
2482	+	-	-	-	+	-	-	-
2484	+	-	-	-	+	-	-	-
Subtotal:	5	0	0	0	5	0	0	0
2480	+	-	+	-	+	-	•	-
2483	+	-	+	-	+	-	•	-
2485	+	-	+	-	+	-	•	-
2488	+	-	+	-	+	-	•	-
1203	+	-	+	-	+	-	•	-
Subtotal:	5	0	5	0	5	0	5	0

General Significance Categories:

A = Important for information content, further data collection necessary (PHRI=research value);
X = Important for information content, no further data collection necessary (PHRI=research value, DLNR-HSS=not significant);
B = Excellent example of site type at local, region, island, State, or National level (PHRI=interpretive value); and
C = Culturally significant (PHRI=cultural value).

Recommended General Treatments:

FDC = Further data collection necessary (further survey and testing, and possibly subsequent data recovery/mitigation excavations);
NFW = No further work of any kind necessary, sufficient data collected, archaeological clearance recommended, no preservation potential;
PID = Preservation with some level of interpretive development recommended (including appropriate related data recovery work); and
PAI = Preservation "as is," with minimal further work (and possible inclusion into landscaping), or appropriate data recovery/disinterments.

• Provisional assessment; definite assessment pending further data collection (e.g., detailed recordings, testing features for presence/absence of skeletal remains).

Table 3. (cont.)

Site Number	Significance Category A	X	B	C	Recommended Treatment FDC	NFW	PID	PAI
2487	-	+	-	-	-	+	-	-
Subtotal:	0	1	0	0	0	1	0	0
2486	+	-	-	•	+	-	-	•
Subtotal:	1	0	0	1	1	0	0	1
Total:	11	1	5	1	11	1	5	1

Interpretive Value

At this stage of analysis (inventory-level), archaeological sites with potentially high value as excellent examples of a site type (Category B) (interpretive value), are identified by considering those attributes which, if occurring together at one site, would provide a representative example of particular kinds of behavior, activities, or conditions. As well, sites exhibiting unique, or one-of-a-kind qualities, would also qualify for such consideration.

In the present project area, five sites are believed to exhibit qualities which could render them worthy of consideration for preservation and/or possible interpretive development.

Site 2480 within Hahakea Gulch represents the only complex within this area which contains relatively well-preserved habitation features in association with agricultural terracing. The same observation can be extended to the agricultural/habitation complex located within the southern branch of Kahoma Stream (Site 2483), while previously recorded Site -1203, located within the north branch of Kahoma Stream, contains the widest range of associated feature types identified within the entire project area. In addition to these three sites, two well-constructed walled enclosures are located within the general vicinity of Puu Laina (Sites 2485 and 2488), which together represent 100% of the known examples of this feature type within the immediate project vicinity.

Cultural Value

Sites with cultural significance (Category C) (cultural value) would include those with traditional uses and those that have significant meaning in the context of a traditional way of life. In the present project area, one site contains, or likely contains, human remains (Site 2486), and is considered potentially culturally significant on this basis.

The other feature types represented within the project area include small habitation areas and associated agricultural terracing. There is no evidence that the activities associated with these feature types were undertaken by designated specialists or high ranking individuals. There is no reason to suspect, therefore, that these sites were especially culturally significant to the prehistoric occupants of the area (as per the definition of "cultural value" provided above).

RECOMMENDATIONS

Based on the findings of significance and potential significance and cultural value as outlined above and summarized in Table 3, the following recommendations have been developed and are here offered. Of the 12 sites identified within or immediately adjacent to the present project area (including that portion of the Honoapiilani Alternate C Roadway Corridor examined during the present project), six are assessed as being significant solely for information content. No further work is recommended for

of-the-century agricultural access road segment with a partial dry masonry foundation. This site is without associated cultural deposits or portable remains and does not represent a unique or one-of-a-kind resource worthy of preservation. Consequently, the present recording is considered adequate mitigation of any potential project effects. For the remaining five sites considered significant solely for information content, further work in the form of vegetation clearing, detailed archaeological recording, and further refinement of the provisional evaluations of subsurface components is recommended.

Of the remaining six sites, five are assessed as being significant for information content, and provisionally as good examples of site types. These sites include one complex in Hahakea Gulch which contains relatively well-preserved habitation features (Site 2480), the two site complexes identified within the two branches of Kahoma Stream (Site 2483 located within the south branch of the stream (Kanaha Stream), and previously recorded Site 1203 located within the north branch), and two well constructed walled enclosures located within the general vicinity of Puu Laina (Sites 2485 and 2488). For these five sites, further work in the form of vegetation clearing and additional data collection (i.e., detailed recording, surface collections, and limited excavations), would be followed by a decision as to whether preservation "as is," or preservation with some level of interpretive development, is appropriate. This determination would be based on functional interpretations, dating results, and evaluation of nearby areas for similar preserved examples.

Lastly, one site is assessed as being significant for information content, and also as being potentially culturally significant (Site 2486). This site is in excellent physical condition, particularly given the level of prior disturbance within the immediate and general project vicinity. However, site function could not be determined on the basis of the inventory data collected during the present project. The configuration of the rock features observed suggests that the site functioned as a prehistoric burial site, and that Feature A "cairn"/platform, morphologically distinct from the other 13 features at the site, may have been utilized for ceremonial purposes. If this hypothesis is correct—i.e., that the site contains burials and is thus culturally significant—preservation "as is" is recommended as the more desirable treatment. In conjunction with implementing such an avoidance strategy, however, site limits should be more accurately delineated on the basis of further data collection (i.e., vegetation clearing and additional detailed recording). If impact avoidance cannot be ensured, then the following additional tasks would be required. First, the site would have to be properly evaluated for the presence and total number of human remains. This evaluation would involve further data collection including detailed recording, possible surface collections, and evaluation of the contents of up to two of the suspected burial features as well as Feature A "cairn." If the presence of human remains is confirmed, then the second phase of the additional work/treatment would involve proper disinterment and reburial, in accordance with Chapter 3238:Section 25-5 and Chapter 6E: Section 43 (as amended by Act 265 SLH 1988), Hawaii Revised Statutes. This latter alternative would also have to include an attempt to locate any lineal descendants of individuals who may be buried at the site.

It should be noted that the above evaluations and recommendations are based on the findings of a surface inventory survey only. Thus, there is always the possibility, however remote, that potentially significant unidentified cultural remains might be encountered in the course of future development activities involving the modification of the ground surface. In such a situation, archaeological consultation should be sought immediately.

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APPENDIX I
TRAFFIC IMPACT REPORT

LAHAINA MASTER PLANNED PROJECT

TRAFFIC IMPACT REPORT

JANUARY 1990

Prepared For

Housing Finance Development Corporation

Prepared By

Parsons Brinckerhoff Quade & Douglas, Inc.

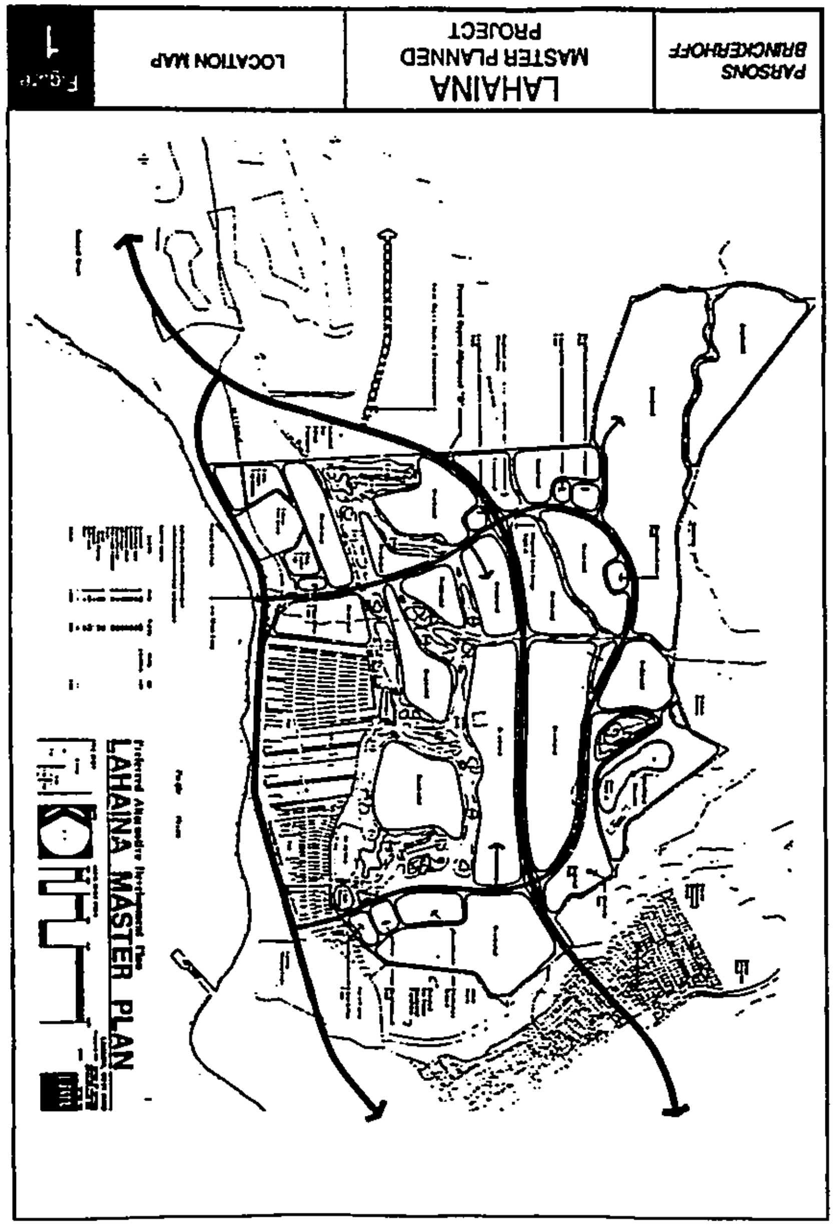
INTRODUCTION

The Housing Finance and Development Corporation (HFDC) has proposed to develop 1120 acres of land located on the east side of Honoapiilani Highway between Kaanapali and Lahaina on the island of Maui (see Figure 1). Development of approximately 4800 single family and multi-family residential dwelling units is proposed. Also proposed for development within the project area are 16 acres of commercial land use, a 12 acre elementary school site, three church/day care centers, an eighteen-hole golf course, and 60 acres of park and open space. This project will be a phased development occurring over the ten year period between 1991 and the year 2000. (See Figure 1)

Existing and future conditions within the study area were evaluated at the five critical intersections along Honoapiilani Highway at Civic Center Road, Kanlau Road, Front Street/Fleming Road, Kapunakea Street, and at Lahainaluna Road to determine the traffic impacts of the proposed project. Future year traffic conditions were also evaluated at the proposed intersections along the future Lahaina Bypass Road which is proposed by the State Department of Transportation, Highways Division, at the extension of Civic Center Road and at the extension of Kapunakea Street.

Trip generation rates promulgated by the Institute of Transportation Engineers were applied to the development to estimate the number of trips attributed to each of the various types of developments proposed. Project generated trips were then distributed to and from the study area based upon the location of various trip attractors.

Levels of service (LOS) at the five critical intersection along Honoapiilani Highway were identified using the procedures outlined in the Transportation Research Board, Circular 212[1] "Critical Movement Analysis - Planning Method". Levels of service are qualitative measures which describe traffic operational conditions.



EXISTING CONDITIONS

The proposed project site is located on the east (mauka) side of Honoapiilani Highway between Kaanapali and Lahaina in the area adjoining the Lahaina Civic Center and the Wahikuli subdivision. This area is currently used for the production of sugarcane.

Roadway System

Honoapiilani Highway is a state highway that is generally aligned in a north-south direction. It is the primary route that provides regional circulation through West Maui linking Kapalua, Kaanapali, and Lahaina with other regions around the island including Kahului, Wailuku, and Kihei.

Honoapiilani Highway, between Kaanapali and Lahaina, was recently widened to four-lanes with dedicated left turn pockets provided at most intersections. Public dedication of these improvements occurred on October 18, 1989. North of Kaanapali, Honoapiilani Highway is an improved two-lane arterial roadway with paved shoulders. South of Lahaina, Honoapiilani Highway is a two-lane roadway with several horizontal curves that limit opportunities for passing.

Within the study area, Honoapiilani Highway is a four-lane arterial roadway that is signal controlled at its intersections with Civic Center Road, Front Street/Fleming Road, and Kapunakea Street. The Honoapiilani Highway/Lahainaluna Road intersection is also signal controlled within the town of Lahaina. North of Fleming Road/Front Street, Honoapiilani Highway is posted 35mph.

Civic Center Road is a two-lane roadway that is generally aligned in an east-west direction. It provides access to the Lahaina Civic Center which is located on the east side of Honoapiilani Highway, north of Lahaina town. Civic Center Road terminates on its makai (western) end forming the east leg of a signalized cross intersection at Honoapiilani Highway. The entrance to the Wahikuli Beach Park forms the west approach of this intersection.

Kaniau Road is a two-lane residential roadway that is aligned in an east-west direction. It provides access to the Wahikuli subdivision and intersects Honoapiilani Highway on its western end forming the stop controlled stem of a T-intersection.

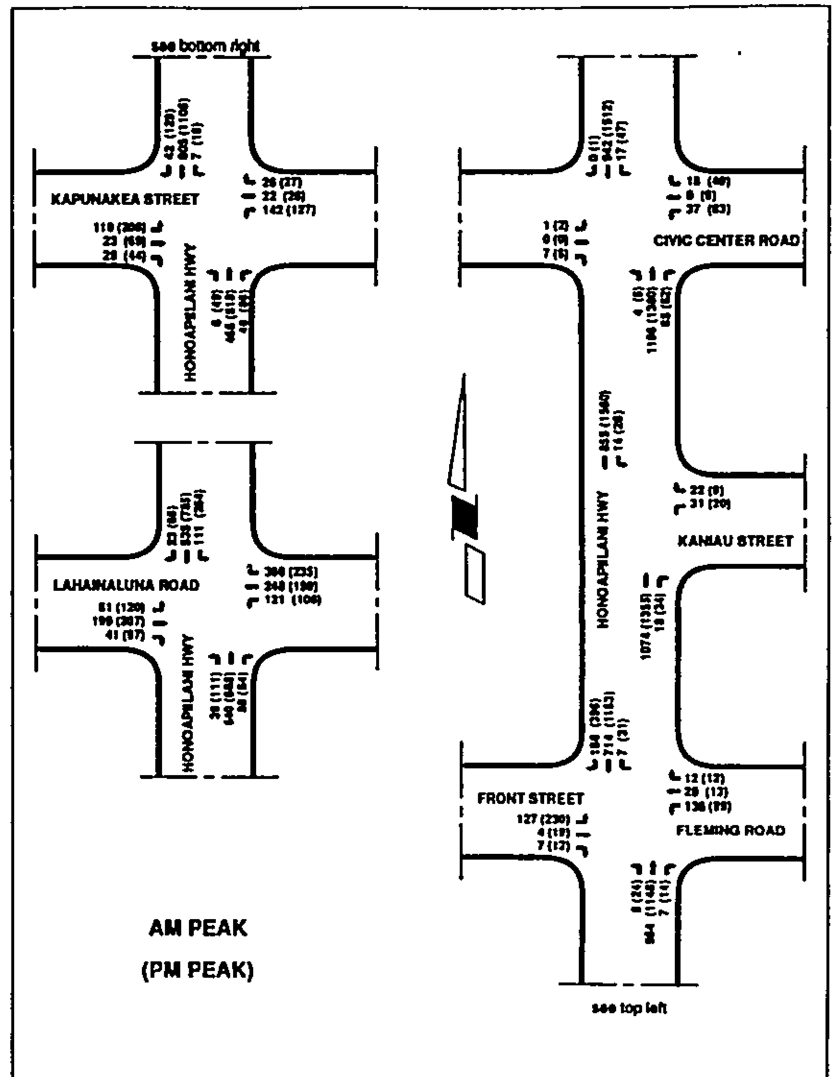
Front Street and Fleming Road are two-lane roadways that are generally aligned in an east-west direction. Fleming Road provides access to the Wahikuli subdivision and intersects Honoapiilani Highway on its western (makai) terminus forming the east approach of a signalized cross intersection. West of Honoapiilani Highway, this roadway continues on as Front Street. Front Street provides access to the northern end of Lahaina.

Kapunakea Street is generally aligned in an east-west direction. It intersects Honoapiilani Highway forming a signalized cross intersection. East of Honoapiilani Highway, Kapunakea Street is a two-lane roadway that provides access to the Wahikuli subdivision. West of Honoapiilani Highway, Kapunakea Street is two lanes wide with dedicated turn lanes. This section of Kapunakea Street provides access to the commercial areas within the town of Lahaina.

Lahainaluna Road is a two-lane roadway within Lahaina that is generally aligned in an east-west direction. On its eastern (mauka) end Honoapiilani Highway terminates at the Lahainaluna High School. It pass by the Lahaina Intermediate and Princess Nahienaena Elementary schools, passes through the Kelawea residential community, and intersects Honoapiilani Highway forming a signalized cross intersection. West of Honoapiilani Highway, Lahainaluna Road continues on through commercial areas and terminates on its western (makai) end forming the stem of a T-intersection at Front Street. The speed limit on Lahainaluna Road is posted 20 mph.

Existing Traffic Conditions

The description of existing traffic conditions is based on 1989 AM and PM peak hour turning movement counts taken by our staff members at the Honoapiilani Highway/Civic Center Road intersection and at the Honoapiilani Highway/Kapunakea Street intersection on October 19,1989. These peak hour turning movement counts were also supplemented with turning movement counts presented in the Honoapiilani Highway: Puamana to Honokowai - Draft Environmental Impact Statement[2]. Existing year 1989 peak hour traffic volumes were projected from these 1987 turning movement counts by applying an average annual growth rate. Current and historic traffic count information revealed a five (5) percent average annual growth in traffic volumes on Honoapiilani Highway. This average growth rate was applied over the two-year period from 1987 to 1989. The 1989 peak hour traffic volumes counted and derived for the existing conditions are summarized in Figure 2.



PARSONS BRINCKERHOFF | LAHAINA MASTER PLANNED PROJECT | EXISTING TRAFFIC VOLUMES | Figure 2

Intersection capacities usually control overall roadway capacities; existing traffic conditions were, therefore, evaluated at five critical intersections along Honoapiilani Highway using the Critical Movement Analysis (CMA) - Planning Method outlined in the Transportation Research Board's (TRB) Circular 212. Operating conditions at an intersection are expressed as a qualitative measure known as level of service. These levels-of-service are expressed as letter designations from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst. A description of these levels-of-service is presented in the Appendix.

Intersections along Honoapiilani Highway at Civic Center Road, Kaniau Road, Front Street/Fleming Road, Kapunakea Street, and at Lahainaluna Road were selected as the most critical location within the study area. Intersection capacity analyses were conducted at each of these critical intersections for the existing, future without project, and future with project conditions. Analyses revealed that these five critical intersections are currently operating at acceptable Levels-of-Service (LOS) B or better during both the AM and the PM peak hours.

FUTURE TRAFFIC CONDITIONS

The Future Traffic Conditions section of this report contains information regarding future year traffic forecasts; generation, distribution, and assignment of trips for the milestone development phases of the proposed project; and analyses of the effects of the project on the surrounding street system. These milestone development years are 1991,1994,1995, and the year 2000.

Planned Transportation System

The State of Hawaii Department of Transportation has proposed the construction of a bypass road from Puamana to Honokowai. This north-south bypass road will connect to Honoapiilani Highway on its southern end, south of Lahaina town. Construction of a two-lane road that will pass mauka (east) of the town of Lahaina, pass through the project site and connect back to Honoapiilani Highway south of Kaanapali is proposed as the first phase of development. Future development phases will widen the bypass between Kaanapali and Lahaina to four-lanes and extend the bypass north towards Honokowai.

Three alternative alignments were proposed in the Draft Environmental Impact Statement prepared for "Honoapiilani Highway - Puamana to Honokowai". All three of the alternative alignments pass through the project area. Alternative B was selected by the State Department of Transportation as the most probable alignment alternative.

Two grade separated connections to the bypass road from the project are also proposed. These connections to the bypass road would occur at the exte[illegible] of Civic Center Road and at the extension of Kapunakea Street.

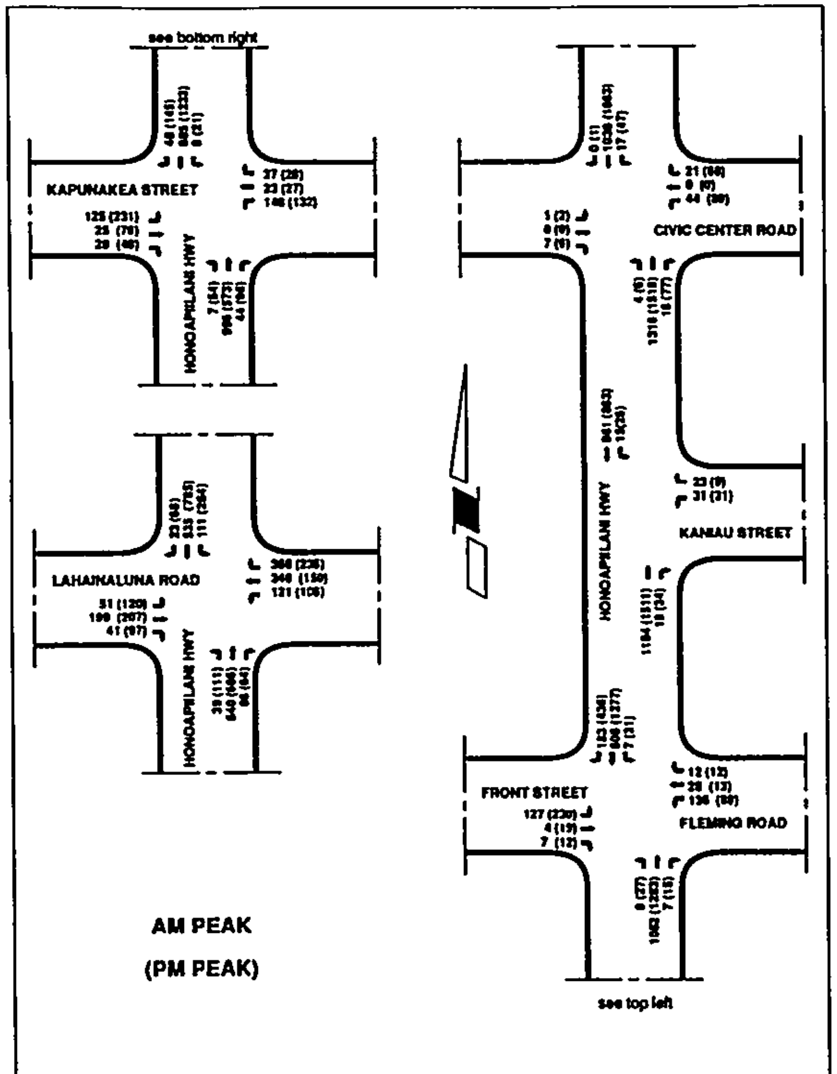
Base Year Traffic Conditions

Construction of 240 single family and multi-family residential dwelling units is proposed in the first phase of development. Completion of this first phase is expected in the future year 1991.

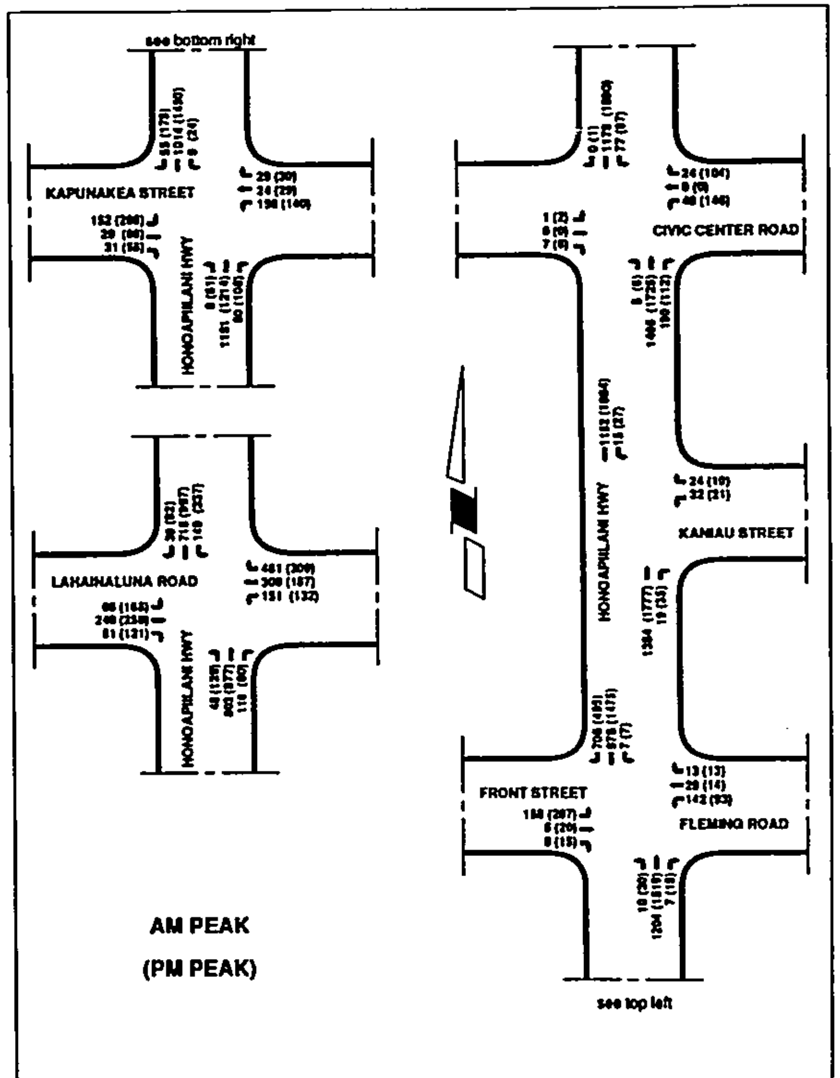
By the future year 1994, completion of a total of 2025 single family and multi-family residential dwelling units and the eighteen-hole golf course is anticipated. Further development within the project site beyond this point will require construction of the Lahaina Bypass Road due to limited roadway capacity on Honoapiilani Highway. With and without project traffic conditions were, therefore, evaluated with the Lahaina Bypass Road in place for the future year 1995 and build-out year 2000. Peak hour traffic volumes forecast for the future years 1991, 1994, 1995, and year 2000 without the proposed project are shown in Figures 3 through 6.

Traffic volumes within the study area for the future milestone years were derived from information presented in the Honoapiilani Highway Draft Environmental Impact Statement. The Honoapiilani Highway Draft Environmental Impact Statement projected traffic volumes to grow at an average annual rate of five (5) percent per year to the future year 2001.

Traffic generated by the proposed expansion of the Lahaina Civic Center was also accounted for in the base year traffic conditions. The proposed sixteen (16) acre Civic Center expansion was assumed to have a building coverage of 25 percent and this expansion was assumed to occur evenly over the ten year period that coincided with this project's phased development.



PARSONS BRINCKERHOFF | LAHAINA MASTER PLANNED PROJECT | BASE YEAR 1991 TRAFFIC VOLUMES | Figure 3



PARSONS BRINCKERHOFF | LAHAINA MASTER PLANNED PROJECT | BASE YEAR 1994 TRAFFIC VOLUMES | Figure 4

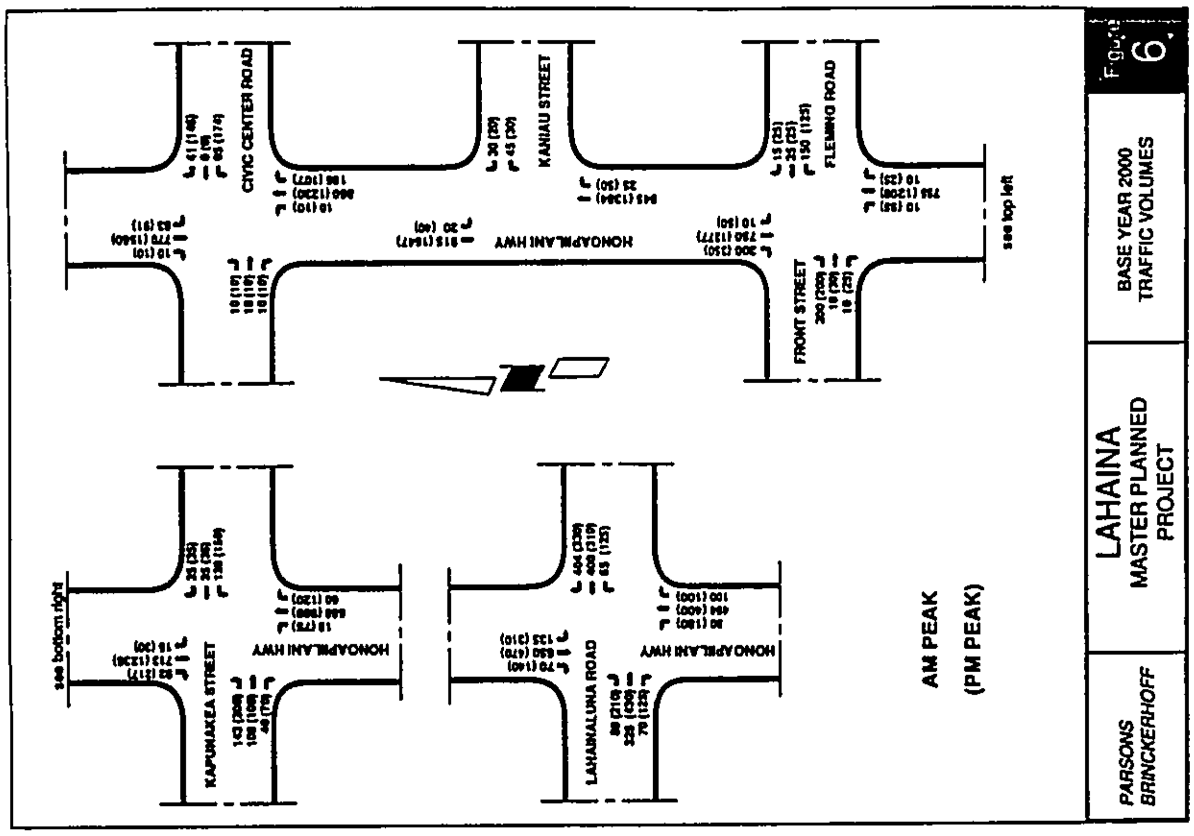


Figure 6
BASE YEAR 2000 TRAFFIC VOLUMES
LAHAINA MASTER PLANNED PROJECT
PARSONS BRINCKERHOFF
AM PEAK
(PM PEAK)
HONOAPIILANI HWY
CIVIC CENTER ROAD
KAHAU STREET
FLEMING ROAD
FRONT STREET
KAPUNAKEA STREET
LAHAINALUNA ROAD
see top left
see bottom right

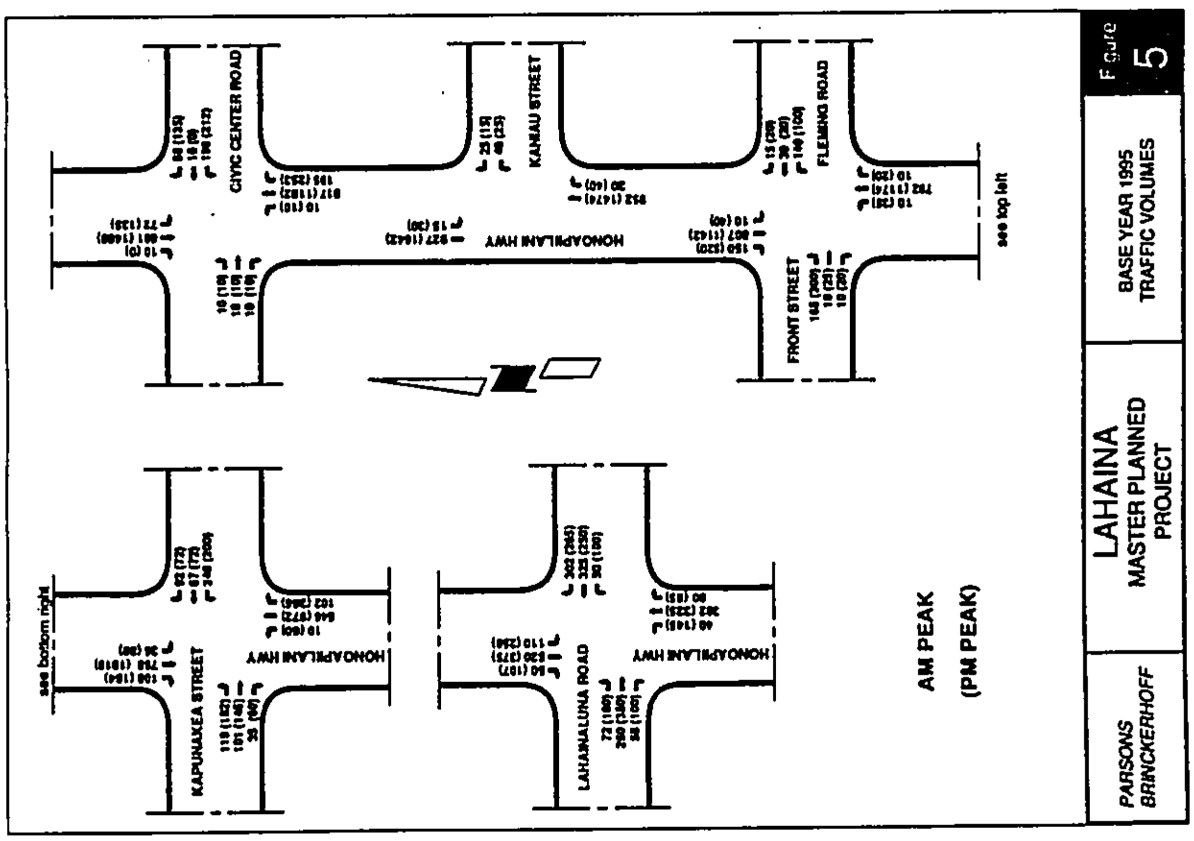


Figure 5
BASE YEAR 1995 TRAFFIC VOLUMES
LAHAINA MASTER PLANNED PROJECT
PARSONS BRINCKERHOFF
AM PEAK
(PM PEAK)
HONOAPIILANI HWY
CIVIC CENTER ROAD
KAHAU STREET
FLEMING ROAD
FRONT STREET
KAPUNAKEA STREET
LAHAINALUNA ROAD
see top left
see bottom right

Traffic volumes generated by the Civic Center expansion were distributed on to the surrounding roadway network based upon existing traffic distribution pattern and the location of existing traffic generators and attractors within the area.

