1996 - Oahu - FEIS -
East Kapolei II

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FINAL
ENVIRONMENTAL IMPACT STATEMENT

# EAST KAPOLEI PROJECT

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VOLUME 2
APPENDICES

SCHULER HOMES, INC.

APRIL 1996

FINAL
ENVIRONMENTAL IMPACT STATEMENT

# EAST KAPOLEI PROJECT

EWA, ◊ OAHU, ◊ HAWAII

VOLUME 2
APPENDICES

PREPARED FOR: SCHULER HOMES, INC.
PREPARED BY: HELBER HASTERT & FEE, PLANNERS
FOR SUBMITTAL TO: PLANNING DEPARTMENT CITY & COUNTY OF HONOLULU
IN SUPPORT OF: EWA DEVELOPMENT PLAN LAND USE MAP AMENDMENT

APRIL 1996

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# A

## Letter from Stephen H. MacMillan, Chief Operating Officer, The Estate of James Campbell, dated October 30, 1995

THE ESTATE OF JAMES CAMPBELL

October 30, 1995

Ms. Cheryl Soon
Chief Planning Officer
Planning Department
City and County of Honolulu
650 South King Street
Honolulu, HI 96813

Dear Ms. Soon:

Subject: Development Plan Land Use Amendment Review at Kapolei, Ewa, Oahu

The Estate of James Campbell hereby authorizes Schuler Homes, Inc. to file a Development Plan Application for the 1996 Development Plan Land Use Amendment Review on approximately 577 acres of land at Honouliuli, Ewa, Oahu (TMK 9-1-17:04 Portion, 9-1-10:02 Portion, 9-1-18:01 Portion, 9-2-02:01 Portion and 9-2-04:05 Portion).

Should you have any questions regarding this matter, please feel free to contact Mr. David Rae at 674-3117.

Very truly yours,

Stephen H. MacMillan
Chief Operating Officer

ks:01033200\K10590

cc: Schuler Homes, Inc.

1001 Kamokila Boulevard, Kapolei, Hawaii 96707 Phone (808) 674-6674 Facsimile (808) 674-3111

# B

LETTER FROM MICHAEL D. WILSON, DEPARTMENT OF LAND AND NATURAL RESOURCES, TO CHERYL SOON, CHIEF PLANNING OFFICER, PLANNING DEPARTMENT, DATED NOVEMBER 21, 1995.

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

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

MICHAEL D. WILSON
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY DIRECTOR
GILBERT S. COLOMA-AGARAN

AGRICULTURE DEVELOPMENT PROGRAM
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CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION PROGRAM
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

CO:gb

November 21, 1995

Ms. Cheryl Soon
Chief Planning Officer
Planning Department
City and County of Honolulu
650 S. King Street
Honolulu, HI 96813

Dear Ms. Soon:

Re: Development Plan Land Use Amendment Review at Kapolei, Ewa, Oahu

The Department of Land and Natural Resources hereby authorizes Schuler Homes, Inc., to file a Development Plan Application for the 1996 Development Plan Land Use Amendment Review on approximately 183 acres of land at Honouliuli, Ewa, Oahu (TMK 9-1-17:04 portion).

Should you have any questions regarding this matter, please feel free to contact Mr. Dean Uchida at 587-0446.

Very truly yours,

GILBERT S. COLOMA-AGARAN
for Michael D. Wilson

c: Schuler Homes, Inc.

# C

MEMORANDUM FROM DON HIBBARD, ADMINISTRATOR, STATE HISTORIC PRESERVATION DIVISION, DEPARTMENT OF LAND AND NATURAL RESOURCES, DATED SEPTEMBER 22, 1994.

LETTER FROM DON HIBBARD, ADMINISTRATOR, STATE HISTORIC PRESERVATION DIVISION, DEPARTMENT OF LAND AND NATURAL RESOURCES, DATED DECEMBER 4, 1995.

JOHN WAIHEE
GOVERNOR OF HAWAII

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

KEITH AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCE

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JOHN P. KEPPELER II
DONA L. HANAIKE

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CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

September 22, 1994

Joseph Kennedy
Archaeological Consultants of Hawaii
59-624 Pupukea Rd.
Haleiwa, Hawaii 96712

**LOG NO: 12769**
**DOC NO: 9409TD21**

Dear Mr. Kennedy:

SUBJECT: **Historic Preservation Review--Preliminary Concept Plan for East Kapolei Project (Schuler Homes, Inc.)**
**Honouliuli, `Ewa, O`ahu**
**TMK: 9-1-17: por. 4**

Thank you for the opportunity to review this proposed project. A review of our records shows that there are no known historic sites at the project location shown on your map. These lands were commercially cultivated with sugar cane for many years and it is unlikely that significant historic sites will be found on them. We believe that this project will have "no effect" on historic sites.

If you have any questions please call Tom Dye at 587-0014.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:jk

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

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

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

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GILBERT COLOMA-AGARAN

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

December 4, 1995

DEC - 8 1995

Leslie Kurisaki
Project Planner
Helber Hastert & Fee
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

LOG NO: 16007
DOC NO: 9511TD31

Dear Ms. Kurisaki:

SUBJECT: East Kapolei Project
Honouliuli, `Ewa, O`ahu
TMK: 9-1-17: por. 4; 9-1-18: por. 1; 9-2-2: por. 1; 9-2-4: por. 5; 9-1-10: por. 2

Thank you for the opportunity to review the revised concept plan for this development with the new project boundaries. A review of our records shows that the new project boundaries take in old sugar cane lands. Thus, our original review of this project is adequate.

A review of our records shows that there are no known historic sites at the project location shown on your map. These lands were commercially cultivated with sugar cane for many years and it is unlikely that significant historic sites will be found on them. We believe that this project will have "no effect" on historic sites.

If you have any questions please call Tom Dye at 587-0014.

Aloha,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:jk

# D

## East Kapolei Project Market Assessment Report, October 1994; East Kapolei Project Limited Scope Update of the Market Assessment, December 1995.

Gail W. Atwater, MBA, MURP, AICP

East Kapolei Project

# Market Assessment

Gail W. Atwater, AICP
Planning Consultant
October 1994

East Kapolei Project

# MARKET ASSESSMENT

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Section I

# INTRODUCTION

**Section I**

# INTRODUCTION

## OVERVIEW

Schuler Homes, Inc. proposes a residential development with minimal support retail uses on approximately 1022 acres of land in Ewa, Oahu. The subject property is divided into two contiguous parcels: a joint venture with Galbraith Trust (approximately 500 acres) in the southern portion and a parcel to be purchased from The Estate of James Campbell in the northern portion (approximately 522 acres).

Gail W. Atwater, AICP was contracted by Schuler Homes, Inc., to assess the market feasibility of residential and neighborhood retail developments on the property generally known as the East Kapolei Project. This report presents the results of that analysis.

## PURPOSE AND OBJECTIVES

The purpose of the Market Assessment was to evaluate the overall market potential of the subject property. This has been accomplished through an estimate of the absorption of the proposed land uses and an assessment of the property's relationship to other Oahu master planned communities. It should be noted that this is a market analysis and not an assessment of financial feasibility.

The specific objectives of the evaluation were to:

- **Conduct a Site Review and Analyze Existing Conditions.** This included evaluating the site relative to its development potential and analyzing general economic trends and indicators supporting residential and support (neighborhood) commercial development on the subject parcel.

- **Analyze Supply and Demand Conditions for Residential Development.** The supply analysis included evaluating planned and proposed projects. Demand analyses included reviewing relevant trends, analyzing the oversupply or shortfall of supply versus demand and describing the products and target markets for the subject property.

- **Estimate Absorption and Pricing for Residential Development.** This analysis included testing the developer's assumptions of absorption and pricing against existing and estimated market conditions. Prices are stated in 1994 dollars.

- **Evaluate Market Potential for Neighborhood Commercial Development on the Subject Property.** This analysis was based on general rules-of-thumb and an inventory of existing and planned support commercial in the project vicinity.

## METHODOLOGY

To accomplish the above objectives, the scope of work included, but was not limited to:

- Discussions with Schuler Homes, Inc., Hawaiian Trust Company, Ltd. and other consultants on the Environmental Impact Statement analytical team regarding the project and the property.

- Several inspections and evaluations of the site and its surrounding area in order to determine its physical attributes and relationship to other properties in the market. This evaluation did not include any engineering or environmental considerations, but encompassed an evaluation of the site's accessibility, visibility, proximity to towns and other developments, physical layout and appearance and their potential effect on the marketability of the property.

- Analyses of economic and demographic data pertaining to the market area and an evaluation of the present economic climate. These analyses were used in the estimation of future growth potential in the residential and support commercial markets.

- Analysis of housing supply based on published data and interviews with real estate agents and developers of residential projects which could be potentially competitive with the subject property. Additions to supply were based on public and private sources of information.

- Calculation of demand with guidance from the City and County of Honolulu General Plan and Land Use Model, in addition to the State of Hawaii's Series M-K population projections and other demographic documents prepared by public and private sources.

- Estimations of the subject property's performance, using capture rates and taking into consideration its attributes and disadvantages relative to competing projects and the historic performance of similar developments.

## Section II
# EXECUTIVE SUMMARY

Section II

# EXECUTIVE SUMMARY

## Property Location

One of the last major agricultural parcels remaining unplanned in Oahu's developing "second urban center" in Ewa, bordered by Farrington Highway to the north, the planned North South Road to the east, agricultural land to the west and the Ewa Villages golf course to the south. Site is approximately equidistant (2 to 2 1/2 miles) to Makakilo and Fort Weaver Road freeway interchanges.

## Size

Approximately 1,022 acres, divided into two contiguous parcels: a joint venture with Galbraith Trust (approximately 500 acres) in the southern portion and a parcel to be purchased from The Estate of James Campbell in the northern portion (522 acres).

## Physical Attributes

Relatively flat terrain on former coral plain which historically has been planted in sugarcane.

Limited access until construction of North South Road. Currently accessible through Farrington Highway which in turn provides access to H-1 via interchanges at Makakilo Drive to the west and Fort Weaver Road to the east.

Sunny, leeward-type climate

## Market Study Area

Master Planned Communities within the Ewa Development Plan Area and along the western H-1 corridor including the communities of Waikele and Royal Kunia.

## Economic

Moderate near term and strong long term growth trends in both commercial and residential indicators, with demonstrated pent-up residential and retail demand.

## Government Policy

State and County governments have established population allocation policies and invested capital in support of developing a second urban center and affordable housing in Ewa.

## Residential

| | | |
|---|---|---|
| Supply/Demand Shortfall, 1994 - 2010, Market Study Area | 8,509 - 13,322 units | |
| Demand for Additional Units, 1994 - 2010, Market Study Area (includes Ewa DP Area) | 36,070 - 40,883 units | |
| Demand for Additional Units, 1994-2010, Ewa DP Area Portion Only | 28,856 - 32,706 | |
| Planned Units East Kapolei Project | 2,590 | Single Family - Market Priced |
| | 1,810 | Townhomes - Market Priced |
| | 2,400 | Multifamily - Low Density Units (DU) - Market |
| | 200 | Multifamily - Medium DU - Market |
| | 2,000 | Multifamily - Medium DU - Affordable (up to 80% of median household income) |
| | 1,000 | Multifamily - Medium DU - Affordable (81-120% of median) |
| | 10,000 | Total |
| Year Sales Begin | 1997 | |
| Average Annual Absorption | 650 - 700 units | |
| Capture Rate of Market Study Area Residential Demand to 2010 | 25 to 30 percent | |
| Capture Rate of Oahu Residential Demand to 2010 | 12 to 14 percent | |

## Retail

| | |
|---|---|
| Potential Need for New Support Retail Space by 2010 | Up to 218,000 square feet within the deed restrictions of the subject property. Overall excess demand within subject's retail trade area is approximately 468,300 square feet by 2010. |
| **Target Tenants** | Supermarkets, drug stores, restaurants, surf and other small apparel shops, bars, photocopiers, dry cleaners. |

## Additional Uses

Recreation: Several community parks.

## Section III
# SITE DESCRIPTION

Section III

# SITE DESCRIPTION

## INTRODUCTION

**Oahu.** The subject property is located on the island of Oahu, whose name means "the gathering place" in Hawaiian. True to its appellation, the island serves as Hawaii's governmental, commercial and cultural center. Although the capital island possesses only ten percent of the State's land area, three-quarters of its population lives and works there.

**Ewa.** The subject property is located in the Ewa region of western Oahu. This region historically comprised the Hawaiian ahupuaa (mountain-to-sea division of land) known as Honouliuli. Much of this area has long been under the control of one major landowner, The Estate of James Campbell. According to government policy Ewa is destined to become the island's second urban center by early in the next century, with its focal point being the "City of Kapolei."

**Organization of this Section.** This section first discusses the project site in terms of location, boundaries, access, visibility and surrounding uses. This is followed by a presentation of regional context and plans for the second city.

## SITE LOCATION

The East Kapolei Project site is located in the eastern area of Ewa. The property is currently in agricultural use which is being phased out of sugarcane production. It is one of the last major unplanned agricultural parcels south of H-1 freeway.

Schuler Homes, Inc., partly through a joint venture with Galbraith Trust, is proposing residential development on approximately 1022 acres of land at the project site. Of the 1022 acres:

- 500 acres are owned by the State of Hawaii and are planned as Phase I of the proposed project. These lands are proposed for exchange with Galbraith Trust land holdings

which lay north of the town of Wahiawa in Central Oahu. Under the terms of this agreement, the Ewa acreage would be urbanized in exchange for the opportunity to retain the agricultural use of Galbraith's Wahiawa lands.

- An additional 522 acres, contiguous with the state's parcel, will be purchased from The Estate of James Campbell by Schuler Homes, Inc. These lands also are proposed for residential use as Phase II of the proposed project.

The project site and its relationship to the island of Oahu are shown on the following page in Exhibit III-1, *East Kapolei Project - Location Map*.

## SITE BOUNDARIES AND ACCESS

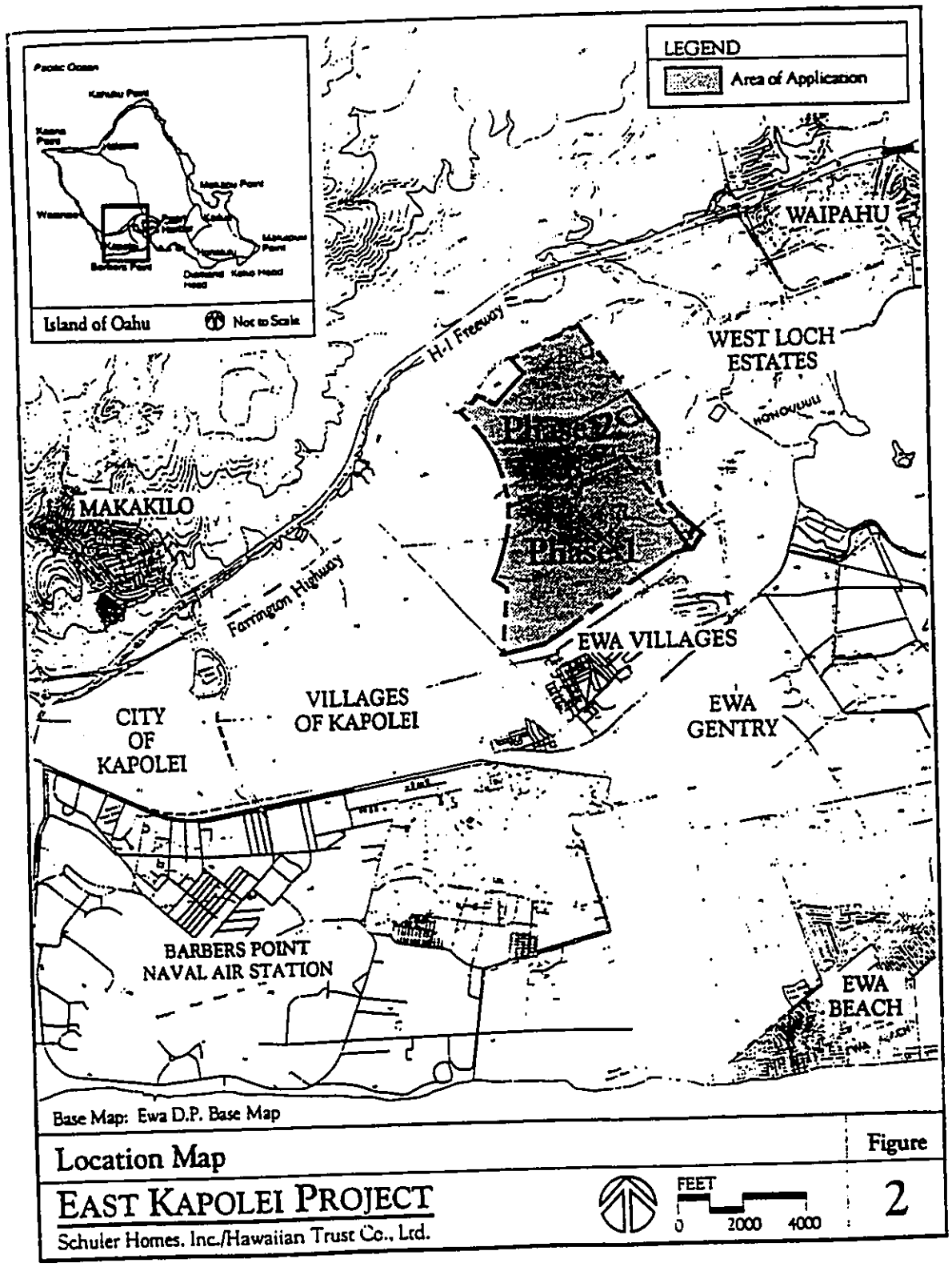
### Boundaries

The subject property lies south of Farrington Highway between Makakilo Drive and Fort Weaver Road. The irregularly-shaped parcel is bounded by Farrington Highway to the north, the planned North South Road to the west, remnants of a cane haul road known as Pipeline Road and agricultural land to the east and the golf course associated with the Ewa Villages residential project to the south. The site is approximately equidistant (two to two and a half miles) to the H-1 freeway interchanges at Makakilo and Fort Weaver Road.

### Access to the Site

The subject site is adequately served by existing roads, at least for Phase I which is planned using the southernmost 500 acres. Future improvements will make access excellent. These improvements include the construction of the North South Road, completion of Kapolei Parkway and widening of Farrington Highway. Following is a review of the major points of access to the project site, both existing and planned.

**Exhibit III-1**
**East Kapolei Project - Location Map**



*H-1 Freeway.* Oahu's first and primary interstate highway is located to the north of the parcel, providing a vital link to Central Oahu and the Primary Urban Center. There are two existing freeway interchanges in the subject property's vicinity: Makakilo Drive to the west and Fort Weaver Road to the east. Additionally an interchange is planned along the future North South Road.

*Farrington Highway.* This is a major arterial which will provide the primary access route for the subject development until construction of the North South Road. In the project vicinity, Farrington Highway is currently a two-lane, county-maintained highway that may be widened as an improvement associated with this project. After H-1, this road serves as the area's primary access to Waipahu and the Primary Urban Center. Farrington Highway also is the major local connection between the City of Kapolei and development in the West Loch Estates and Waipahu areas.

*North South Road.* This road is planned as the major feeder connecting H-1 with Farrington Highway in the north and a future section of the Kapolei Parkway in the south. The alignment of this road will approximate the western boundary of the subject parcel, as well as the eastern boundary of the planned campus of the University of Hawaii at West Oahu. It is expected that this road will facilitate regional transportation flow by alleviating traffic on Fort Weaver Road and Makakilo Drive.

*Kapolei Parkway.* Kapolei Parkway is partially constructed at this time. It is planned to provide a major connection between eastern Ewa and the City of Kapolei and the resort-oriented communities of Ewa Marina and Ko Olina.

*Project Access Roads.* Two access roads intersecting the North South Road are planned within the subject site.

## PROPERTY VISIBILITY

The subject property is visible but not easily defined when traveling southbound on H-1 and Farrington Highway. When traveling northbound, the project area is visible from the Ewa Villages golf course and residential areas.

The major view planes are toward downtown Honolulu and Diamond Head to the southeast and toward the Waianae Mountains to the north of the parcel. Due to the relatively flat topography, view planes of Honolulu will be obstructed by multi-story development for all parcels except those along the property's fringes. Views of the mountains will be obstructed to a much lesser degree.

## SURROUNDING USES

### Ewa Villages

To the south of the parcel are the existing clustered communities known as Ewa Villages. This residential area is separated from the subject parcel by a golf course being developed by the City and County of Honolulu, which plans to conduct a rehabilitation program for the existing "historic" plantation villages of Ewa. This master plan for Ewa Villages also includes development of additional single family residential units. The first new home models are nearing completion. For more information on Ewa Villages see Appendix A, *Competitive Product.*

### Other Uses

Aside from Ewa Villages, the lands surrounding the subject property all are currently in agricultural use. The most significant urbanization plan for these lands is the location of the University of Hawaii at West Oahu campus on the adjacent parcel to the west. This Site Description section concludes with

a discussion of specific plans for this campus and its possible impact on the subject property.

## REGIONAL CONTEXT

### The Second City at Kapolei

The development pattern of Oahu has always relied on employment and government services centered within the urban core of Honolulu. This pattern worked well until developable land dwindled in the central city and prices for commercial, industrial and residential land skyrocketed. Also, due to the building of bedroom communities throughout the island, traffic problems mounted between the outlying homes and the job center in Honolulu.

The location of a second city at Kapolei in the center of Ewa was conceived through a collaboration between The Estate of James Campbell, the State of Hawaii and the City and County of Honolulu. The Kapolei area includes land from Pearl Harbor's West Loch to Kahe Point and from the lower slopes of the Waianae Mountains to the West Oahu beaches and Barbers Point.

The main objectives of the building second city are:

> *To direct commerce, jobs and industry to West Oahu; and*
>
> *To direct population growth to "a vital new urban center where people can live, work and play."*
>
> (Source: "Kapolei: A New City Comes to Life," Hawaii Investor, 1993)

A regional plan for the Ewa area, entitled the Kapolei Area Long Range Master Plan, has been developed The Estate of James Campbell. However, earnest planning for the area can be traced back almost forty years:

*Employment Base.* Development of an employment base in Ewa dates back to 1955 when planners advised The Estate of James Campbell to develop an industrial complex on the western tip of Oahu, utilize prime beachfront areas as resort destinations and encourage the siting of a new university within Ewa.

- The industrial concept evolved into the James Campbell Industrial Park which opened in 1959 and has been a major center for heavy industry on the island ever since.

- Ewa Marina and Ko Olina emerged as the planned resort developments.

- The location of a major campus of the University of Hawaii in Ewa has only recently begun to appear likely.

*Second Urban Center at Ewa.* The origins of the full "second city" concept date back to 1974 when planner Donald Wolbrink authored the comprehensive and prescient study entitled "Honoululi: A Self-Contained City at Ewa." Current plans have much in common with this twenty year old study.

There are several critical differences between the second city and previous major developments on Oahu. First, there is a major regional plan which integrates the various land uses into an integrated whole, rather like the pieces of a mosaic creating a complete picture. This is not to be the building of one community, but an integration of many. Second, as the objectives above indicate, the second urban center is to be not only a residential development but also offer a range of employment opportunities. This employment-center orientation sets Kapolei apart from past developments which primarily provided housing and limited commercial facilities.

## The Evolution of Ewa

Ewa spent the first half of this century primarily as a sugar plantation bordered by the sea, Pearl Harbor, the rural community of Waianae and uninhabited hills and mountains.

In the late 1940s the U.S. military took over use of the site which is now the Naval Air Station at Barbers Point.

By the 1960s, James Campbell Industrial Park had been constructed and residential development had begun on the foothills of Makakilo led by Finance Realty Company, Ltd. The community of Ewa Beach was settled.

By the late 1970s large-scale residential development began with Gentry's Ewa development. A regional plan for Ewa was taking shape.

In 1989 the final concept was approved by the Honolulu City Council when it adopted the General Plan which recognizes Kapolei as the island's secondary urban center.

During the early 1990s the second city's master planned communities began construction and the commercial center started taking shape with the opening of the Kapolei Shopping Center and the office buildings of James Campbell Square, further infrastructure development and several major new office and retail complexes.

## Government Support for the Second City

**City and County of Honolulu.** The General Plan is "a comprehensive statement of objectives and policies which sets forth the long-range aspirations of Oahu's residents" and the strategies and actions to achieve them (General Plan, 1992). This Plan specifically states the intention to: *"Direct major economic activity and government services to the primary urban center and the secondary urban center at Kapolei"* (Objective G, Policy 1).

County actions are implementing this policy already: the Department of Housing and Community Development is sponsoring the project to redevelop and augment the community of Ewa Villages. In addition, planning is underway for a major County facility at the Kapolei Civic Center to provide regional municipal services and increase the region's employment base. This includes construction of Kapolei Fire Station, which is estimated to be operational in 1995. The Kapolei Police Station, located at the entrance to the City of Kapolei, is in the design stage.

**State of Hawaii.** The State of Hawaii also has demonstrated its support for urbanization of Ewa/Kapolei by a variety of actions, including:

- Joint ventures with various developers and landowners to provide the 4,200 residential housing units at the Villages of Kapolei master planned community;
- Purchase of a "State Land Bank" in the Kapolei Area for urbanization and other public purpose land uses, which contains 500 acres or about half of the subject property;
- Development of a regional state civic center to provide employment and regional services to the new second city; and
- Designation of Ewa as the site for construction of the University of Hawaii at West Oahu on a parcel of land adjacent to the subject property.

**U.S. Government.** The federal government will figure indirectly in the development of the second city at Kapolei through the land uses within its major holding in the area, the Naval Air Station at Barbers Point. This military base has defined land use in a significant portion of Ewa since World War II, but is slated for closure under the national Base Realignment and Closure Act. Plans for reuse are underway and are likely to play a significant role in shaping land use patterns within the southern Ewa region.

## The University of Hawaii at West Oahu

**Location Adjacent to Subject Parcel.** The State of Hawaii has expressed its intention to locate a second major Oahu campus of the University of Hawaii in Ewa. This will be a major force in the evolution of the subject development, as the designated campus site is directly across the planned North South Road from the proposed East Kapolei Project.

**Long Range Plans.** As discussed above, the concept of locating a major university campus in the Ewa region had its roots in the 1950s. Not until the 1990s, however, has this scenario truly begun to appear likely. The Estate of James Campbell (EJC) has provided lands for a campus to the State of Hawaii. This transfer of title contains conditions, however. The University of Hawaii at West Oahu must enroll 2,750 students at the new campus by the year 2006 or land ownership will revert to The Estate of James Campbell. EJC staff interviewed for this analysis quoted a City and County planning study which estimated 6,020 students at the campus by the year 2020.

Discussions with policy executives within the University of Hawaii administration indicated the following tentative timeline for development of the campus at Ewa:

*Five to Ten Years Out (circa 1999-2004)* - the campus is planned as a four-year baccalaureate (undergraduate) liberal arts college with limited masters-level study. Programs will duplicate those currently offered at the University of Hawaii at Manoa. Students are expected to be net additions to the system, taking the growth burden off the already at-capacity, 23,000 student Manoa campus.

*Ten to Fifty Years Out (circa 2005-2045)* - the campus could qualify as a "Carnegie Comprehensive Campus" providing full bachelors and masters level programs.

*More than Fifty Years Out (after 2045)* - the campus has the potential to evolve into a doctorate-granting university.

**Expected Impacts on Development of the Subject Parcel.** The location of the University of Hawaii at West Oahu campus adjacent to the proposed development is likely to have a number of ramifications.

First, the university is likely to result in increased demand for housing on the subject property. A portion of students, faculty and, to a lesser degree, university staff will likely favor living close to campus. Most students favor off-campus housing that facilitates walking or bicycle transportation within a two-mile radius of campus; the subject parcel is well within that radius.

Second, the university is likely to generate retail demand. In general, the second city will benefit from meeting the localized shopping needs of a university campus. In particular, the subject parcel's support commercial will be well positioned to benefit from some university-generated retail demand.

## SITE DESCRIPTION CONCLUSION

The project site is ideally situated to take advantage of the growth expected to occur in Oahu's second urban center. Access is currently adequate with prospects for becoming excellent with planned improvements. Surrounding uses are primarily agricultural, with the exception of the Ewa Villages to the south. The development of the second city at Kapolei and the location of the University of Hawaii at West Oahu will both contribute to activity and demand within the subject property.

# Section IV
# AREA REVIEW

Section IV

# AREA REVIEW

## INTRODUCTION

The Area Review presents an analysis of major economic trends both in the State of Hawaii and the island of Oahu. Three sets of key indicators offer economic support for the proposed residential and support commercial development on the subject property:

- General Trends
- Residential Indicators
- Commercial Indicators

## GENERAL TRENDS

### Hawaii versus Mainland U.S. Economic Trends

**Hawaii Business Cycles.** Hawaii's economic growth over the past decades indicates the strength and resiliency needed for continued expansion of both housing and commercial markets. Over time, economic indicators such as employment, visitor expenditures and inflation have consistently exhibited more vigor than the Mainland United States.

An analysis of long term trends (50 years) appears to indicate an approximately nine-year business cycle in the State. In the 1980s Hawaii's economic growth rate far outpaced the rest of the nation. Hawaii economists argued it was not sustainable over the long run. Indeed it was not. The peak of this strong, some would say over-heated, development cycle appears to have occurred in 1990.

**Recent Recessionary Trends.** Historically, Hawaii's economic declines have been comparatively modest compared to those experienced on the Mainland and have lagged by twelve to eighteen months. According to the economists at Bank of Hawaii, the state's recent recession had three phases:

(1) The early phase saw high inflation eroding income but continued growth in production and employment despite the Persian Gulf War.

(2) The middle phase occurred from fall of 1991 to fall of 1992. During this time, an export-led contraction was caused by westbound tourism's decline [tourism is an "export" in economic terms]. This combined with a construction downturn which slowed employment growth and created the true "recession" period.

(3) The final phase occurred after Hurricane Iniki and continued through much of 1993 when stagnation persisted but gradual improvement in unemployment took place.

Source: Hawaii 1993: Annual Economic Report

One prominent local economist interviewed for this analysis indicated that Hawaii's "recession" was not a recession at all, but merely a period of flat economic performance. This is supported by information on growth in jobs which experienced extremely low upward change as opposed to the net *loss* in jobs normally associated with a recessionary cycle. State of Hawaii and Oahu job trends are presented later in this section as Exhibit IV-10.