Base Year 1991 (Without Bypass)

Critical Movement Analyses performed at the intersections along Honoapiilani Highway at Civic Center Road, Kanlau Road, and Front Street/Fleming Road revealed that these intersections would operate at LOS A during the AM peak hour and at LOS B or better during the PM peak hour in the future year 1991. Analyses also revealed that the Honoapiilani Highway/Kapunakea Street intersection would operate at LOS A during the AM peak hour and at LOS C during the PM peak hour while the Honoapiilani Highway/Lahainaluna Road intersection would operate at LOS B during the AM peak hour and at LOS C during the PM peak hour.

Base Year 1994 (Without Bypass)

Analyses performed under the existing roadway geometric conditions for the future year 1994 without project traffic revealed that the Honoapiilani Highway/Civic Center Road intersection would operate at LOS B during the AM peak hour and at LOS D during the PM peak hour. The Honoapiilani Highway/Kanlau Road intersection and the Honoapiilani Highway/Front Street/Fleming Road intersection would operate at LOS A during the AM peak hour and at LOS C or better during the PM peak hour. The Honoapiilani Highway/Kapunakea Street intersection would operate at LOS A during the AM peak hour and at LOS D during the PM peak hour while the Honoapiilani Highway/Lahainaluna Road intersection would operate at LOS C during the AM peak hour and at LOS D during the PM peak hour.

Analysis at the intersection of Honoapiilani Highway and Lahainaluna Road also reveals that dual southbound left-turn lanes may be needed on Honoapiilani Highway to accommodate the anticipated heavy left-turn demand. With a second southbound left-turn, this intersection would operate at a LOS C during both the AM and the PM peak hours.

Lahaina Bypass Road

The Lahaina Bypass Road would improve traffic conditions along the existing Honoapiilani Highway by providing through vehicles with an alternative route around the town of Lahaina. For the purposes of our analysis it was assumed that the Lahaina Bypass Road would be a two-lane roadway in the future years 1995 through 2000. Analyses performed for the future year traffic conditions also assumed that between 40% and 50% of the through traffic currently using Honoapiilani Highway would divert to the Bypass Road during the AM peak hour and between 27% and 45% would divert during the PM peak hour.

Base Year 1995 With Bypass Road

Analyses performed for the future year 1995 traffic conditions with existing roadway geometric conditions on Honoapiilani Highway and with the Lahaina Bypass Road in place, revealed that the intersections along Honoapiilani Highway at Civic Center Road, Kanlau Road, Front Street/Fleming Road, Kapunakea Street, and at Lahainaluna Road would operate at LOS B or better during both the AM and PM peak hours.

Base Year 2000 With Bypass Road

Analyses of the future year build-out conditions in the year 2000 with the Lahaina Bypass Road in place revealed that the intersections along Honoapiilani Highway at Civic Center Road, Kanlau Road, and Front Street/Fleming Road would operate at LOS B or better during both the AM and the PM peak hours. Analyses also revealed that the Honoapiilani Highway/Kapunakea Street intersection would operate at LOS A during the AM peak hour and at LOS C during the PM peak hour while the Honoapiilani Highway/Lahainaluna Road intersection would operate at LOS B during the AM peak hour and at LOS D during the PM peak hour.

FUTURE WITH PROJECT

Development of approximately 4800 single family and multi-family residential dwelling units, 16 acres of commercial land use, a 12 acre elementary school site, three separate church/day care centers, an eighteen-hole golf course, and 60 acres of park and open space are proposed by the year 2000. Of the 4800 residential dwelling units proposed, it is anticipated that 70% will be single family residential units with the remaining 30% being multi-family residential units. This project will be a phased development over the ten year period between 1991 and the year 2000.

Construction of 240 single family and multi-family residential dwelling units is planned in the first phase of development in the area adjoining the existing Lahaina Civic Center. Access to the first phase from Honoapiilani Highway was assumed to be provided through Civic Center Road. Completion of this first phase of development is anticipated by the year 1991.

Completion of 2025 single family and multi-family residential dwelling units and the eighteen-hole golf course is planned for by the future year 1994. Any further development within the project site will require the completion of the Lahaina Bypass Road due to roadway capacity limitations on Honoapiilani Highway. Traffic conditions on the surrounding roadway system were, therefore, evaluated for the years 1991 and 1994 without the Lahaina Bypass Road and for the years 1995 and 2000 with the Lahaina Bypass Road.

Development of the Elementary School was assumed to occur in the future year 1995. Trips generated by the proposed Elementary School was, therefore, accounted for in the future year 1995 with project traffic analyses. All other proposed land uses were assumed to be developed in subsequent phases of the project.

Trip Generation

Trip generation rates promulgated by the Institute of Transportation Engineers in the Trip Generation Manual, Fourth Edition[3], were used to estimate the volume of traffic generated by the proposed project. The Apartment land-use category was applied to the multi-family residential development since it most closely represents multi-family residential trip generation characteristics. Trip generation characteristics for the commercial land-use was based on an estimated 160,000 gross square feet of development (25 percent coverage) while each of the

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three church/day care centers were assumed to be 5000 square feet in size. Trip generation characteristics for the Elementary School was based on a assumed student enrollment of 800.

In large residential developments such as this proposed project, the average trip generation rates promulgated in the Trip Generation Manual tends to over estimated the number of trips produced. In larger projects, trips internal to the project site comprise a larger portion of the total trips produced

Mixed use developments have also been found to generate fewer vehicular trips than their aggregate totals. This is due in part to the capture of bypass trips from the traffic stream and multi-purpose trips within a mixed use development.

To account for this over estimation in project generated traffic in the future years 1994, 1995 and 2000, the trips generated by the proposed single family residential developments where reduced by 20 percent during the AM peak hour and by 10 percent during the PM peak hour. The vehicular trip generation rates used for the proposed project are presented in Table 1 with a summary of the trips produced in each of the milestone years summarized in Table 2.

Trip Distribution

Trip distribution determines the origins and destinations of the project generated traffic. The project trips were distributed in three directions: north towards Kaanapali and Kapalua, south towards Kihei, and southwest and southeast into Lahaina. Directional distribution of project generated traffic was based upon existing traffic distribution pattern in the surrounding area. Table 3 lists the directional trip distribution factors used for this project.

Trip Assignment

Project generated traffic was assigned onto the existing circulation system, the proposed Lahaina Bypass Road, and the projects internal roadway system using the distribution factors presented in Table 3. The assignment of project generated traffic onto the surrounding street system is shown for each of the milestone years in Figures 7 through 10.

TABLE 2
TRIP GENERATION SUMMARY
PROJECT GENERATED TRAFFIC

	1991 RES	1994 RES	1994 GOLF COUR	1994 TOTAL	1995 RES	1995 GOLF COUR	1995 ELEM. SCH	1995 TOTAL
QUANTITY	240	2,025	175		2,488	175	800	
UNITS	DU	DU	AC		DU	AC	STUD	
ADT	2,130	17,970	1,457	19,427	22,079	1,457	826	24,362
AM	165	1,393	47	1,440	1,712	47	184	1,943
ENTER	41	346	37	383	425	37	110	572
EXIT	124	1,045	10	1,065	1,284	10	74	1,368
PM	217	1,833	68	1,901	2,252	68	12	2,332
ENTER	139	1,177	6	1,183	1,446	6	6	1,458
EXIT	78	658	62	720	809	62	6	877

2000	RES	GOLF COUR	ELEM. SCH	COMM	DAY CARE	PARK	TOTAL
QUANTITY	4,800	175	800	160	5	60	
UNITS	DU	AC	STUD	KSF	KSF	AC	
ADT	42,595	1,457	826	10,086	1,005	220	56,189
AM	3,302	47	184	232	170	146	4,081
ENTER	821	37	110	162	90	73	1,293
EXIT	2,477	10	74	70	80	73	2,784
PM	4,344	68	12	796	185	202	5,607
ENTER	2,789	6	6	390	89	101	3,381
EXIT	1,560	62	6	406	96	101	2,231

CIVIC CENTER GENERATED TRAFFIC

YEAR	1991	1994	1995	2000
ADT	438	1,750	2,188	4,375
AM	39	158	197	394
ENTER	35	140	175	350
EXIT	4	18	22	44
PM	50	200	250	500
ENTER	16	62	78	155
EXIT	34	138	172	345

AC - Acres
ADT - Average Daily Traffic
COMM - Commercial
DU - Dwelling Units
KSF - Thousand Square Feet
RES - Residential
STUD - Students

TABLE 1
TRIP GENERATION RATES

		Single Family	Multi-Family	Elementary School	Day Care Center	Golf Course	Civic Center Expansion	Park	Commercial
Units		DU	DU	Pupils	KSF	Acres	Acres	Acres	KSF
ADT		10.062	6.103	1.032	67.00	8.325	25	3.664	$Ln (T) = 0.65 Ln (x) + 5.92$
	Enter	—	—	—	—	—	—	—	50%
	Exit	—	—	—	—	—	—	—	50%
AM		0.754	0.532	0.230	11.365	0.266	2.250	2.431	$Ln (T) = 0.60 Ln (x) + 2.40$
	Enter	27%	18%	60%	53%	80%	89%	—	70%
	Exit	73%	82%	40%	47%	20%	11%	—	30%
PM		1.005	0.673	0.015	12.302	0.388	2.857	3.370	$Ln (T) = 0.52 Ln (x) + 4.04$
	Enter	63%	68%	—	48%	8%	31%	—	49%
	Exit	37%	32%	—	52%	92%	69%	—	51%

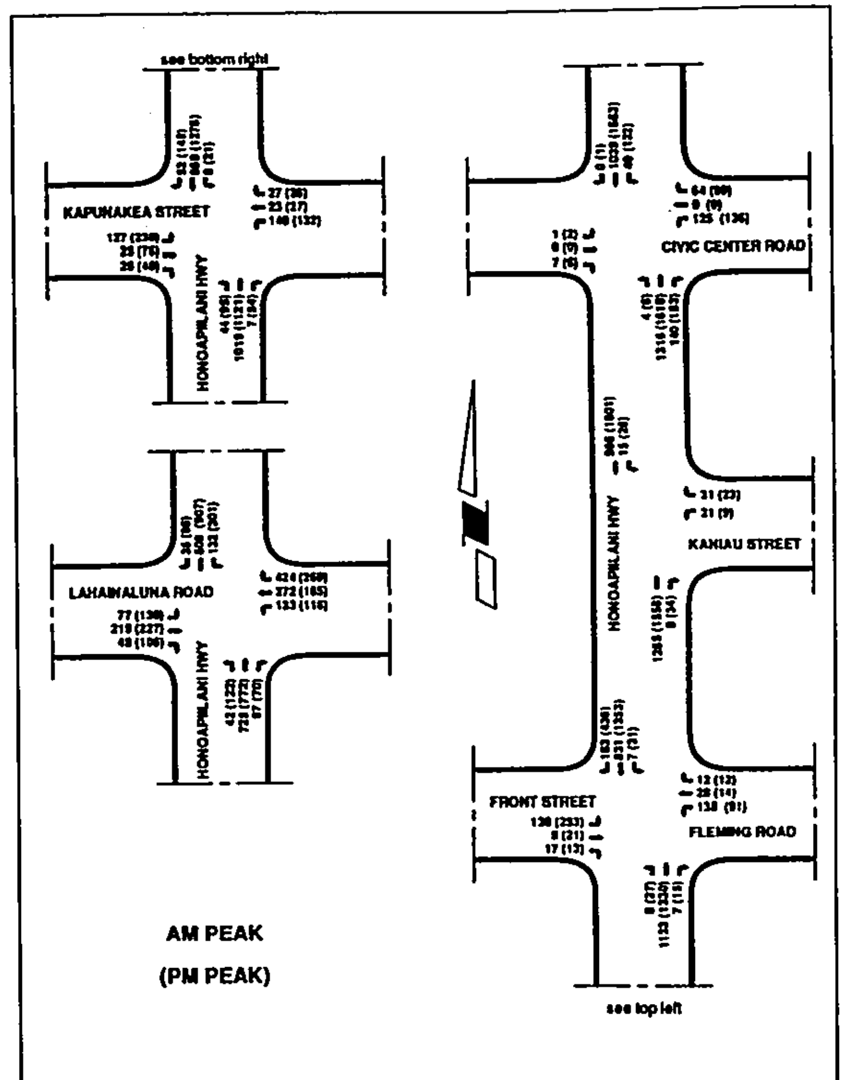
DU – Dwelling Units
KSF – Thousand Square Feet
ADT – Average Daily Traffic

Source: Trip Generation Manual, Fourth Edition

TABLE 3

TRAFFIC DISTRIBUTION FACTORS

DESTINATION	ENTER ADT	ENTER AM	ENTER PM	EXIT ADT	EXIT AM	EXIT PM
KAPALUA/ KAANAPALI	45%	40%	45%	45%	35%	40%
LAHAINA	35%	25%	30%	35%	30%	35%
KIHEI	20%	35%	25%	20%	35%	25%
	100%	100%	100%	100%	100%	100%



PARSONS BRINCKERHOFF | LAHAINA MASTER PLANNED PROJECT | FUTURE YEAR 1991 WITH PROJECT TRAFFIC VOLUMES | Figure 7

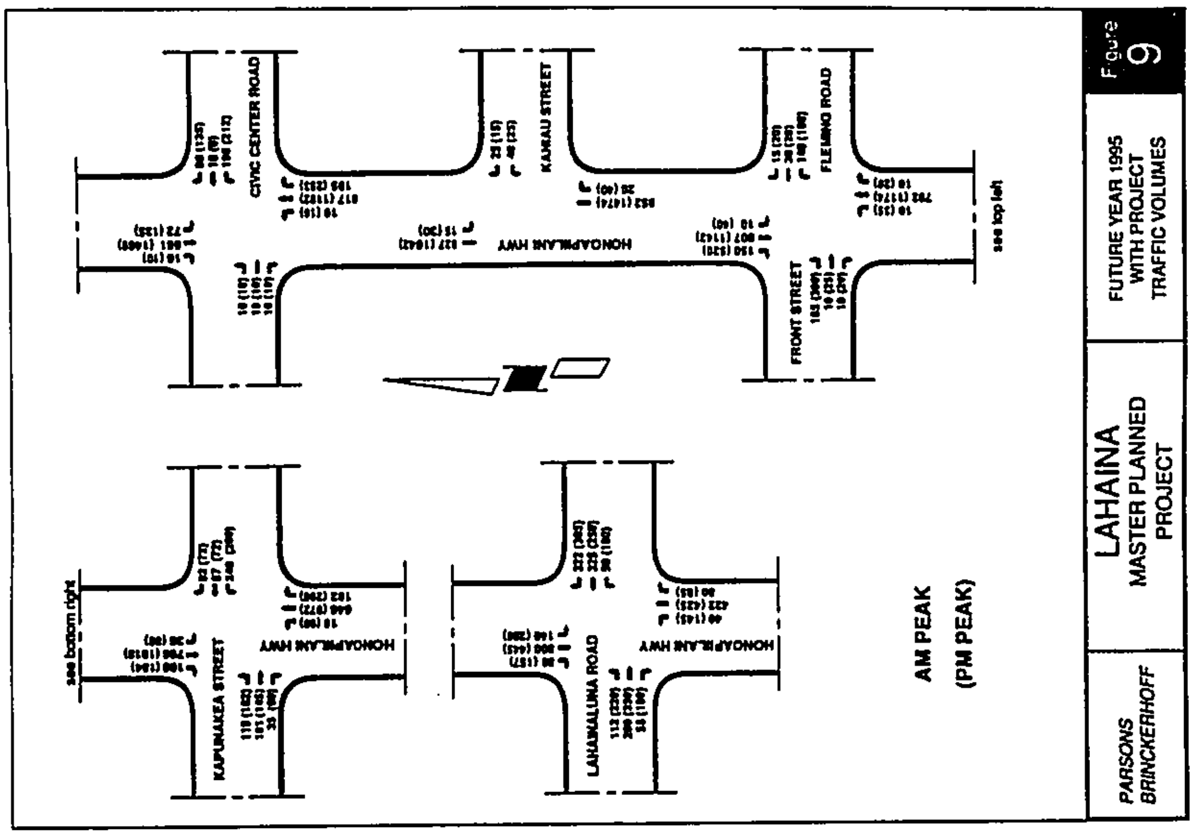


Figure 9
FUTURE YEAR 1995 WITH PROJECT TRAFFIC VOLUMES
LAHAINA MASTER PLANNED PROJECT
PARSONS BRINCKERHOFF
AM PEAK
(PM PEAK)
CIVIC CENTER ROAD
KAMAU STREET
FLEMING ROAD
FRONT STREET
HONOAPIILANI HWY
KAPUNAKEA STREET
LAHAINALUNA ROAD
see top left
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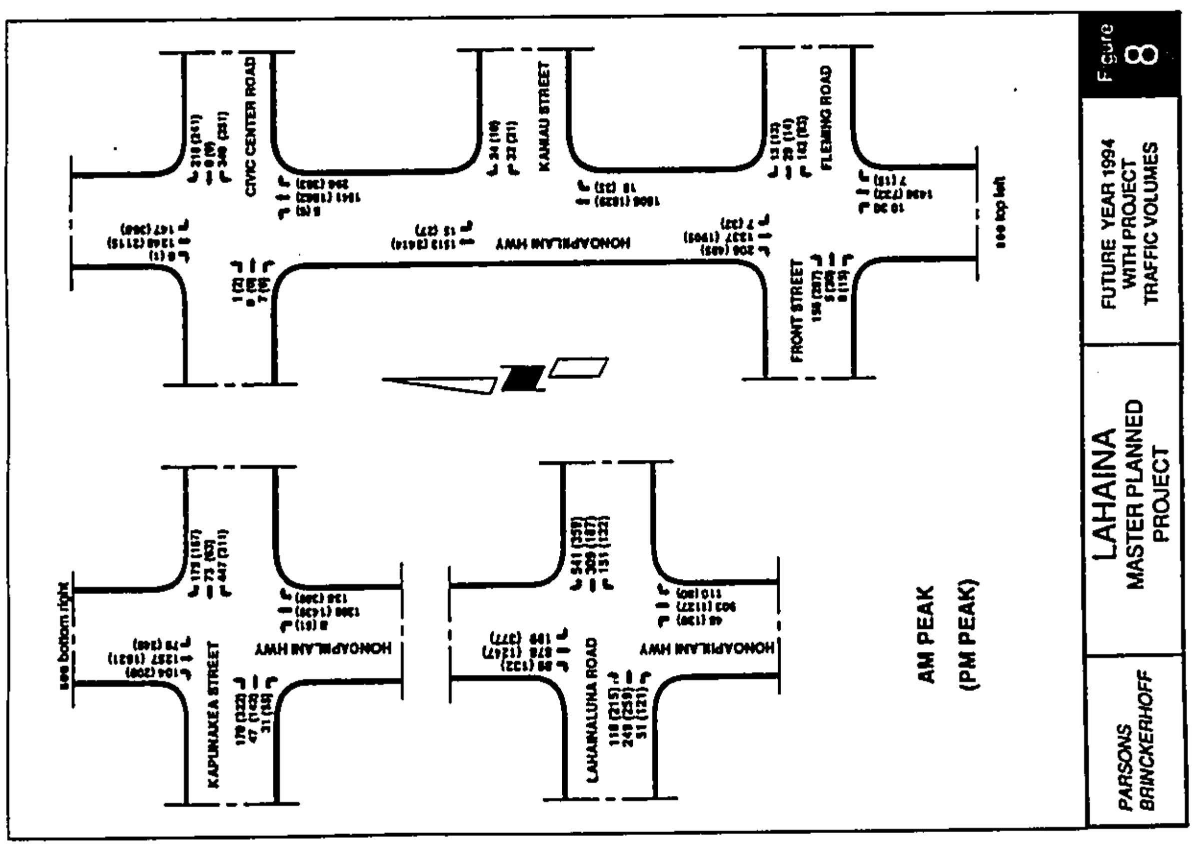
Figure 8
FUTURE YEAR 1994 WITH PROJECT TRAFFIC VOLUMES
LAHAINA MASTER PLANNED PROJECT
PARSONS BRINCKERHOFF
AM PEAK
(PM PEAK)
CIVIC CENTER ROAD
KAMAU STREET
FLEMING ROAD
FRONT STREET
HONOAPIILANI HWY
KAPUNAKEA STREET
LAHAINALUNA ROAD
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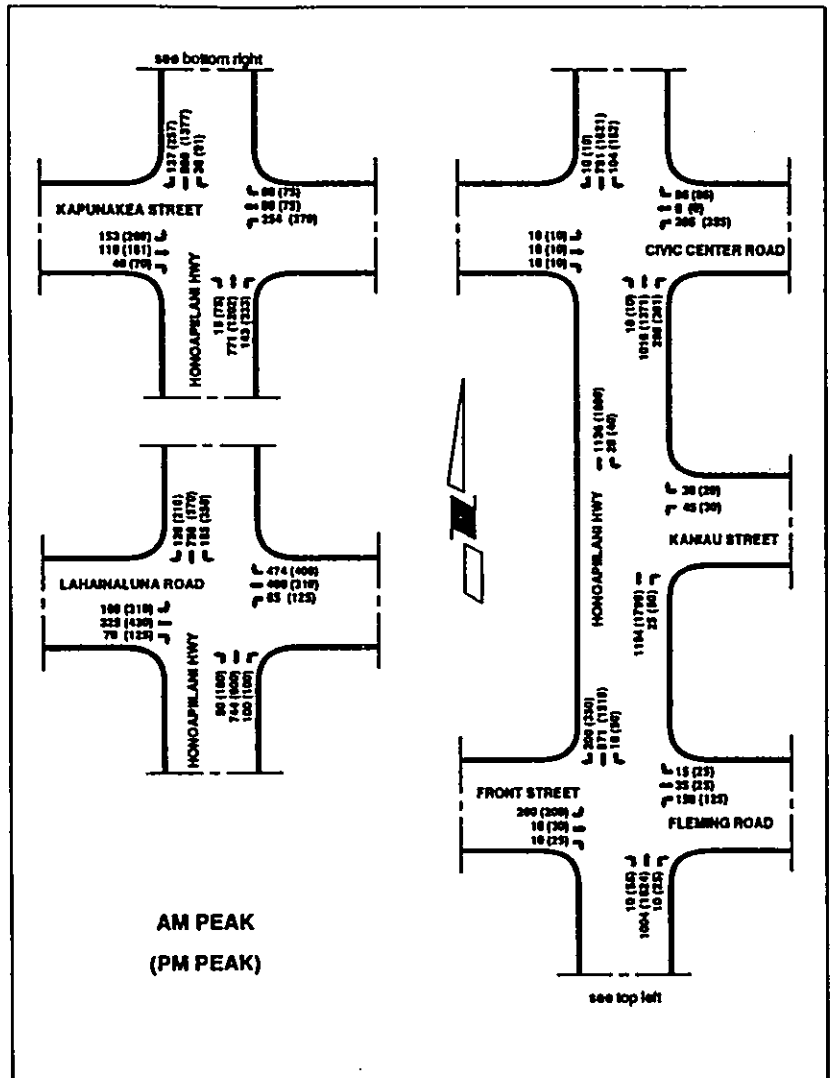

PARSONS BRINCKERHOFF	LAHAINA MASTER PLANNED PROJECT	FUTURE YEAR 2000 WITH PROJECT TRAFFIC VOLUMES	Figure 10

Project Related Impacts

The traffic impacts of the proposed development was assessed by re-evaluating intersection capacities at each of the critical intersections within the project area for both the AM and PM peak hour conditions for each of the milestone years. The results of these analyses are summarized in Table 4.

Future Year 1991 (Without Bypass)

In the future year 1991 with the first phase of the proposed project, the intersections along Honoapiilani Highway at Kaniau Road, Front Street/Fleming Road, Kapunakea Street, and Lahainaluna Road would continue to operate at LOS C or better during both the AM and PM peak hours. The intersection of Honoapiilani Highway and Civic Center Road would go from a LOS A to LOS B during the AM peak hour and from LOS B to LOS C during the PM peak hour with the addition of the project generated traffic.

Future Year 1994 (Without Bypass)

In the future year 1994, under existing geometric conditions, the addition of the project generated traffic would cause the Honoapiilani Highway/Civic Center Road and the Honoapiilani Highway/Kapunakea Street intersections to experience undesirable LOS F conditions during both the AM and the PM peak hours. The Honoapiilani Highway/Kaniau Road intersection would operate at LOS A during the AM peak hour and at LOS D during the PM peak hour while the Honoapiilani Highway/Front Street/Fleming Road intersection would operate at LOS B during the AM peak hour and at LOS E during the PM peak hour. The Honoapiilani Highway/Lahainaluna Road intersection would operate at LOS D during the AM peak hour and at LOS F during the PM peak hour.

At the Honoapiilani Highway/Civic Center Road intersection, providing a second southbound left-turn lane and a northbound right-turn lane on Honoapiilani Highway and widening Civic Center Road to a four-lane road with dual makaibound (westbound) left-turn lanes and a shared through and right-turn lane would improve intersection operations to LOS C during the AM peak hour and to LOS E during the PM peak hour.

The addition of a northbound right-turn lane on Honoapiilani Highway and providing dual left-turn lanes on each approach of Kapunakea Street at the Honoapiilani

Highway/Kapunakea Street intersection would improve operating conditions to LOS C during the AM peak hour and to LOS E during the PM peak hour.

The Honoapiilani Highway/Lahainaluna Road intersection could operate at LOS C during the AM peak hour and at LOS E during the PM peak hour with the addition of a second southbound left-turn lane on Honoapiilani Highway and modifications to Lahainaluna Road. These modifications would include providing dedicated left-turn, through, and right-turn lanes on the makaibound (westbound) approach of Lahainaluna Road and providing a dedicated left-turn and a shared through and right-turn lane on the maukabound (eastbound) approach.

Future Year 1995 With Bypass Road

The construction of the Lahaina Bypass Road would reduce the volume of through traffic on Honoapiilani Highway through the town of Lahaina. The completion of the Bypass Road would, therefore, improve intersection operation at the five critical intersections along Honoapiilani Highway.

The completion of the Lahaina Bypass Road would improve operating conditions at the Honoapiilani Highway/Kanlau Road and the Honoapiilani Highway/Front Street/Fleming Road intersection to LOS B or better during both the AM and the PM peak hours. The intersections along Honoapiilani Highway at Civic Center Road, Kapunakea Street, and Lahainaluna Road would also improve to LOS A during the AM peak hour and to LOS C during the PM peak hour.

The mauka (easterly) extensions of Civic Center Road and Kapunakea Street to form grade separated intersections with the Lahaina Bypass Road is proposed as a part of this project. If these intersections were at-grade crossings they would operate at LOS B or better during the AM period and at LOS D or better during the PM peak hour.

Future Build-Out Year 2000 With Bypass Road

With full project build-out and completion of the Lahaina Bypass Road, the five critical intersections along Honoapiilani Highway would operate at LOS C or better during the AM peak hour. During the PM peak hour the intersections along Honoapiilani Highway at Kanlau Road and at Front Street/Fleming Road would also operate at LOS C or better. During the PM peak hour, the intersection along Honoapiilani Highway at Civic Center Road and at

Kapunakea Street would operate at LOS E and the Lahainaluna Road intersection would operate at LOS F.

Implementation of the improvements previously mentioned in the Future Year 1994 (Without Bypass) section above, would improve operations at the Honoapiilani Highway/Civic Center Road, Honoapiilani Highway/Kapunakea Street, and Honoapiilani Highway/Lahainaluna Road intersections. With these improvements, the Honoapiilani Highway/Civic Center Road intersection would operate at LOS A during the AM peak hour and at LOS C during the PM peak hour. The Honoapiilani Highway/Kapunakea Street intersection would operate at LOS A during the AM peak hour and at LOS E during the PM peak hour while the Honoapiilani Highway/Lahainaluna Road intersection would operate at LOS C during the AM peak hour and at LOS E during the PM peak hour. A summary of the peak hour levels-of-service is presented in Table 4.

The grade separated crossings of the Lahaina Bypass Road, proposed for development as a part of this project, should be designed to accommodate the major directions of traffic flow. Recommended schematic ramp configurations for the Civic Center Road and Kapunakea Street grade separated crossings are shown in Figure 11. The on/off ramps at these grade separated crossings should be signal controlled at their intersections to the Civic Center Road extension and the Kapunakea St. extension. Analysis reveals that all four signalized ramp locations would operate at LOS C or better during both peak hours. As at-grade crossings, the intersections formed with the Lahaina Bypass Road by the extension of Civic Center Road and by the extension of Kapunakea Street would operate at LOS F during both the AM and PM peak hours.