Stronger signs of economic recovery are being demonstrated in 1994, in which "there are enough positive forces at work to impart the most encouraging outlook in almost two years." This recovery is being fueled by an upturn in visitor arrivals and tourism expenditures that have"raised hopes that the three year tourism slump [is] at an end." (Source: First Hawaiian Bank Research Department, Supplement to Economic Indicators, May/June 1994)

**Long-term view.** Economists believe that the continuation of slower, more sustainable economic growth rate in Hawaii will "rely on internal rather than external forces." The local

economy has been buoyed from the harsher recession experienced elsewhere in the U.S. by:

- The lowest interest rates in thirty years;
- A continued low-inflation environment; and
- Sectoral strength in the areas of insurance, diversified agriculture, residential construction, health care and financial services. For example, growth in health care jobs was roughly equal to the loss of tourism jobs during the visitor industry downturn. (Source: Bank of Hawaii, 1994)

## Transportation

Oahu's strategic location between the West Coast and Asia places it 2,400 statute miles from San Francisco and 4,000 miles from Tokyo. Due to its location, Oahu serves as the gateway to both the Mainland U.S. and Asia/Pacific regions.

Supporting growth and development on Oahu is a transportation system which includes land, air and sea modes. While most of Hawaii's visitors and residents arrive and travel interisland by air, nearly all of the goods needed in the islands arrive through its harbors.

**Land transportation.** Hawaii maintains a system of 4,102 miles of interstate, state and county roads. Oahu has two interstate highways, H-1 and H-2 (which is currently being widened), with a third, H-3, currently under construction. Public mass transportation is limited to Oahu's TheBus service which served 79 million passengers in 1993.

The H-1 freeway provides multi-lane access to the subject property from the urban core and Central Oahu. Additional regional arterials such as Kapolei Parkway and the North South Road are planned for the Ewa region.

**Ocean transportation.** According to the State Department of Transportation's Harbors Division, four-fifths of the goods required by Hawaii are imported, and 98% percent of those arrive by sea. The interisland cargo system supplies Neighbor

Islands with over 5 million tons of goods per year. Oahu has two deep draft commercial harbors, Honolulu Harbor and Barbers Point. The Barbers Point Harbor is located in the Ewa region and supports commercial activity in the area. A third, the famous Pearl Harbor, is controlled by the U.S. Navy.

**Air transportation.** The advent of overseas air transportation revolutionized Hawaii's economy. Prior to the introduction of regular air service to Honolulu, access was limited to ocean liners and other forms of sea-based transportation. By 1990, only two out of every thousand arrivals to Hawaii was by ship. Almost all scheduled interisland passenger travel is now by air.

Facilitating the gateway position of Oahu is the Honolulu International Airport, which serves over 13 million overseas and interisland passengers annually. In addition, the location of a new reliever airport is under consideration at the site of the Naval Air Station at Barbers Point within the Ewa region. The opportunity to locate a civilian-use airport within Ewa will occur when military aviation is curtailed by the planned base closure. Location of such a commercial facility would provide additional economic stimulus to the Ewa region.

## General Trends Conclusion

The general economic trends presented in the preceding discussion lead to several conclusions:

*Hawaii versus Mainland economic trends* - Hawaii's business cycles tend to lag Mainland cycles by twelve to eighteen months and tend to be shallower during recessionary periods. For example, during the recent recession Hawaii largely experienced no growth rather than declining economic indicators such as those experienced in other regions of the United States. Further, during the recent decline in tourism the local economy showed a fair degree of strength within other sectors.

*Transportation* - Oahu and the subject region of Ewa are well-served by transportation infrastructure. The H-1 freeway provides vehicular access to both urbanized and newly-urbanizing areas of Oahu and intra-regional arterials are planned.

## RESIDENTIAL INDICATORS

Population growth can be closely correlated with household formation, which in turn increases the demand for housing. Specific social and economic indicators which support the demand for future residential development on Oahu include:

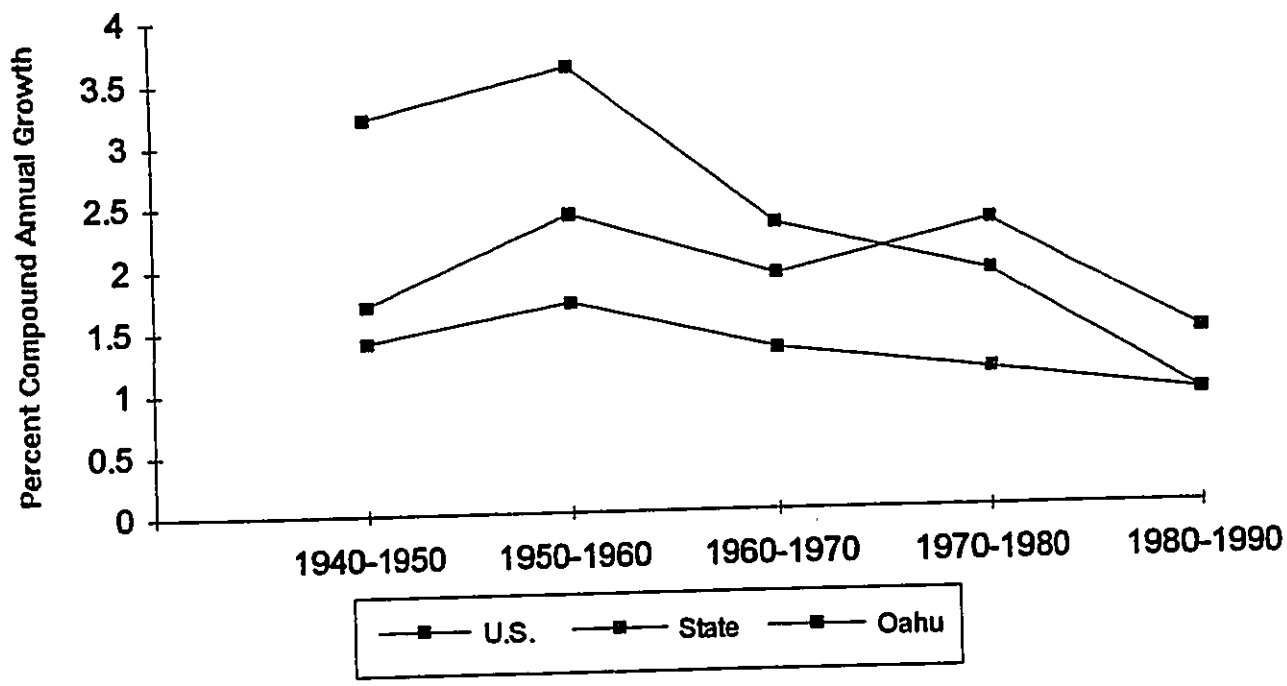
- Population growth
- Household formations
- Income trends
- Residential building permit trends
- Oahu's for-sale residential market
- Mortgage interest rates

### Population Growth

**Historical Trends.** Oahu has experienced population growth during every census period since 1950. Since the spike in growth following statehood in 1959, Oahu's percent growth rate of population has gradually tapered off while greater increases were seen on the Neighbor Islands, as shown in Exhibit IV-1, *Population Trends, 1940-1990* on the following page. Despite the deceleration in the rate of growth, the absolute increase in Oahu residents continues.

**Exhibit IV-1**
**East Kapolei Project**

**Population Trends, 1940-1990**




**Oahu Population Projections.** Oahu's resident population is expected to grow by 20 percent in absolute numbers between 1990 and 2010, according to the State's Series M-K projections. Population trends illustrated in Exhibit IV-2, *Population Projections - State and Oahu (Series M-K)* on the following page can be summarized as follows:

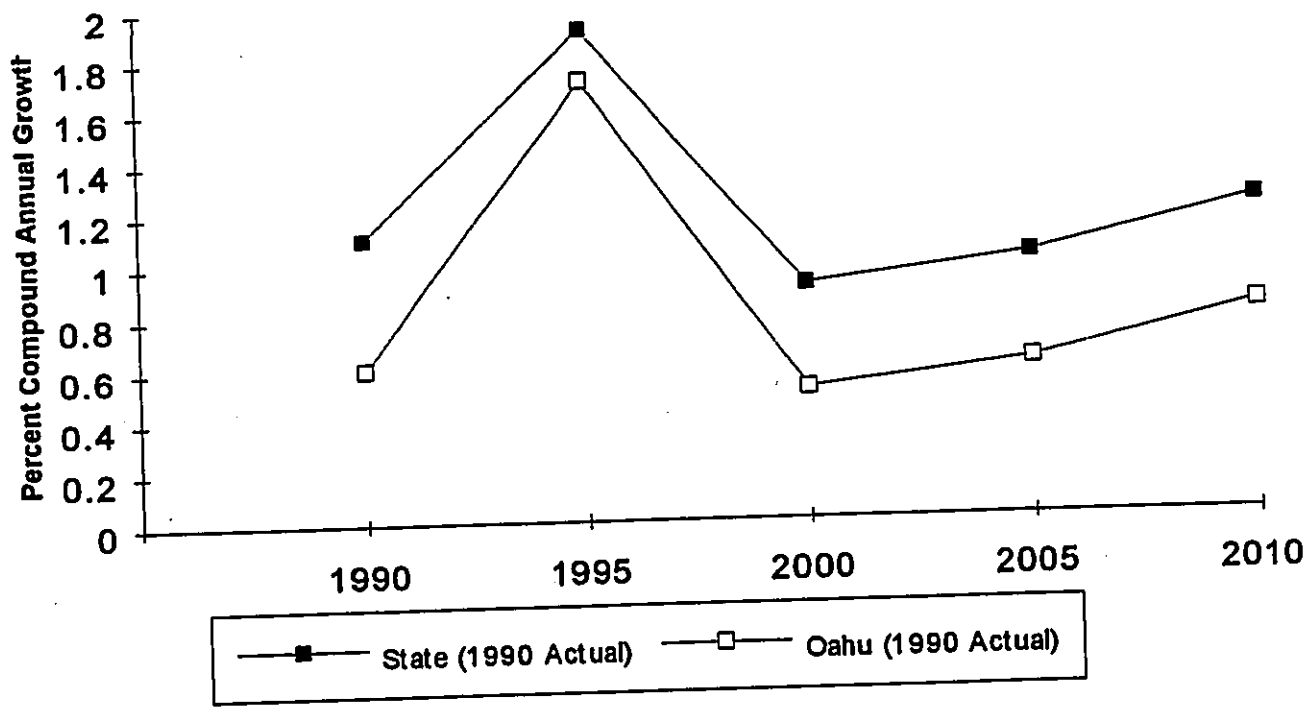
- Compound annual growth in population in both the State and Oahu is expected to remain positive, with a range from 0.6 percent to almost 2 percent along the trend line shown in Exhibit IV-2.

- The lower end of these growth rates falls below the percentage growth experienced in the 1980s. However, as the base population increases, the absolute changes are not materially different.

- Between 1980 and 1990 Oahu's population grew by 73,666 persons. Between 1990 and 2000 absolute growth is expected to increase to 96,569 persons, before falling off to 66,700 persons in the 2000 to 2010 period. As such on average while the percentage change in population is expected to gradually decline, the absolute growth may actually approximate or exceed the level experienced in the 1980s.

**Exhibit IV-2**
**East Kapolei Project**

**Population Projections**
**State and Oahu (Series M-K)**



**Regional Population Projections.** The fastest growing region on Oahu between 1994 and 2010 will be the Ewa region, according to the island's General Plan. The allocation of future population on Oahu is guided by the General Plan's Population Objective C Policy 4, which states:

*Seek a year 2010 distribution of Oahu's residential population which would be in accord with the following table:*

| Location | % of Year 2010 Islandwide Population | Population General Plan Range |
|---|---|---|
| PUC | 45.1% - 49.8% | 450,800 - 497,800 |
| Ewa | 12.0% - 13.3% | 119,900 - 132,900 |
| Central Oahu | 14.9% - 16.5% | 148,900 - 164,900 |
| East Honolulu | 5.3% - 5.8% | 53,000 - 58,000 |
| Koolaupoko | 11.0% - 12.2% | 109,000 - 121,900 |
| Koolauloa | 1.3% - 1.4% | 13,000 - 14,000 |
| North Shore | 1.6% - 1.8% | 16,000 - 18,000 |
| Waianae | 3.8% - 4.2% | 38,000 - 42,000 |
| Total | 95.0% - 105% | 949,500 - 1,049,500 |

Based on General Plan guidelines, the Planning Department projects regional population growth trends using its computerized Land Use Model. According to this model:

- The Ewa region's annual population growth rate is estimated to accelerate from 1.87 percent between 1980-1990 to 3.94 percent between 1990-2010.
- The growth rate of the Central Oahu region is projected to decline from 2.54 percent annually to 1.33 percent during the same time periods.
- The Oahu annual population growth rate is estimated to be less than one percent overall.

(Source: Forecast of Population, Housing and Employment on Oahu by Small Area 1990-2010, Planning Department, 1993, Table 3)

## Household Formations

New household formations will support the demand for future residential development on Oahu. New households will result from two major factors: the *rate of growth in housing stock* and the *decline of household size.*

**Rate of Growth in Housing Stock.** Exhibit IV-3, *Trends: Oahu Population and Housing Stock,* illustrates Oahu's historic and projected trends.

**Exhibit IV-3**
**East Kapolei Project**

**Trends: Oahu Population and Housing Stock**

| Year | Oahu Population | Housing Stock |
|---|---|---|
| 1980 | 762,565 | 230,214 |
| 1990 | 836,231 | 281,683 |
| 2010 | 999,500[1] | 359,827[2] |
| Percent Change (1980-2010) | 31% | 56% |
| Compound Annual Growth (1990-2010) | 0.90% | 1.23% |

1 Series M-K and Oahu General Plan (midpoint)
2 Planning Department Land Use Model projection (Source: Forecast of Population, Housing and Employment on Oahu by Small Area 1990-2010, Table 4)

The following observations can be made relative to the information presented in the chart above:

- The rate of growth in the housing stock typically lags population growth in Hawaii, creating latent demand for new residential housing product.

- The increase in housing stock on Oahu is expected to be almost double the rate of population growth between 1980 and 2010. However, this may not be sufficient to alleviate the doubling up of households that occurs on Oahu.

**Decline in Household Size.** Household size in Hawaii ranked second among the fifty states in 1990 with 3.01 persons (by the census definition of households), reflecting among other factors the frequency of doubling up. However, the Planning Department anticipates a decrease in household size is expected over time to approximately 2.8 in 2010, which is conservative in the consultant's opinion. The decline in household size is expected to follow a national demographic trend toward smaller family units and the expectation that the availability of affordable housing on Oahu will enable many doubled-up families to acquire their own homes.

## Income Trends

Hawaii's total and disposable personal income more than doubled between 1980 and 1990, reflecting a rapidly growing economy (State of Hawaii Data Book, 1993-94, Table 13.4). However, according to statistics quoted by the Bank of Hawaii, real personal income growth in the state decelerated during the late 1980s, reaching a low in 1991. A slow upward trend began several quarters after the nationwide trend of renewed growth in real personal income (Hawaii 1993: Annual Economic Report). The trend of slow growth in personal income, when evaluated along with accelerating housing price trends, is a strong indicator for the development of affordable and moderate-priced housing.

## Residential Building Permit Trends

Exhibit IV-4, *Oahu Building Permit Trends*, illustrates the historic trends in permitting activity in the City and County of Honolulu from 1962 through 1993. Housing categories include single family detached, duplex, multifamily and total residential units permitted. The average annual permitting levels during this period were 2,493 single family units, 137 duplex units and 3,756 multifamily units.

Building permit trends over the past few years follow the real estate trend of decreasing production of single family homes during economic slumps and increasing production of multi-family homes. This pattern occurred in the 1990-91 time frame. In 1992 and 1993 conditions such as affordability and a favorable interest rate environment spurred renewed growth in the construction of single family homes.

Although the pattern of building permits does not present clearly definable real estate cycles as one might expect, real estate cycles are more apparent in the progression of resale housing prices discussed in the following section.

## Exhibit IV-4
## East Kapolei Project

### Oahu Building Permit Trends, 1962 - 1993

| Year | Single Family Detached | | Duplex | | Multi Family | | Total Residential | |
|---|---|---|---|---|---|---|---|---|
| 1962 | 3654 | | 170 | | 4076 | | 7900 | |
| 1963 | 3354 | -8.21% | 190 | 11.76% | 2891 | -29.07% | 6435 | -18.54% |
| 1964 | 3671 | 9.45% | 90 | -52.63% | 2868 | -0.80% | 6629 | 3.01% |
| 1965 | 4512 | 22.91% | 132 | 46.67% | 5551 | 93.55% | 10195 | 53.79% |
| 1966 | 2944 | -34.75% | 52 | -60.61% | 6320 | 13.85% | 9316 | -8.62% |
| 1967 | 3005 | 2.07% | 46 | -11.54% | 3159 | -50.02% | 6210 | -33.34% |
| 1968 | 3683 | 22.56% | 330 | 617.39% | 6043 | 91.29% | 10056 | 61.93% |
| 1969 | 3569 | -3.10% | 286 | -13.33% | 7285 | 20.55% | 11140 | 10.78% |
| 1970 | 3809 | 6.72% | 212 | -25.87% | 3957 | -45.68% | 7978 | -28.38% |
| 1971 | 3771 | -1.00% | 70 | -66.98% | 4017 | 1.52% | 7858 | -1.50% |
| 1972 | 3352 | -11.11% | 112 | 60.00% | 6902 | 71.82% | 10366 | 31.92% |
| 1973 | 3008 | -10.26% | 312 | 178.57% | 9745 | 41.19% | 13065 | 26.04% |
| 1974 | 1626 | -45.94% | 464 | 48.72% | 11070 | 13.60% | 13160 | 0.73% |
| 1975 | 1078 | -33.70% | 112 | -75.86% | 4240 | -61.70% | 5430 | -58.74% |
| 1976 | 1326 | 23.01% | 56 | -50.00% | 3142 | -25.90% | 4524 | -16.69% |
| 1977 | 2210 | 66.67% | 84 | 50.00% | 2389 | -23.97% | 4683 | 3.51% |
| 1978 | 2075 | -6.11% | 260 | 209.52% | 2111 | -11.64% | 4446 | -5.06% |
| 1979 | 3046 | 46.80% | 134 | -48.46% | 1854 | -12.17% | 5034 | 13.23% |
| 1980 | 1650 | -45.83% | 46 | -65.67% | 3365 | 81.50% | 5061 | 0.54% |
| 1981 | 768 | -53.45% | 42 | -8.70% | 1873 | -44.34% | 2683 | -46.99% |
| 1982 | 891 | 16.02% | 32 | -23.81% | 2553 | 36.31% | 3476 | 29.56% |
| 1983 | 1562 | 75.31% | 60 | 87.50% | 1220 | -52.21% | 2842 | -18.24% |
| 1984 | 2199 | 40.78% | 112 | 86.67% | 942 | -22.79% | 3253 | 14.46% |
| 1985 | 2313 | 5.18% | 124 | 10.71% | 1781 | 89.07% | 4218 | 29.66% |
| 1986 | 2024 | -12.49% | 112 | -9.68% | 2076 | 16.56% | 4212 | -0.14% |
| 1987 | 2684 | 32.61% | 124 | 10.71% | 785 | -62.19% | 3593 | -14.70% |
| 1988 | 2001 | -25.45% | 172 | 38.71% | 1377 | 75.41% | 3550 | -1.20% |
| 1989 | 2026 | 1.25% | 124 | -27.91% | 1852 | 34.50% | 4002 | 12.73% |
| 1990 | 2054 | 1.38% | 150 | 20.97% | 1171 | -36.77% | 3375 | -15.67% |
| 1991 | 1335 | -35.00% | 70 | -53.33% | 3885 | 231.77% | 5290 | 56.74% |
| 1992 | 2326 | 74.00% | 40 | 42.86% | 2954 | 31.52% | 5320 | 0.57% |
| 1993 | 2223 | 4.43% | 31 | 47.50% | 2290 | 22.48% | 4544 | 14.6% |

Source: Building Department, City and County of Honolulu

**The Trend toward Affordability.** A pronounced trend toward affordability has been seen recently in housing, especially on Oahu. Bank of Hawaii, in its publication Construction in Hawaii 1994, presents its own analysis of statewide building permit data which reflects a strong indication of greater affordability in both single family and multifamily new residential product.

*Single family product.* Developers appear to be holding the line on construction costs for single family homes. Over the past four years the estimated per-unit construction cost of single family units increased only 1.9 percent annually, from $120,000 to $122,286.

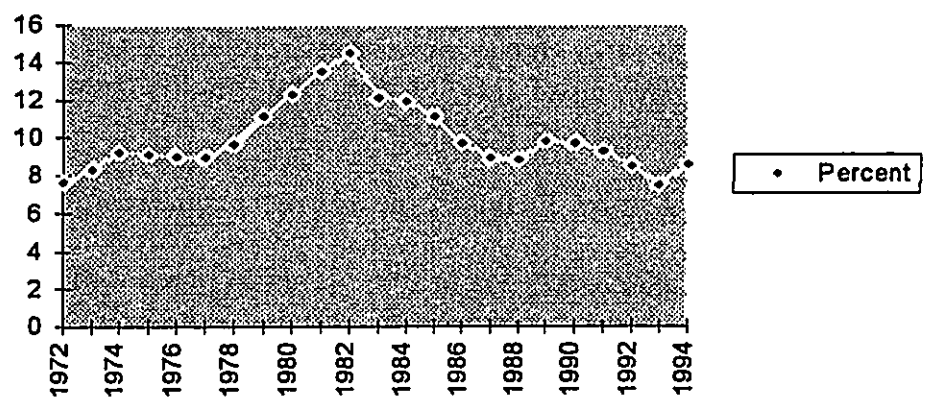
*Multifamily product.* Estimated unit construction cost for multifamily homes has fallen radically from a high of $137,242 in 1991 to a low of $77,341 in 1993. This 44 percent drop indicates that multifamily construction is "decidedly in the affordable range." Oahu accounted for 82 percent of this impact during 1993.

**Interest Rate Trends.** Affordability has also been supported by the lowest long-term interest rates since 1973, as shown in the trend line in Exhibit IV-5, *Long Term Mortgage Loan Rates: 1972-1994* on the following page. Interest rates have an important impact on affordability for many buyers, where a slight change in rates makes the difference between continuing to rent and being able to buy a new home.

Interest rates also affect the so-called "gap group" of buyers. The gap group includes families and individuals who do not qualify for affordable housing based on income, can afford higher monthly payments due to their family income, but find it difficult to come up with a down payment.

**Exhibit IV-5**
**East Kapolei Project**

**Long-Term Mortgage Loan Rates, 1972-1994**




Source: Statistical Abstract of the U.S., 1981, 1993

## Oahu's For-Sale Residential Market

**Overall Resale Market.** Oahu has experienced an upward trend in the price of resold residential units over time. According to purchased data from Prudential Locations, Inc., compound annual growth (CAG) rates of the average prices of residential resales were 12.5 percent per year for single family homes and 6.4 percent for multifamily homes, as shown in Exhibit IV-6, *Increases in Oahu's Average Resale Prices* on the following page:

**Exhibit IV-6**
**East Kapolei Project**

**Increases in the Average Oahu Resale Prices**

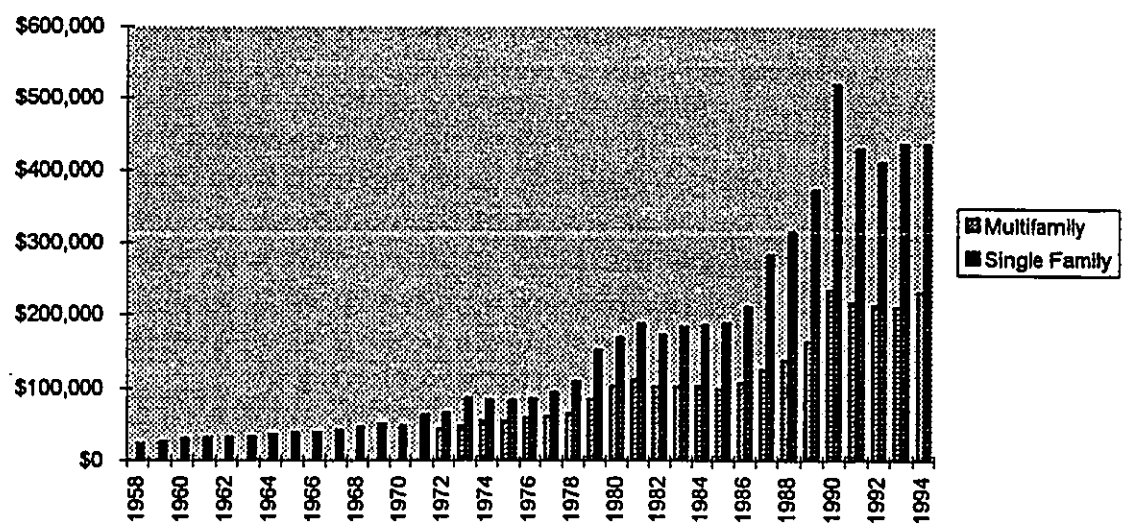
| Time Frame | Type of CAG Product Oahu | Low | 1993 | Rate |
|---|---|---|---|---|
| 1958 - 1993 | Single Family | $23,000 | $436,279 | 12.5% |
| 1972 - 1993 | Multifamily | $44,000 | $209,650 | 6.4% |

Source: Prudential Locations, Inc.

Year-by-year residential resale pricing trends on Oahu are presented graphically below in Exhibit IV-7, *Trends in Average Resale Prices on Oahu: Single Family (1958-1994) and Multifamily (1972-1994).*

**Exhibit IV-7**
**East Kapolei Project**

**Trends in Average Resale Prices on Oahu: Single Family (1958-1994) and Multifamily (1972-1994)**




Data Source: Prudential Locations, Inc.

The trend line of the previous chart indicates a series of real estate cycles of approximately nine years in duration with minor subcycles. It also shows that prices tend to move up during economic upswings and stabilize rather than decline during slower growth periods. The data reflect few major dips, with the exception of 1991 which followed the spike in prices apparent in 1990.

The cyclical nature of the Hawaii real estate market is corroborated by Dr. Michael Sklarz of Prudential Locations, Inc., who in 1994 supported "the notion that the Hawaii real estate market follows an 8 to 10 year cycle which is apparent when one analyzes longer term time series." He added:

"While no two cycles are exactly the same, this approach does provide a potential roadmap for the future." Sklarz maintains that:

- Using the assumption of an eight-to-ten year cycle, the market should gradually increase to a peak in 1996-97 and rising prices should be seen in the 1997-98 period.

- Despite these expected upturns in the market, the rate of increase is expected to be "considerably slower" than the pace of the late 1970s or late 1980s.

The historical pattern of eight-to-ten year cycles should be interpreted with the proviso that future fluctuations in cycles may not be as pronounced as in the past. This could be true for several reasons:

1. The relatively few developers involved in large-scale development have the resources to keep up production through varying market conditions.

2. There is a greater diversity of product and price ranges than in the past, including a range of affordable in addition to traditional market-priced offerings.

These reasons indicate that although real estate cycles are likely to persist, market conditions may cause less variation than in the past. This is because developers may be able to switch between a wider array of products and price ranges as the type

of demand varies and thereby maintain production rates at a more stable level.

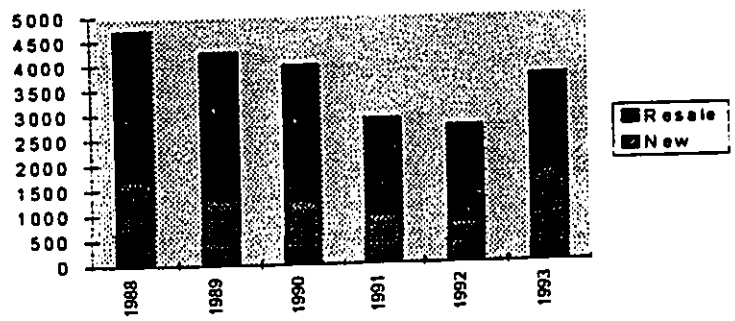
**Proportion of Single Family versus Multifamily Residential Resales.** On the following page, Exhibit IV-8, *Comparison of Single Family to Multifamily Housing 1988-1993*, shows that the proportion of single family detached to total residential units on Oahu has steadily decreased over time. This has resulted from a number of factors, including:

- The limited supply of urban-zoned land for development;
- An increase in the number of single parent families;
- Decline in housing affordability as growth in housing prices outpaced growth in income for many Oahu residents, forcing them into more affordable attached units; and
- An increase in low or medium density multifamily product offerings, as developers responded to affordable housing requirements by taking advantage of the lower per-unit construction costs associated with multifamily units.

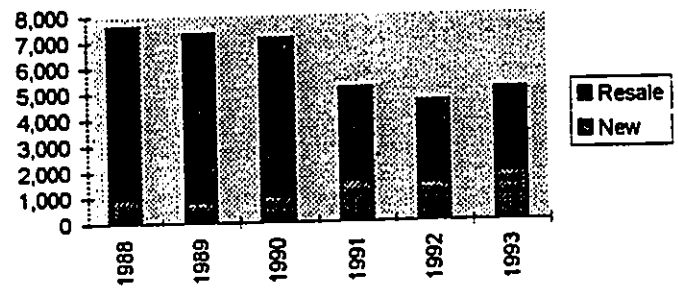
## Exhibit IV-8
## East Kapolei Project

### Comparison of Single Family to Multifamily Housing 1988 - 1993

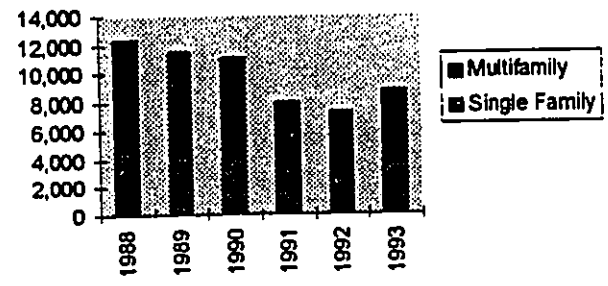
**Single Family**




**Multifamily**




**Total Residential**



## Residential Indicators Conclusion

The residential indicators presented above lead to the following conclusions relative to the economic viability of the proposed project:

*Population growth* - Oahu's General Plan and Land Use Model forecast the most rapid population growth in the subject property's region of Ewa.

*Household formations* - The combination of increasing housing stock and decreasing household size will create demand for additional housing in the future on Oahu.

*Income trends* - After dipping in the early 1990s, real personal income in Hawaii has been rising very slowly. This slow rise in real income, combined with accelerating home prices, creates a need for affordable and moderate-priced housing.

*Residential building permit trends* - Trends over the last 32 years show an economic cycle of 8-10 years which may have less pronounced fluctuations in the future. Building permit trends also indicate a trend toward greater affordability, based on construction cost statistics.

*Oahu's for-sale residential market* - Prices for Oahu real estate have continued to grow since 1958 when the data series began, with approximately nine-year cycles. The past several years have shown a trend toward a higher proportion of multifamily units.

# COMMERCIAL INDICATORS

Trends in the following indicators appear to support demand for further development of commercial space on Oahu:

- Growth in Gross State Product (GSP)
- Wage and salary employment
- Unemployment
- Consumer prices
- Retail sales
- Visitation and tourism expenditures

Commercial demand on Oahu is an important element of the economic analysis with regard to the subject development for two reasons. First, it will influence the development of the second city at Ewa as a true "growth pole" or secondary urban agglomeration, complete with a wide-ranging employment base. To a lesser degree commercial demand also will influence the demand for the neighborhood retail planned for the subject property. The strongest factors in support of the subject property's commercial potential will be proximity to housing and the university campus.