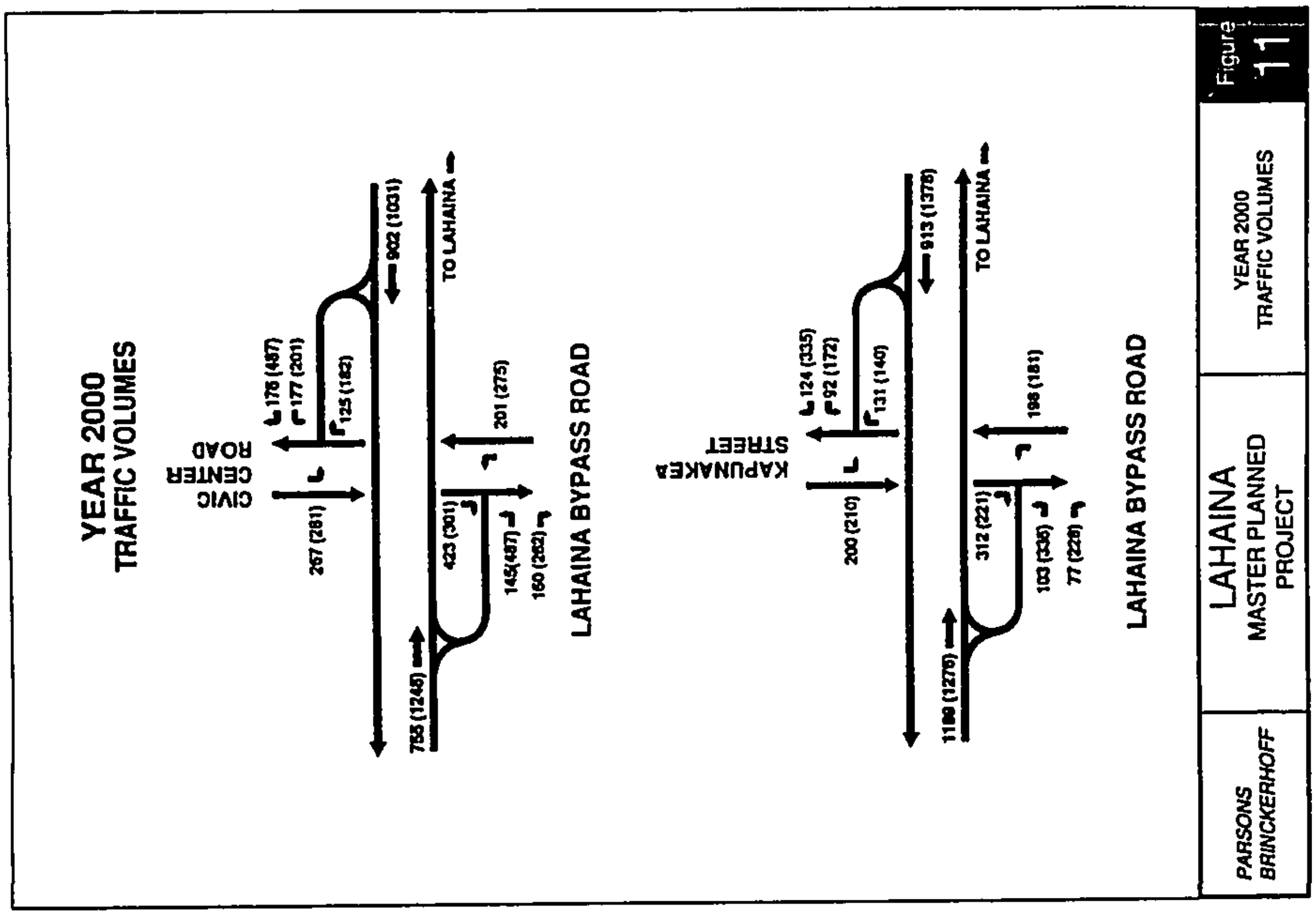

TABLE 4

LEVELS OF SERVICE

SUMMARY

HONOAPIILANI HWY	1989 CMA	1989 LOS	1991 W/O PROJECT CMA	LOS	1991 W/PROJECT CMA	LOS	1994 W/O PROJECT CMA	LOS	1994 W/PROJECT CMA	LOS	1994 MITIGATED CMA	LOS	1995 W/O PROJECT CMA	LOS	1995 W/PROJECT CMA	LOS	1995 MITIGATED CMA	LOS	2000 W/O PROJECT CMA	LOS	2000 W/PROJECT CMA	LOS	2000 MITIGATED CMA	LOS
● CIVIL CENTER RD																								
AM	702	A	800	A	909	B	678	B	1463	F	1071	C	868	A	784	A	863	A	898	A	1041	C	713	A
PM	837	A	962	B	1100	C	1158	D	1583	F	1297	E	847	A	1080	C	876	B	999	B	1403	E	1023	C
● KANIAU RD																								
AM	813	A	671	A	708	A	758	A	884	A	-	-	804	A	888	A	-	-	880	A	708	A	-	-
PM	808	A	883	A	801	B	1023	B	1236	D	-	-	777	A	881	A	-	-	874	A	1016	B	-	-
● FRONT ST/FLEMING RD																								
AM	884	A	715	A	756	A	787	A	823	B	-	-	634	A	689	A	-	-	813	A	737	A	-	-
PM	873	B	867	B	881	B	1121	C	1306	E	-	-	671	B	982	B	-	-	848	B	1130	C	-	-
● KAPUNAKEA ST																								
AM	882	A	720	A	738	A	834	A	1475	F	1047	C	863	A	866	A	708	A	881	A	932	B	796	A
PM	843	B	1060	C	1081	C	1238	D	1704	F	1367	E	858	A	1062	C	988	C	1110	C	1322	E	1368	E
● LAHAINALUNA RD																								
AM	844	A	833	B	946	B	1088	C	1188	D	1067	C	721	A	756	A	817	A	887	B	1101	C	1084	C
PM	968	B	1068	C	1088	C	1340	D	1466	F	1341	E	871	B	1111	C	988	C	1200	D	1440	F	1280	E

CMA - Critical Movement Analysis
LOS - Level of Service
W/O - Without
W/ - With

SUMMARY AND CONCLUSIONS

Resort development in West Maui is the primary driving influence in regional population and vehicular traffic growth. The work force required to service these resorts has created a large demand for housing that has not been met within the region. As a result employees are forced to find housing in areas outside the West Maui region and commute into the area to work.

The 4800 residential dwelling units proposed for development within this project area will accommodate most of the existing and future housing needs within the region. This development will in effect shorten trip lengths and reduce vehicle miles traveled by providing housing closer to the employment source. The proposed project will result in the redistribution of traffic patterns within the region by capturing a significant portion of the existing traffic stream.

Although the total traffic generated by the proposed project could have been reduced to account for the capture in by-pass traffic and redistribution of regional traffic, no reduction in project generated traffic was made. Our analysis is, therefore, conservative in nature.

The intersections along Honoapiilani Highway at Civic Center Road, Kanlau Road, Front Street/Fleming Road, Kapunakea Street, and Lahainaluna Road are currently experiencing acceptable LOS C or better during both the AM and the PM peak hours. These intersections will continue to operate at an acceptable LOS C or better with the addition of the traffic generated by the 240 residential dwelling units proposed for development in the first phase of the project.

By the future year 1994, the traffic generated by additional phases of the project will cause the intersections at Honoapiilani Highway/Civic Center Road, Honoapiilani Highway/Kapunakea Street, and Honoapiilani Highway/Lahainaluna Road to operate at over capacity LOS F conditions under existing geometric roadway conditions. Providing additional lanes and restriping intersection approaches can, however, provide sufficient additional capacity to improve operations to LOS C during the AM peak hour and LOS E during the PM peak hour.

At the Honoapiilani Highway/Civic Center Road intersection, these improvements include a second southbound left-turn lane on Honoapiilani Highway, a northbound right-turn

lane on Honoapiilani Highway, dual makaibound (westbound) left-turn lanes on Civic Center Road, and a shared through and right-turn lane on Civic Center Road. At the Honoapiilani Highway/Lahainaluna Road intersection, these improvements include a second southbound right turn lane on Honoapiilani Highway; dedicated left-turn, through, and right-turn lanes on the makaibound (westbound) approach of Lahainaluna Road and a dedicated left-turn and shared through and right-turn lane on the maukabound (eastbound) approach. It should be noted, however, that the dual southbound left-turn lanes on Honoapiilani Highway would be required with or without the proposed project due to the anticipated heavy left-turn demand at this location.

The addition of a northbound right-turn lane on Honoapiilani Highway and dual left-turn lanes on both approaches of Kapunakea Street would also improve intersection operations at the Honoapiilani Highway/Kapunakea Street intersection to LOS C during the AM peak hour and to LOS E during the PM peak hour.

Roadway capacity on Honoapiilani Highway will be exceeded by any further project development past what was assumed to be developed by the year 1994. Completion of the Lahaina Bypass Road would, therefore, be required to maintain acceptable traffic conditions on Honoapiilani Highway before any further development within the project occurs.

The Lahaina Bypass Road will provide additional roadway capacity through the Lahaina corridor. It is anticipated to divert between 27% and 50% of the peak hour traffic volumes off Honoapiilani Highway by providing through traffic with an alternative route around Lahaina.

At full project build-out in the year 2000, the Lahaina Bypass Road and the intersection improvements previously mentioned will provide sufficient roadway capacity to accommodate project generated traffic through the Lahaina corridor. The five critical intersections along Honoapiilani Highway will experience LOS E conditions or better during both the AM and the PM peak hours.

Two grade-separated connections to the Lahaina Bypass Road are proposed for development as a part of this project. The on/off ramps to these grade-separated connections, should be signal controlled at their intersections with the extension of Civic Center Road and the extension of Kapunakea Street.

The two major mauka-makai roadways proposed within the proposed project site, Civic Center Road and Kapunakea Street, will provide good access to and circulation within the project. Civic Center Road, which is proposed for development as a four-lane arterial roadway, should provide sufficient capacity to accommodate both project generated traffic and regional traffic demands.

REFERENCES:

1. Transportation Research Board, National Academy of Sciences, Transportation Research Circular 212, Interim Materials on Highway Capacity, Washington, D.C., 1980.
2. State of Hawaii, Department of Transportation, Highways Division, Honoapiilani Highway: Puamana to Honokowai - Draft Environmental Impact Statement, 1988.
3. Institute of Transportation Engineers, Trip Generation, Fourth Edition, Washington, D.C., 1987.

APPENDIX

Level of Service Descriptions

"Levels of Service" are qualitative measures which describe traffic operational conditions considering speed and travel time, freedom to maneuver, traffic interruptions and delays, comfort and convenience, and safety. Six levels of service, from "A" (best) to "F" (worst), are defined.

- <u>Level of Service A</u> represents free flow. Individual users are virtually unaffected by the presence of others. For a two-lane highway, passing demand is well below passing capacity: platooning of three or more vehicles is rare. For unsignalized intersections, little or no delay is experienced.
- <u>Level of Service B</u> represents stable flow where the presence of other users in traffic becomes noticeable. On a two-lane highway, platooning is common as passing demand approaches passing capacity. Short traffic delays occur at unsignalized intersections.
- <u>Level of Service C</u> describes stable flow with greater constraints on maneuvering. Long platoons and lower speeds are experienced on two-lane highways. Delays at unsignalized intersections are described as "average."
- <u>Level of Service D</u> represents high density, stable flow. Significant restrictions in speed and maneuverability begin to occur. The opposing traffic streams of a two-lane highway operate separately as passing capacity approaches zero. Delays at unsignalized intersections are long as acceptable gaps in the main traffic stream become infrequent.
- <u>Level of Service E</u> represents capacity or near-capacity conditions. Speeds are low and flow is considered unstable. Passing on two-lane highways is virtually impossible and platooning becomes intense where there are slow moving vehicles or other interruptions. Very long delays occur at unsignalized intersections.
- <u>Level of Service F</u> describes a condition in which traffic demands exceed capacity. Forced flow, with extreme delays and long queues, occur.

APPENDIX J
AIR QUALITY IMPACT REPORT

AIR QUALITY IMPACT REPORT
LAHAINA MASTER PLANNED PROJECT
November 27, 1989

Prepared for

PBR Hawaii

and

State of Hawaii
Housing Finance and Development Corporation

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1. INTRODUCTION

The State of Hawaii Housing Finance and Development Corporation (HFDC) is proposing to develop a 1,120-acre parcel of land located east of Honoapiilani Highway between Lahaina and Kaanapali on the Island of Maui (Figure 1). The proposed development, to be phased in over the 1991 - 2000 period, includes the following major elements:

- 4,800 single- and multi-family homes (730 acres)
- commercial area (16 acres)
- elementary school (12 acres)
- church/day care center sites (6 acres)
- eighteen-hole golf course (175 acres)
- park and open space (60 acres)

The primary existing use of the property is sugar cane cultivation as shown in Figure 2.

The purpose of this report is to assess the impact of the proposed development on air quality on a local and regional basis. The overall project can be considered an "indirect source" of air pollution as defined in the federal Clean Air Act [1] since its primary association with air quaity is due to its inherent generation of mobile source, i.e., motor vehicle and power boat activity. Much of the focus of this analysis, therefore, is on the project's ability to generate traffic and the resultant impact on air quality. Air quality impact was evaluated for existing (1989) and future (1991 - 2000) conditions.

The following direct and indirect impacts have also been addressed:

- offsite impacts due to electrical generation
- pesticides use at the golf course
- onsite and offsite construction impacts

2. AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 1 [2, 3]. Note that Hawaii's standards are not divided into primary and secondary standards as are the federal standards.

Primary standards are intended to protect public health with an adequate margin of safety while secondary standards are intended to protect public welfare through the prevention of damage to soils, water, vegetation, man-made materials, animals, wildlife, visibility, climate, and economic values [4].

Some of Hawaii's standards are clearly more stringent than their federal counterparts but, like their federal counterparts, may be exceeded once per year. It should also be noted that in April, 1986, the Governor signed amendments to Chapter 59 (Ambient Air Quality Standards) making the state's standards for particulate matter aNd sulfur dioxide the same as national standards. In the case of particulate matter, however, this uniformity did not last long. On July 1, 1987, the EPA revised the federal particulate standard to apply only to particles 10 microns or less in diameter (PM-10) [5], leaving the state once again with standards different than the federal ones.

In the case of the automotive pollutants [carbon monoxide (CO), oxides of nitrogen (NOx), and photochemical oxidants (Ox)], there are only primary standards. Until 1983, there was also a hydrocarbons standard which was based on the precursor role hydrocarbons play in the formation of photochemical oxidants rather than any unique toxicological effect they had at ambient levels. The hydrocarbons standard was formally eliminated in January, 1983 [6].

The U.S. Environmental Protection Agency (EPA) is mandated by Congress to periodically review and re-evaluate the federal standards in light of new research findings [7]. The last review resulted in the relaxation of the oxidant standard from 160 to 235 micrograms/cubic meter (ug/m3) [8]. The carbon monoxide (CO), particulate matter, sulfur dioxide (SO2), and nitrogen dioxide (NO2) standards are currently under review, but no new standards have been proposed [9].

Finally, the State of Hawaii also has fugitive dust regulations for particulate matter (PM) emanating from construction activities [10]. There simply can be no visible emissions from fugitive dust sources.

3. EXISTING AIR QUALITY

3.1 General. There are a number of possible sources which may affect air quality in the project area. Agricultural activities including sugar cane field burning, bagasse and fossil fuel burning at sugar mills, and pesticide spraying all have the potential for affecting air quality in varying degrees. Nearby resort activity with its concomitant motor vehicle traffic can also affect local air quality. A recent study in Lahaina, for example, revealed carbon monoxide concentrations which exceeded

State standards [11]. Occasionally, volcanic air pollution from Kilauea volcano on the Island of Hawaii can also influence Maui's air quality (see Figure 3).

The State Department of Health maintains a network of air monitoring stations around the state to gather data on the following regulated pollutants:

- o total suspended particulates (TSP)
- o particulate matter - 10 microns (PM-10)
- o sulfur dioxide (SO2)
- o carbon monoxide (CO)
- o ozone (O3)
- o lead (Pb)

In the case of TSP, PM-10, and SO2, measurements are made on a 24-hour basis to correspond with the averaging period specified in state and federal standards. Samples are collected once every six days in accordance with U.S. Environmental Protection Agency (EPA) guidelines. Carbon monoxide and ozone, however, are measured on a continuous basis due to their short-term (1-hour) standards. Lead concentrations are determined from the TSP samples which are sent to an EPA laboratory for analysis. It should also be noted that the majority of these pollutants are monitored only in Honolulu.

3.2 Department of Health Monitoring Sites. The State Department of Health has recently installed PM-10 samplers at Lahaina and at Kihei to the southeast (Figure 1). SO2 sampling has also been conducted at Kihei. Summaries of the most recent data from those sites are presented in Table 2 and 3. These data suggest that state and federal standards for inhalable particulates (PM-10) and sulfur dioxide (SO2) are being met, although it should be pointed out that the state currently has total suspended particulate matter (TSP) standards, but is measuring PM-10 particulates which are not directly comparable.

Unfortunately, and despite the growing population on Maui, the principal automotive pollutants, carbon monoxide (CO), nitrogen dioxide (NO2), and ozone (O3) are not routinely monitored on Maui. NO2 was last measured in 1976 and at that time ranged <0 - 39 ug/m3 with an average of 18 ug/m3 in Kahului (Table 4).

3.3 Onsite Carbon Monoxide Sampling. In conjunction with this study, air sampling was conducted at the Civic Center Road - Honoapiilani Highway intersection during November, 1989.

The actual sampling site was within 10 meters of the road edge and on the west side in the morning and east side in the afternoon due to the winds prevailing at the time. A continuous carbon monoxide (CO) instrument was set up and operated during the a.m. and p.m. peak traffic hours based on the results of the traffic impact study [19]. An anemometer and vane were installed to record onsite surface winds. A simultaneous manual count of traffic along Honoapiilani Highway was also made. The variability of each of the parameters measured during the peak hours is clearly seen in Figures 4 and 5.

During the two days of sampling, the synoptic weather pattern was characterized by light and variable winds with a southerly component that transported volcanic air pollution from Kilauea Volcano and resulted in a general deterioration in visibility due to the "VOG" haze. During the November 13th afternoon sampling, onsite winds were light west-northwesterlies, and CO averaged 5.8 mg/m3. During the a.m. period of November 14th, winds were calm with an average CO level of 3.8 mg/m3. Traffic volumes on both days were comparable to those reported by the traffic consultant.

4. CLIMATE & METEOROLOGY

The project area is typical of Hawaii's climate with little seasonal or diurnal temperature variation. Monthly temperature averages vary by only a few degrees from the warmest months (July and August) to the coolest (January and February) [12]. The area is dry with annual rainfall of about 12 inches and Thornwaite precipitation/evaporation (P/E) index of 14.9 [13].

Local terrain in Maui plays an extremely important role in determining both wind direction and speed at any particular location. Areas within the "wind shadows" of the highest elevations of the West Maui Mountains (Puu Kukui) or Haleakala are shielded from all but the strongest tradewinds and experience a very pronounced land-seabreeze regime. The northeasterly tradewinds are accelerated due to a venturi effect as they pass between the two major mountain masses. The project area would appear to be at times within the wind shadow of the West Maui Mountains under daytime trade wind conditions and thus subjected to the lighter onshore seabreezes (Figure 6). At night, drainage winds coming down the mountains frequently prevail (Figure 7)

[14]. An annual wind rose in tabular form for the Kaanapali Airport north of the project site shows the predominance of northeasterly (58%) and southwesterly (22%) winds (Table 5).

5. SHORT-TERM IMPACTS

The principal source of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along Honoapiilani Highway as well as in the vicinity of the project site itself.

Because of the moderate level of existing traffic volumes, the additional construction vehicle traffic should not exceed road capacities although the presence of large trucks can reduce a roadway's capacity as well as lower average travel speeds.

The site preparation and earth moving will create particulate emissions as will building and on-site road construction. Construction vehicles movement on unpaved on-site roads will also generate particulate emissions. EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30%), and a precipitation/evaporation (P/E) index of 50 [13,15].

In this case, the predominant soils on the project site are silty clays and silty clay loams (silt content about 55%). With this soil composition and a P/E Index of 14.9 (semiarid) as determined by the local temperature/ rainfall conditions, one must conclude that there is a clear potential for fugitive dust generation.

In addition to the onsite impacts attributable to construction activity, there will also be offsite impacts due to the operation of concrete and asphalt concrete batching plants needed for construction. Since the concrete and asphalt requirements for the proposed action are not yet known, and it is also too early to identify specific facilities that will be providing the concrete and asphalt, the discussion of air quality impacts is necessarily generic.

Design and operating features of a typical concrete batching plant on Maui were obtained for this analysis.. This plant (Rex Transit Mix Batch Plant, Model LO GO 5) [16], is a portable unit capable of producing up to 100 cubic yards of concrete per hour. Assuming 8 hours/day operation and published EPA emission factors [15] for both direct plant emissions and fugitive dust emissions, estimates of worst case ambient impact were derived using the PTPLU screening model [17]. Ninety percent control of particulate emissions from the plant itself and 60% control of fugitive dust emissions from the process were assumed. One-hour concentration estimates were adjusted to 8-hour averages using an

EPA-recommended factor [18] and then to 24-hour averages based on a weighted averaging technique. The worst case concentration of total suspended particulates (TSP) was thus estimated to be 105 micrograms/cubic meter (ug/m3) due to the plant operation.

Assuming that the plant would be located near the project site, existing data from the Lahaina site were reviewed (Table 2). If one assumes that the particulate emissions from the batch plant are all 10 microns or less, then the batch plant's TSP level of 105 ug/m3, if added to the second highest 24-hour PM-10 concentration at Lahaina (34 ug/m3), would indicate compliance with the federal PM-10 standard of 150 ug/m3.

Since the project will involve fairly extensive road construction, design and operating data for a typical asphalt concrete batch plant (Astec Industries Model PDM-636-C) on Maui were also obtained and reviewed. This plant has a production capacity of 186 T/hour and thus could provide the required 2,400 tons of asphalt within a short period. The two primary emission sources associated with such a plant are the drum mix asphalt plant and a 600 Kw diesel generator.

The modeling technique employed for the concrete batch plant was again employed for the asphalt plant with the results as shown in the following table.

ESTIMATED IMPACT OF AN ASPHALT CONCRETE BATCH PLANT

Pollutant	24-hour Concen. (ug/m3)	Existing Concen. (ug/m3)	Total (ug/m3)
Particulates	34.9	34	68.9
Sulfur dioxide	13.6	5	18.6
Nitrogen dioxide	203	30	233
Carbon monoxide	44.2	n/a	44.2
Volatile organic compounds	16.2	n/a	16.2

The existing concentrations for particulates and SO2 are 1987-88 Lahaina and Kihei data, respectively (Tables 2 & 3). Existing NO2 concentration is based on historical data from the Kahului monitoring site. The same caveats noted for the concrete batch plant also apply in this case, i.e., uncertainty about background concentration at the plant site and requirement for DOH review and permit.

6. MOBILE SOURCE IMPACT

6.1 Mobile Source Activity. A traffic impact report (TIR) was prepared for the proposed Lahaina Master Planned Project and served as the basis for this mobile source impact analysis [19]. After reviewing the TIR, the following intersections were selected for air quality impact analysis:

- Civic Center Road
- Kapunakea Street
- Lahainaluna Road

Each of these intersections was analyzed for existing (1989) and future (1991, 1994, 1995, and 2000) both with and without the proposed development. Existing conditions at these intersections are depicted in Figures 8, 9 and 10.

6.2 Emission Factors. Automotive emission factors for carbon monoxide (CO) were generated for calendar years 1989, 1991, 1994, 1995, and 2000 using the Mobile Source Emissions Model (MOBILE-3) [20]. To localize the emission factors as much as possible, the August, 1988 age distribution for registered vehicles in the City & County of Honolulu [21] was input in lieu of national statistics.

6.3 Modeling Methodology. Due to the present state-of-the-art in air quality modeling, analyses such as this generally focus on estimating concentrations of non-reactive pollutants. For projects involving mobile sources as the principal source, carbon monoxide is normally selected for modeling because it has a relatively long half-life in the atmosphere (ca. 1 month) [22], and it comprises the largest fraction of automotive emissions.

Due to the generally low level of urbanization in the area which would otherwise contribute to a "heat island" effect and increased turbulence, a stable atmosphere (Category "F") and neutral atmosphere (Category "D") [23] were assumed for morning and afternoon peak hours, respectively. A 1 meter per second (m/sec) wind speed and an acute wind-road angle completed the the "worst case" meteorological conditions. Review of the traffic data, and the potential for queuing in particular, indicated that southeasterly and southwesterly wind directions were most likely to produce the maximum CO concentrations near the intersection; thus, these wind directions were input for all initial modeling.

An updated version of the EPA guideline model CALINE-4 [24, 25] was employed to estimate near-intersection carbon monoxide concentrations. An array of receptor sites at distances of 10 to 40 meters from the road edge were input to the model. Because of

the growing traffic and urbanization in the area, a background CO concentration of 1.0 milligram per cubic meter (mg/m3) was assumed.

6.4 Results. The results of this modeling are presented in Figures 11 -13. The figures depict the concentrations in milligrams per cubic meter (mg/m3) at 12 receptor locations on the northeast and northwest sides of the intersection for each of the scenarios.

Compliance with federal and state 8-hour standards can also be estimated by applying a "persistence" factor of 0.6 to the 1-hour maximum CO values. This "persistence" factor is recommended in an EPA publication on indirect source analysis [26]. When using this approach, any CO concentration greater than 8.4 mg/m3 would indicate exceedance of the State's 8-hour standard. Similarly, any 1-hour concentration over 15.7 mg/m3 would indicate exceedance of the federal 8-hour standard.

The results indicate that the potential for exceeding the state but not the federal standards already exists at the three intersections studied during both a.m. and p.m. peak traffic hours under "worst case" meteorology. It should be noted that the highest CO levels are in close proximity to the intersections and are considered "hotspots". CO concentrations drop off sharply with distance from the intersection.

At the Civic Center Road intersection, CO levels tend to decline over the 1991 - 2000 period without the project. By 2000, no exceedance of the state 1-hour standard is predicted and only one exceedance of the 8-hour standard at a close-in receptor is shown. Not surprisingly, the addition of the project tends to offset this decline such that potential exceedance of the state standards continues into 2000 although with less possible exceedances as the years go by. One possible exceedance of the federal 8-hour standard is predicted in 1994 with the project, but disappears by 1995.

The Kapunakea Street intersection appears to have a similar future with the State's 1-hour standard being met by 2000 with or without the project. The 8-hour standard appears to be threatened through the year 2000 with or without the project, but again it should be noted that this is only in close proximity to the intersection. The federal standards appear to be complied with.

At Lahainaluna Road the situation is somewhat better in that both 1-hour and 8-hour standards are met by the year 2000 with or without the project. At close-in receptors, exceedance of the State's two standards appears possible into 1995.

6.5 Correlation with Meteorological Data. A more detailed analysis of the local meteorological data was undertaken in order to estimate the frequency of occurrence of the maximum CO concentrations. A one-year record from Kaanapali Airport (1981) was reviewed for the frequency of "worst case" wind conditions (1 m/sec, SE and SW winds) during the specified peak hours (7:15 - 8:15 a.m. and 3:15 - 4:15 p.m.). The conditions could not be matched during those time periods. During the a.m. period, 27 occurrences of calm or 1.5 m/sec winds from various directions were found. During the p.m. period, 8 occurrences of calm or 1.5 m/sec or less winds were found. One of those was NE winds at 0.5 m/sec. A wind speed of 1.5 m/sec would reduce 1-hour CO levels by about one-third. In all but a few cases, this would results in compliance with the state's stringent 1-hour standard. Thus, the overall probability of the predicted violations appears very low.

7. OTHER LONG-TERM IMPACTS

7.1 Agricultural Activities. Burning of sugar cane fields prior to harvest is a long-standing practice in Hawaii's sugar industry. As urbanization closes in around agricultural operations, however, it is inevitable that complaints about air pollution will arise. Cane fires result in the emission of particulates, carbon monoxide, and trace amounts of other organics. This was most recently demonstrated in an EPA study of cane burning on Maui [27]. Concentrations of particulates can reach high levels within about one mile of the fires [28]. A complete quantitative characterization of cane smoke, however, has yet to be performed. Most pre-harvest fires occur once every two years and only last about 20 - 30 minutes. Other field fires, e.g., seed fields, may be more frequent.

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Continued use of the cane haul road on the western portion of the project property will also result in some fugitive dust emissions. During those times of the year when the road is heavily used, dust control will be important.

Continued operation of the Pioneer Mill sugar factory (Figure 14) located about 0.5 kilometer south of the site may also at times affect local air quality. The principal emissions would be particulate matter when the mill burns bagasse and sulfur dioxide when it fires oil. A screening analysis of that impact was conducted using the EPA screening model PTPLU [17]. The results indicated maximum 1-hour concentrations of 39 ug/m3 and 95 ug/m3, respectively. When added, without adjustment to appropriate averaging times, to the existing background levels as indicated at the Lahaina and Kihei monitoring sites, the resultant concentrations are below state and federal standards.

7.2 Electrical Generation The estimated electrical demand of 37 million kilowatt hours per year (Kwhr/yr) will contribute to the load on the local utility necessitating additional fuel combustion. The nearest power generating station to the proposed project is Maui Electric Company's Maalaea facility. It is currently comprised of 11 diesel units ranging in size from 2.75 to 12.5 megawatts. Emissions from this facility would eventually increase as a result of the project's electrical demand. Estimates of the annual emissions resulting from diesel fuel combustion to meet the project's electrical demand are presented in the following table and have been compared with the county emissions inventory (see also Table 6):

Estimates of Annual Emissions Due to Electrical Generation

Pollutant	Emissions (T/yr)	Percent of County Emissions
Nitrogen oxides	641	12.6 %
Carbon monoxide	139	0.23
Total hydrocarbons	51	0.81
Particulate matter	46	1.00
Sulfur oxides	43	1.19

As part of its ongoing energy planning process, the Maui Electric Company, Ltd. (MECO) maintains a forecast committee which meets annually to review growth in electrical demand and refine its plan for meeting that demand [29]. The company recently installed two 2.5 MW units at Maalaea and is currently seeking permits for two additional 12.5 MW diesels. As the West Maui Marina and other projects on Maui proceed, MECO will continue to evaluate the increasing demand and plan for new generating capacity as required.

In order to provide some indication of the ambient air quality impact resulting from that electrical demand, a recent air permit application for the Maalaea Generating Station was reviewed [30]. That particular application addressed two 12.5 MW diesel units. The estimated individual impact of a single 12.5 MW unit as derived from that application is shown in the following table.

IMPACT OF A SINGLE 12.5 MW DIESEL GENERATOR

Pollutant	Concentration (ug/m3) 1-Hour	3-Hour	8-Hour	24-Hour	Annual
SO2	--	40.8	--	5.2	0.53
NO2	--	--	--	--	6.3
TSP	--	--	--	3.6	0.2
CO	112	--	15	--	--

The cumulative impact of all the existing and proposed new units is depicted in the following table.

PROJECTED CUMULATIVE IMPACT OF THE MAALAEA GENERATING STATION

Pollutant	Concentration (ug/m3) 3-Hour	24-Hour	Annual
SO2	463.6	158	22.5
NO2	--	--	50.3

The above data from the permit application indicate that while there will be additional air quality impact, compliance with both state and federal ambient air quality standards will still be maintained.

7.3 Pesticide Use. The use of pesticides is routinely required at golf courses in order to maintain fairways and greens. Typical pesticide use at an 18-hole golf course is shown in Table 7 [31].

The herbicides MSMA, glyphosate, metribuzin, and pendimethalin all have relatively low mammalian toxicities with LD_{50} values on the order of hundreds or thousands of milligrams active agent per kilogram body weight (mg/kg) [32, 33]. They do, however, have WARNING and CAUTION labels because of their irritative effects on the eyes and skin. The OSHA 8-hour time-weighted average standard for metribuzin in the air is 5 mg/m3 [33].

The insecticide Sevin is a relatively low toxicity carbamate which can affect the normal functioning of mammalian nervous systems through its inhibition of the enzyme cholinesterase. It also has a relatively high LD_{50} value of about 500 - 850 mg/kg and therefore only has a CAUTION label on its containers. The OSHA standard for airborne concentrations of carbaryl (the active ingredient in Sevin) is 5 mg/m3 as an 8-hour average [33].