## Growth in Gross State Product

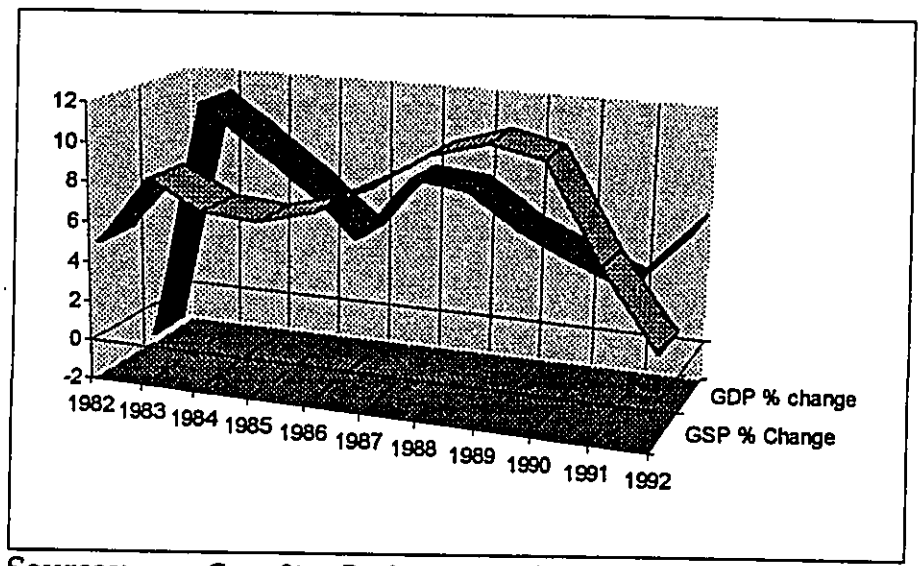
The Gross State Product (GSP) is an indicator of economic prosperity in a region. During the last half of the 1980s, Hawaii consistently experienced over five percent real annual growth in its GSP.

Exhibit IV-9, *Trends: Hawaii Gross State Product Versus U.S. Gross Domestic Product, 1982-1992,* illustrates the following:

- Growth continues to be positive (above zero), however the 1991-92 figures indicate that it has subsided from the brisk growth rate of the 1980s.
- Hawaii's business cycles tend to lag in time behind the Mainland's macroeconomic trends.

**Exhibit IV-9**
**East Kapolei Project**

**Comparison of Hawaii Gross State Product and U.S. National Domestic Product, 1982 - 1992**




Sources: *Gross State Product*: State of Hawaii Data Book, 1993-94, Table 13.2
*Gross Domestic Product*: "Economic Indicators, June 1994," prepared for the Joint Committee by the Council of Economic Advisers, 103rd Congress, 2d Session

## Wage and Salary Employment

**Jobs.** Hawaii's long-term employment indicators show a basically healthy state economy, although one which is not immune to corrections such as the recessions in 1982 and 1991-92. Exhibit IV-10, *Trends in Wage and Salary Employment for the State of Hawaii and City and County of Honolulu, 1970-1993* reveals the following trends:

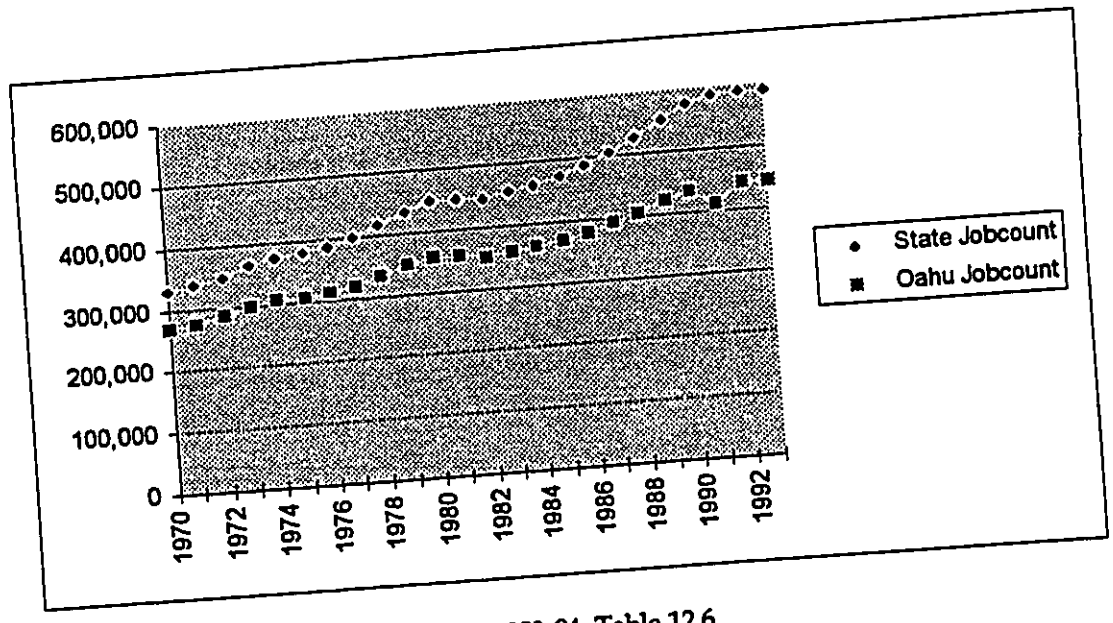
- Recent data indicate a basically flat trend of jobs with a 0.2% dip occurring in 1993.

- On a statistical basis as Oahu goes, so goes Hawaii. The close correlation that exists between shifts in economic performance on Oahu and the State as a whole is illustrated in the employment trend lines.

Job growth may become positive again in 1994 with the resurgence in visitor industry activity, although growth will likely be modest compared to the pace of the late 1980s.

**Exhibit IV-10**
**East Kapolei Project**

**Trends in Wage and Salary Employment for the State of Hawaii and City and County of Honolulu, 1970-1993**




Source: State of Hawaii Data Book, 1993-94, Table 12.6

**Annual Wages per Employee.** According to the Department of Business, Economic Development and Tourism, Hawaii ranked twelfth among the fifty states in annual wages per employee for all workers in 1992. As shown in Exhibit IV-11, *Annual Change in Wages per Employee*, wages per employee exhibited annual increases from 1982 through 1991, the last year for which this data was available. After a dip in the percent increase between 1990 and 1991, wages rebounded in 1992.

**Exhibit IV-11**
**Annual Change in Wages Per Employee**

| Year | Total Annual Wages/Employee ($) | Percent Change Year Over Year |
|---|---|---|
| 1982 | 15,353 | |
| 1983 | 16,108 | +4.9% |
| 1984 | 16,701 | +3.7% |
| 1985 | 17,329 | +3.8% |
| 1986 | 18,101 | +4.5% |
| 1987 | 19,091 | +5.5% |
| 1988 | 20,444 | +7.1% |
| 1989 | 21,624 | +5.8% |
| 1990 | 23,167 | +7.1% |
| 1991 | 24,104 | +4.0% |
| 1992 | 25,613 | +6.3% |

Source: State of Hawaii Data Book, 1993-94, Table 12.25

**Employment Composition.** Equally as important as the level of overall employment to Oahu's economy is the type of employment. An analysis of predicted job growth on Oahu and its composition is presented on the following page in Exhibit IV-12, *Composition of Employment on Oahu, 1985 - 2010.*

## Exhibit IV-12
## East Kapolei Project

### Composition of Employment on Oahu, 1985-2010

| Employment Island of Oahu (in thousands) | 1985 | 1990 | % Chg | 1995 | % Chg | 2000 | % Chg | 2005 | % Chg | 2010 | % Chg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manufacturing | 5.7 | 6.7 | 18% | 7.1 | 6% | 7.7 | 8% | 8.2 | 6% | 8.7 | 6% |
| Transp. commun, utilities | 27 | 29.7 | 10% | 31.2 | 5% | 32.3 | 4% | 32.8 | 2% | 33 | 1% |
| Trade (excl. eating/drinking) | 60.4 | 70.3 | 16% | 76 | 8% | 77.6 | 2% | 83.7 | 8% | 86.7 | 4% |
| Eating and drinking | 31.5 | 36.6 | 16% | 38.5 | 5% | 40.1 | 4% | 41.1 | 2% | 42.2 | 3% |
| Banking and finance | 26.9 | 29.4 | 9% | 32.1 | 9% | 33.4 | 4% | 34 | 2% | 34.8 | 2% |
| Services, other | 71.1 | 86.8 | 22% | 100 | 15% | 111 | 11% | 119.8 | 8% | 129 | 7% |
| Government | | | | | | | | | | | |
| State/local | 47.8 | 50.1 | 5% | 52.6 | 5% | 54.8 | 4% | 55.8 | 2% | 56 | 0% |
| Federal | 31.4 | 31.3 | 0% | 31.7 | 1% | 32.1 | 1% | 32.5 | 1% | 32.9 | 1% |
| Total | 79.2 | 81.4 | 3% | 84.3 | 4% | 86.9 | 3% | 88.3 | 2% | 88.9 | 1% |
| Self-employed | 24.7 | 26.3 | 6% | 31.2 | 19% | 33.7 | 8% | 35.7 | 6% | 37.7 | 6% |

Source: Department of Business Economic Development and Tourism, Series M-K

As shown in the previous table, the greatest increases are expected in service, manufacturing and retail trade jobs. These trends will support the planned neighborhood retail land uses on the subject property.

**White Collar Employment.** Office demand can be related to increases in white collar employment categories. The primary white collar employment category is the finance, insurance and real estate sector. Since a portion of the service sector is typically housed in office space, the growth in these categories

should support a moderate level of continued office development.

The advent of the second city at Ewa/Kapolei is likely to cause some regional redistribution of white collar employment due to the following plans:

- The State of Hawaii has a master plan for its civic center in Kapolei. The center will initially consist of six state office buildings encompassing 1.2 million square feet of space and 567,000 square feet of space for judiciary, library and history museum facilities. The first Kapolei state office building with 120,000 square feet of useable floor space is expected to be ready for occupancy in late 1997 or early 1998.

- Major new Bank of Hawaii office building facilities will accommodate 1,200 white collar workers within a 250,000 square foot building.

- Location of the University of Hawaii at West Oahu campus within the second city area eventually will bring with it a full complement of faculty and administrative staff.

- Location of a civic center at the City of Kapolei will provide regional municipal services by the City and County of Honolulu.

**Manufacturing.** Manufacturing sector growth is expected to be one of the largest in the Oahu employment market. This strong growth, combined with decreases in the supply of industrial space, should sustain demand for light industrial land on Oahu.

The subject region is well positioned to take advantage of growth in manufacturing and industrial activity because of the existing James Campbell Industrial Park and the addition of the light industrial/warehouse-oriented Kapolei Business Park. Jobs in these areas will in turn result in housing and retail demand within the market study area.

**Wholesale and retail employment.** Wholesale and retail employment growth has the greatest effect on the demand for

retail space. According to Exhibit IV-12 above, this sector is projected to have a roller coaster future.

- A stabilizing force may be the additional demand which comes from growth in the service sector, restaurant employment and banking and financial services. Often these businesses choose retail locations in order serve the public.

- Employment in warehousing could be somewhat destabilized due to the advent of volume discounters in Hawaii, whose method of doing business eliminates much of the warehousing and distribution component. However, such discounters still remain a relatively small proportion of the total retail scene in Hawaii.

The fluctuation in retail employment on Oahu is derived to a significant degree from fluctuations in tourism-related demand. The neighborhood retail type of commercial development planned for the subject property will be less susceptible to these fluctuations because it will service the immediate residential area and the future university campus.

## Unemployment

Throughout the 1980s and into the 1990s, Hawaii's employment trends have exhibited strength relative to Mainland performance. The highest unemployment rate in Hawaii between 1987 and 1992 was equal to the lowest Mainland unemployment rate.

According to Bank of Hawaii economists writing in Hawaii 1993: Annual Economic Report, the following trends are evident with regard to unemployment in Hawaii:

- In 1989, Hawaii ranked 49th in the nation for business failures. By 1993 business failures, loan delinquencies and foreclosures had risen but still placed the state among the better performing states, even those where economic recovery had begun.

- Already low, Hawaii's unemployment rate may continue to decline gradually during 1994 as the economic recovery continues to take hold.

## Consumer Prices

Consumer prices on Oahu have exceeded national trends in the recent past, although the trend is still one of low inflation. For example, Oahu experienced a *3.3 percent* change in consumer prices from 1992-93, compared *to 4.7 percent* between 1991-2 and *10.5 percent* in the previous Hawaii recessionary period in 1980-81.

## Retail Trends

It has long been stated that Oahu is underserved with regard to retail space. This is illustrated both by square feet per resident estimates and sales per square foot of retail space indicators. This continuing demand will support anticipated neighborhood retail operations on the subject property well into the future.

**Retail Sales Performance.** Hawaii's retail sales performance has been consistent with other positive economic trends in both real terms (i.e., constant dollars) and when compared to Mainland markets. For example, Mainland retail sales fell dramatically in 1990 while Hawaii's sales continued to be robust but at a slightly lower level.

Hawaii's healthier retail climate is the result of a number of factors:

- Limited supply of retail space in the islands compared to relatively overbuilt areas of the Mainland.
- Limited supply which creates higher per square foot retail expenditures.
- Tourism expenditures which bolster the local retail trade by increasing the retail market significantly beyond demand generated by residents. In 1993 it was estimated that retail spending from tourists accounted for between 20 and 25

percent of total retail sales in the state. (Bank of Hawaii, Hawaii 1993: Annual Economic Report).

**Structural change in Hawaii retail trade.** Hawaii retail sales remained stable throughout the recent recessionary period. According to Bank of Hawaii, this reflected "a greater underlying strength of the economy and less dependence on visitor purchases than has tended to be assumed."

The State of Hawaii followed the rest of the nation's trend toward large discount and wholesale outlets by almost a decade. This has significantly altered the pricing structure for retail goods and the type of goods being purchased by residents and visitors alike (Bank of Hawaii, Hawaii 1993: Annual Economic Report). For example, Hawaii residents have become more price-conscious and make regular bulk purchases of staple commodities at warehouse discounters. This has affected the pricing of retail goods at smaller stores, which must try to compete.

Hawaii is capitalizing on another national trend at the present time: the enhanced purchasing power provided by recent devaluation of the dollar relative to major world currencies. While not a coveted trend, the dollar's loss has been retailers' gain because visitors have greatly increased their level of purchasing (Time, September 5, 1994, "Shopping Spoken Here"). Locally, visitor traffic to the discount stores and manufacturers' outlets such as Waikele Power Center has resulted in some redistribution of retail expenditures from prior favorites such as duty free shops (Hawaii Investor, September 1994, "A Yen for Waikele").

## Visitation and Tourism Expenditures

**The Economic Impact of Tourism.** The Hawaii economy benefits greatly from its role as a major tourist destination. Tourists support local employment directly through employment in service industries and indirectly in construction and other job categories. Continuing demand for tourism on Oahu is significant to the subject property in several ways:

- Oahu has been able to provide a more steady source of employment for its tourism work force than other islands and will therefore continue to support the demand for residential development.

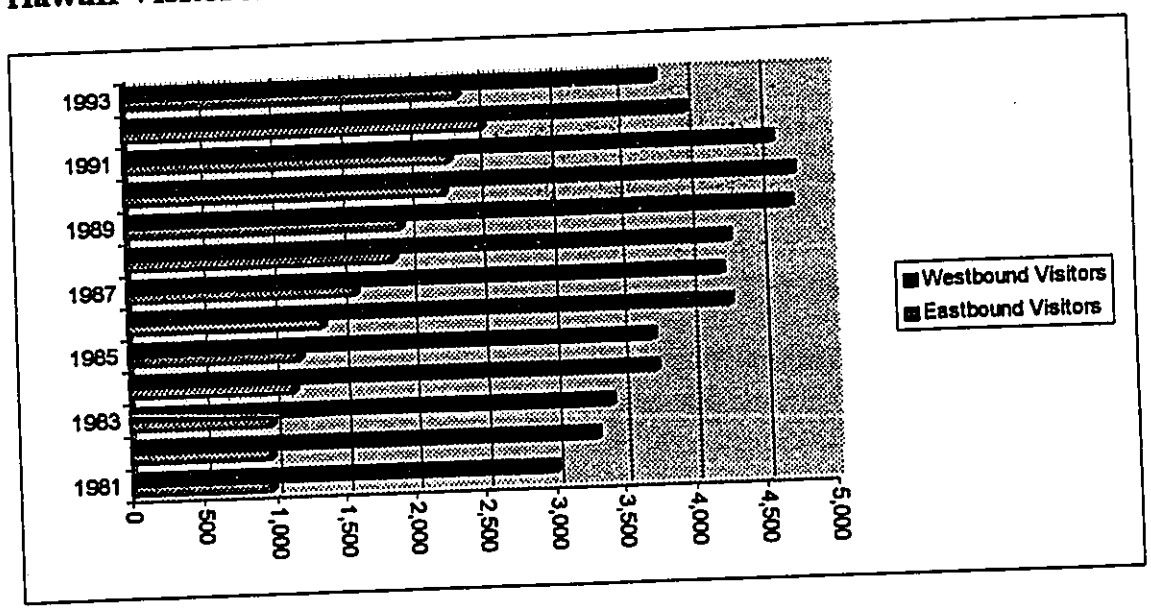
- The resort-oriented communities of Ko Olina and Ewa Marina will contribute to the Ewa/Kapolei regional economy through an infusion of visitor expenditures.

- Oahu visitors make purchases which will continue to sustain retail demand throughout the island.

**Visitor Arrivals.** Over time the distribution between Mainland U.S. (westbound) and Japanese and Asian (eastbound) visitors has changed dramatically. Exhibit IV-13, *Hawaii Visitor Arrivals,* illustrates this contrast as well as the decline in visitors experienced in 1991 and 1992 during the Mainland and Japanese recessionary periods.

**Exhibit IV-13**
**East Kapolei Project**

**Hawaii Visitor Arrivals**




Source: State of Hawaii Data Book, 1993-94 Table 7.3

**1994 Results.** Visitor counts for the first half of 1994 show a significant upturn to levels not seen for the past three years. This will in turn result in increased visitor expenditures.

**Commercial Indicators Conclusion.** Based on the preceding discussion, numerous factors appear to support demand for further development of commercial space on Oahu:

*Growth in Gross State Product* - growth continues to be positive and to lag Mainland business cycles.

*Wage and salary employment* - long term job growth has been strong, although recent statistics show a relatively flat trend. Job growth may increase in 1994 due to the recent surge in tourism. The Ewa region is likely to benefit from growth anticipated by the State's M-K projections in several categories, including white collar employment and manufacturing.

*Unemployment* - Hawaii has exhibited considerably more strength in this indicator than Mainland regions. Even during the recent recessionary period, business failures in Hawaii were among the better performing states.

*Consumer prices* - Hawaii exhibits relatively low inflation in consumer prices.

*Retail sales* - Hawaii's retail industry has been undergoing a structural transformation which is making room for discount retailers by changing shopping patterns and retail pricing.

*Visitation and tourist expenditures* - After a three-year slump, tourism arrivals and expenditures appear to be rebounding in 1994.

## AREA REVIEW CONCLUSION

The State of Hawaii, especially the island of Oahu, has demonstrated substantial growth in all sectors of the economy over time. Based on current and past economic trends, such growth is expected to continue for the foreseeable future and should support development of the site. Housing demand -- especially for affordable product such as that being offered in the proposed development -- has remained strong throughout the recent recessionary period and is expected to remain strong in the coming years.

## Section V
# RESIDENTIAL

Section V

# RESIDENTIAL

## INTRODUCTION

The Oahu housing market provides a variety of residential products ranging from high rise luxury condominiums and oceanfront homes to older plantation homes and small ranches. This wide spectrum of homes is located over a broad geographic base extending from Honolulu's primary urban center to the rural communities of Leeward, Windward and the North Shore areas. The dramatic variety in residential products also contributes to great diversity in the price of housing.

While housing and its associated pricing vary greatly on the island of Oahu, one thing is universally known: Honolulu's housing ranks as the most expensive in the nation. Relatively low wages, high costs of living, a limited supply of land and high construction costs all lead to a shortage of affordable and gap housing for Honolulu's existing and future population. The demand for affordable housing is further illustrated by:

- *A relatively high ratio of renters to owners.* This proportion was 48 percent renters in the 1990 census (Source: U.S. Census Bureau).

- *The phenomenon of "pent-up demand."* In the 1990 census over 17,000 Oahu households or about 7% reported more than one "subfamily" (married couple with or without children living in a household with relatives). This is a figure which census experts consider understated (Source: U.S. Census Bureau).

- *High percentage of shared accommodations.* In 1992, it was estimated that about 22 percent of Hawaii households were either doubled up or sharing with unrelated families or individuals (Source: Hawaii Housing Policy Study, 1993).

**Organization of this Section.** This section of the Market Assessment presents the existing and future estimates of supply and demand for housing on Oahu. Included throughout this analysis are discussions regarding the market study area's relationship to the overall housing market. The section concludes with a description of the proposed property's development concept (which is dominated by a residential component of approximately 10,000 units), an estimate of the property's market position and estimated schedule of absorption.

## MARKET STUDY AREA

Based on an assessment of actively selling and proposed subdivisions it is the consultant's opinion that the relevant competitive supply for the subject property will come from the master planned communities within the Ewa Development Plan Area and along the western H-1 corridor including the communities of Waikele and Royal Kunia. These two communities are within the Central Oahu Development Plan Area.

## SUPPLY AND DEMAND ANALYSIS

The following discussion provides an explanation of the analysis of interaction between supply and demand within the residential market on Oahu and within the defined market study area.

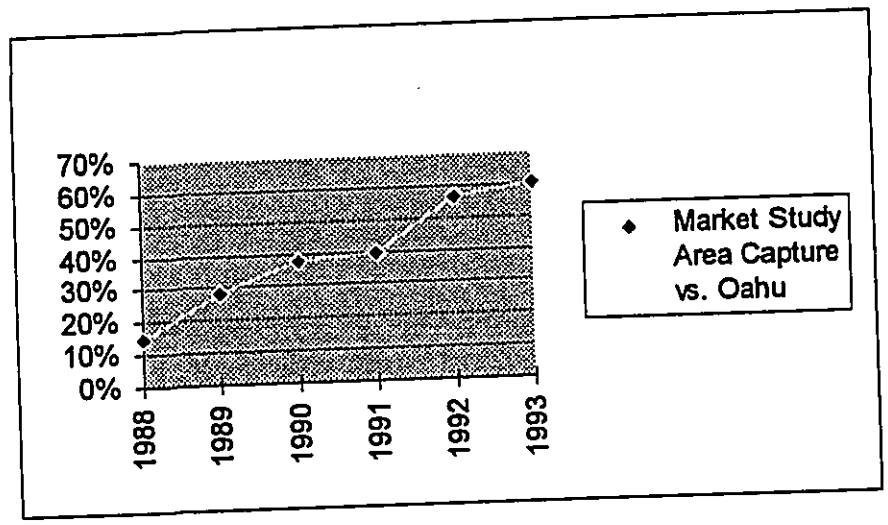
## DEMAND

The calculation of future demand for housing is a function of both population growth and a need for vacancy to provide a healthy real estate market. Once housing demand is calculated for Oahu, it must be allocated to the market study area to project future demand in the area of the subject property.

The demand for housing can be closely associated with the formation of new households within a growing population. In an undersupplied market area the direction of demand is typically affected by the location of the supply. Exhibit V-1, *New Home Sales: Market Study Area Capture vs. Oahu,* shows how the proportion of Oahu's new residential supply provided by the market study area quadrupled between 1988 to 1993 (from fifteen percent to over 60 percent).

**Exhibit V-1**
**East Kapolei Project**

**New Home Sales: Market Study Area Capture vs. Oahu**




Source: Prudential Locations, Inc. (for raw data)

## Calculation of Market Study Area Demand

The following sections discuss the expected sources of demand for additional residential units within the market study area. Demand factors include estimated growth in households (as a function of population and household size) and a provision for vacant units. The calculation of demand for additional housing in the market study area is based on the following analyses:

(1) Estimation of future increases in households are based on future population;

(2) Allowance for vacant units needed for a healthy real estate market;

(3) Calculation of Oahu residential unit demand in 2010;

(4) Allocation of Oahu demand to the market study area based on its forecast proportion of the island's population;

(5) Adjustments to study area demand based on expected market conditions; and

(6) Final calculation of demand within the market study area in 2010.

## (1) Estimation of Increases in Households

***Estimated Occupied Housing Units by 2010:*** ***352,000 units***

***Rationale***

The required number of occupied housing units that will be needed in the year 2010 -- approximately 351,551 units -- is a derived estimate based on:

(a) The Planning Department's Land Use Model projection of 359,827 units in 2010. This is based on a household size of approximately 2.8 persons. (Source: Forecast of Population, Housing and Employment on Oahu by Small Area 1990-2010, Table 4, "Housing Growth"); and

(b) Netting out the built-in vacancy factor of 2.3 percent which is included in the Land Use Model. The reason for this recalculation is to apply a more healthy vacancy rate of five percent to the estimation of Oahu housing demand.

The methodology for deriving occupied units is shown in Exhibit V-2, *Calculation of Occupied Households.*

**Exhibit V-2**
**East Kapolei Project**

**Calculation of Occupied Households**

| | |
|---|---|
| Total Oahu Unit Demand 2010 - Land Use Model | 359,827 |
| Built-in vacancy factor of Land Use Model | 2.30% |
| Occupied Oahu households (net of vacancy factor) | 351,551 |

## (2) Allowance for Vacancy on Oahu

*Estimated Number of Vacant Units as of December 31, 2010:* *18,000 units*

*Rationale*

A certain level of vacancy is considered healthy in any market area. This vacancy level allows the free movement of the population in and out of a community and within the community.

- According to the 1990 U.S. Census, the vacancy factor in the Honolulu residential market area was 5.87 percent. This factor included both owned and rented units.

- A rule of thumb of five percent for desirable vacancy level in residential communities is used by organizations such as the Urban Land Institute and the U.S. Department of Housing and Urban Development.

A vacancy rate of five percent for Oahu has been utilized in this analysis. This figure appears to be at a reasonable and conservative level. Applying this vacancy rate to the estimated demand for housing on Oahu, an additional 18,503 vacant units should be introduced into the market by 2010.

## (3) Calculation of Total Oahu Housing Demand (occupied units plus vacancy)

| | |
|---|---|
| *Expected Total Demand for Oahu by December 31, 2010:* | *370,000 units* |

*Rationale*

Based on the above discussion the total demand for new housing units on the island of Oahu in 2010 is estimated to be 370,054 units, which includes demand for 351,551 occupied units (derived in Step 1 above) plus an additional 18,503 to provide a healthy level of vacancy (derived in Step 2).

## (4) Market Study Area Allocation - Unadjusted

| | |
|---|---|
| *Expected Total Demand between June 30, 1993 and December 31, 2010 in Market Study Area (includes existing units):* | *53,000 to 57,000 units* |
| *Expected Additional Demand between June 30, 1993 and December 31, 2010 in Market Study Area (excludes existing units):* | *36,000 to 41,000 units* |

*Rationale*

Through its General Plan, the City and County of Honolulu allocates a share of future Oahu population (and, consequently, housing demand) to each Development Plan (DP) Area. The range of percentage allocations to a DP Area is generally expressed in terms of low, mid and high points of projected population.

The market study area's percentage share of 2010 Oahu population and housing demand combines Ewa DP Area forecasts with those for Waikele and Royal Kunia from Central Oahu. The market study area share of total Oahu demand for housing is estimated between 14.23 (low), 14.88 (midpoint) and 15.53 percent (high). This range was derived by combining General Plan population projections for the Ewa DP Area with a proportion of Central Oahu growth as forecast by the Land Use Model's Traffic Analysis Zones for Royal Kunia and Waikele.

The foregoing analyses result in a range of unadjusted demand for the market study area of 52,661 residential units at the low end, 55,068 units at the midpoint or 57,474 units at the high end. Each of these estimates includes 16,891 existing units or a net of 36,070 at the low end, 38,477 units at the midpoint or 40,883 units at the high end (see Exhibit V-5 on page V-13 for detail of existing units).

### (5) Adjustments to Demand for the University of Hawaii at West Oahu

*+300 units*

Discussions with University of Hawaii (UH) officials indicate that there is likely to be additional demand for housing in the vicinity of the subject property resulting from the planned new campus at West Oahu. According to current estimates, there are expected to be approximately 4,000 mostly undergraduate students enrolled at the University of Hawaii at West Oahu in the year 2010. The estimate of 4,000 students in the year 2010 is based on:

(1) The assumption that the State of Hawaii will meet student enrollment goals set by the Estate of James Campbell as a condition of the gift of land (2,750 students enrolled in 2006); and

(2) Enrollment will steadily progress to levels estimated in Planning Department studies (6020 students in year 2020).

UH Manoa housing officials indicate that the Board of Regents has set a policy for commuter-oriented campuses such as Manoa and West Oahu of providing 25% of the students with on-campus housing. This means that approximately 3,000 students will need off-campus housing in 2010, although clearly many will continue to live at home and/or commute to campus. Housing officials further indicated that the highest demand for affordable rental situations is within two miles of campus, an area which includes the entire subject parcel.

University facilities planning officials indicated that construction of dormitories and on-campus faculty housing will

be a low priority during the first ten or so years, leaving students and a portion of the faculty in search of conveniently located, off-campus housing accommodations.

Demand for approximately 300 units on the subject property is estimated to accommodate groups of UH West Oahu students housed off-campus on the subject property plus a proportion of faculty and staff who will wish to relocate close to work.

## (6) Calculation of Demand

Total adjusted demand for the market study area by 2010 is estimated at 52,961 to 57,774 units, including an existing inventory of 16,891 units. On the following page, Exhibit V-3, *Calculation of Demand, 1994 - 2010*, summarizes the foregoing discussion and includes comparative information on net demand (excluding existing inventory) in the market study area as a whole as well as its Ewa Development Plan Area portion.

## Exhibit V-3
## East Kapolei Project

## Calculation of Demand
## 1994 - 2010

| | | | | |
|---|---|---|---|---|
| Oahu Housing Units - 2010 | 359,827 | | | Land Use Model (includes vacancy) |
| Oahu Occupied Units - 2010 | 351,551 | | | Net of 2.3 percent vacancy rate<br>Refer to Step 1 |
| Vacancy Provision | 18,503 | | | Refer to Step 2 |
| Total Demand for Oahu - 2010 | 370,054 | | | Occupied units plus 5% vacancy provision<br>Refer to Step 3 |
| Study Area Allocation Factor (% of total Oahu) | 14.23<br>Low End | 14.88<br>Midpoint | 15.53<br>High End | General Plan and Land Use Model<br>Refer to Step 4 |
| Study Area Demand (unadjusted) | 52,661 | 55,068 | 57,474 | Refer to Step 4 |
| Adjustment for University Housing Demand | 300 | 300 | 300 | Refer to Step 5 |
| **Total Adjusted Study Area Demand** (Includes 16,891 existing units) | **52,961** | **55,368** | **57,774** | |
| Comparative Data | | | | |
| **Net Additional Study Area Demand** (total adjusted study area demand less existing units) | 36,070 | 38,477 | 40,883 | |
| **Net Additional Demand - Ewa DP Area portion only** | 28,856 | 30,782 | 32,706 | |

## SUPPLY

The analysis of the Oahu's housing supply is presented in the following steps:

(1) Overview of the existing housing stock (supply) on Oahu;

(2) Analysis of existing housing stock within the market study area;

(3) Expectation of future additions to supply within the market study area during the scope of the analysis; and

(4) Adjustments to supply based on expected future conditions.