The fungicides Dithane M45, Kocide 101, and Subdue are also low toxicity chemical mixtures with LD_{50} values in the hundreds and

thousands of mg/kg [32, 33]. Subdue has a WARNING label because of its potential for eye injury.

If properly used in accordance with label instructions, all of the aforementioned chemicals should present no hazard to the properties or owners of properties adjoining the proposed golf course. In fact, the greatest risk in using such chemicals is generally to the users themselves if they do not strictly follow label instructions. This is because the user may come in contact with the concentrated product while nearby properties and people may only be exposed to the greatly diluted and dispersed application solution.

The potential for significant airborne concentrations of these chemicals is relatively slight when one considers the dilution factor in application solutions plus the coarse spray that is normally used to assure adequate coverage in the desired area and avoidance of drift. Should a user improperly apply these chemicals under wind conditions which would contribute to drift, then there would be an increased possibility of downwind exposure of property and people.

7.4 Railroad Operations. Another mobile source which operates daily is the Lahaina-Kaanapali & Pacific railroad which serves tourists in the Lahaina-Kaanapali area (Figure 15). Although its emissions are quite visible as it travels between the two towns along the east side of Honoapiilani Highway, its impact on the proposed project should be minimal because of its small size, relatively infrequent operation, and distance from the proposed residential areas.

7.5 Solid Waste Disposal. The residents of the 4,800 homes as well as all the ancillary facilities being proposed will generate solid waste which must be disposed of. While Maui County does not at this time have a municipal incinerator or resource recovery plant, it has been investigating the feasibility of constructing such a facility in the future. Should that occur, then the refuse from this development will contribute to additional air emissions if it is burned at the facility.

8. CONCLUSIONS AND MITIGATION

8.1 Short-Term Impacts. Since as noted in Section 5, there is a significant potential for fugitive dust due to the dry climate and fine soils, it will be important for adequate dust control measures to be employed during the construction period. Fugitive dust, particularly during the drier, windier summer months, could be a source of complaints not to mention possible violations of the state or federal standards.

Dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as much as 50%. The earliest possible landscaping of completed areas and paving of roadways will also help.

With regard to construction vehicle movement on the Honoapiilani Highway, the impact on highway level of service (LOS) will be less if such movements are restricted to off-peak hours as much as possible.

8.2 Mobile Source Impacts. As noted in Section 6, it appears that federal carbon monoxide standards will be met with or without the project, but state standards may already be exceeded in close proximity to major intersections serving the project area during peak hours. Despite the offsetting effect of federal emissions standards for new motor vehicles, continued exceedance of state standards seems possible through the year 2000. Examination of local weather data, however, indicates that the probability of "worst case" meteorological conditions conducive to high CO levels is very low. Some measures which can contribute to a reduction in ambient CO concentrations include:

- additional highway improvements
- institution of public transit systems
- institution of a inspection/maintenance (I/M) program
- encouragement of carpooling

8.3 Other Long Term Impacts.

The agricultural operations that will continue around the proposed development will have some impact on the project. In the case of pre-harvest cane burning, the following measures could help mitigate the impact:

- close attention to meteorological conditions to conduct burning during conditions which minimize human exposure
- notification of downwind residents prior to burning
- required notification of prospective home buyers that purchase of a residence in the project includes possible cane smoke exposure

The Hawaiian Sugar Planters' Association is participating in and encouraging development of an agricultural burning management program to use real-time local meteorological data to help in determining the optimum times to burn fields so as to minimize human exposure [34]. Should it prove successful, it will likely be adopted by other sugar companies and contribute to the reduction of human impacts of the cane burning.

Use of the cane haul road on the western boundary of the property is likely to cause fugitive dust emissions during periods of heavy use. Dust suppression, e.g., oiling, can reduce the impacts. The presence of the proposed golf course as a buffer zone between the road and residential areas is a good mitigative measure.

Emissions from the Pioneer Mill stack will at times effect air quality in the project area, but not significantly. In addition, the southerly winds necessary to carry those emissions to the project area are not too frequent (<5%).

The proposed project will increase electrical demand which in turn will cause more fuel to be burned and more pollutants to be emitted into Maui's air. Until other nonpolluting means of generating electricity are developed or higher efficiency control technologies are applied, such increases in emissions are inevitable. Emissions can be reduced to some extent by reducing electrical demand by the user, e.g., use of solar water heating, heat pumps, waste heat recovery, etc. Ambient air quality standards, however, are predicted to be met despite the increased emissions.

Pesticide use on the proposed golf course should not cause a significant air quality problem if label instructions are strictly adhered to. That, in fact, is the primary mitigation measure, i.e., proper application in accordance with the legally binding label instructions. Another possible mitigation measure would be to seek non-chemical means of pest control and thus avoid any pesticide drift problems altogether.

In the case of solid waste disposal, Maui County and its residents should be concentrating efforts on waste minimization recycling, and reduction at the source in order to reduce the per capita waste generation rate of a growing population. If vigorously pursued, this approach could reduce the burden on existing landfill sites and reduce the need for a municipal incinerator.

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T A B L E S

TABLE 1

SUMMARY OF STATE OF HAWAII AND FEDERAL
AMBIENT AIR QUALITY STANDARDS

POLLUTANT	SAMPLING PERIOD	FEDERAL STANDARDS PRIMARY	FEDERAL STANDARDS SECONDARY	STATE STANDARDS
1. Total Suspended Particulate Matter (TSP)	Annual Geometric Mean	--	--	60
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	--	--	150
2. PM-10	Annual	50	50	--
(micrograms per cubic meter	Maximum Average in Any 24 Hours	150	150	--
3. Sulfur Dioxide (SO2)	Annual Arithmetic Mean	80	--	80
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	365	--	365
	Maximum Average in Any 3 Hours		1,300	1,300
4. Nitrogen Dioxide (NO2) (micrograms per cubic meter)	Annual Arithmetic Mean	100		70
5. Carbon Monoxide (CO)	Maximum Average in Any 8 Hours	10		5
(milligrams per cubic meter)	Maximum Average in Any 1 Hour	40		10
6. Ozone (O3) (micrograms per cubic meter)	Maximum Average in Any 1 Hour	235		100
7. Lead (Pb) (micrograms per cubic meter)	Maximum Average in Any Calendar Quarter	1.5		1.5

TABLE 2

PM-10 MONITORING DATA
LAHAINA, MAUI, 1987-88

Particulate Matter - 10-microns
24-Hour Concentrations (ug/m3)

MONTH	SAMPLES	MIN.	MAX.	MEAN
Jul 87	1	14	14	14
Aug 87	2	13	14	13
Sep 87	3	19	19	19
Oct 87	1	8	8	8
Nov 87	2	12	14	13
Dec 87	2	12	14	13
Jan 88	2	9	12	10
Feb 88	2	15	21	18
Mar 88	5	9	22	16
Apr 88	5	10	34	22
May 88	5	14	34	22
Jun 88	3	20	25	22
ANNUAL	31	8	34	18

SOURCE: Department of Health

TABLE 3
PM-10 AND SO2 MONITORING DATA
KIHEI, MAUI, 1987-88

	Particulate Matter - 10 microns (PM-10) 24-Hour Concentrations (ug/m3)				Sulfur Dioxide (SO2) 24-Hour Concentrations (ug/m3)			
MONTH	SAMPLES	MIN.	MAX.	MEAN	SAMPLES	MIN.	MAX.	MEAN
Jul 87	5	18	42	29	4	<5	12	7
Aug 87	3	13	33	22	4	<5	13	8
Sep 87	5	24	36	31	2	<5	<5	<5
Oct 87	-	--	--	--	-	--	--	--
Nov 87	3	12	30	22	4	<5	<5	<5
Dec 87	2	11	27	19	2	<5	<5	<5
Jan 88	1	8	8	8	4	<5	<5	<5
Feb 88	4	19	22	20	5	<5	<5	<5
Mar 88	5	18	38	26	5	<5	<5	<5
Apr 88	5	17	36	22	4	<5	5	<5
May 88	5	19	39	31	4	<5	<5	<5
Jun 88	3	25	32	29	2	<5	<5	<5
Jul 88	3	31	46	36	-	--	--	--
Aug 88	6	18	48	29	6	<5	<5	<5
ANNUAL	42	8	48	26	38	<5	5	<5

SOURCE: Department of Health

TABLE 4
NO2 MONITORING DATA
KAHULUI MAUI, 1975-76

	Nitrogen Dioxide 24-Hour Concentrations (ug/m3)			
MONTH	SAMPLES	MIN.	MAX.	MEAN
Apr 75	2	13	25	19
May 75	5	11	24	16
Jun 75	5	14	22	18
Jul 75	6	10	22	15
Aug 75	6	10	25	17
Sep 75	7	10	19	13
Oct 75	4	16	19	17
Nov 75	6	12	30	21
Dec 75	4	6	32	19
Jan 76	8	0	27	15
Feb 76	7	11	28	19
Mar 76	6	14	39	24
ANNUAL	66	0	39	18

SOURCE: Department of Health

TABLE 5

DAYTIME WIND ROSE (0800-1700 HST)
KAANAPALI AIRPORT
1981

Direction	Speed (knots) 1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	TOTAL
N	0.00042	0.00380	0.01267	0.01732	0.00000	0.00000	0.03421
NNE	0.00000	0.00296	0.01352	0.03422	0.00000	0.00000	0.05070
NE	0.00127	0.00887	0.04140	0.23196	0.00000	0.00000	0.28350
ENE	0.00253	0.02156	0.03718	0.18505	0.00127	0.00211	0.24970
E	0.00127	0.01352	0.00845	0.00676	0.00000	0.00000	0.03000
ESE	0.00042	0.00718	0.00296	0.00084	0.00000	0.00000	0.01140
SE	0.00127	0.00803	0.00042	0.00042	0.00000	0.00000	0.01014
SSE	0.00424	0.01605	0.00634	0.00000	0.00000	0.00000	0.02663
S	0.00127	0.00634	0.00507	0.00084	0.00000	0.00000	0.01352
SSW	0.00042	0.01774	0.01605	0.00549	0.00000	0.00042	0.04012
SW	0.00084	0.04689	0.03042	0.00000	0.00000	0.00000	0.07815
WSW	0.00127	0.06379	0.02746	0.00253	0.00000	0.00000	0.09505
W	0.00084	0.00972	0.00169	0.00591	0.00000	0.00000	0.01816
WNW	0.00042	0.01141	0.00169	0.00042	0.00000	0.00000	0.01394
NW	0.00042	0.01225	0.00465	0.00000	0.00000	0.00000	0.01732
NNW	0.00084	0.01098	0.00718	0.00296	0.00000	0.00000	0.02196
Total:	0.01774	0.26109	0.21715	0.49472	0.00127	0.00253	0.99450

Fraction of calms: 0.00550
Total 1-hour periods: 2,367

TABLE 6

1980 Emissions Inventory
County of Maui

Source Category	Annual Emissions (tons) TSP	SOx	NOx	CO	HC
Steam Electric Power Plants	131	2,892	1,353	367	73
Gas Utilities	0	0	5	0	0
Fuel Combustion in Agriculture	1,866	354	677	0	7
Mineral Products Industry	158	36	61	0	0
Municipal Incineration	0	0	0	0	0
Motor Vehicles	212	143	2,483	34,422	3,676
Construction, Farm and Industrial Vehicles	23	21	300	796	139
Aircraft	5	14	137	1,286	159
Vessels	14	114	71	61	26
Agricultural Field Burning	2,110	0	0	24,316	2,228
Total (T/yr)	4,518	3,575	5,088	61,250	6,307

SOURCE: Department of Health
Environmental Permits Branch

TABLE 7

TYPICAL PESTICIDE USE AT AN 18-HOLE GOLF COURSE

PRODUCT	AREA (acres)	QUANTITY	FREQUENCY	ANNUAL REQUIREMENT
Herbicides (fairways & roughs)				
MSMA	100	33 gal	4/yr	132 gal
Glyphosate				25 gal
Metribuzin	100	25 lb	2/yr	50 lb
Pendimethalin	100	400 lb	2/yr	800 lb
Insecticides (greens & tees)				
Sevin	10	21 gal	12/yr	252 gal
Fungicides (greens & tees)				
Dithane M-45	10	109 lb	25/yr	2,725 lb
Kocide 101	10	217 lb	12/yr	2,604 lb
Subdue	10	6.7 gal	3/yr	20 gal

F I G U R E S

CORRECTION

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

TABLE 7

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Insecticides (greens & tees)				
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Fungicides (greens & tees)				
Dithane M-45	10	109 lb	25/yr	2,725 lb
Kocide 101	10	217 lb	12/yr	2,604 lb
Subdue	10	6.7 gal	3/yr	20 gal

F I G U R E S

FIGURE 1

PROJECT LOCATION

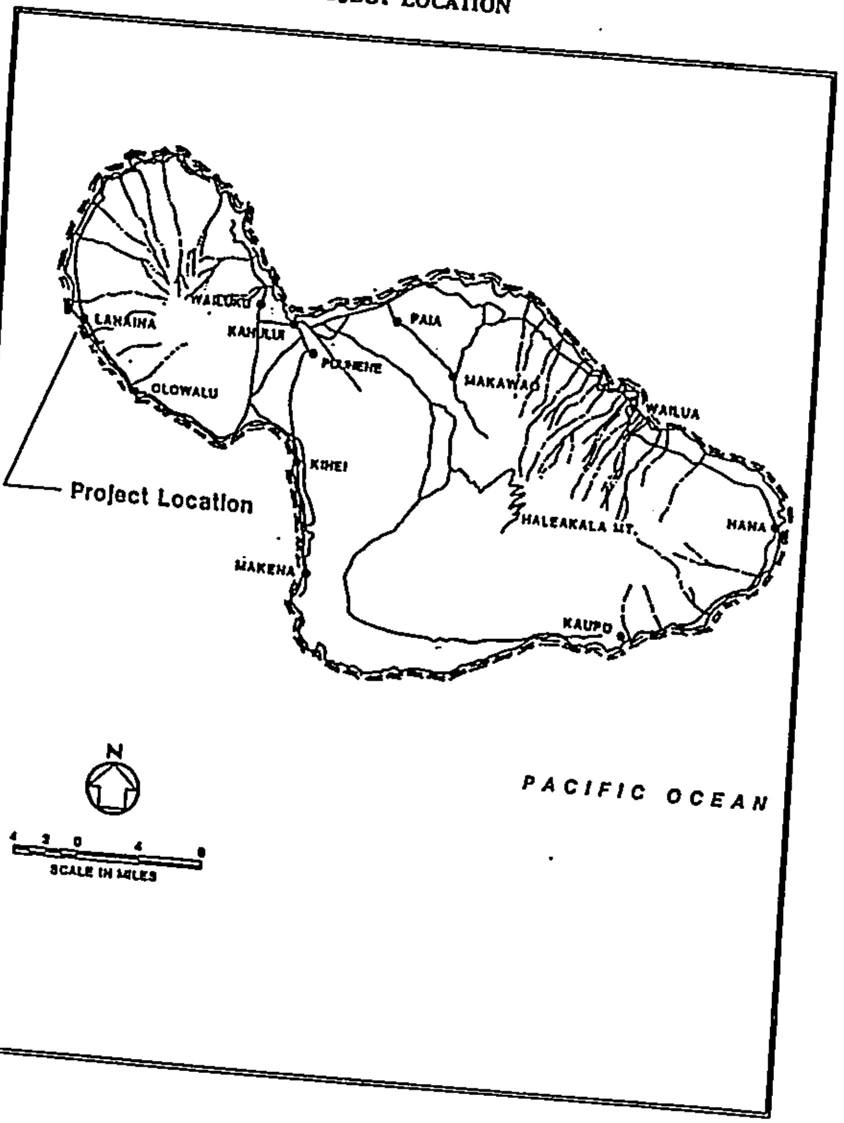


FIGURE 2

EXISTING SITE CONDITIONS

Southwest Corner of Site (Facing Northeast)

Northwest Corner Near Civic Center (Facing East)

CORRECTION

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

FIGURE 1

PROJECT LOCATION

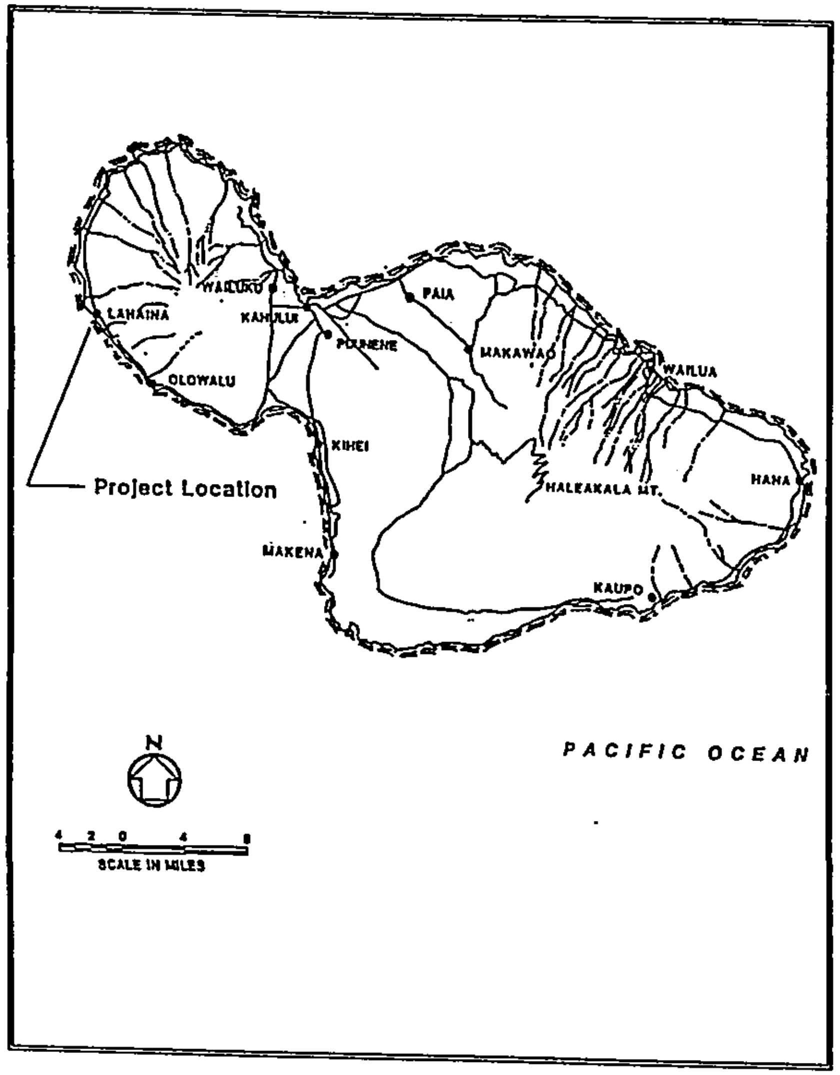


FIGURE 2

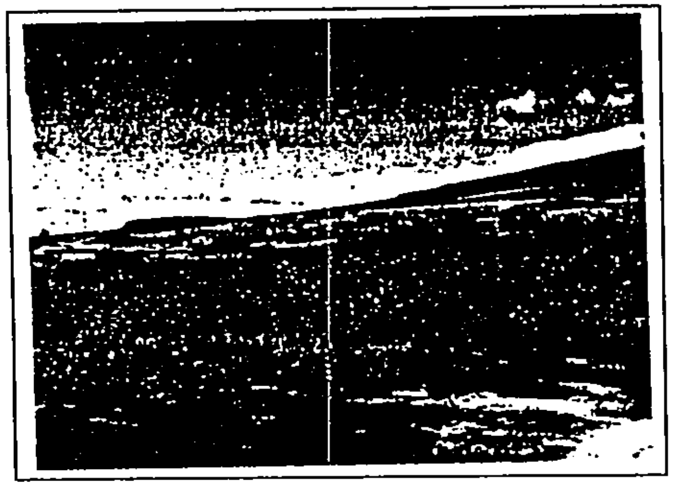
EXISTING SITE CONDITIONS

Southwest Corner of Site (Facing Northeast)

Northwest Corner Near Civic Center (Facing East)

FIGURE 3

EFFECT OF VOLCANIC AIR POLLUTION ON PROJECT AREA AIR QUALITY



"Normal" Air Quality

Volcanic Air Pollution "VOG" Effects

FIGURE 4

A.M. PEAK HOUR CONDITIONS HONOAPIILANI HIGHWAY AT CIVIC CENTER ROAD NOVEMBER 14, 1989

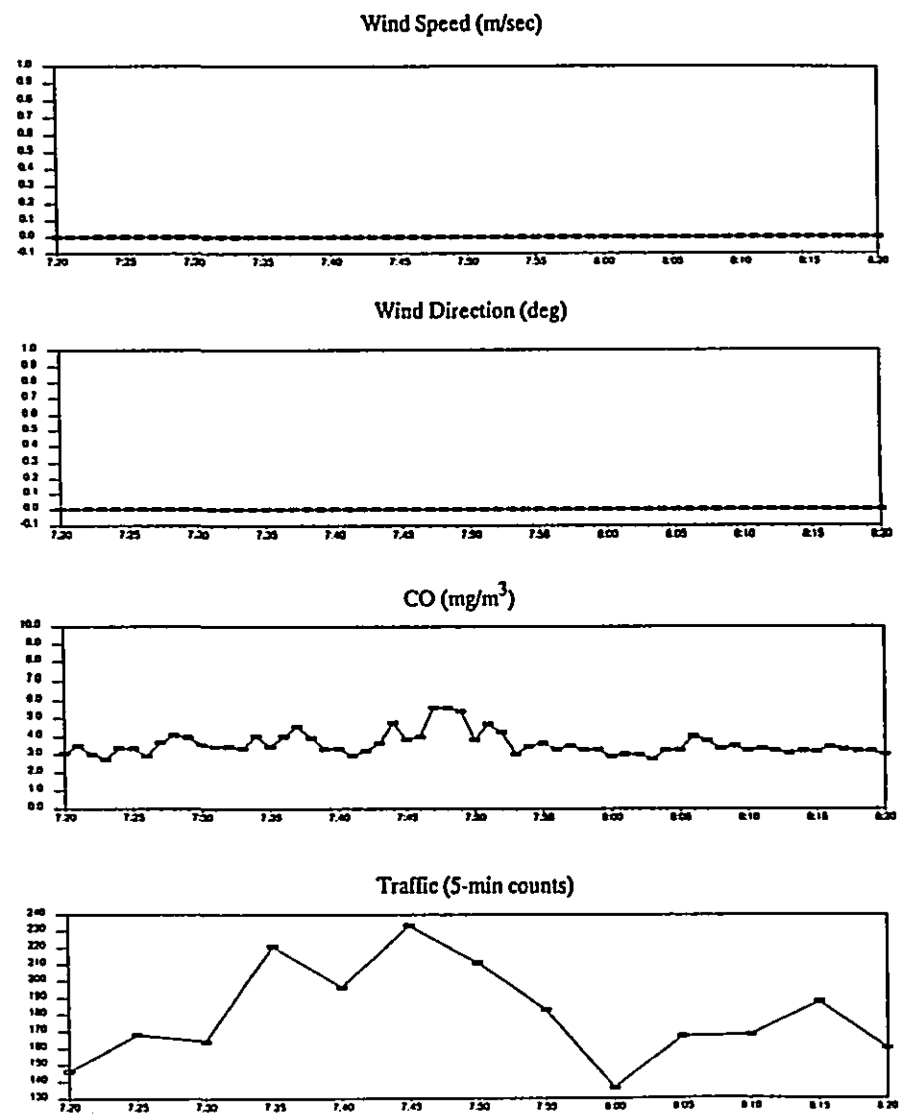
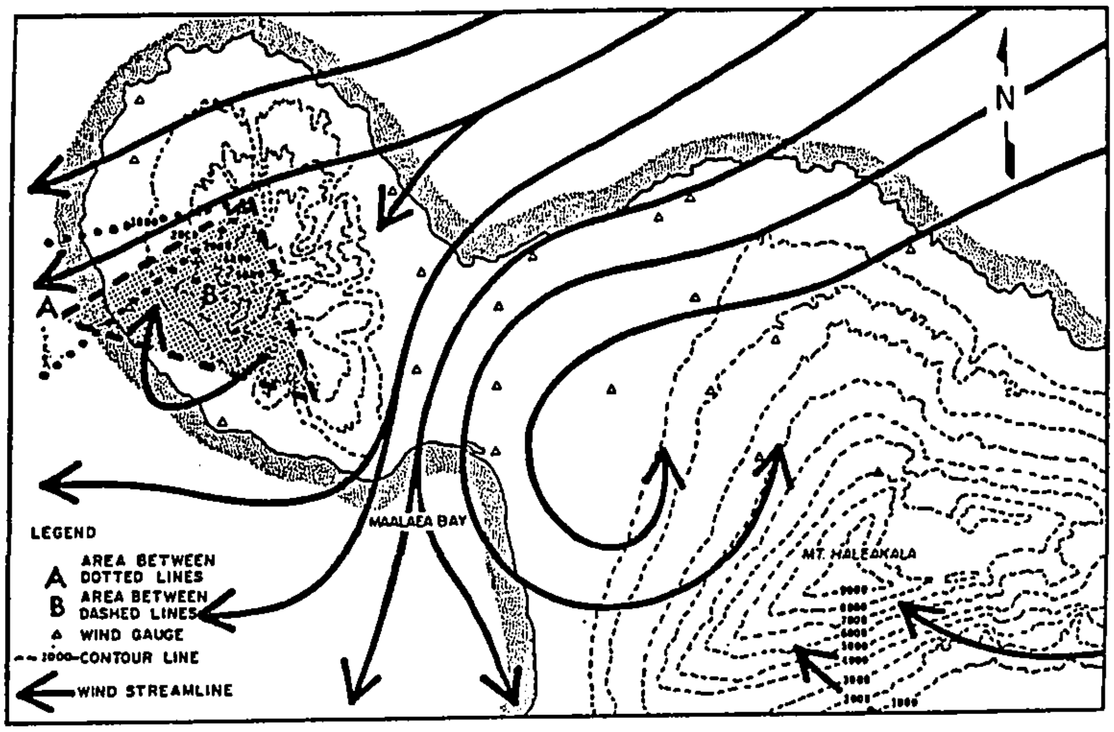


FIGURE 6

SURFACE TRADE WIND STREAMLINES DURING DAYTIME HOURS
ISLAND OF MAUI



SOURCE: National Weather Service

FIGURE 5

P.M. PEAK HOUR CONDITIONS
HONOAPIILANI HIGHWAY AT CIVIC CENTER ROAD
NOVEMBER 13, 1989

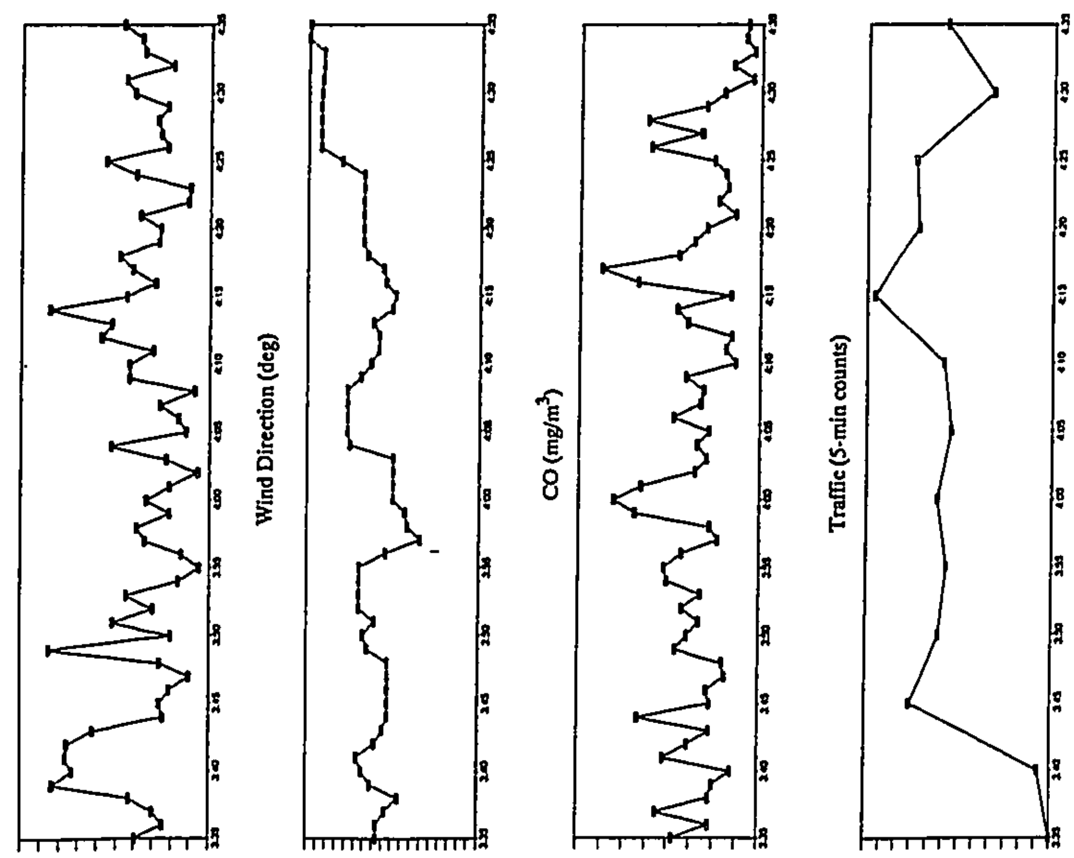


FIGURE 8

CIVIC CENTER AT HONOAPIILANI HIGHWAY
1989

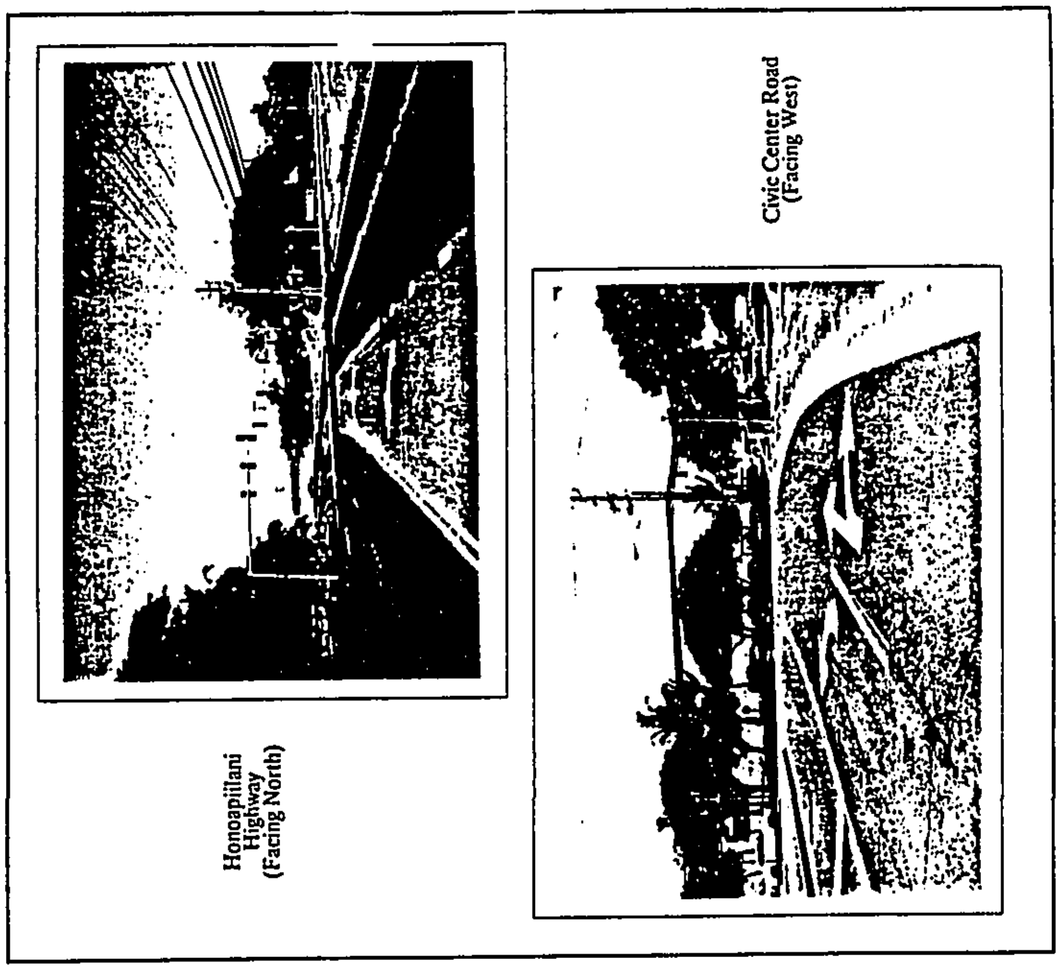
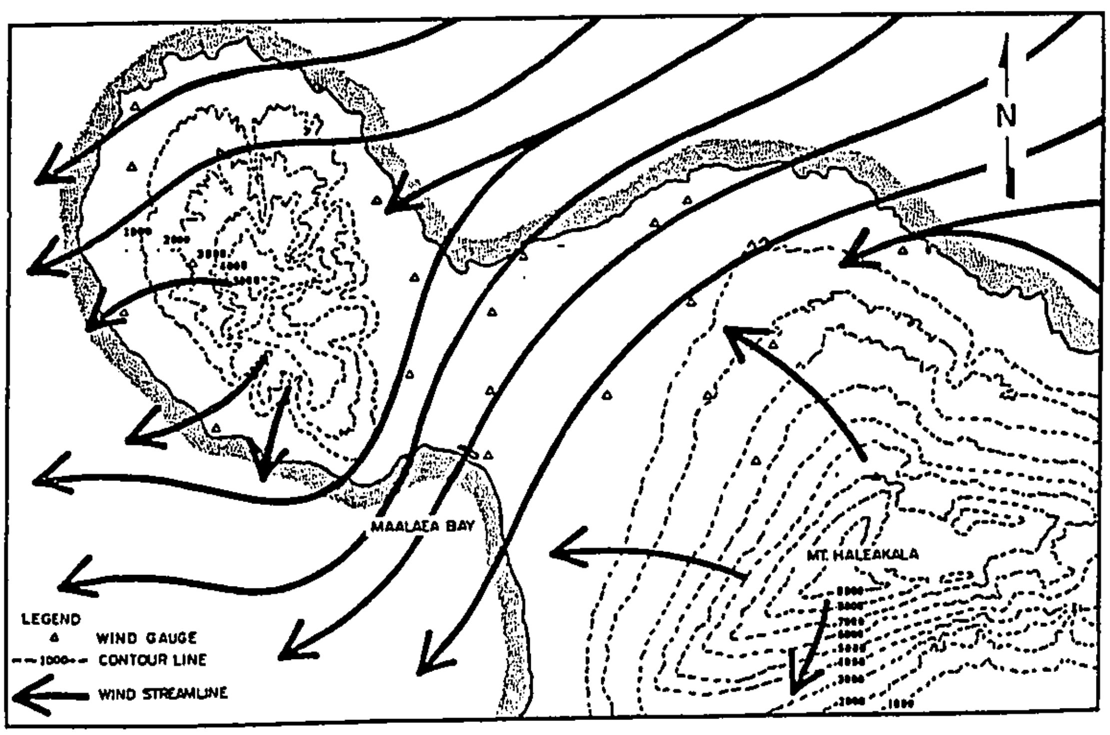