(5) Calculation of supply based on the above steps.

## (1) Existing Supply on Oahu *295,000 units*

The most recent information regarding the supply of housing within the Development Plan areas on the island of Oahu was provided by the City and County of Honolulu's Planning Department and is summarized on the following page in Exhibit V-4, *Distribution of Housing Stock by Development Plan Area (June 30, 1993).*

**Exhibit V-4, East Kapolei Project**

**Distribution of Housing Stock by Development Plan Area (June 30, 1993)**

| Oahu Statistics by Development Plan Area - 1992 | Existing Housing Stock as of June 30, 1993 | Share of Housing Stock |
|---|---|---|
| Primary Urban Center | 168,342 | 57.06% |
| Ewa | 15,301 | 5.19% |
| Central Oahu | 39,115 | 13.26% |
| East Honolulu | 15,972 | 5.41% |
| Koolaupoko | 35,189 | 11.93% |
| Koolauloa | 3,970 | 1.35% |
| North Shore | 5,837 | 1.98% |
| Waianae | 11,288 | 3.82% |
| Total | 295,014 | 100.00% |

Source: Planning Department, September 1994

**Primary Urban Center** - As illustrated in Exhibit V-4 above, the majority of the island's population is located in the Primary Urban Center (PUC). The PUC is a 65,028-acre sector and is the third largest of the eight planning regions in terms of geographic area.

Approximately 36% of the PUC was designated for urban uses in 1993. The majority of the developed area within this district consists of higher density housing structures. This region will continue to be popular with island residents due to its proximity to Honolulu's central business district. However, housing prices in the region continue to be pushed out of reach financially for more and more Oahu residents. This is a function of rapidly increasing land and housing prices associated with developing in the PUC.

**Ewa** - The subject property is located within the Ewa Development Plan area, which encompasses about eight percent of Oahu's land. The Ewa region has been designated as Oahu's second urban center to alleviate pressure for development within the Primary Urban Center and Central Oahu. As such:

- According to Oahu's General Plan, the highest proportion of the island's development potential is by policy being directed to the Ewa Development Plan Area over the next 25 years.
- The Ewa region will be differentiated from other large residential communities on Oahu because it also is planned as a major employment center rather than bedroom community or communities serving the primary urban center.

The Ewa Development Plan Area accounted for approximately five percent of Oahu's housing stock in 1993. The Ewa region is a study in the contrast between old and new from many perspectives, including housing. Aging plantation and beach communities stand in contrast to new master planned communities which offer a variety of homes in many price ranges.

The relatively high proportion of affordable housing planned for the Ewa area and expected pricing structure for new homes is expected to result in significant levels of medium density development in the region. High density, high rise-type construction such as that found in the Primary Urban Center is

not likely, however, due to regional urban design standards which include a height limit of 150 feet.

**Central Oahu (H-1 corridor)** - This region is Oahu's second largest planning district based on geographic area and concentration of housing units. Due to their proximity to the subject property along the western H-1 corridor, two active developments in the Central Oahu Development Plan Area have been included within the market study area: Waikele and Royal Kunia. Each is a golf course-oriented community and according to this analysis 1,590 units have been completed or 4% of the existing Central Oahu housing stock.

The majority of the Central Oahu district's lands are in preservation, agricultural and military uses. Government policies and actions have supported continued agricultural use of Central Oahu's "prime" agricultural lands. For example, the 2,100 acres of Galbraith Trust lands being exchanged for 500 acres of the subject parcel are located within Central Oahu and are intended to be preserved for agricultural use as state lands.

General Plan population policies are also likely to curtail the pace of residential growth in Central Oahu as future housing demand is directed to Ewa.

### (2) Existing Supply within the Market Study Area — *17,000 units (6/30/93)*

The most important segment of supply is that which exists in the competitive market study area, defined as the master planned communities in the Ewa Development Plan area plus H-1 corridor projects of Waikele and Royal Kunia.

The Planning Department estimated that in June 1993 there were approximately 16,891 residential units within the designated market study area, including existing

neighborhoods and new home sales. The existing stock includes homes already sold within competitive projects such as:

- Ewa by Gentry
- Villages of Kapolei
- Makakilo
- West Loch Estates (in final phase)
- Royal Kunia
- Waikele

The breakdown of existing housing stock within the market study area is shown on the following page in Exhibit V-5, *Distribution of Housing Stock by Market Study Area (1993).*

**Exhibit V-5**
**East Kapolei Project**

**Distribution of Housing Stock by Market Study Area (1993)**

| | Existing Housing Stock as of June 30, 1993 | Share of Oahu Market |
|---|---|---|
| Ewa Development Plan Area | 15,301 | 5.19% |
| Waikele (Traffic Analysis Zones 148.02, 148.03) | 1,005 | 0.34% |
| Royal Kunia (Traffic Analysis Zones 146.01, 150.01) | 585 | 0.20% |
| **Total Market Study Area** | **16,891** | **5.73%** |
| Total Oahu | 295,014 | 100.00% |

Source: Planning Department (August 1994)

## (3) Additions to Supply within the Market Study Area

*34,000 units*

Projects which will be actively selling residential product within the market study area at the time the subject property is targeted for development must be considered in the analysis of supply and demand. These include:

- City of Kapolei
- Ewa by Gentry
- Ewa Marina
- Ewa Villages
- Villages of Kapolei
- Ko Olina
- Makakilo
- Makaiwa Hills
- Royal Kunia
- Waikele
- West Loch (will be completed prior to subject development)

A descriptive summary of the history and future plans for these major future additions to supply (projects of over 1,000 units) is presented in Appendix A, *Competitive Product*.

Estimations of future supply are shown the following table, Exhibit V-6, *Additions to Residential Supply - Market Study Area, 1994 - 2010*. It should be noted that the development schedule presented in Exhibit V-3 is only a general indicator of the timing of these planned projects. This is based on the "build-out" schedule which the developers have provided to the Planning Department and a review of the source information for tables which indicates that projects often slip on timing or are not built at all.

## Exhibit V-6, East Kapolei Project
## Additions to Residential Supply - Market Study Area, 1994 - 2010

| Project | Area | Total Units in Project[1] | 7/1/93-6/30/94 | 1995 | 1996-2000 | 2001-2005 | 2006-2010 |
|---|---|---|---|---|---|---|---|
| City of Kapolei | | | | | | | |
| Makai | Ewa | 2,000 | | | 500 | 1,000 | 500 |
| Mauka | Ewa | 750 | | | 250 | 500 | |
| Ewa by Gentry | Ewa | 5,622 | 503 | 1,069 | 4,050 | | |
| Ewa Marina | Ewa | 4,850 | | | 2,109 | 2,335 | 406 |
| Ewa Villages | Ewa | 1,716 | | 113 | 1,603 | | |
| Ewa Fairways | Ewa | 1,300 | | | 360 | 720 | 220 |
| Kapolei Knolls | Ewa | 380 | | | 380 | | |
| Ko Olina, Phase 1[2] | Ewa | 2,500 | | 280 | Remainder of schedule unknown | | |
| Ko Olina, Phase 2[3] | Ewa | 0 | Delayed Indefinitely | | | | |
| Makaiwa Hills[4] | Ewa | 2,130 | | | | 1,000 | 1,130 |
| Makakilo | | | | | | | |
| Post 1986 phases | Ewa | 1,707 | 10 | 102 | 1,096 | 499 | |
| Makakilo Hts. (Palailai) | Ewa | 404 | 69 | 136 | 199 | | |
| Makakilo Hts. (Schuler) | Ewa | 550 | 148 | 172 | 230 | | |
| Royal Kunia - Ph 1 | Central | 1,748 | | 350 | 1,398 | | |
| Royal Kunia - Ph 2 | Central | 2,000 | | | 1400 | 600 | |
| Villages of Kapolei | Ewa | 4,464 | 311 | 993 | 2,211 | 949 | |
| Waikele | Central | 1,530 | 532 | 578 | 420 | | |
| West Loch | Ewa | 503 | 328 | 175 | | | |
| Total Future | | 34,154 | 1,901 | 3,968 | 16,206 | 7,603 | 2,256 |

**Total Future Units to be Constructed** **34,154**

[1]Total units 7/1/93 - 2010
[2]Planning Department estimate based on Land Use Model and current observations
[3]Phase 2 Ko Olina "delayed indefinitely" per Planning Department, September 1994
[4]Planning Dept. estimate of units based on Land Use Model; consultant estimate of timing

Sources: Development Plan Annual Report, Fiscal Year 1994, Tables III-d and III-e

**Ko Olina Assumptions.** Due to inconsistencies in the developer's reporting, it was necessary for the consultant to make certain assumptions regarding the Ko Olina project.

- The Development Plan (DP) Annual Report, Fiscal Year 1994, published developer-provided construction schedules which indicate that Ko Olina residential component has been "delayed indefinitely," apparently due to the developer's failure to respond to the Planning Department's annual survey of construction.

- Subsequent discussions with Planning Department staff indicate that based on the department's Land Use Model and recent observations, a reasonable estimate for Ko Olina appears to be approximately 2,500 units before the year 2010, this compared to the 8,700 reported in last year's survey and the zero showing in the Development Plan Annual Report, FY 1994.

- According to conversations with the developer, 280 units are planned for construction in 1994.

**Makaiwa Hills Assumptions.** Exhibit V-6 reflects a total of 2,130 units for Makaiwa Hills by the year 2010, which is the estimate used in the Planning Department's Land Use Model. This estimate is utilized in the analysis of future supply rather than the 1,066 units reflected in the Development Plan Annual Report, Fiscal Year 1994. The latter estimate was based on a Committee Report reflecting Development Plan Amendment approval of 305 acres and 1,066 units. The 2,130 unit figure used in the Land Use Model and this analysis is more reflective of the probable density of the approved acreage (approximately 7 units per acre versus 3 per acre reflected by 1,066 units).

**Government Projects** - The Planning Department recognizes a number of housing developments as being sponsored by government. These include:

- **City Projects:** Ewa Villages, West Loch Estates, and Ewa Fairways, sponsored by the City and County of Honolulu; and

- **State of Hawaii Projects:** Villages of Kapolei, sponsored by the State of Hawaii's Housing Finance and Development Corporation;

- **Federal Projects:** An on-base, multi-family residential project of 120 units in the portion of Barbers Point Naval Air Station, which is to be retained for Department of Defense use following the planned base closure.

The government projects listed above were included in the estimation of future residential supply presented in Exhibit V-6 above, with the exception of Barbers Point. Planning Department staff advised against including this project in future supply as it was not intended to serve the local residential market.

**Projects Approved by the Land Use Commission** - In addition to reviewing advanced information on the projects included in future supply as reported to the City's Planning Department, the consultant reviewed the files of developments which have been submitted to the State Land Use Commission (LUC). The finding was that the majority of master planned communities presented as additions to future supply have received prior approval on the state level from the Land Use Commission, as shown in Exhibit V-7, ***Land Use Commission Approvals.***

## Exhibit V-7
## East Kapolei Project

### Land Use Commission Approvals

| Project | Date of Approval | Docket No. | Acres |
|---|---|---|---|
| City of Kapolei Phase I | June 29, 1988 | 87-613 | 135 |
| City of Kapolei Phase II | June 17, 1993 | 87-613 | 586 |
| Ewa by Gentry | Year of 1974 | N/A | 331 |
| Ewa by Gentry | May 8, 1989 | 88-627 | 673 |
| Ewa Marina | October 17, 1990 | 89-651 | 403 |
| Kapolei Knolls | November 20, 1989 | 88-628 | 77 |
| Ko Olina, Phase 1 | September 12, 1985 | 83-562 | 642 |
| Ko Olina, Phase 2 | February 14, 1991 | 90-655 | 372 |
| Makaiwa Hills | October 28, 1993 | 92-687 | 1,700 |
| Royal Kunia Phase 1 | October 24, 1986 | 86-600 | 547 |
| Royal Kunia Phase 2 | December 9, 1993 | 92-683 | 504 |
| Villages of Kapolei | August 23, 1988 | 88-622 | 830 |
| Waikele | February 28, 1986 | 85-594 | 577 |
| West Loch Estates | April 15, 1988 | 87-616 | 212 |

The acreage approved by the Land Use Commission suggests that for projects such as Makaiwa Hills, additional units beyond those shown in the Planning Department's construction estimates may be expected in some future period. In the absence of further specificity, the Planning Department's Land Use Model estimate Makaiwa Hills (2,130 units by 2010) was used to reflect the future for the purposes of this assessment.

**Unadjusted supply.** The unadjusted estimate of total supply for the market study area in the year 2010 is 51,045 units, as shown in Exhibit V-8, *Supply Summary, 1994-2010.*

## Exhibit V-8, East Kapolei Project, Supply Summary, 1994 - 2010

| Project | Area | Total Units in Project[1] | 7/1/93-6/30/94 | 1995 | 1996-2000 | 2001-2005 | 2006-2010 |
|---|---|---|---|---|---|---|---|
| Existing (6/30/93) | | 16,891 | | | | | |
| City of Kapolei | | | | | | | |
| Makai | Ewa | 2,000 | | | 500 | 1,000 | 500 |
| Mauka | Ewa | 750 | | | 250 | 500 | |
| Ewa by Gentry | Ewa | 5,622 | 503 | 1,069 | 4,050 | | |
| Ewa Marina | Ewa | 4,850 | | | 2,109 | 2,335 | 406 |
| Ewa Villages | Ewa | 1,716 | | 113 | 1,603 | | |
| Ewa Fairways | Ewa | 1,300 | | | 360 | 720 | 220 |
| Kapolei Knolls | Ewa | 380 | | | 380 | | |
| Ko Olina, Phase 1[2] | Ewa | 2,500 | | 280 | Schedule unknown | | |
| Ko Olina, Phase 2[3] | Ewa | 0 | | Remainder Delayed Indefinitely | | | |
| Makaiwa Hills[4] | Ewa | 2,130 | | | | 1,000 | 1,130 |
| Makakilo | | | | | | | |
| Post 1986 phases | Ewa | 1,707 | 10 | 102 | 1,096 | 499 | |
| Makakilo Hts. (Palailai) | Ewa | 404 | 69 | 136 | 199 | | |
| Makakilo Hts. (Schuler) | Ewa | 550 | 148 | 172 | 230 | | |
| Royal Kunia - Ph 1 | Central | 1,748 | | 350 | 1,398 | | |
| Royal Kunia - Ph 2 | Central | 2,000 | | | 1400 | 600 | |
| Villages of Kapolei | Ewa | 4,464 | 311 | 993 | 2,211 | 949 | |
| Waikele | Central | 1,530 | 532 | 578 | 420 | | |
| West Loch | Ewa | 503 | 328 | 175 | | | |
| Total Future | | 34,154 | 1,901 | 3,968 | 16,206 | 7,603 | 2,256 |

| | |
|---|---|
| **Total Future Additions[1]** | **34,154** |
| **Existing Stock** | **16,891** |
| **Total Unadjusted Supply** | **51,045** |

[1]Total units 7/1/93 - 2010
[2]Planning Department estimate based on Land Use Model and current observations
[3]Phase 2 Ko Olina "delayed indefinitely" per Planning Department, September 1994
[4]Land Use Model estimate of units; consultant estimate of timing
Sources: Future: Development Plan Annual Report, Fiscal Year 1994, Tables III-d and III-e (obtained pre-publication from Planning Department); Existing stock: Planning Department

## (4) Adjustments to Supply

Adjustments to future supply calculations were necessary to ensure that the analysis conforms to the most likely future conditions. These included (a) an adjustment for timing which is caused by projects not meeting their intended development schedules and (b) allowance for the occupancy of resort area residential units by non-residents.