FIGURE 7

SURFACE TRADE WIND STREAMLINES DURING NIGHTTIME HOURS
ISLAND OF MAUI

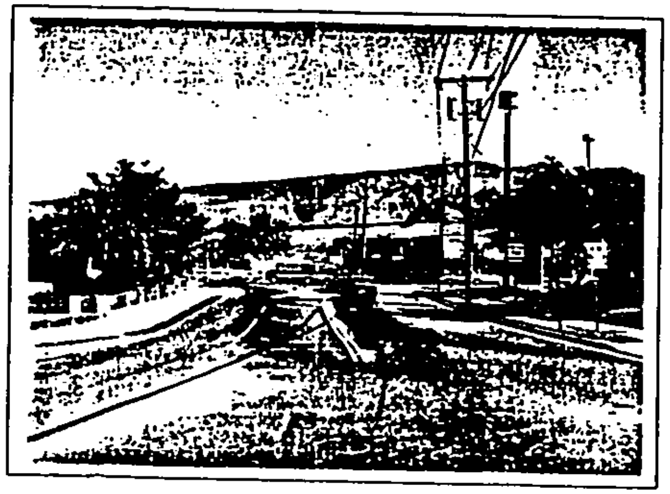


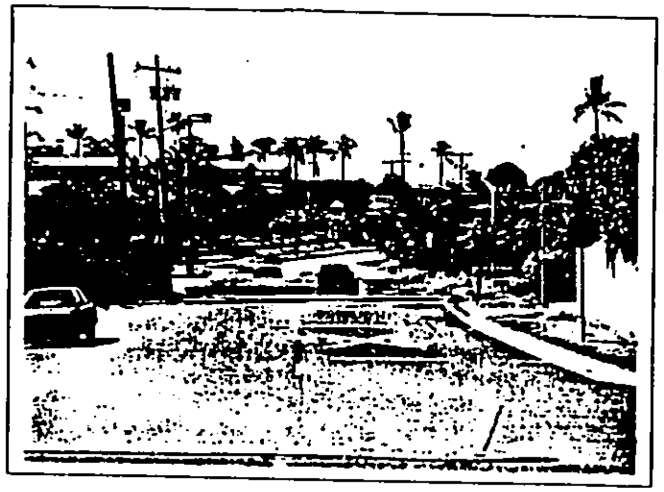
SOURCE: National Weather Service

FIGURE 9

KAPUNAKEA STREET AT HONOAPIILANI HIGHWAY
1989

Kapunakea Street
(Facing East)



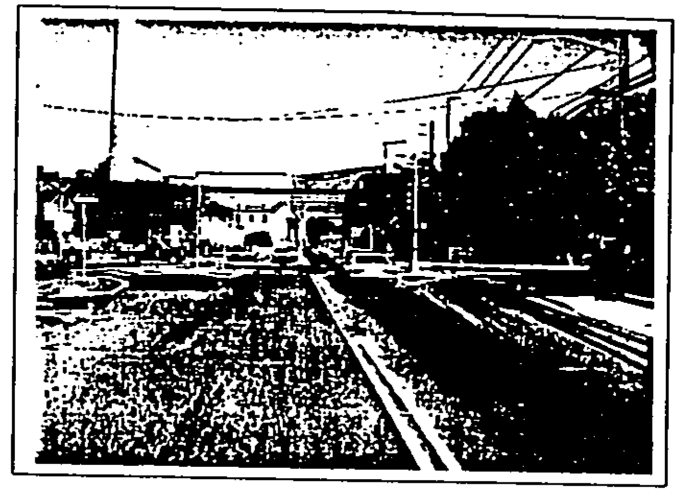


Kapunakea Street
(Facing West)

FIGURE 10

LAHAINALUNA ROAD AT HONOAPIILANI HIGHWAY
1989

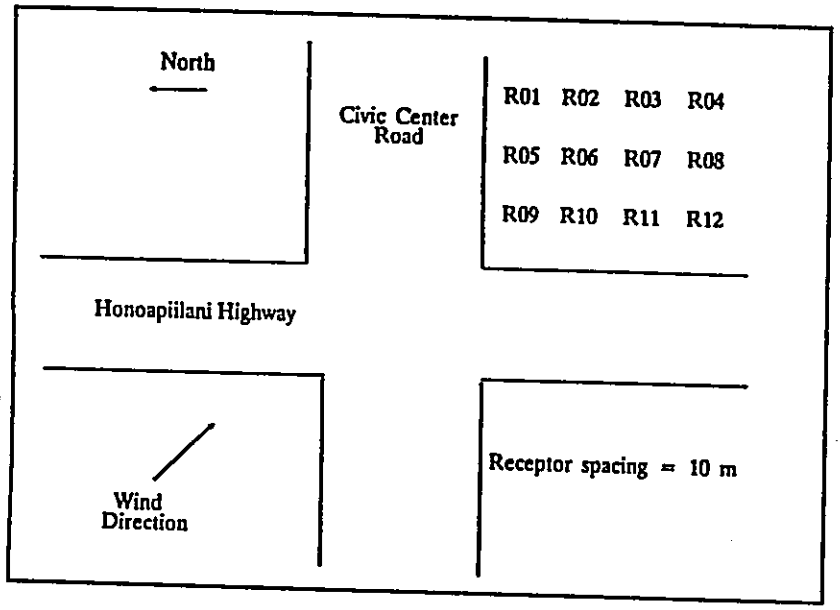
Lahainaluna Road
(Facing East)



Lahainaluna Road
(Facing West)

FIGURE 11

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Honoapiilani Highway at Civic Center Road
A.M. Peak Hour
1989 - 2000

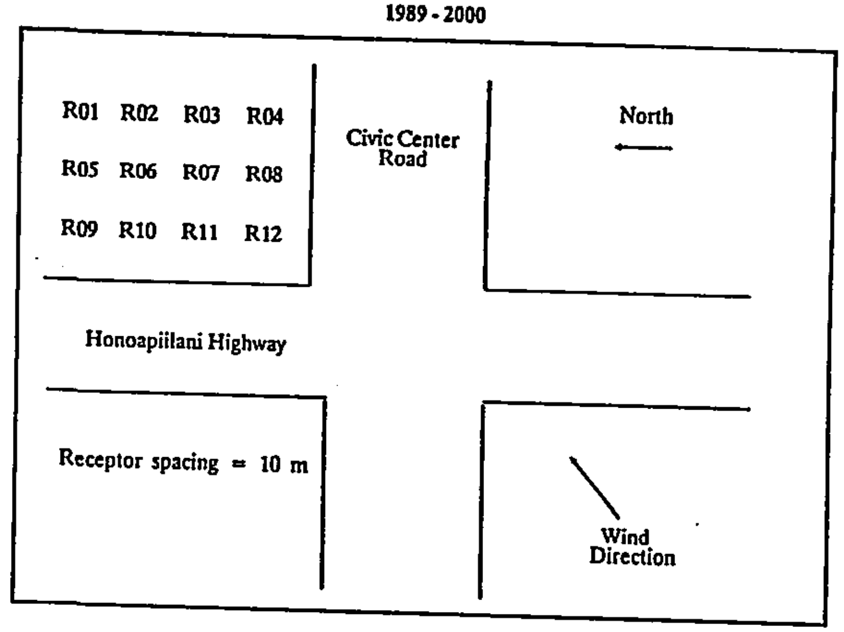


Concentration (mg/m^3)

Receptor	1989	Without Project 1991	Without Project 1994	Without Project 1995	Without Project 2000	With Project 1991	With Project 1994	With Project 1995	With Project 2000
R01	0.2	5.6	5.4	4.9	3.4	6.4	7.3	4.0	4.3
R02	7.0	6.5	6.2	5.5	4.0	7.4	8.2	4.8	5.1
R03	7.8	7.3	6.8	5.6	4.1	8.1	8.4	5.0	5.6
R04	8.0	7.5	7.2	5.1	4.0	8.2	8.2	4.8	5.6
R05	8.3	7.9	7.4	7.1	4.8	9.2	10.7	5.9	6.3
R06	9.5	8.9	8.4	7.1	5.1	10.0	10.7	6.4	6.8
R07	10.4	9.8	9.3	6.6	5.0	10.7	10.6	6.3	7.2
R08	9.9	9.7	9.2	5.5	4.3	10.4	9.9	5.2	6.6
R09	12.9	12.1	11.4	10.3	7.0	14.1	15.6	9.1	9.5
R10	14.5	13.6	13.0	9.2	7.1	14.8	14.7	8.9	9.9
R11	15.2	14.4	13.8	7.6	6.2	15.3	14.6	7.5	9.9
R12	11.4	12.1	11.6	5.2	4.3	12.7	11.9	5.1	7.1

FIGURE 12

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Honoapiilani Highway at Civic Center Road
P.M. Peak Hour
1989 - 2000

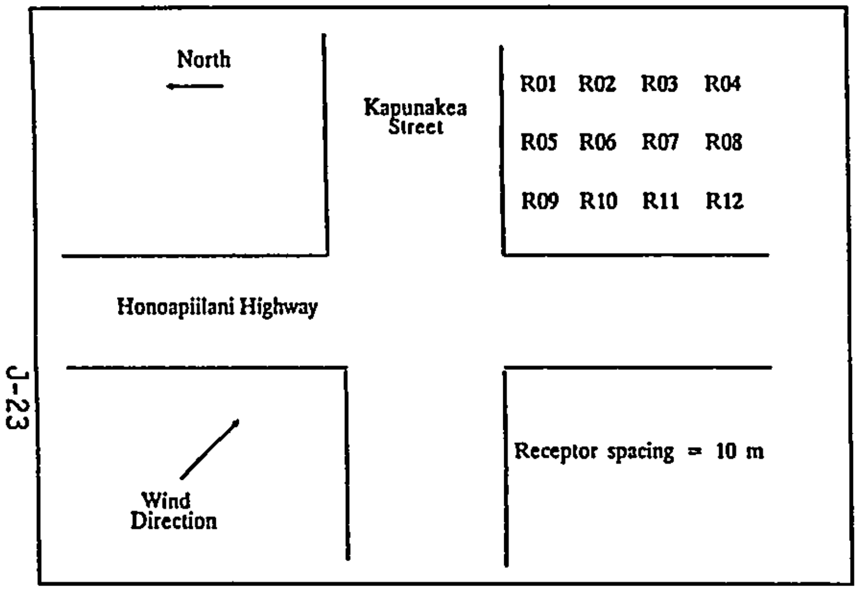


Concentration (mg/m^3)

Receptor	1989	Without Project 1991	Without Project 1994	Without Project 1995	Without Project 2000	With Project 1991	With Project 1994	With Project 1995	With Project 2000
R01	8.3	7.9	6.8	6.2	5.1	7.9	8.2	6.2	5.5
R02	8.3	7.9	7.1	6.4	5.4	7.9	8.8	6.4	5.9
R03	8.3	8.0	7.4	6.4	5.4	7.8	9.3	6.4	6.3
R04	8.0	7.8	7.3	5.8	5.1	7.4	9.2	5.8	6.2
R05	10.4	9.7	8.3	7.3	6.0	9.9	9.7	7.3	6.4
R06	10.6	9.8	8.5	7.8	6.4	9.9	10.3	7.8	6.8
R07	10.6	10.0	9.0	8.2	6.7	9.9	11.5	8.2	7.5
R08	10.6	10.5	9.6	8.3	7.0	10.1	12.5	8.3	8.2
R09	12.9	12.3	10.4	8.7	7.1	12.8	12.2	8.7	7.6
R10	13.9	12.8	10.8	9.6	7.8	13.1	12.5	9.6	8.1
R11	13.7	12.5	10.8	10.0	8.1	12.7	13.2	10.0	8.5
R12	14.7	14.1	13.0	12.2	9.8	14.4	17.7	12.2	11.4

FIGURE 13

ESTIMATES OF MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS
Honoapiilani Highway at Kapunakea Street
A.M. Peak Hour
1989 - 2000

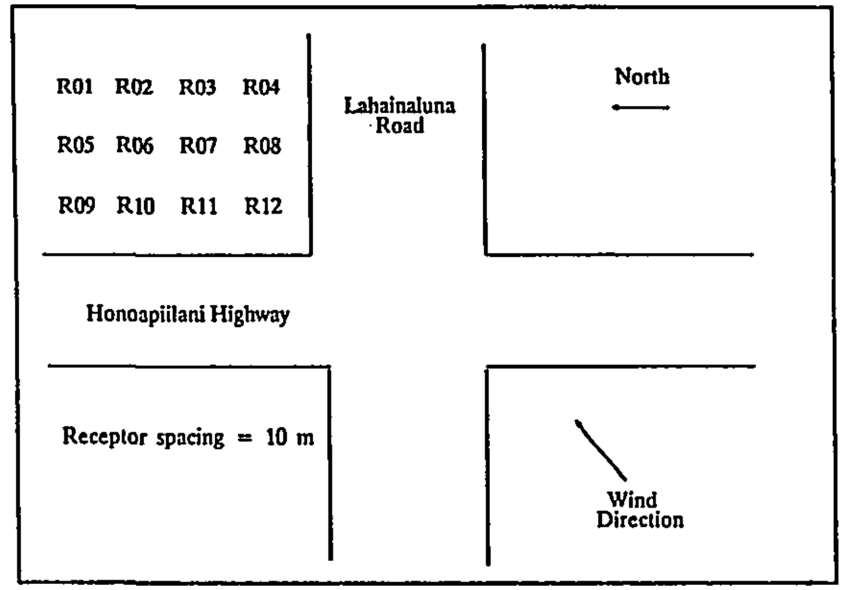


Concentration (mg/m^3)

Receptor	1989	Without Project 1991	1994	1995	2000	With Project 1991	1994	1995	2000
R01	5.4	6.3	5.8	4.8	3.9	6.5	7.5	4.8	4.1
R02	5.9	7.4	6.6	5.7	4.6	7.8	7.9	5.6	4.7
R03	5.9	8.1	7.1	6.0	5.0	8.4	8.1	6.0	4.9
R04	5.4	8.1	6.8	5.8	4.8	8.3	8.3	5.8	4.6
R05	7.6	9.1	8.2	6.8	5.5	9.5	9.0	6.8	5.7
R06	7.6	10.3	8.9	7.8	6.2	10.6	9.5	7.6	6.0
R07	6.8	10.6	8.9	7.8	6.3	10.9	9.9	7.6	5.9
R08	5.5	9.5	7.9	6.5	5.4	9.7	10.7	6.5	5.0
R09	10.8	14.2	12.4	10.6	8.3	14.7	10.7	10.6	8.3
R10	9.7	15.0	12.5	11.3	9.0	15.4	12.1	11.3	8.4
R11	7.2	14.2	11.5	9.5	7.6	14.6	12.3	9.3	7.0
R12	5.0	9.8	8.1	6.2	5.1	10.0	13.7	6.2	4.8

FIGURE 14

ESTIMATES OF MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS
Honoapiilani Highway at Kapunakea Street
P.M. Peak Hour
1989 - 2000

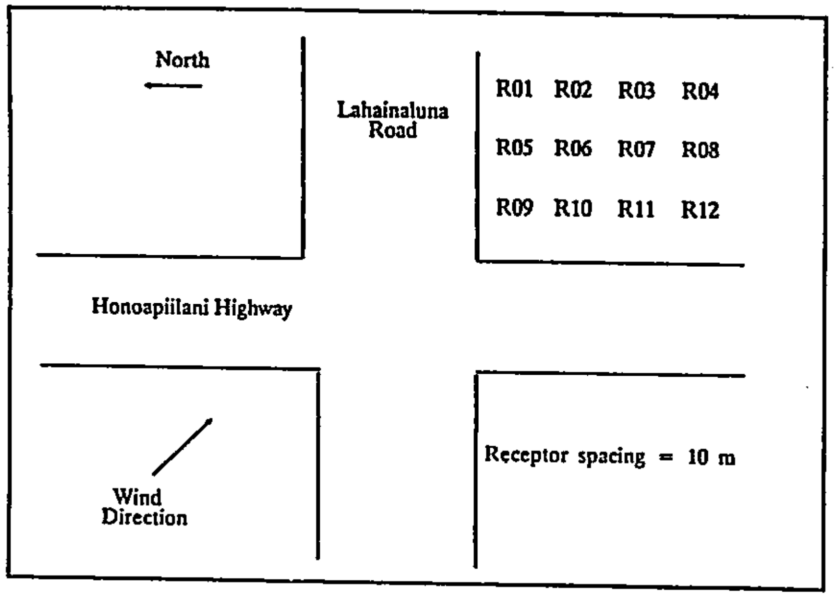


Concentration (mg/m^3)

Receptor	1989	Without Project 1991	1994	1995	2000	With Project 1991	1994	1995	2000
R01	7.9	7.2	7.1	6.4	5.2	7.5	7.1	6.4	5.6
R02	7.8	7.1	7.1	6.7	5.4	7.5	7.5	6.7	5.6
R03	7.2	6.6	7.1	7.0	5.2	7.2	7.5	7.0	5.6
R04	6.3	5.8	6.8	7.0	5.0	6.6	7.1	7.0	5.6
R05	9.3	8.7	8.5	7.3	6.2	9.0	9.6	7.3	6.7
R06	10.1	9.2	8.9	8.1	6.6	9.7	9.6	8.1	7.0
R07	9.9	9.0	8.9	8.5	6.6	9.5	9.1	8.5	7.0
R08	9.0	8.3	9.0	9.1	6.6	9.1	8.0	9.1	7.2
R09	10.4	9.6	10.1	7.9	6.8	10.0	13.6	7.9	8.1
R10	13.0	12.1	11.4	9.8	8.3	12.4	12.7	9.8	9.0
R11	13.7	12.4	11.5	10.5	8.5	12.8	11.5	10.5	8.9
R12	13.6	12.3	12.1	11.7	8.8	13.0	8.1	11.7	9.5

FIGURE 15

ESTIMATES OF MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS
Honoapiilani Highway at Lahainaluna Road
A.M. Peak Hour
1989 - 2000

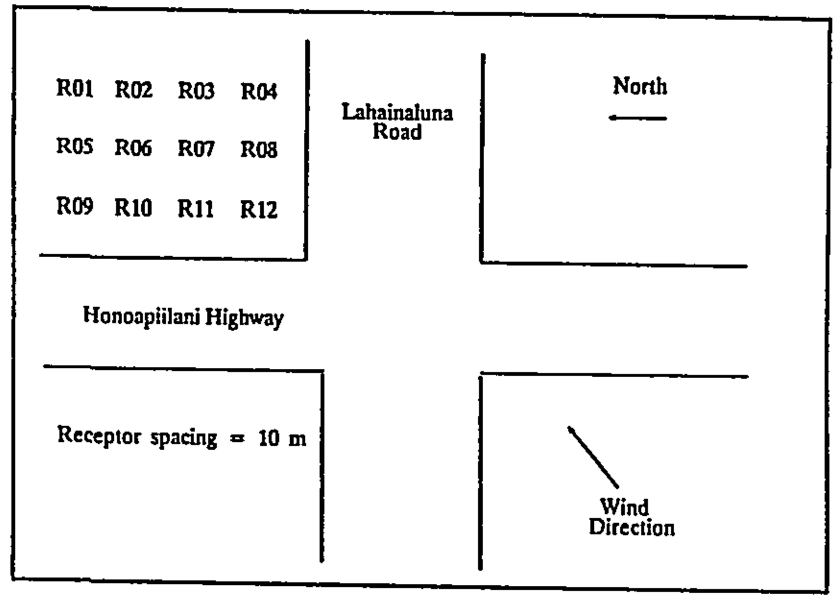


Concentration (mg/m^3)

Receptor	1989	Without Project 1991	Without Project 1994	Without Project 1995	Without Project 2000	With Project 1991	With Project 1994	With Project 1995	With Project 2000
R01	6.5	6.0	6.2	5.0	4.4	6.6	6.8	5.1	4.4
R02	7.0	6.3	6.4	5.1	4.4	7.0	7.2	5.2	4.6
R03	7.1	6.4	6.3	4.9	4.1	7.1	7.3	5.0	4.6
R04	6.6	6.0	5.7	4.2	3.6	6.7	7.0	4.4	4.2
R05	8.7	8.1	8.1	6.8	5.8	9.0	9.2	7.0	5.9
R06	9.1	8.1	8.0	6.2	5.2	9.1	9.2	6.4	5.6
R07	8.8	7.8	7.3	5.4	4.4	8.7	9.0	5.6	5.2
R08	7.2	6.5	5.9	4.2	3.5	7.3	7.6	4.4	4.4
R09	12.9	11.3	11.3	8.5	7.2	12.7	13.1	8.9	7.6
R10	12.9	11.1	10.3	7.4	6.0	12.4	12.5	7.9	7.2
R11	10.4	9.2	8.1	5.4	4.4	10.4	11.1	5.7	5.9
R12	6.8	6.4	5.5	3.6	3.2	7.2	7.8	3.9	4.2

FIGURE 16

ESTIMATES OF MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS
Honoapiilani Highway at Lahainaluna Road
P.M. Peak Hour
1989 - 2000

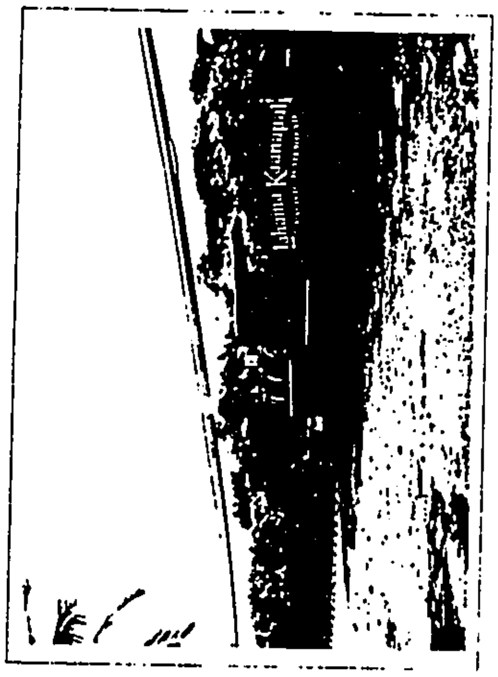


Concentration (mg/m^3)

Receptor	1989	Without Project 1991	Without Project 1994	Without Project 1995	Without Project 2000	With Project 1991	With Project 1994	With Project 1995	With Project 2000
R01	7.4	6.5	6.2	5.1	4.0	7.3	7.3	5.1	4.7
R02	7.6	6.7	6.5	5.7	4.2	7.5	7.2	5.7	4.9
R03	7.5	6.6	6.6	5.8	4.1	7.3	7.0	5.8	5.0
R04	7.2	6.4	6.6	5.6	3.9	7.0	6.7	5.6	5.0
R05	8.3	7.4	6.8	5.4	4.3	8.4	9.0	5.4	5.0
R06	9.6	8.3	7.9	6.5	5.0	9.5	9.3	6.5	5.8
R07	9.9	8.5	8.3	7.3	5.2	9.6	9.0	7.3	6.2
R08	9.8	8.4	8.7	7.9	5.1	9.3	8.9	7.9	6.7
R09	8.7	7.9	7.2	5.0	4.4	8.9	10.4	5.0	5.0
R10	11.5	10.1	9.1	7.0	5.7	11.5	12.5	7.0	6.6
R11	13.2	11.3	10.5	8.8	6.8	12.9	12.4	8.8	7.8
R12	13.8	11.7	11.6	10.1	7.3	13.2	12.2	10.1	8.0

FIGURE 18

LAHAINA - KAANAPALI & PACIFIC RAILROAD
ISLAND OF MAUI

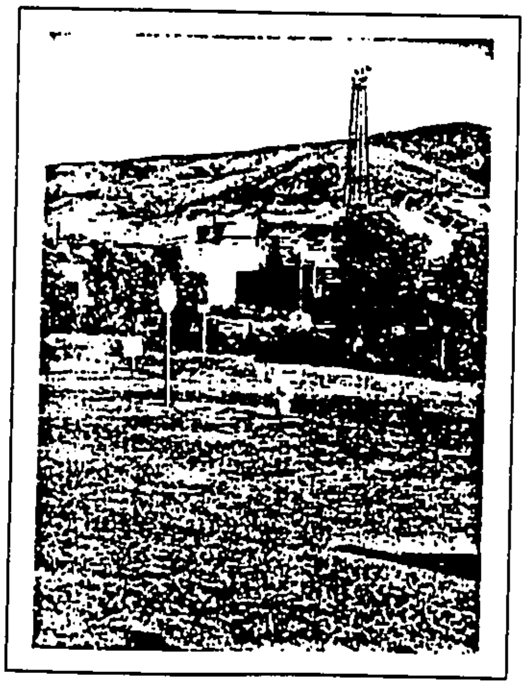


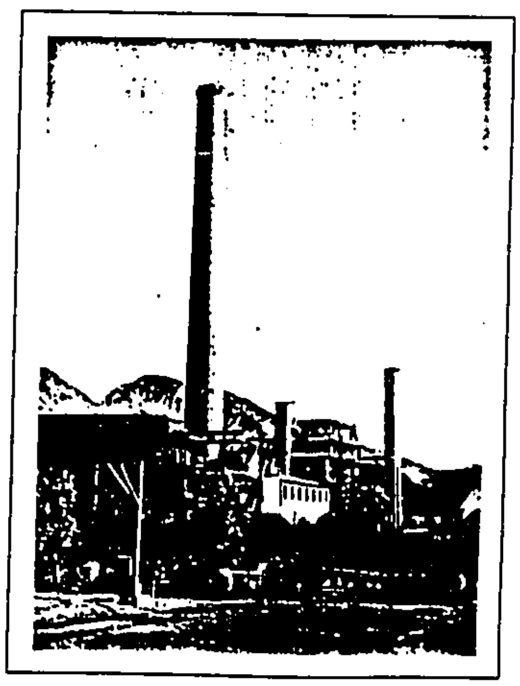
Engine Heading
North to Kaanapali

Visible Emissions

FIGURE 17

PIONEER MILL
LAHAINA, MAUI





APPENDIX K
NOISE STUDY

NOISE STUDY
FOR THE
LAHAINA MASTER PLANNED PROJECT
WAIHIKULI, MAUI

Prepared for:
PBR HAWAII

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NOVEMBER 19[illegible]

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CHAPTER I. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed Lahaina Master Planned Project in Waihikuli, Maui were evaluated for their potential impact on present and future noise sensitive areas. The future traffic noise levels along the primary access roadways to the project were calculated for the Years 1994 and 2000.

Along the existing Honoapiilani Highway, traffic noise levels are expected to remain similar to existing noise levels between CY 1989 and CY 1994, with worsening traffic conditions resulting in reduced average speeds along the existing highway. These lower average speeds will tend to offset the increases in traffic volumes forecasted for CY 1994, and will result in traffic noise levels which are approximately equal to CY 1989 levels. Beyond CY 1994, after completion of the proposed Bypass Road, traffic noise levels along the existing highway are predicted to increase by 0.5 to 1.5 Ldn as traffic volumes decline, traffic conditions improve, and average vehicle speeds increase back up to CY 1989 values. Project traffic are predicted to cause a 0.4 to 1.0 Ldn increase in traffic noise levels along the existing Honoapiilani Highway from the present to CY 2000. This amount of increase in traffic noise levels over an 11 year period is not considered to be significant.

The greatest traffic noise increase of 4.0 Ldn is expected to occur along the proposed Bypass Road following complete project build-out by CY 2000. Although potential impacts from this increase in traffic noise are possible along the Ikena Avenue crossing of the Bypass Road, these impacts are expected to be minimized by the planned implementation of noise mitigation measures at existing residences along Ikena Avenue during the construction of the Bypass Road.

Project residents may be impacted by traffic noise from the proposed Bypass Road if adequate setback distances are not provid-

ed from the highway or if other noise mitigation measures are not incorporated into the development. Following finalization of the Bypass Road's alignment and profile, a reevaluation will be required of the traffic noise levels at the proposed residential areas adjacent to the Right-of-Way. The mitigation measures necessary to meet FHA/HUD noise standards should then be included within the plans of the affected subdivisions.

Project residents are not expected to be impacted by traffic noise above FHA/HUD noise standards from the three proposed connector roadways since adequate setback distances are provided from these roadways to planned residential areas of the project. If the preferred development alternative is selected for implementation, noise levels from the cane haul road are also expected to be well within FHA/HUD noise standards.

Approximately 11 lots of the existing Wahikuli Subdivision will probably be impacted by increased traffic noise levels along the existing section of Kapunakea Street which is near the intersection with Honapiilani Highway. Due to the relatively small setback distances of these lots from the centerline of the improved Kapunakea Street, future traffic noise levels will exceed the FHA/HUD level of 65 Ldn at these lots. Noise mitigation measures will probably be required prior to construction of the proposed Kapunakea Connector Road.

Unavoidable, but temporary, noise impacts may occur during the construction of the proposed project. Because construction activities are predicted to be audible at adjoining properties, the quality of the acoustic environment may be degraded to unacceptable levels during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. For this reason, the use of quiet equipment and construction curfew periods as required under the State Department of Health noise regulations are recommended to minimize construction noise impacts.

CHAPTER II. PURPOSE

The objectives of this study were to describe the existing and future noise environment in the environs of the proposed HFDC Lahaina Master Planned Project at Wahikuli on the island of Maui. Traffic noise level increases and impacts associated with the proposed development were to be determined within the project site as well as along the public roadways expected to service the project traffic. A specific objective was to determine future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases. Recommendations for minimizing these noise impacts were also to be provided as required. Assessments of possible future impacts from aircraft noise, from cane haul road traffic noise, and from short term construction noise at the project site were also included in the noise study objectives.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies to assess environmental noise is the Day-Night Average Sound Level (Ldn). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. By definition, the minimum averaging period for the Ldn descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the Ldn descriptor. A more complete list of noise descriptors is provided in **APPENDIX B** to this report.

TABLE 1, derived from **Reference 1**, presents current federal noise standards and acceptability criteria for residential land uses. Land use compatibility guidelines for various levels of environmental noise as measured by the Ldn descriptor system are shown in **FIGURE 1**. As a general rule, noise levels of 55 Ldn or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, Ldn levels generally range from 55 to 65 Ldn, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 Ldn, and as high as 75 Ldn when the roadway is a high speed freeway. In the West Maui area, noise levels at lots which front Honoapiilani Highway are typically above 60 Ldn. Due to noise shielding effects from intervening structures, interior lots are usually exposed to 3 to 10 Ldn lower noise levels than the front lots which are not shielded from the traffic noise.

For the purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 Ldn or lower is considered acceptable. This standard is applied nationally (**Reference 2**), including Hawaii. Because of our open-living conditions, the predominant use of nat-

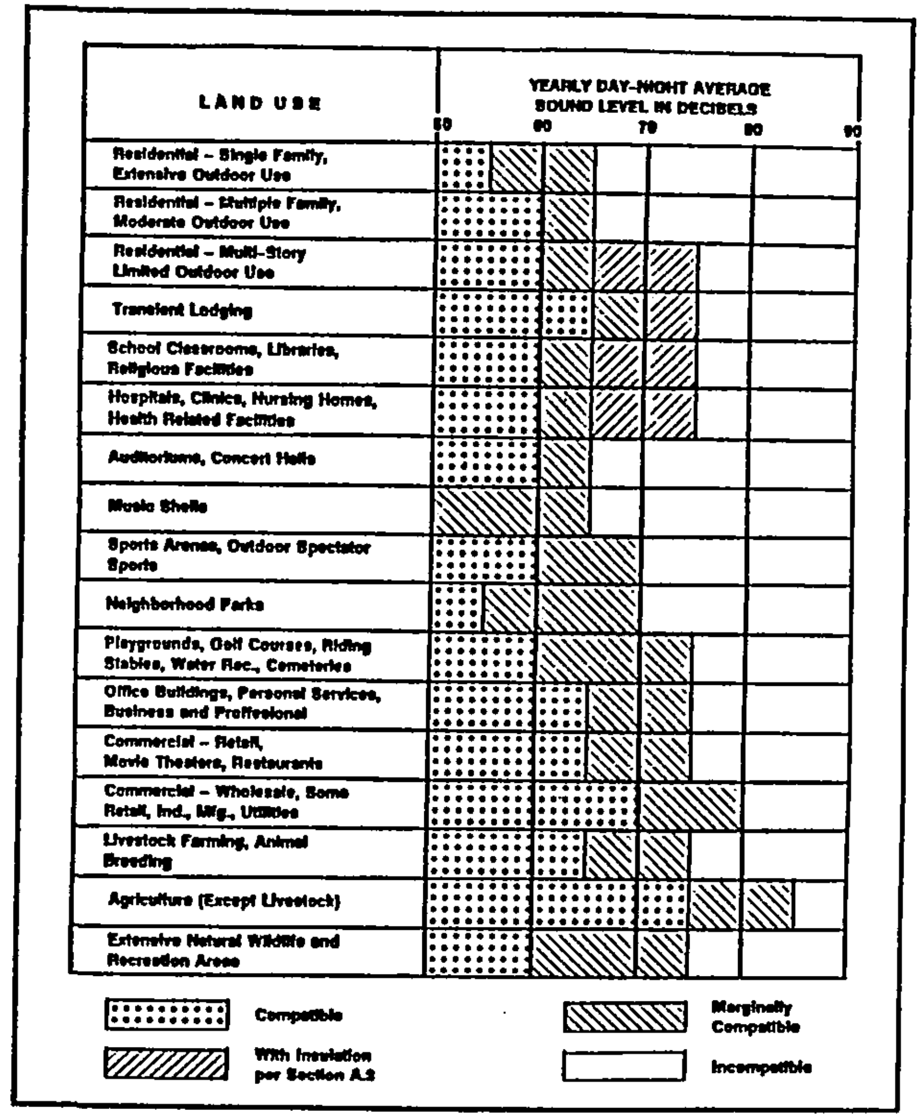
TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL(1) STANDARD
Minimal Exposure	Not Exceeding 55 L_{dn}	Not Exceeding 55 L_{eq}	Unconditionally Acceptable
Moderate Exposure	Above 55 L_{dn} But Not Above 65 L_{dn}	Above 55 L_{eq} But Not Above 65 L_{eq}	Acceptable(2)
Significant Exposure	Above 65 L_{dn} But Not Above 75 L_{dn}	Above 65 L_{eq} But Not Above 75 L_{eq}	Normally Unacceptable
Severe Exposure	Above 75 L_{dn}	Above 75 L_{eq}	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the L_{eq} instead of the L_{dn} descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 L_{eq}.



LAND USE COMPATIBILITY WITH YEARLY DAY-NIGHT AVERAGE SOUND LEVEL AT A SITE FOR BUILDINGS AS COMMONLY CONSTRUCTED (Source: American National Standards Institute)

FIGURE 1

urally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 Ldn does not eliminate all risks of noise impacts. Because of these factors, and as recommended in Reference 3, a lower level of 55 Ldn is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 Ldn, government agencies such as FHA/HUD and VA have selected 65 Ldn as a more appropriate regulatory standard.

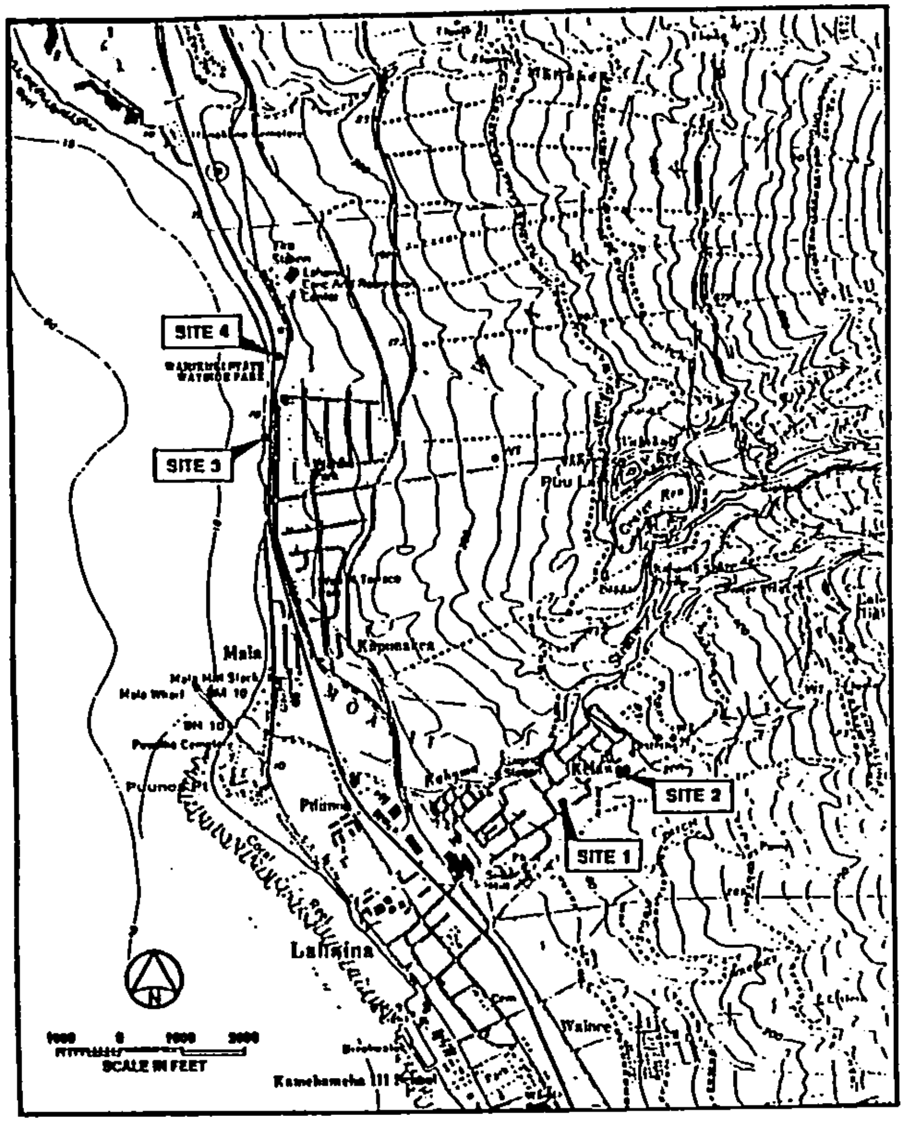
For aircraft noise, the State Department of Transportation, Airports Division, has recommended that 60 Ldn be used as the common level for determining land use compatibility or noise sensitive uses near its airports. In addition, for those noise sensitive land uses which are exposed to aircraft noise greater than 55 Ldn, the division recommends that disclosure of the aircraft noise levels be provided prior to any real property transactions. Reference 4 requires that such disclosure be provided prior to real property transactions concerning properties located within Air Installation Compatibility Use Zones (AICUZ) or located within airport noise maps developed under Federal Aviation Regulation Part 150 - Airport Noise Compatibility Planning (14 CFR Part 150). For the purposes of this study, the most conservative level of 55 Ldn was used to evaluate potential impacts from aircraft noise over the project site.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic noise levels were measured at six locations in the project environs to provide a basis for developing the project's traffic noise contributions along the roadways which will service the proposed development: Honoapiilani Highway, Lahainaluna Road, the proposed Lahaina Bypass Road, and three new roadways which cross through the project and connect Honoapiilani Highway with the Bypass Road. The locations of the measurement sites are shown in FIGURE 2. Noise measurements were performed during the latter part of July 1989. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in TABLE 2. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used.

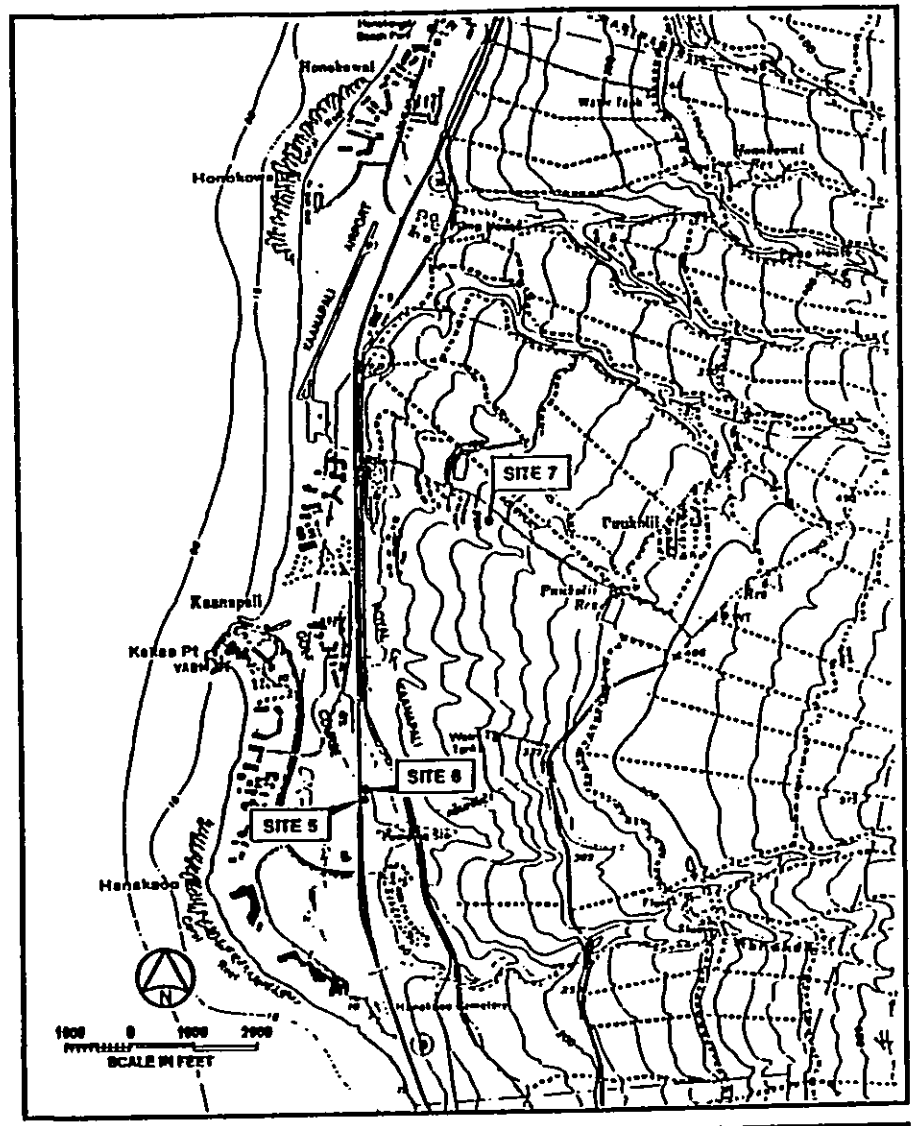
Traffic noise calculations for the existing conditions as well as noise predictions for the Years 1994 and 2000 were performed using the Federal Highway Administration (FHWA) Noise Prediction Model (Reference 5). Traffic data entered into the noise prediction model were: hourly traffic volumes, average vehicle speeds, estimates of traffic mix, and soft ground propagation loss factor. The traffic study for the project (Reference 6) and Hawaii State Department of Transportation counts on Honoapiilani Highway (References 7 and 8), were the primary sources of data inputs to the model. For existing and future traffic, it was assumed that the average noise levels, or Leq(h), during the PM peak hour were 0.5 dB less than the 24-hour Ldn along each roadway segment. This assumption was based on computations of both the hourly Leq and the 24-hour Ldn of traffic noise on Honoapiilani Highway at Lahainaluna Road (see FIGURES 3 and 4).

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level receptors without the benefit of shielding effects. Traffic noise



LOCATIONS OF NOISE MEASUREMENT SITES

FIGURE 2



LOCATIONS OF NOISE MEASUREMENT SITES (CONTINUED)

FIGURE 2

FIGURE 3

HOURLY VARIATIONS OF TRAFFIC NOISE AT 50 FT SETBACK DISTANCE FROM THE CENTERLINE OF HONOAPIILANI HIGHWAY AT LAHAINALUNA RD.

(TOWARD WAILUKU JULY 14-15, 1987)

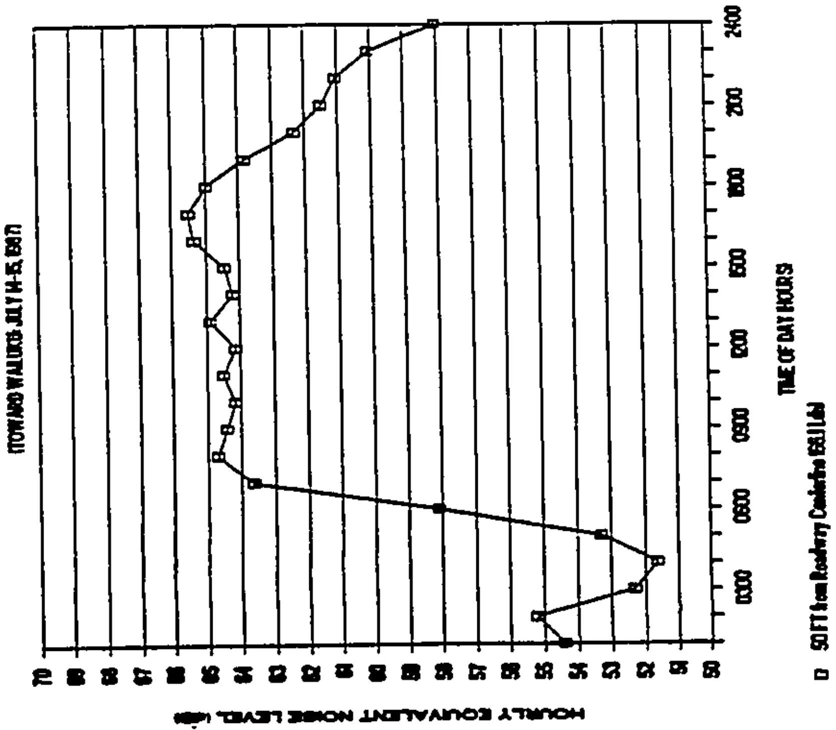


TABLE 2

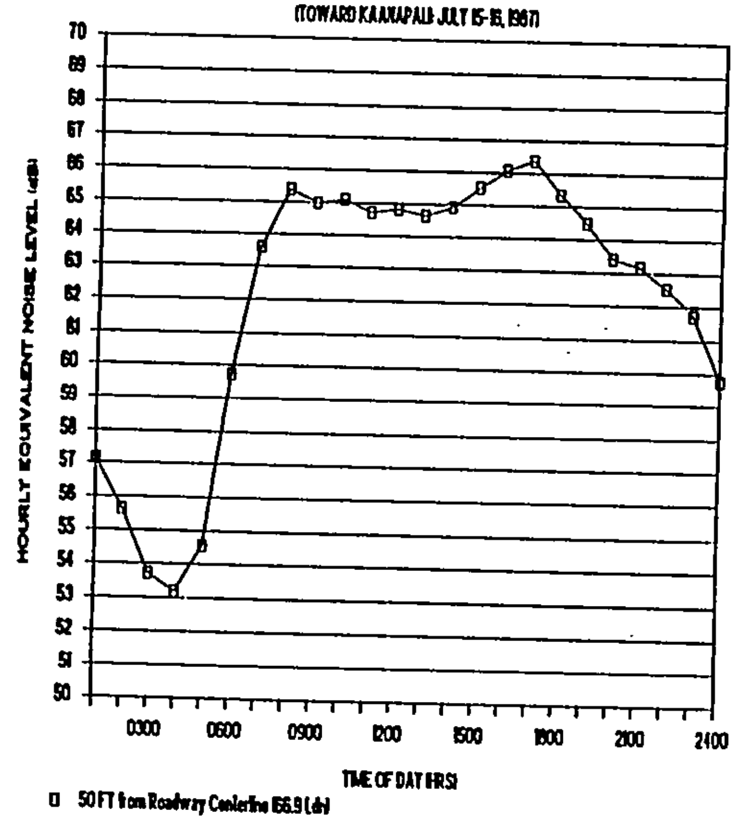
TRAFFIC NOISE MEASUREMENTS

Location	Time of Day (HRS)	Ave.Speed (MPH)	——Hourly Traffic Volume—— Auto	Med.Truck	Heavy Truck	Measured Leq (dB)	Predicted Leq(dB)
1. 30 FT from the center-line of Lahainaluna Road (7/26/89).	0700 TO 0800	35	522	4	2	63.7	63.8
2. 60 FT from the center-line of Lahainaluna Road (7/27/89).	0700 TO 0800	35	334	4	2	58.6	57.9
3. 39 FT from the center-line of Honoapiilani Highway (7/26/89).	1300 TO 1400	43	2,328	48	54	71.6	71.8
4. 60 FT from the center-line of Honoapiilani Highway (7/27/89).	1330 TO 1430	38	2,290	24	48	66.8	66.7
5. 25 FT from the center-line of Honoapiilani Highway (7/26/89).	1130 TO 1230	50	1,604	32	48	74.9	75.6
6. 55 FT from the center-line of Honoapiilani Highway (7/27/89).	1200 TO 1300	50	1,478	18	22	68.9	68.7

FIGURE 4

HOURLY VARIATIONS OF TRAFFIC NOISE AT 50 FT SETBACK DISTANCE FROM THE CENTERLINE OF HONOAPIILANI HIGHWAY AT LAHAINALUNA RD.

(TOWARD KAANAPALI; JULY 15-16, 1997)



levels were calculated for future conditions prior to (CY 1994) and following (CY 2000) the construction of the proposed Bypass Road. The forecasted increases in traffic noise levels over existing levels were calculated for both scenarios, and noise impact risks evaluated. The relative contributions of non-project and project related traffic to the total noise levels were also calculated, and an evaluation of possible traffic noise impacts was made.

Aircraft noise measurements were obtained at Site 7 (see FIGURE 2) off Puukolii Road, which was located in excess of 1 mile north of the project site. These aircraft noise measurements were made to confirm that noise associated with aircraft operations at Kapalua (West Maui) Airport and with transiting overhead jet aircraft are well below noise compatibility standards and guidelines. Aircraft noise levels from crop spraying operations were estimated from operational information provided by Pioneer Mill, and potential risks of adverse noise impacts from these operations were evaluated.

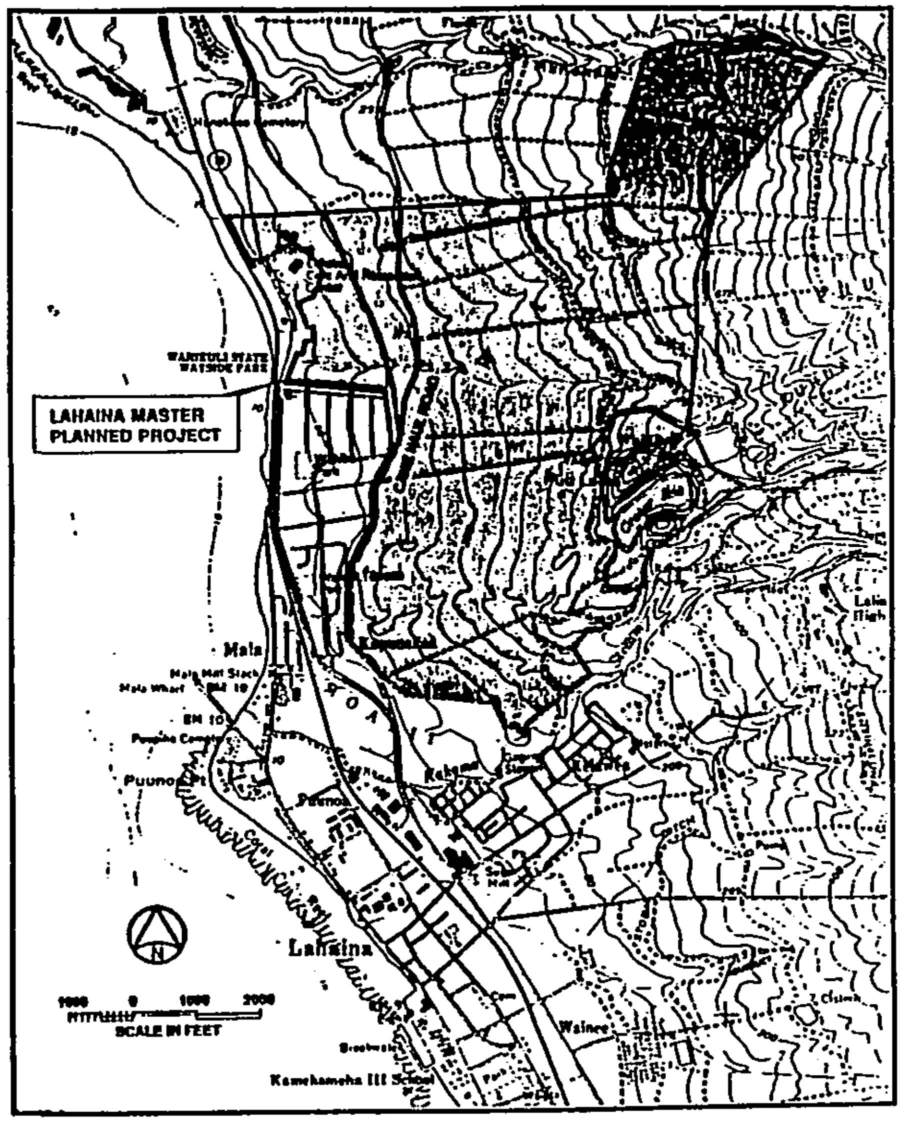
Levels of cane haul and other diesel truck noise along the main cane haul road which runs along the western boundary of the project site were calculated based on operational information provided by Pioneer Mill. Using this operational information, and assuming that a consolidation of these haul roads will occur as a result of this project, minimum setback distances from the haul road sections to the 65 Ldn noise contour lines were calculated to determine noise impact risks from the operations on the cane haul road.

CHAPTER V. EXISTING NOISE ENVIRONMENT

The existing traffic noise levels in the project environs (see FIGURE 5) are in the "Significant Exposure, Normally Unacceptable" category at 50 FT distance from the centerline of Honoapiilani Highway. Traffic noise levels along the Right-of-Way of a roadway generally represent the worst case (or highest) levels due to the proximity of the Right-of-Way to the noise sources. At greater setback distances of approximately 100 to 200 FT, traffic noise along Honoapiilani Highway decrease to the "Moderate Exposure, Acceptable" category.

Calculations of existing traffic noise levels during the PM peak traffic hour are presented in TABLES 3A and 3B. The hourly Leq (or Equivalent Sound Level) contribution from each roadway section in the project environs was calculated for comparison with forecasted traffic noise levels with and without the project. The existing setback distances from the roadways' centerlines to their associated 60, 65, and 70 Ldn contours were also calculated as shown in TABLES 4A and 4B. The contour line setback distances do not take into account noise shielding effects or the additive contributions of traffic noise from intersecting street sections. However, as indicated previously, the setback distances to the 65 Ldn contour lines are relatively large for Honoapiilani Highway. Along Lahainaluna Road, which is a lower volume street, the setback distance to the 65 Ldn contour is relatively small.

Existing traffic noise levels at the mauka (inland) portions of the project site are very low (less than 60 Ldn) due to their large setback distances from Honoapiilani Highway. Only one parcel of the project located between the existing Civic Center and the Wahikuli Subdivision is located within 250 FT of the existing highway. For this reason, the existing levels of highway traffic noise on the project site are not expected to exceed current FHA/HUD noise standards or cause adverse noise impacts on future project residents.



PROJECT SITE LOCATION

FIGURE 5

TABLE 3A

COMPARISONS OF EXISTING AND CY 1994 TRAFFIC NOISE LEVELS
ALONG ACCESS ROADS TO PROJECT SITE
(PM PEAK HOUR AND 50 FT FROM ROADWAY CENTERLINES)

LOCATION	SPEED (MPH)	VPH	***** HOURLY LEQ IN dB **** AUTO	MT	HT	ALL VEH
EXISTING (CY 1989) PM PEAK HR. TRAFFIC:						
Honoapiilani Hwy. (Section A)	50	2,991	70.0	64.2	68.6	73.0
Honoapiilani Hwy. (Section B)	43	2,970	67.5	63.7	66.2	70.9
Honoapiilani Hwy. (Section C)	43	2,439	66.6	62.9	65.4	70.0
Honoapiilani Hwy. (Section D)	36	2,360	63.5	59.5	64.8	67.9
Lahainaluna Road at West End	30	1,026	59.6	51.5	55.0	61.3
CY 1994 PM PEAK HR. TRAFFIC WITH THE PROJECT:						
Honoapiilani Hwy. (Section A)	45	4,589	70.2	64.5	69.3	73.4
Honoapiilani Hwy. (Section B)	38	4,301	67.1	63.5	66.5	70.7
Honoapiilani Hwy. (Section C)	38	3,818	66.5	63.0	66.0	70.2
Honoapiilani Hwy. (Section D)	33	3,876	64.3	60.4	66.1	68.9
Lahainaluna Road at West End	30	1,394	60.9	52.9	56.3	62.7
Civic Center Connector Rd.	40	1,353	62.9	59.2	62.8	66.7
Kapunakea St. Connector Rd.	40	1,321	62.8	59.1	62.7	66.6

Notes:

The following assumed traffic mixes of autos, medium trucks, and heavy trucks were used for existing and future conditions:

(a) Honoapiilani Highway (north of project): 96.0% autos, 2.0% medium trucks, and 2.0% heavy trucks and buses.

(b) Honoapiilani Highway (fronting project): 95.3% autos, 3.0% medium trucks, and 1.7% heavy trucks and buses.

(c) Honoapiilani Highway (south of project): 95.0% autos, 2.6% medium trucks, and 2.4% heavy trucks and buses.

(d) Lahainaluna Road (existing): 98.5% autos, 1.0% medium trucks, and 0.5% heavy trucks and buses.

(e) Lahainaluna Road (CY 1994): 98.5% autos, 1.0% medium trucks, and 0.5% heavy trucks and buses.

TABLE 3B

COMPARISONS OF EXISTING AND CY 2000 TRAFFIC NOISE LEVELS
ALONG ACCESS ROADS TO PROJECT SITE
(PM PEAK HOUR AND 50 FT FROM ROADWAY CENTERLINES)

LOCATION	SPEED (MPH)	VPH	***** HOURLY LEQ IN dB **** AUTO	MT	HT	ALL VEH
EXISTING (CY 1989) PM PEAK HR. TRAFFIC:						
Honoapiilani Hwy. (Section A)	50	2,991	70.0	64.2	68.6	73.0
Honoapiilani Hwy. (Section B)	43	2,970	67.5	63.7	66.2	70.9
Honoapiilani Hwy. (Section C)	43	2,439	66.6	62.9	65.4	70.0
Honoapiilani Hwy. (Section D)	36	2,360	63.5	59.5	64.8	67.9
Lahainaluna Road at West End	30	1,026	59.6	51.5	55.0	61.3
CY 2000 PM PEAK HR. TRAFFIC WITH THE PROJECT:						
Honoapiilani Hwy. (Section A)	50	3,350	70.5	64.7	69.1	73.5
Honoapiilani Hwy. (Section B)	43	3,768	68.5	64.8	67.3	71.9
Honoapiilani Hwy. (Section C)	43	3,322	68.0	64.2	66.7	71.3
Honoapiilani Hwy. (Section D)	36	3,327	65.0	61.0	66.3	69.4
Lahainaluna Road at West End	30	1,715	61.7	56.1	60.2	64.7
Civic Center Connector Rd.	40	1,103	62.0	58.4	61.9	65.8
Kapunakea St. Connector Rd.	40	939	61.3	57.7	61.2	65.1
Mauka Project Connector Road	40	1,505	63.3	59.7	63.2	67.1
Bypass Road (North of Proj.)	50	3,491	70.7	64.9	69.3	73.7
Bypass Road (Front of Proj.)	50	3,555	70.7	66.7	69.3	74.0
Bypass Road (South of Proj.)	50	3,563	70.7	66.7	69.3	74.0

Notes:

The following assumed traffic mixes of autos, medium trucks, and heavy trucks were used for existing and future conditions:

(a) Honoapiilani Highway (north of project): 96.0% autos, 2.0% medium trucks, and 2.0% heavy trucks and buses.

(b) Honoapiilani Highway (fronting project): 95.3% autos, 3.0% medium trucks, and 1.7% heavy trucks and buses.

(c) Honoapiilani Highway (south of project): 95.0% autos, 2.6% medium trucks, and 2.4% heavy trucks and buses.

(d) Lahainaluna Road (existing): 98.5% autos, 1.0% medium trucks, and 0.5% heavy trucks and buses.

(e) Lahainaluna Road (future): 98.5% autos, 1.7% medium trucks, and 1.0% heavy trucks and buses.

TABLE 4A

EXISTING AND CY 1994 DISTANCES TO 60, 65, AND 70 Ldn CONTOURS

STREET SECTION	60 Ldn SETBACK (FT)		65 Ldn SETBACK (FT)		70 Ldn SETBACK(FT)	
	EXISTING	CY 1994	EXISTING	CY 1994	EXISTING	CY 1994
Honoapiilani Hwy. (Section A)	397	421	184	195	86	91
Honoapiilani Hwy. (Section B)	286	280	133	130	62	60
Honoapiilani Hwy. (Section C)	250	259	116	120	54	56
Honoapiilani Hwy. (Section D)	182	212	85	98	39	46
Lahainaluna Road at West End	66	81	31	38	14	18
Civic Center Connector Rd.	N/A	151	N/A	70	N/A	32
Kapunakea St. Connector Rd.	N/A	148	N/A	69	N/A	32

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLE 3A for traffic volume, speed, and mix assumptions.
(3) Ldn assumed to be equal to PM Peak Hour Leq plus 0.5 dB along all roadways.
(4) Setback distances are for unobstructed line-of-sight conditions.
(5) Soft ground conditions assumed along all roadways.

TABLE 3B (CONTINUED)

COMPARISONS OF EXISTING AND CY 2000 TRAFFIC NOISE LEVELS ALONG ACCESS ROADS TO PROJECT SITE (PM PEAK HOUR AND 50 FT FROM ROADWAY CENTERLINES)

Notes:

(f) New Bypass Road (North of Project): 96.0% autos, 2.0% medium trucks, and 2.0% heavy trucks and buses.

(g) New Bypass Road (Fronting and South of Project): 95.0% autos, 3.0% medium trucks, and 2.0% heavy trucks and buses.

TABLE 4B

EXISTING AND CY 2000 DISTANCES TO 60, 65, AND 70 Ldn CONTOURS

STREET SECTION	60 Ldn SETBACK (FT) EXISTING	60 Ldn SETBACK (FT) CY 2000	65 Ldn SETBACK (FT) EXISTING	65 Ldn SETBACK (FT) CY 2000	70 Ldn SETBACK(FT) EXISTING	70 Ldn SETBACK(FT) CY 2000
Honoapiilani Hwy. (Section A)	397	428	184	199	86	92
Honoapiilani Hwy. (Section B)	286	335	133	155	62	72
Honoapiilani Hwy. (Section C)	250	308	116	143	54	66
Honoapiilani Hwy. (Section D)	182	229	85	106	39	49
Lahainaluna Road at West End	66	111	31	52	14	24
Civic Center Connector Rd.	N/A	131	N/A	61	N/A	28
Kapunakea St. Connector Rd.	N/A	118	N/A	55	N/A	25
Mauka Project Connector Road	N/A	162	N/A	75	N/A	35
Bypass Road (North of Proj.)	N/A	440	N/A	204	N/A	95
Bypass Road (Front of Proj.)	N/A	463	N/A	215	N/A	100
Bypass Road (South of Proj.)	N/A	464	N/A	215	N/A	100

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLE 3B for traffic volume, speed, and mix assumptions.
(3) Ldn assumed to be equal to PM Peak Hour Leq plus 0.5 dB along all roadways.
(4) Setback distances are for unobstructed line-of-sight conditions.
(5) Soft ground conditions assumed along all roadways.

Existing aircraft noise levels in the project environs are less than 55 Ldn, and as such, are considered to be in the "Minimal Exposure, Unconditionally Acceptable" category for the planned land uses on the project site. Aircraft noise sources in the project environs are associated with operations at the Kapalua (West Maui) Airport, operations at the existing airstrip near the Crater Reservoir, and operations of interisland and tour aircraft which are in transit. The existing noise contours associated with the West Maui Airport, which is north of the project site, do not extend into the project site and are less than 45 Ldn. TABLE 5 summarizes the results of the aircraft noise measurements obtained at Site #7. Typical maximum noise levels of all aircraft measured at this location, which was well north of the project site, were less than 70 dB. Typical maximum noise levels from transiting, interisland jet aircraft ranged from 55 to 65 dB, with total noise exposure levels from these aircraft also less than 45 Ldn. The crater airstrip is used primarily by 4-passenger, single engine, fixed wing aircraft. Approximately 10 to 12 operations per month may occur at the airstrip, which is used whenever helicopters are not available for crop control chemical spraying operations, and whenever human observers are required to survey the cane fields from the air. Because the airstrip is relatively short and sloped, fixed wing aircraft land from and depart toward the makai (seaward) end of the airstrip. Due to the relatively low number of daily operations at the airstrip, the noise levels associated with these operations are believed to be less than 55 Ldn.

The dominant noise sources in the project environs are heavy diesel and haul trucks which travel on the existing dirt roads through the existing sugar cane fields. These heavy trucks generate maximum noise levels of approximately 85 to 92 dBA at 50 FT setback distance. The cane haul roads, which are at the west (makai) side of the project site as well as those which cross the site in the makai/mauka direction, service cane and pineapple fields which are north of the sugar mill (see FIGURE 5). The main

TABLE 5

SUMMARY OF AIRCRAFT NOISE MEASUREMENTS
(MEASUREMENT SITE #7)

AIRCRAFT TYPE	MAXIMUM SOUND LEVELS Lmax (in dB)	SOUND EXPOSURE LEVELS Lse (in dB)
DASH 7	65.1; 59.9; 70.0; 62.8; 67.7	73.3; 67.2; 76.5; 73.0; 75.5
DASH 6	56.5; 58.9; 61.2	67.9; 68.2; 69.6
Helicopters	56.4; 52.5; 52.6; 61.2; 58.7	67.1; 62.2; 59.0; 69.5; 69.1
Overhead Jets	56.9; 64.4; 69.1	68.2; 72.8; 74.4
Ave. DASH 7	65.1	74.0
Ave. DASH 6	58.9	68.6
Ave. Helicopter	56.3	66.9
Ave. Ovhd. Jet	63.5	72.5

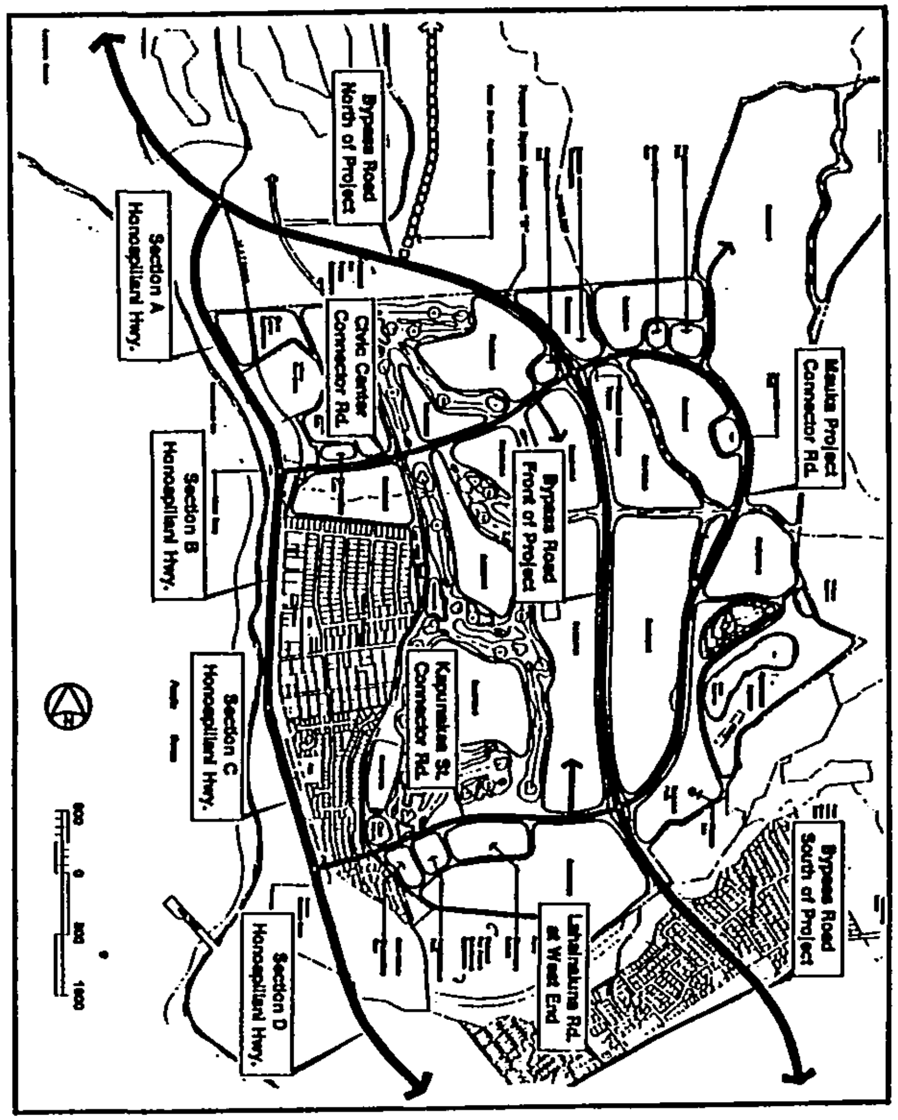
Composite Aircraft Equivalent Sound Level (Leq) = 45.9 dB

sections of cane haul road which are located along the west side of the project site service approximately 83 percent of the sugar cane fields north of the mill, while the two haul roads which cross the project site in the makai/mauka direction service approximately 17 percent of the fields north of the mill. Cane haul trucks are the dominant noise sources along these roads during the sugar cane harvesting season, which occurs on a 2 year cycle. During a typical day of the harvesting season, cane haul and diesel trucks operate on these roads 24 hours a day, at an average number of 4 to 6 trips per hour along the main (north/south) haul road. Existing noise exposure levels along the main haul road are between 65 and 70 Ldn at 50 FT distance from the centerline of the haul road during the harvesting season.

CHAPTER VI. FUTURE TRAFFIC NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 6 for CY 1994 and CY 2000. FIGURE 6 identifies the major roadways of the preferred project development alternative for which traffic noise levels were calculated. The future projections of project plus non-project traffic on the roadways which would service the project are shown in TABLES 3A and 3B for the PM peak hour of traffic. As indicated in TABLE 3A, by CY 1994, traffic conditions on Honoapiilani Highway will worsen, with average vehicle speeds reduced by at least 5 MPH from existing conditions. The net result of this is that traffic noise levels during the PM peak hour will tend to remain the same as existing noise levels. TABLES 4A and 4B summarize the predicted setback distances to the 65, 70, and 75 Ldn traffic noise contour lines along the roadways servicing the project and attributable to both project plus non-project traffic by CY 1994 and CY 2000, respectively. The setback distances in TABLES 4A and 4B do not include the beneficial effects of noise shielding from terrain features and highway cuts, or the detrimental effects of additive contributions of noise from intersecting streets. As indicated in TABLES 4A and 4B, relatively large setback distances to the 65 Ldn contour of 100 to 200 FT from the centerlines of the existing Honoapiilani Highway or the planned Bypass Road are predicted in both CY 1994 and CY 2000.

TABLE 6 presents the predicted increases in traffic noise levels associated with non-project and project traffic by CY 2000, and as measured by the Ldn descriptor system. As indicated in TABLE 6, the increases in traffic noise along Honoapiilani Highway due to project traffic are slightly greater than those due to non-project traffic, with the combined traffic noise increases considered to be small to moderate for the 11-year forecast period. Minimal to moderate increases of 0.5 to 1.5 Ldn are expected to occur along Honoapiilani Highway in the vicinity of the project, and



PREFERRED PROJECT DEVELOPMENT ALTERNATIVE AND IDENTIFICATION OF PRIMARY ROADWAYS SERVICING THE PROJECT

FIGURE 6

TABLE 6

CALCULATIONS OF PROJECT AND NON-PROJECT TRAFFIC NOISE CONTRIBUTIONS (CY 2000)

STREET SECTION	NOISE LEVEL INCREASES (Ldn) DUE TO NON-PROJECT TRAFFIC	PROJECT TRAFFIC
Honoapiilani Hwy. (Section A)	0.1	0.4
Honoapiilani Hwy. (Section B)	0.2	0.8
Honoapiilani Hwy. (Section C)	0.5	0.9
Honoapiilani Hwy. (Section D)	0.5	1.0
Lahainaluna Road at West End	3.1	0.3
Civic Center Connector Rd.	N/A	65.8
Kapunakea St. Connector Rd.	N/A	65.1
Mauka Project Connector Road	N/A	67.1
Bypass Road (North of Proj.)	69.7	4.0
Bypass Road (Front of Proj.)	70.0	4.0
Bypass Road (South of Proj.)	70.0	4.1

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these changes will be difficult to measure on an annual basis. Increases in noise levels associated with project traffic are expected to be small along Lahainaluna Road. The largest increases in noise levels attributable to project traffic are expected to occur along the proposed Bypass Road which crosses through the eastern portion of the project site. Traffic volumes on the Bypass Road are expected to increase by 150 percent as a result of project traffic by CY 2000.

As a result of the construction of the proposed Kapunakea Street Connector Road between Honoapiilani Highway and the proposed Lahaina Bypass Road, traffic noise levels are expected to increase along the existing section of Kapunakea Street at the Wahikuli Subdivision. By CY 1994, following the completion of the initial phases of the project, traffic noise levels at the existing lots which front Kapunakea Street are expected to increase to levels between 65 to 70 Ldn, which is above the FHA/HUD noise standard. The primary cause of the increase is predicted to be project traffic. Following completion of the Bypass Road and the Kapunakea Street Connector Road and beyond to CY 2000, traffic noise levels are expected to remain above 65 Ldn at these existing street frontage lots along Kapunakea Street.

CHAPTER VII. DISCUSSION OF PROJECT RELATED TRAFFIC NOISE IMPACTS AND POSSIBLE NOISE MITIGATION MEASURES

By CY 1994, traffic conditions along Honoapiilani Highway are expected to worsen as project traffic is added to the highway. As a result of this, average vehicle speeds along the existing highway are expected to decrease by at least 5 MPH, and result in traffic noise levels which are similar to existing noise levels. By CY 2000, the proposed Bypass Road is expected to be completed, and a portion of project and non-project traffic are expected to be diverted from the existing highway to the new bypass. As a result of the improved conditions along Honoapiilani Highway, it is expected that average vehicle speeds will increase back up to existing conditions, with traffic noise levels along the existing highway increasing between CY 1994 and CY 2000.

The increases in traffic noise levels attributable to the project from the present to CY 2000 are predicted to range from 0.4 to 1.0 Ldn along Honoapiilani Highway, where traffic noise levels are expected to remain above 65 Ldn along the highway Right-of-Way. This degree of increase in traffic noise levels attributable to the project will be difficult to perceive over an 11-year period from CY 1989 to CY 2000, and is not considered to be significant. For these reasons, traffic noise impacts along Honoapiilani Highway and resulting from project traffic are not considered to be serious.

Relatively large increases in traffic noise levels along the proposed Bypass Road are expected to occur as a result of the proposed project. By CY 2000, project traffic is expected to increase traffic noise levels along the Bypass Road by approximately 4.0 Ldn. Maximum setback distances of approximately 200 FT from the Bypass Road's centerline could be required to meet FHA/HUD noise standards if unobstructed line-of-sight conditions occur between the Bypass Road and noise sensitive receptors. Under conditions of noise shielding by terrain features or man-made obstructions, setback distances required to meet the FHA/HUD standard would be significantly less, and be probably less than 100 FT from the highway centerline. The proposed Bypass Road's alignment in the Lahaina Master Planned Project's preferred development alternative (see **FIGURE 6**) differs from the original State Department of Transportation planned Alignment B. Because of this, a more detailed evaluation of the required setback distances from the Bypass Road will be required following redefinition of its final alignment and profile.

Along the new connector roadways within the project site, traffic noise levels are expected to be below the FHA/HUD standard of 65 Ldn at distances ranging from 55 to 75 FT from the centerlines of the connector roadways (see **TABLES 4A and 4B**). With approximately 150 FT wide Rights-of-Way planned for these connector roads, traffic noise levels should be in the "Moderate Exposure, Acceptable" category at noise sensitive developments along these roadways.

Potential noise impacts along the proposed Bypass Road are possible, both in respect to existing and planned noise sensitive receptors along the bypass route. Existing residences located along the Ikena Avenue crossing of the bypass, which is south of the project (see **FIGURE 6**), may be impacted by the added traffic noise along the proposed bypass crossing if noise mitigation measures are not included with the construction of the bypass. Mitigation of off-site traffic noise impacts are generally performed by individual property owners fronting the roadways' Right-of-Way or by public agencies during roadway improvement projects. These mitigation measures generally take the form of increased setbacks, sound attenuating walls, total closure and air conditioning, or the use of sound attenuating windows. At the present time, the use of large setbacks plus 6 to 8 FT high walls are planned to attenuate noise from Bypass Road traffic to approximately 58 Ldn at residences along the Ikena Avenue crossing. The design of the noise abatement measures along Ikena Avenue were based upon the previously forecasted PM peak hour traffic volume of 2,218 VPH for CY 2005. By CY 2000, with the proposed Lahaina Master Planned Project completed, traffic volumes are expected to increase to 3,563 VPH at the Ikena Avenue crossing (see TABLE 3B), and result in a 2 Ldn increase over previously forecasted noise levels without the project. Resulting total traffic noise levels at existing residences along the Ikena Avenue crossing are expected to be 60 Ldn in CY 2000 with the planned noise mitigation measures in place, and should not exceed the FHA/HUD standard of 65 Ldn. For this reason, severe noise impacts should not occur as a result of the proposed project as long as the planned noise mitigation measures are incorporated into the Bypass Road construction project as is currently planned.

Because of probable traffic noise impacts along the existing section of Kapunakea Street, noise mitigation measures will probably be required in conjunction with the improvements to the existing roadway and construction of the new Kapunakea Street Connector Road. These mitigation measures may take the form of new sound attenuation walls along Kapunakea Street, land purchase, closure and air conditioning of affected homes, or the addition of sound attenuating windows. Prior to the construction of the roadway improvements, a more detailed study will be required to identify and design the final noise mitigation measures.

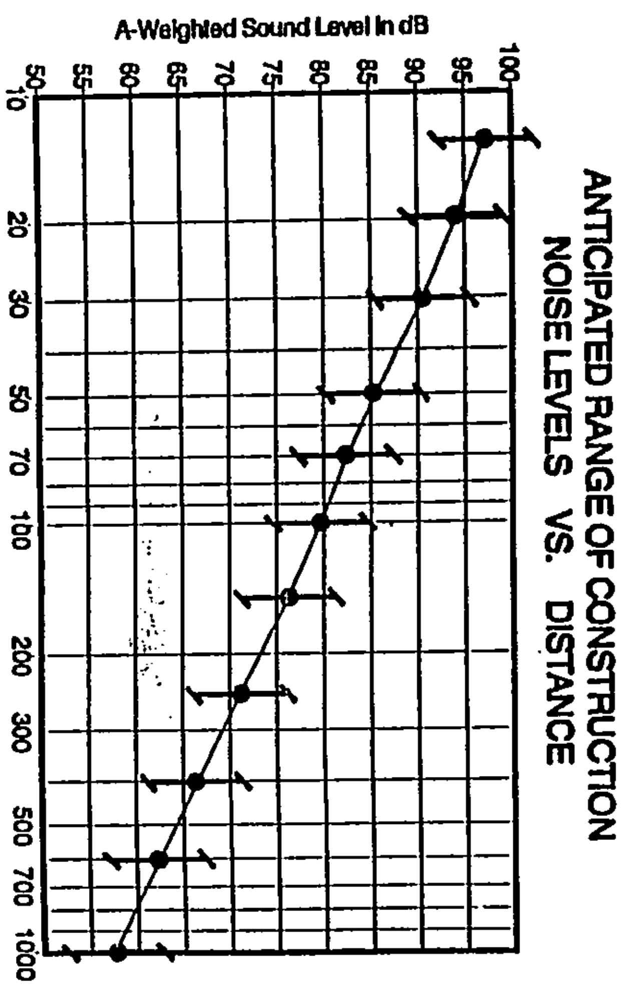
CHAPTER VIII. OTHER NON-TRAFFIC NOISE CONSIDERATIONS

Construction Noise. Audible construction noise will probably be unavoidable during the entire project construction period. The total time period for construction is unknown, but it is anticipated that the actual work will be moving from one location on the project site to another during that period. Actual length of exposure to construction noise at any receptor location will probably be less than the total construction period for the entire project. Typical levels of noise from construction activity (excluding pile driving activity) are shown in FIGURE 7. The impulsive noise levels of impact pile drivers are approximately 15 dB higher than the levels shown in FIGURE 7, while the intermittent noise levels of vibratory pile drivers are at the upper end of the noise level ranges depicted in the figure. The noise sensitive properties which are predicted to experience the highest noise levels during construction activities on the project site are the existing residential subdivisions west and south of the project site, and the Lahaina Civic Center. Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project site.

Mitigation of construction noise to inaudible levels will not be practical in all cases due to the intensity of construction noise sources (80 to 90+ dB at 50 FT distance), and due to the exterior nature of the work (pile driving, grading and earth moving, trenching, concrete pouring, hammering, etc.). The use of properly muffled construction equipment should be required on the job site. In addition, if soil conditions allow, the use of vibratory pile driving equipment is also recommended for minimizing construction noise impacts. The incorporation of State Department of

FIGURE 7

CONSTRUCTION NOISE LEVELS VS. DISTANCE



Health construction noise limits and curfew times, which are applicable on the island of Oahu (Reference 9), is another noise mitigation measure which can be applied to this project. TABLE 7 depicts the allowed hours of construction for normal construction noise (levels which do not exceed 95 dB at the project's property line) and for construction noise which exceeds 95 dB at the project's property line. Noisy construction activities are not allowed on holidays under the DOH permit procedures.

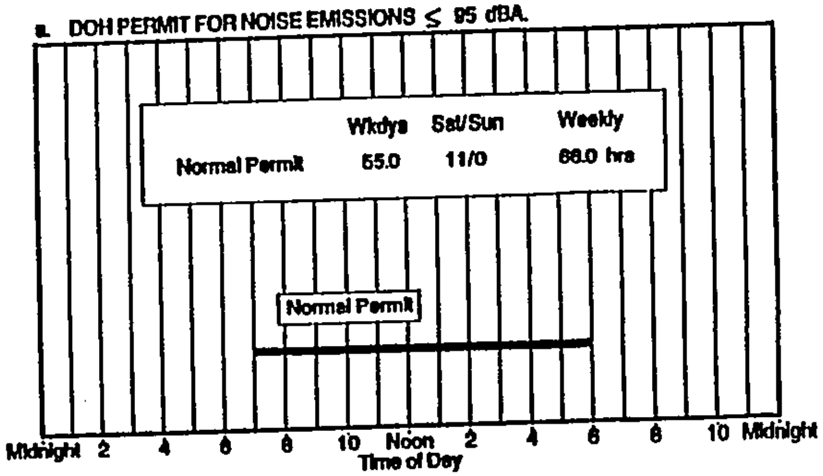
<u>Aircraft Noise.</u> Future aircraft noise levels over the project site are predicted to be less than 55 Ldn based on noise contour modeling of worst case forecasts of 2,160,000 enplanements plus deplanements at the West Maui Airport. At this very high level of activity at the West Maui Airport, the 55 Ldn noise contour should not extend south beyond Puukolii Road and should not enter the project site. Existing and future aircraft noise levels over the project site are sufficiently below land use compatibility criteria, and impacts from aircraft noise over the project site are not expected. In addition, since aircraft noise levels are sufficiently below roadway traffic noise levels by at least 10 Ldn units along the 65 Ldn traffic noise contour lines, their effect on total noise levels will be negligible. Because fixed wing aircraft which occasionally operate at the crater airstrip may overfly proposed residential areas to the west (makai) of the airstrip at low altitudes, complaints regarding these overflights can be expected. In order to minimize the risks of these complaints, a vacant flight corridor should be provided along the western (makai) extension of the airstrip's centerline. In addition, adequate disclosure of these agricultural aircraft operations should be provided to potential purchasers of the residences near the airstrip.

<u>Cane Haul Road Noise.</u> The proposed project's Master Plan assumes that the makai/mauka haul roads crossing the project site will be relocated, and that the existing north/south haul roads will be consolidated into one north/south road along the western

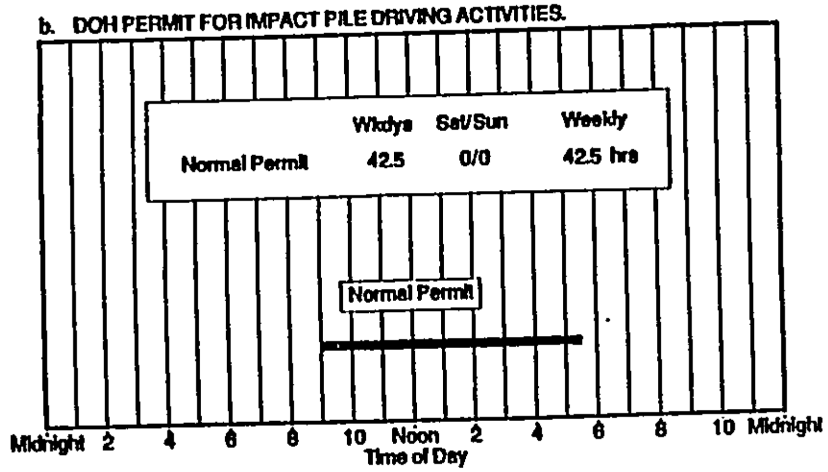
TABLE 7

AVAILABLE WORK HOURS UNDER DOH PERMIT PROCEDURES FOR CONSTRUCTION NOISE

a. DOH PERMIT FOR NOISE EMISSIONS ≤ 95 dBA.



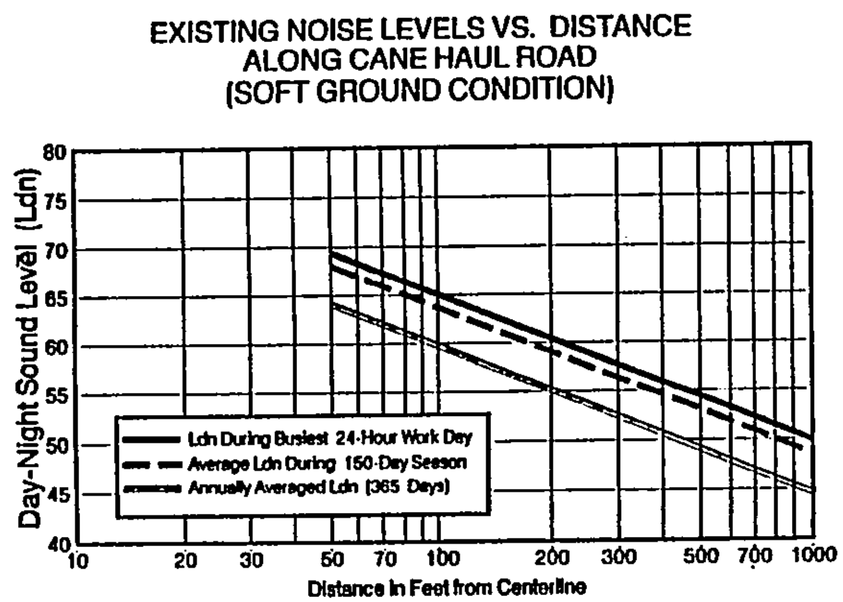
b. DOH PERMIT FOR IMPACT PILE DRIVING ACTIVITIES.



edge of the project site. Under these assumptions, all of the mill trucks traveling to the fields north and east of the project site will use the single north/south haul road. The following additional assumptions were used in computing the existing Ldn values associated with haul truck noise:

- o Total cultivated area serviced by haul roads north of mill: 4,300 acres.
- o Field harvesting cycle: Every two years.
- o Total cane haul truck loads per acre harvested: 3.5 loads (or inbound trips) per harvested acre.
- o Total hauling (work) days per harvesting season: 150 days per season.
- o Total 24-hour (3-shift) hauling days per harvesting season: 150 days per season.
- o Maximum number of loads during 24-hour hauling day: 44 daytime (7:00 AM to 10:00 PM) loads, and 27 nighttime (10:00 PM to 7:00 AM) loads from fields north of the mill.
- o Average daily number of loads during 150 day harvesting season: 30 daytime loads, and 20 nighttime loads from fields north of the mill.
- o Annually averaged (365 days/year), daily number of loads on north mill entrance road: 12 daytime and 8.2 nighttime;

8 During a peak harvesting day of 24-hour operation, haul road noise levels could exceed 65 Ldn within 100 FT setback distance from the haul road's centerline. However, average Ldn values for the 150 day harvest season or for the 365 day annual period do not exceed 65 Ldn at setback distances of 100 FT (see FIGURE 8). Under the preferred development alternative for the proposed project, a minimum 100 FT setback distance from the centerline of the haul road will be maintained for residences, and haul road noise levels will be in the "Moderate Exposure, Acceptable" category at the proposed residential lots closet to the haul road. Under these conditions, the use of berms or sound attenuating walls will not be required to meet FHA/HUD noise standards.



EXISTING NOISE LEVELS VS. DISTANCE
ALONG CANE HAUL ROAD (SOFT GROUND CONDITIONS)

FIGURE 8

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control"; Federal Interagency Committee on Urban Noise; June 1980.

(2) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B"; U.S. Department of Housing and Urban Development; July 12, 1979.

(3) "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety"; Environmental Protection Agency (EPA 550/9-74-004); March 1974.

(4) Act 208, Session Laws of Hawaii 1987; Fourteenth Legislature, State of Hawaii; June 7, 1987.

(5) Barry, T. and J. Reagan, "FHWA Highway Traffic Noise Prediction Model"; FHWA-RD-77-108, Federal Highway Administration; Washington, D.C.; December 1978.

(6) Traffic Impact Report for Lahaina Master Planned Project; Parsons Brinckerhoff Quade & Douglas, Inc.; November 1989.

(7) July 14-15, 1987 24-Hour Traffic Counts; Honoapiilani Highway at Lahainaluna Road; Hawaii State Department of Transportation.

(8) July 15-16, 1987 Vehicle Type Classification; Honoapiilani Highway at Kaanapali Parkway and Halelo Street; Hawaii State Department of Transportation.

(9) "Title 11, Administrative Rules, Chapter 43, Community Noise Control for Oahu"; Hawaii State Department of Health; November 6, 1981.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

TERM	SYMBOL
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78, NOISE REGULATION REPORTER.

APPENDIX B (CONTINUED)

TABLE II
RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level[4] Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_d	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average value over (non-time domain) set of observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level exceeded x% of the total set of (non-time domain) observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

STUDY OF ACOUSTICAL COMPATIBILITY OF LAHAINA CIVIC AND RECREATION CENTER WITH THE LAHAINA MASTER PLANNED PROJECT
Wahikuli, Maui

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DECEMBER 1989

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CHAPTER I. SUMMARY

Potential noise impacts and complaint risks associated with recreational activities at the Lahaina Civic and Recreation Center were evaluated in respect to proposed housing developments of the Lahaina Master Planned Project. Specifically, the acoustical emissions from activities at the center's amphitheater, gymnasium, and tennis courts were evaluated. Potential noise impacts from activities at the gymnasium and outdoor tennis courts were not considered to be serious. The potential impacts from loud concerts at the amphitheater were identified as a major concern, and possible noise mitigation measures were suggested.

CHAPTER II. PURPOSE

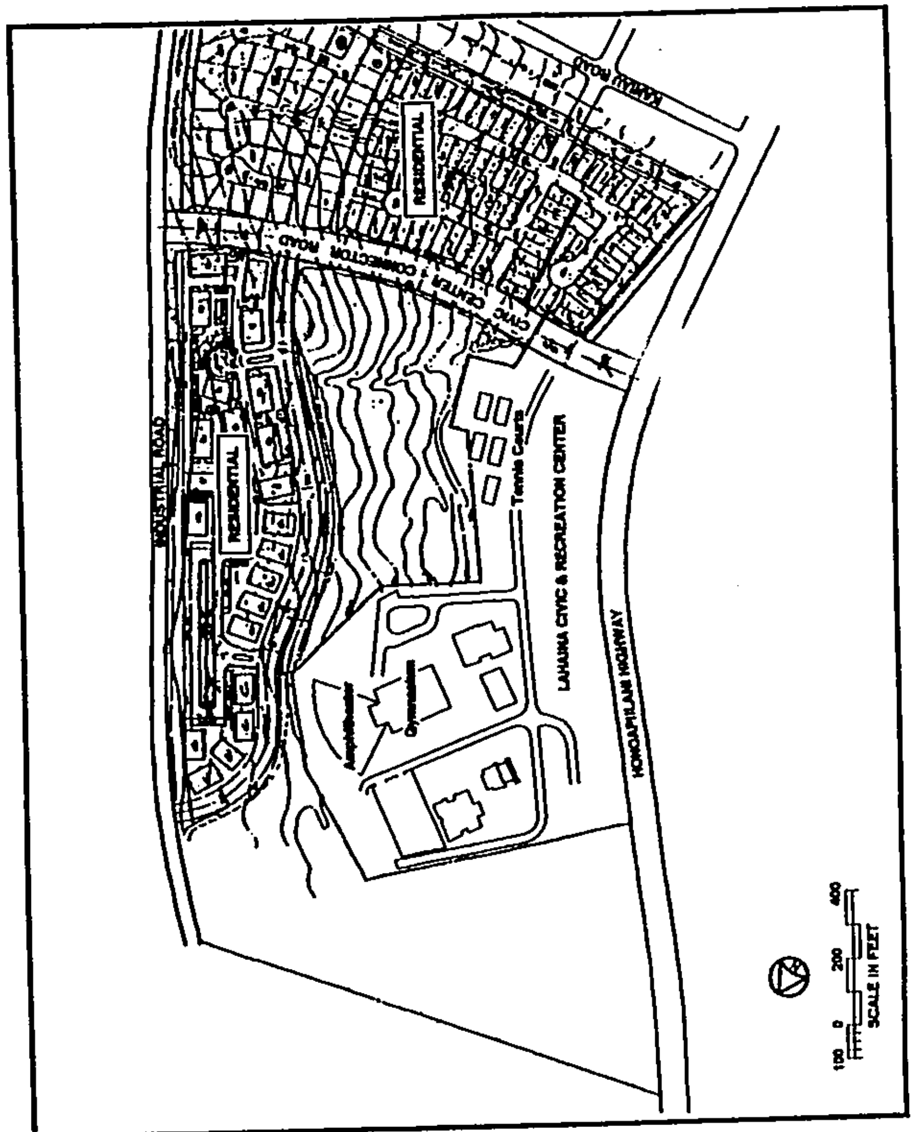
The purpose of this study was to describe and evaluate the potential noise impacts from activities at the Lahaina Civic and Recreation Center on single and multifamily developments of the proposed Lahaina Master Planned Project. Specifically, activities at the amphitheater, gymnasium, and tennis courts were of concern. Possible noise mitigation measures were to be provided as appropriate.

CHAPTER III. GENERAL STUDY METHODOLOGY

Analysis of potential noise impacts from the louder recreational activities at the Lahaina Civic and Recreation Center were made to determine risks of adverse noise impacts on the proposed noise sensitive areas at the Lahaina Master Planned Project (see FIGURE 1). The analysis was limited to the evaluation of noise impact risks associated with rock and other music concerts at the outdoor amphitheater, sports events and large assemblies within the gymnasium, and matches on the 5 tennis courts of the civic center. It was assumed that these activities at the center do not normally occur after 10:00 PM or prior to 7:00 AM. The possible methods of containing on-site sounds and minimizing sound spillage into the adjoining project areas were examined, as were the additional sound attenuation benefits of a wall or landscaped berm located at the rear (mauka end) of the amphitheater.

Sound levels associated with the louder activities at the amphitheater and gymnasium were predicted after evaluating sound level measurements which were obtained at the Lahaina Civic and Recreation Center on December 2, 1989. During the early afternoon of December 2, a rock group was practicing at the amphitheater, and during the evening of December 2, the scoreboard horn and crowd noise were measured during two high school basketball games at the gymnasium. Sound levels associated with play on the civic center's 5 tennis courts were estimated using sound level measurements obtained at the Diamond Head Tennis Center on Oahu. Sound level contours were then developed around the amphitheater, gymnasium, and tennis courts for expected worst case sound emission levels from the facilities.

The risks of adverse noise impacts on future project residents and risks of complaints from these future residents were evaluated using these sound level contours, the measured levels of existing background ambient noise levels, and existing State Department of Health property line noise limits which are applicable on the island of Oahu.



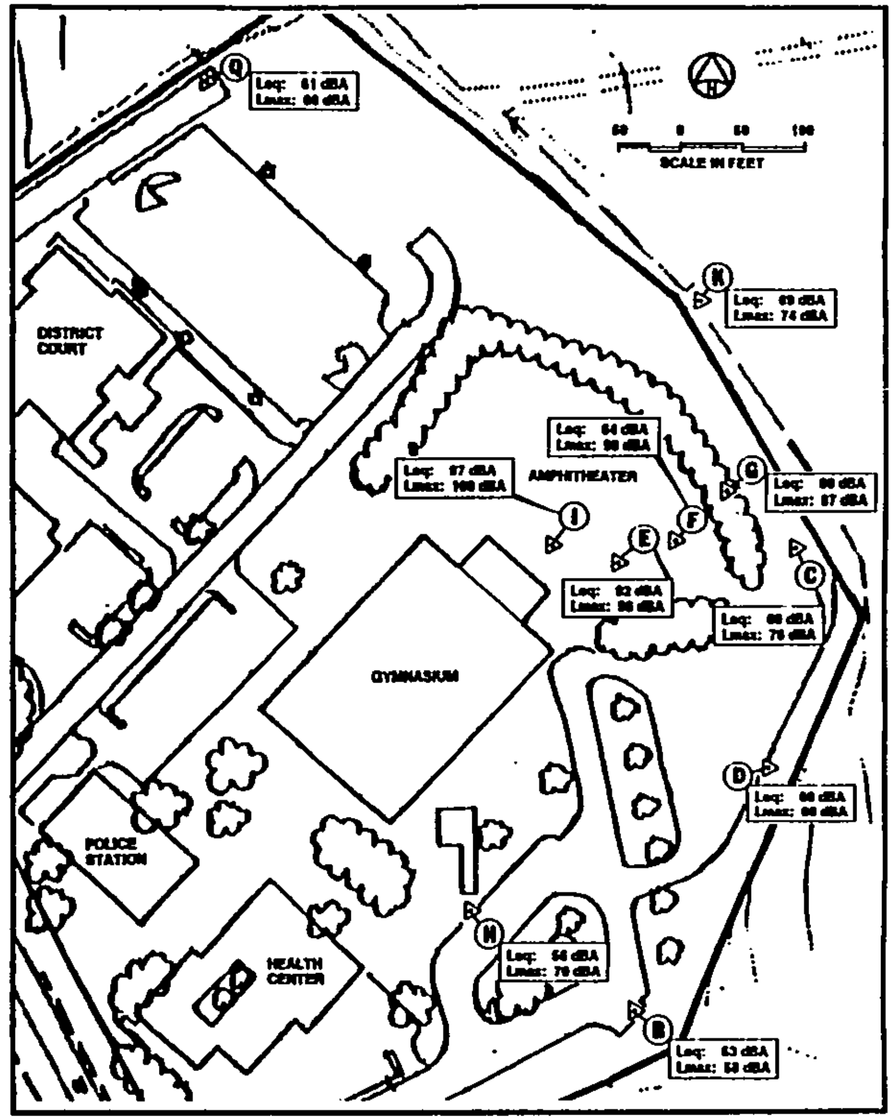
RELATIONSHIP OF PROJECT TO LAHAINA CIVIC AND RECREATION CENTER

FIGURE 1

CHAPTER IV. POTENTIAL NOISE IMPACTS FROM AMPHITHEATER CONCERTS

The on-site facility with the highest potential for causing noise impacts on future noise sensitive communities of the proposed project is the outdoor amphitheater. Approximately 6 times a year, rock music concerts are held at the amphitheater. In addition, the amphitheater is also used for practice sessions by musicians or community groups, festivals, and other concerts. Average and maximum sound levels measured during a rock group practice session at the amphitheater on December 2, 1989 are shown in FIGURE 2 at measurement locations "B" thru "Q". Maximum sound levels (Lmax) measured within the amphitheater ranged from 90 to 100 dB, which were typical of levels during actual rock concerts. The daytime background ambient noise environment at the mauka side of the Lahaina Civic and Recreation Center ranged from 40 to 50 dB, which is considered to be very quiet.

Based on the measurements shown in FIGURE 2, sound level contours of average (or Leq) rock music levels were constructed around the amphitheater as shown in FIGURE 3. The maximum (Lmax) sound levels are estimated to be approximately 5 dB greater than the average contour values shown in FIGURE 3. It should be noted that applicable State Department of Health daytime noise limits for single and multifamily dwelling areas are 55 and 60 dB, respectively, and these levels are not to be exceeded more than 10 percent of the time. The sound level contours of FIGURE 3 do not take into account any beneficial noise shielding effects which may be present, particularly following project development. However, if the 55 dB average sound level contour in FIGURE 3 is used as an approximate complaint risk threshold, risk of complaints during rock music concerts are expected to be high if noise sensitive developments are constructed within 1,400 to 2,000 FT distance east (or mauka) and within 800 to 1,200 FT distance south of the amphitheater stage. During other (such as Hawaiian) music concerts, the sound level contours are expected to be approximately 10 to 15



LOCATIONS AND RESULTS OF ROCK MUSIC SOUND LEVEL MEASUREMENTS (DECEMBER 2, 1989)

FIGURE 2

PREDICTED AVERAGE SOUND LEVEL CONTOURS DURING A ROCK MUSIC CONCERT AT THE AMPHITHEATER

FIGURE 3

dB less than those shown in **FIGURE 3**, and the high complaint risk zone would be reduced to a smaller area within 1,000 FT east and 600 FT south of the stage.

Based on the results of **FIGURE 3**, as well as predicted sound levels from other non-rock music concerts, approximately 50 to 75 percent of the project's proposed residential development between Industrial Road and the civic center would probably be in the high complaint risk zone during concerts at the amphitheater. The current policy at the center is to limit attendance at the concerts to approximately 1,800 and to not schedule the concerts when other events are scheduled at the gymnasium or meeting rooms of the civic center. The county cannot exclude rock concerts from the facility, but due to other factors besides noise, does not encourage use of the amphitheater for rock concerts.

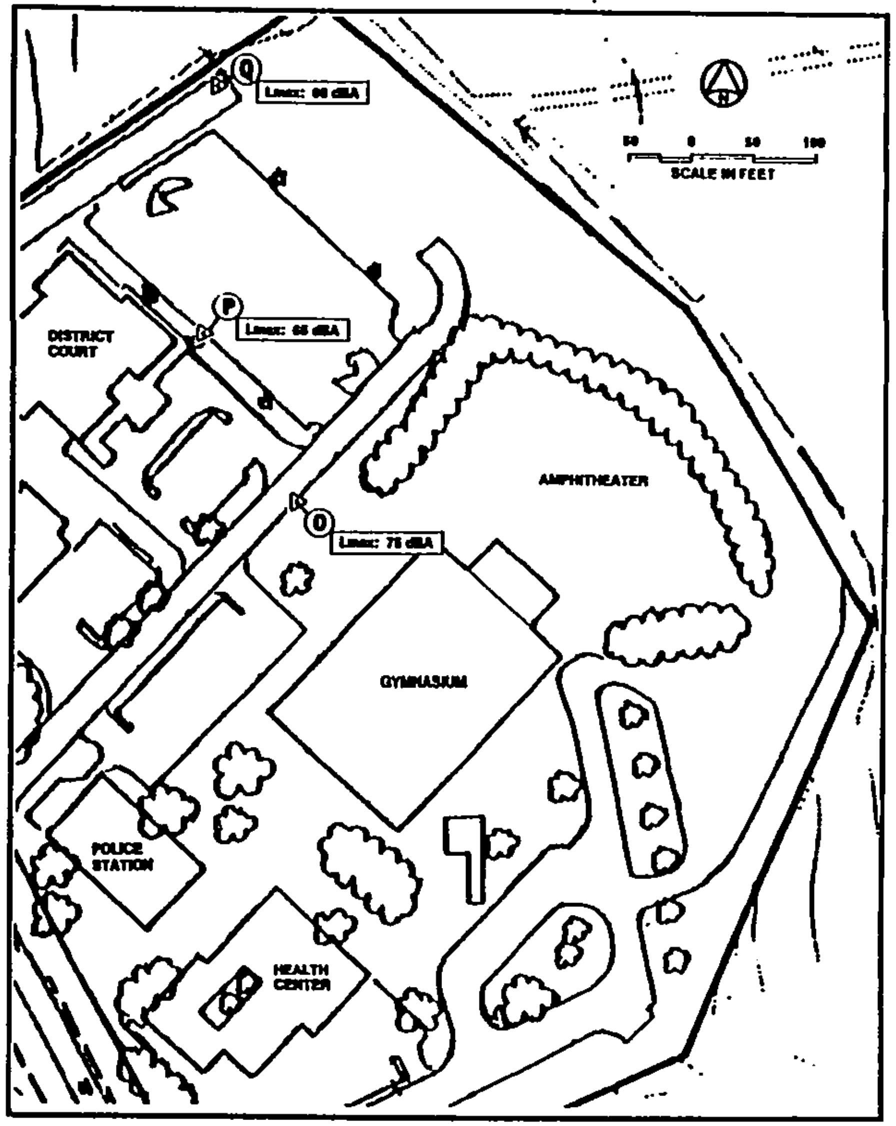
If residences are developed within the high complaint risk zones identified by the 55 dB contour of **FIGURE 3**, conflicts between the project residents and the civic center management would probably result. In the area west (or makai) of Industrial Road, the expected sound levels from the loud concerts are sufficiently above background ambient noise levels and State DOH limits for Oahu, such that these complaints would be difficult to dismiss as being unreasonable. Over a period of time, if the complaints continue, the utilization of the amphitheater by loud concerts or events would probably decline from their current low levels. During special events, where obvious public benefits occur as a result of loud concerts, complaint risks could be lower than those previously assumed. However, because of these potential noise complaints, it is expected that the amphitheater operations will ultimately be impacted by the proposed multifamily residential development on the east (or mauka) side of the amphitheater.

CHAPTER V. POTENTIAL NOISE IMPACTS FROM GYMNASIUM EVENTS

The gymnasium at the Lahaina Civic and Recreation Center is primarily used for basketball games, and occasionally used for volleyball games and convention meetings. The existing, resilient wood floor of the gymnasium tends to inhibit more general and varying uses on a regular basis. All music concerts are scheduled at the outdoor amphitheater rather than within the gymnasium. The loudest sound source within the gymnasium is probably the basketball scoreboard's horn, which was measured at 95 to 97 dB at the center section of the top row of the bleachers. Maximum crowd noise levels within the gymnasium probably approaches 90 to 95 dB during capacity conditions of approximately 4,300 persons, but probably do not exceed the sound level of the horn. The more frequent local basketball games draw small crowds of less than 1,000 fans, but the annual Maui Classic Basketball Tournament can fill the gymnasium to capacity.

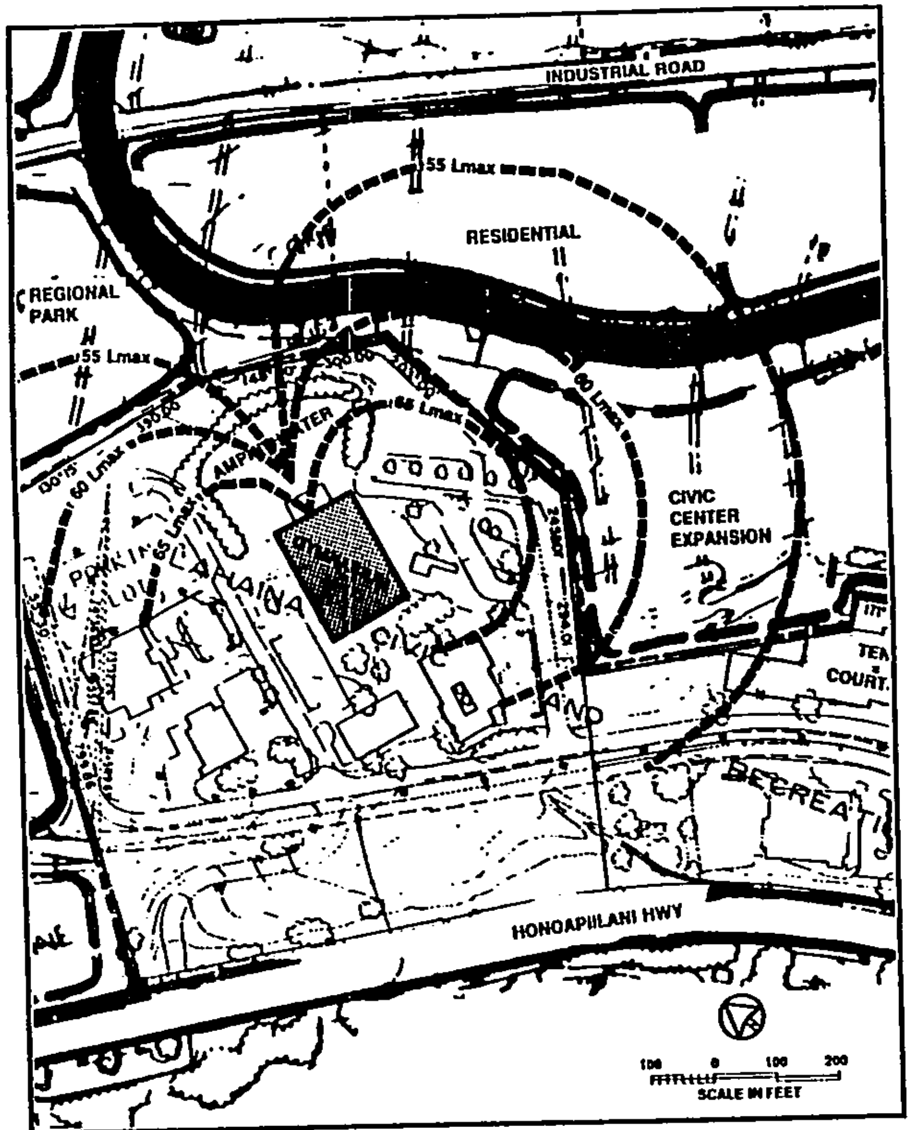
If the gymnasium was air conditioned, potential sound spillover into the proposed housing project would probably not be a major concern. However, because the gymnasium is naturally ventilated, with jalousie windows on its east, west, and south walls, sounds originating inside the gymnasium will escape and propagate outdoors. The maximum (Lmax) sound levels of the game horn were measured on December 2, 1989 outside the gymnasium at Locations "O," "P," and "Q", with resulting maximum sound levels as shown in FIGURE 4. After comparing the interior and exterior measurements of the horn, it was determined that approximately 13 dB of sound attenuation was provided by the exterior walls and ventilation openings of the gymnasium. Based on these measurements, the maximum exterior noise level contours associated with events at the gymnasium were developed as shown in FIGURE 5.

Based on the location of the 55 dB contour shown in FIGURE 5, there is a risk of noise complaints within the project area west of Industrial Road in respect to the basketball game horn. Be-



LOCATIONS AND RESULTS OF GYMNASIUM SCOREBOARD HORN MEASUREMENTS (DECEMBER 2, 1989)

FIGURE 4



PREDICTED MAXIMUM SOUND LEVEL CONTOURS FOR SCOREBOARD HORN OUTSIDE THE GYMNASIUM

FIGURE 5

cause of its intermittent use, however, it is unlikely that the game horn would exceed the DOH noise limits of 55 and 60 dB more than 10 percent of the time. Therefore, the basketball game horn is not considered to be a serious problem in respect to generating adverse noise impacts on proposed project residents.

During low attendance events at the gymnasium, such as during local basketball games, crowd noise is expected to be 10 to 15 dB less than the contour values associated with the game horn as depicted in **FIGURE 5**. Therefore, the 55 and 60 dB noise contours associated with low attendance crowds at the gymnasium should not extend into the proposed housing project, and should not generate risks of adverse noise impacts on future project residents.

During capacity attendance events at the gymnasium, such as the Maui Classic, crowd noise is expected to be approximately 5 dB less than the contour values associated with the game horn shown in **FIGURE 5**. Even during capacity crowd events at the gymnasium, the 55 and 60 dB noise contours associated with crowd noise emanating from the gymnasium should not extend into the proposed housing project, and should not generate risks of adverse noise impacts on future project residents.

Because of the low background ambient noise levels in the project area mauka and south of the gymnasium, crowd noise, officials' whistles, and the game horn will be intermittently audible at the proposed residential area west of Industrial Road. Under these conditions, it will not be possible to eliminate all risks of complaints regarding spillover noise from the gymnasium. However, because of the relatively low level of noise emissions expected from the gymnasium, these complaints are expected to be manageable, and are not expected to adversely impact gymnasium operations. For these reasons, special mitigation measures for gymnasium noise emissions are not required.

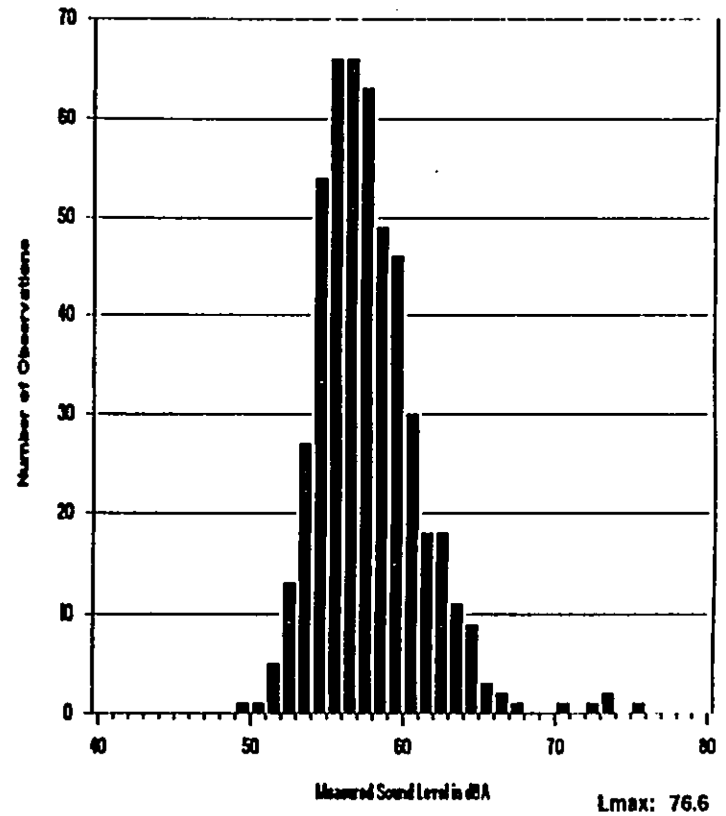
CHAPTER VI. POTENTIAL NOISE IMPACTS FROM TENNIS COURTS

There are 5 tennis courts (with night lights) located at the south end of the Lahaina Civic and Recreation Center. Measured sound levels during a tennis match at the Diamond Head Tennis Center on Oahu (see FIGURE 6) were used to develop the potential noise contours associated with play on the civic center's 5 tennis courts. These noise contours are depicted in FIGURE 7, and were developed using the L10 noise descriptor, and represent the predicted noise levels which are expected to be exceeded 10 percent of the time when all 5 of the courts are in use. The State DOH noise limit for single family residential districts is 55 dB, or 55 L10. The average noise levels (or Leq) associated with play on the tennis courts are approximately 5 to 7 dB less than the L10 contour values shown.

The proposed project's residential development located south of the tennis courts is located outside the 55 L10 contour of FIGURE 7. Based on these results, it was concluded that risks of adverse noise impacts on the proposed housing project from matches at the tennis courts should be low. It should also be noted that background ambient noise levels in the project's residential area south of the tennis courts are expected to increase above current levels due to future traffic on the proposed Civic Center Connector Road. For these reasons, special noise mitigation measures are not considered necessary for reducing noise impacts from the 5 tennis courts.

FIGURE 6

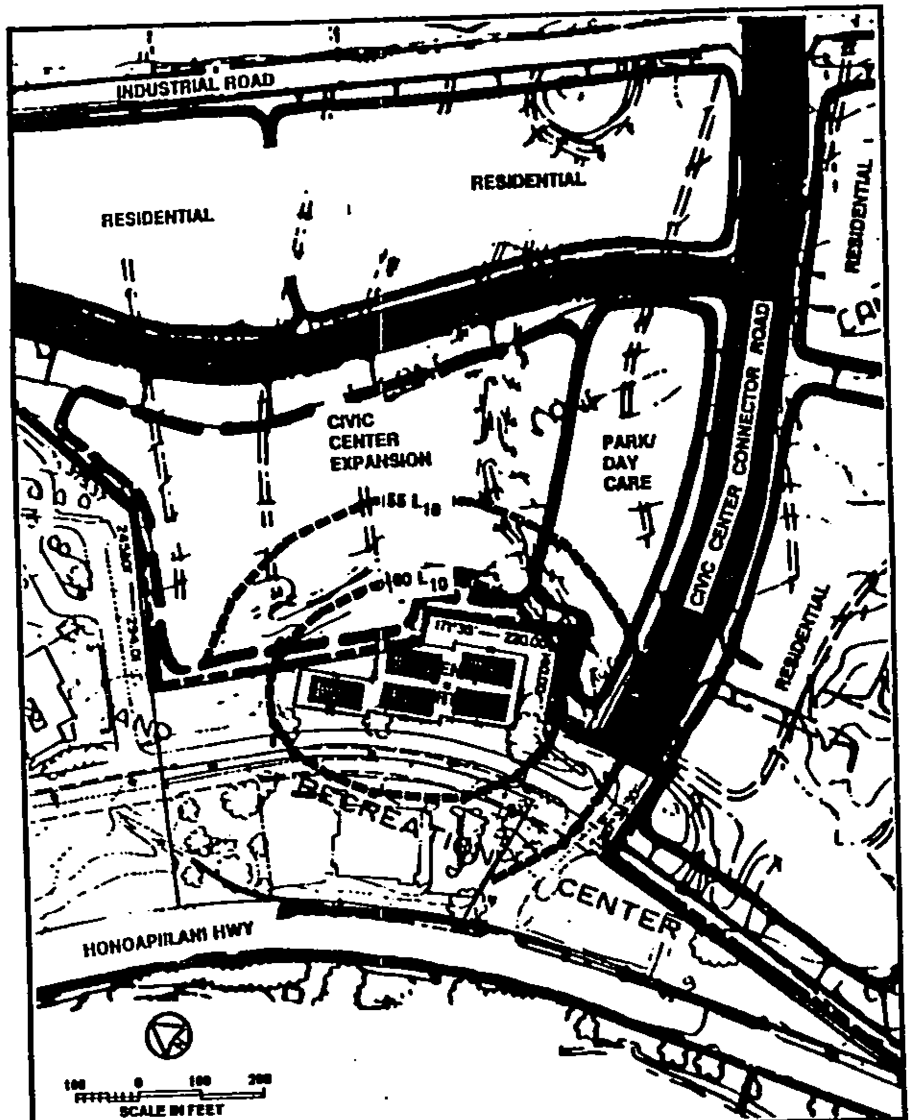
HISTOGRAM OF SOUND LEVELS MEASURED AT 70 FEET FROM THE CENTER OF A TENNIS COURT



Date: February 5, 1988

Meter Response: Fast

Lmax: 76.6
Leq: 55.3
Lmin: 45.6
L10: 62.0



CONTOURS OF TENNIS COURT SOUND LEVELS WHICH ARE PREDICTED TO BE EXCEEDED TEN PERCENT OF THE TIME

FIGURE 7

CHAPTER VII. POSSIBLE NOISE MITIGATION MEASURES

Noise mitigation measures are suggested in respect to minimizing adverse noise impacts and complaint risks associated with concerts held at the amphitheater. Maximizing the amount of buffer space within the amphitheater's noise contours of FIGURE 3 and to the project's noise sensitive developments is recommended. Although it may be unrealistic to expect that the very large buffer distances (1,400 to 2,000 FT) required to accommodate rock music concerts can be provided, any increase of buffer distances to proposed noise sensitive dwellings would ultimately result in reducing the future constraints and limitations on the types of activities which could be held at the amphitheater.

The construction of walls mauka of the amphitheater and near the center's mauka boundary line can be partially beneficial in reducing the noise contours of FIGURE 3 under certain conditions, and particularly if project dwellings west and southwest of the amphitheater are of single story construction. A 6 to 10 FT high CMU wall constructed along the 95 to 100 FT topographic map contour lines could attenuate amphitheater music levels by approximately 5 to 8 dB at proposed project dwellings on the mauka side of the wall. In order to achieve significantly higher attenuations of 13 to 16 dB at project residences mauka of the wall, heights in the order of 15 to 20 above grade would be required of the wall. The negative aesthetic properties of the wall may be mitigated by use of a earth berm. However, it may not be possible to accommodate the large footprint required for a berm of this height. If multistory or other elevated structures are used for project dwellings west and southwest of the amphitheater stage, the attenuation performance of the walls would be significantly less than those listed above, and construction of a wall for noise mitigation purposes would not be a possible mitigation measure.

The installation and use of a distributed outdoor speaker system within the amphitheater complex would also contribute towards minimizing sound spillover from the amphitheater. This type of speaker system is generically different from the point source speaker systems which are temporarily located on the amphitheater stage. The point source speaker system located on the stage must generate high sound levels to illuminate the rear rows of the audience approximately 150 to 175 FT away with adequately amplified sound levels. In contrast to this, a distributed speaker system can reduce the high sound spillover characteristic of a point source system by 10 to 20 dB. By locating the speakers closer to the audience and thus reducing the throw distances between the speakers and the audience, lower sound levels need to be projected from each of the distributed system speakers while producing equivalent levels of sound at the audience. In this respect, the distributed sound system is similar to the pole mounted, movable automobile speakers used in drive-in theaters. Additional reduction of spillover sound toward the west and southwest directions is possible by taking advantage of speaker directivity characteristics, and by projecting the sound from the rear quarter and/or downward into the audience areas. The primary disadvantages of a distributed speaker system are that source localization by the listener (or the ability to tell where the sound is coming from) may not be possible, and the distances to the reverberant field can be shortened and decrease articulation. However, the installation of a distributed sound system has the potential to decrease sound spillover levels by amounts equal to those possible from high walls or earth berms.

Another possible mitigation measure is to increase the sound attenuation characteristics of the project dwellings which are proposed to be located within the amphitheater noise contours. A desirable goal is to reduce the predicted exterior music levels (77 to 55 dB) to approximately 45 dB within the interiors of the dwellings. This goal requires that the project structures provide between 10 to 32 dB of sound attenuation. Because a typical naturally ventilated structure will provide approximately 10 dB of

exterior-to-interior noise reduction, special construction in the form of closure, air conditioning, insulated double wall/roof construction, and thick, laminated glazing could be required for those dwellings which are exposed to music levels above 55 dB.

The remaining mitigation measure is to improve the existing gymnasium so that it can accommodate loud music concerts. The existing structure, with concrete floor and CMU walls, has the potential to be adequately sound sealed, although the wood deck roof may need to be supplemented with additional sound attenuating materials. The gymnasium would need to be provided with the capability for total closure and air conditioning, and would also need to be provided with a multipurpose floor system to accommodate other more abusive uses. Ultimately, this may be the best long term mitigation measure, particularly if adequate buffer distances cannot be achieved between the amphitheater and the project, and if other noise sensitive developments occur in areas north and northwest of the amphitheater.