### (a) Adjustment for Timing of Additions to Supply *(5,000) units*

In practice the construction of units included in future additions to supply may not occur according to planned development schedules. In fact, history has shown this to be consistently true. Delay can result from a variety of factors, including:

- **Timing of construction vs. schedule.** Over the past several years, the projects of Ko Olina, Ewa by Gentry, Ewa Marina, and Royal Kunia each have experienced difficulties in meeting the schedules published in the Planning Department's Development Plan Annual Report. If these developer-provided construction schedules were taken at face value with no analysis or adjustment, there could be a danger of disapproving viable projects.

- **Recent market conditions.** Recent upturns in interest rates, the recession in Hawaii and cyclical downturn in the residential market probably have accounted for some delays. Scarce investment capital for developer financing also has been a factor. Several projects reflected in the estimate of unadjusted future supply have fallen prey to these conditions.

- **Delays in the provision of needed infrastructure.** In a situation where so much new infrastructure is required, delays in government financing of off-site improvements can delay housing construction. Although this situation is clearly beyond the control of the developer, it still results in construction delays and affects the timing of future residential supply.

**Committed versus Proposed Residential Units.** There is an important distinction between the level of "committed" versus "proposed" projects. The Planning Department categorizes new development using the following definitions:

> ***Committed projects*** *are considered certain to occur, because they are either under construction, have building permits in place, or are government projects whose completion is assumed. They are directly assigned to the location specified based on the schedule provided, subject only to the condition of not exceeding islandwide demand.*
>
> ***Proposed projects*** *are not considered certain. They consist of projects with known characteristics and schedules as given by developers. Their completion is dependent on the interaction between supply and demand factors.*
>
> *Source: Forecast of Population, Housing and Employment on Oahu by Small Area 1990 - 2010, Planning Department, 1993.*

Figure V-9, *Housing Units Committed Versus Proposed: Market Study Area,* indicates that in September 1993 only 21 percent of the future supply in the primary competitive area was "committed." The implication is that nearly four-fifths of the additions to future supply reflects the characteristics and schedules proposed by developers, which are by no means assured.

**Exhibit V-9**
**East Kapolei Project**

**Housing Units Committed versus Proposed: Market Study Area**

| Project Name | Proposed[1] | Committed[2] | Total proposed or committed | Percent Committed |
|---|---|---|---|---|
| Ewa | | | | |
| Ewa by Gentry | 6,364 | 0 | 6,364 | 0% |
| Ewa Marina | 4,800 | 0 | 4,800 | 0% |
| Ewa Villages | 120 | 0 | 120 | 0% |
| Kapolei Knolls | 475 | 0 | 475 | 0% |
| City of Kapolei (makai) | 2,299 | 0 | 2,299 | 0% |
| City of Kapolei (mauka) | 1,044 | 0 | 1,044 | 0% |
| Villages of Kapolei | 0 | 5,004 | 5,004 | 100% |
| Ko Olina | 9,509 | 0 | 9,509 | 0% |
| Makakilo | 961 | 404 | 1,365 | 30% |
| Makaiwa Hills[3] | 0 | 0 | 0 | 0% |
| Central Oahu | | | | |
| Waikele | 1,268 | 1,915 | 3,183 | 60% |
| Royal Kunia | 2,452 | 252 | 2,704 | 9% |
| **Total** | **29,292** | **7,575** | **36,867** | **21%** |

[1]"Proposed projects" are not considered certain but have known characteristics and schedules
[2]"Committed projects" are assumed "certain to occur" by the City and County of Honolulu
Sources: For definitions: Forecast of Population, Housing and Employment on Oahu by Small Area, 1990-2010, Planning Department, 1993; For estimates: "Proposed and Committed Projects Beyond 1990 by DP Area," Planning Department, September 1993)
[3]Makaiwa Hills was excluded from the source of 1993 estimates due to timing

**Construction Timing Conclusion.** As indicated previously, the additions to supply which are published by the Planning Department reflect both committed and proposed projects. In 1993 only 22 percent of the major study area project units were committed (Exhibit V-9, *Committed versus Proposed Projects*). Further, the experience of the past few years has been that several major developers have fallen behind their intended production schedules. Lastly, recent increases in long-term interest rates may affect the ability of residential product to be

sold over the next few years, causing a further extension of project schedules.

Based on the above assessment of timing, an estimate of 15 percent slippage in project build-out schedules has been assumed. This assumption is reflected as a deduction from additions to supply expected in the year 2010 based on habitual delays in actual development as compared to the schedules reported by developers. This deduction for timing is further supported by Exhibit V-9 which indicates that nearly four out of every five the units reflected in the additions to supply is considered "proposed" as opposed to "committed."

### (b) Adjustment for Non-Resident Occupancy *(1,470) units*

Two of the major projects within the study area have been planned as both resort and residential communities -- Ko Olina and Ewa Marina. As a part of this analysis property managers at similar projects were interviewed. They indicated that over time residentially-zoned units near resorts are prone to be removed from local-serving residential supply for at least two reasons:

(1) Units are purchased by non-residents and left vacant, and/or

(2) "Residential" units are absorbed by visitors via long-term rentals and therefore are unavailable to local residents. In one situation, a source estimated that over time at least 80 percent of residential units in resort communities no longer serve the local market after the first two to three years.

Based on the foregoing assessments, an adjustment of 20 percent or 1,470 future units planned for the resort-oriented communities of Ewa Marina and Ko Olina has been assumed. This deduction from future supply is used to reflect the absorption of units by non-residents. This appears to be conservative, based on interviews with property managers indicating up to 80 percent of units being effectively removed

from local residential supply due to non-resident occupancy in comparable situations.

### (5) Calculation of Supply

Total adjusted supply for the market study area is estimated at 44,452 units by 2010, including 16,891 existing units. Exhibit V-10, *Calculation of Supply, 1994-2010,* summarizes the foregoing discussion.

**Exhibit V-10**
**East Kapolei Project**

**Calculation of Supply**
**1994 - 2010**

| | Units | Notes |
|---|---|---|
| Existing Housing Inventory - Study Area | 16,891 | Refer to Step 2; Exhibit V-5 |
| Additions to Future Supply | 34,154 | Refer to Step 3; Exhibit V-6 |
| Deduction for Timing of Additions to Future Supply (15%) | -5,123 | Refer to Step 4(a) |
| Deduction for Non-Resident Occupancy | -1,470 | Refer to Step 4(b) |
| **Adjusted Supply for the Year 2010 - Market Study Area** | **44,452** | |

## SUPPLY AND DEMAND CALCULATION

Exhibit V-11, *Supply and Demand Summary,* presents the estimated supply and demand relationship for the market study area.

Based on these calculations it would appear that adequate demand would exist for residential development on the subject property. These conclusions were confirmed by interviews in the local community and with developers and real estate agents active in the Oahu residential market.

## Exhibit V-11
## East Kapolei Project

### Supply and Demand Summary

| | Low | Midpoint | High | |
|---|---|---|---|---|
| **Demand Calculation** | | | | |
| 1 Unadjusted Study Area Demand | 52,661 | 55,068 | 57,474 | Refer to Exhibit V-3 |
| 2 Adjustment for University of Hawaii at W. Oahu | 300 | 300 | 300 | Refer to Exhibit V-3 |
| 3 **Total Adjusted Demand - Market Study Area** | **52,961** | **55,368** | **57,774** | Includes 16,891 existing units |
| **Supply Calculation** | | | | |
| 4 Existing Inventory - Study Area | 16,891 | 16,891 | 16,891 | Refer to Exhibit V-5 |
| 5 Additions to future supply | 34,154 | 34,154 | 34,154 | Refer to Exhibit V-6 |
| 6 Deduction for Timing of Additions to Future Supply (15%) | -5,123 | -5,123 | -5,123 | Consultant estimate |
| 7 Deduction for Non-Resident Occupancy | -1,470 | -1,470 | -1,470 | Consultant estimate (applies only to Ewa Marina and Ko Olina) |
| 8 **Adjusted Supply for the Year 2010 - Market Study Area** | **44,452** | **44,452** | **44,452** | Includes existing units (Line 4) |
| **Conclusions** | | | | |
| 9 Total Market Study Area Demand (1994-2010) | **52,961** | **55,368** | **57,774** | Line 3 |
| 10 Total Market Study Area Supply (1994-2010) | **44,452** | **44,452** | **44,452** | Line 8 |
| 11 **Estimated Shortfall - Market Study Area (1994-2010)** | **8,509** | **10,916** | **13,322** | Line 3 less Line 8 |
| 12 **Additional demand - Market Study Area (1994-2010)** | **36,070** | **38,477** | **40,883** | Total demand (Line 3) less existing (Line 4) |
| 13 **Additional demand - Ewa Development Plan Area Only (1994-2010)** | **28,856** | **30,782** | **32,706** | Excludes Royal Kunia, Waikele and existing units |

# MARKET POSITION

## Product Survey

The first step in determining the potential market performance of the subject property was to survey products in master planned communities offered for sale in the competitive study area. The projects were surveyed as a guideline for evaluating the product sizing, pricing and absorption proposed by the developer, Schuler Homes, Inc.

Once the existing products were identified and surveyed, a list of comparable products was prepared for the proposed East Kapolei Project. These comparables served as guidelines for potential products which could be developed in the subject project's subdivisions and indicators of their potential performance.

Exhibit V-12, *Existing Residential Products, 1994* on the following page provides an overview of subdivisions which are currently active or have recently been completed within the market study area.

## Exhibit V-12, East Kapolei Project, Existing Residential Products, 1994

| Master Planned Community / Subdivision | Developer | Area | Type | Number | Monthly Absorp.* | Living Area (sq ft) Min | Max | Avg | $(1000s) Min | Max | Avg |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ewa by Gentry | | | | | | | | | | | |
| Sun Terra on the Park (market) | Gentry | Ewa | SFD | 184 | 13 | 945 | 1671 | 1308 | 259 | 310 | 285 |
| Sun Terra South (market) | Gentry | Ewa | SFD | 72 | 18 | 945 | 1671 | 1308 | 259 | 310 | 285 |
| Summerhill (gap)[1] | Gentry | Ewa | SFD | 305 (R) | N/A | 1055 | 1648 | 1352 | 245 | 295 | 270 |
| Coronado (affordable)[2] | Gentry | Ewa | SFA | 138 | Lottery | 407 | 710 | 559 | 90 | 150 | 120 |
| Currently offered - total project | | | | 699 | 31 | | | | | | |
| Villages of Kapolei | | | | | | | | | | | |
| Malanai (market) | HFDC | Ewa | SFD | 327 | 11 | 1730 | 2248 | 1989 | 280 | 350 | 315 |
| Malanai Iki (affordable) | HFDC | Ewa | SFA | 88 | Lottery | 1118 | 1266 | 1192 | 96 | 130 | 113 |
| Kekuilani (market) | HFDC | Ewa | SFA/D | 472 | 32 | 915 | 1510 | 1213 | 270 | 282 | 276 |
| Kekuilani (affordable) | HFDC | Ewa | SFA/D | 472 | Lottery | 800 | 1800 | 1300 | 99 | 177 | 138 |
| Aleloa market | HFDC | Ewa | SFD | 120 | 12 | 1118 | 1430 | 1274 | 275 | 398 | 337 |
| Aleloa affordable | HFDC | Ewa | SFA/D | 203 | Lottery | | | | 190 | 230 | 210 |
| Currently offered - total project | | | | 1682 | 55 | | | | | | |
| West Loch | | | | | | | | | | | |
| Fairway Masters | Zane | Ewa | SFD | 43 | 7 | 1420 | 2072 | 1746 | 388 | 438 | 413 |
| Currently offered - total project | | | | 43 | 7 | | | | | | |
| Makakilo | | | | | | | | | | | |
| West Hills | Fin. Realty | Ewa | SFD | 96 | 10 | 1394 | 1787 | 1591 | 326 | 393 | 360 |
| Royal Ridge | Fin. Realty | Ewa | SFD | 48 | 1 | 1370 | 1818 | 1594 | 376 | 404 | 390 |
| Westview | Schuler | Ewa | SFA | 148 | 12 | 750 | 980 | 865 | 183 | 212 | 198 |
| Currently offered - total project | | | | 292 | 23 | | | | | | |
| Royal Kunia | | | | | | | | | | | |
| Phase I - SFD | CCHH | Central | SFD | 146 | 146(R) | 800 | 2051 | 1426 | 250 | 400 | 325 |
| Phase I - SFA (affordable) | CCHH | Central | SFA | 248 | lottery | 770 | 1000 | 885 | 183 | 205 | 194 |
| Currently offered - total project | | | | 394 | N/A | | | | | | |
| Waikele | | | | | | | | | | | |
| ParkGlen | Schuler | Central | SFA | 204 | 20 | 796 | 918 | 857 | 229 | 239 | 234 |
| Highlands | Schuler | Central | SFA | 118 | 26 | 829 | 965 | 897 | 198 | 244 | 221 |
| Royal Pines | Schuler | Central | SFD | 126 | 24 | 1183 | 1664 | 1425 | 309 | 325 | 317 |
| Signature | Schuler | Central | SFD | 67 | 20 | 1329 | 1663 | 1496 | 356 | 437 | 397 |
| Champions | Schuler | Central | SFD | 117 | 9 | 1336 | 1664 | 1500 | 355 | 445 | 400 |
| Currently offered - total project | | | | 632 | 99 | | | | | | |

SFA= single family attached; SFD= single family detached; CCH = Castle & Cooke Homes Hawaii; Fin. Realty= Finance Realty
HFDC=Housing Finance and Development Corporation; R=reservations; * based on realtor interviews
[1] Summerhill has been on the market for two months and all units are reserved; [2] Excludes an additional 118 affordable rental units

## Profile of Target Markets

As part of this analysis, a written survey regarding target markets was conducted among real estate agents currently selling residential products within the market study area. Based on information provided by the developer concerning the range of products to be offered at the subject property, the target markets for the proposed project are expected to be as shown in Exhibit V-13, *Profile of Target Markets*:

**Exhibit V-13**
**East Kapolei Project**

**Profile of Target Markets**

| Residential Product | Age Range | Ownership History |
|---|---|---|
| Multifamily | | |
| Affordable | All | First time |
| Gap | 25-45 | First time and move up |
| Market | 25-45 | Move up |
| Single Family | 30-40 | Move up |

## Residential Pricing Overview

The proposed community is anticipated to be developed in conformance with draft guidelines for development agreements between the City and County of Honolulu and residential developers. These draft *Rules for Unilateral Agreements Requiring Affordable Housing* are dated August 1994 by the Department of Housing and Community Development. They currently provide for 30 percent of a development's housing component to be affordable and the remainder to be offered at market rates.

Prices for affordable and market-priced homes within the subject property were calculated by the East Kapolei Project's developer, Schuler Homes, Inc. Based on a comparison with

prices in competitive communities, they appear to be reasonable.

## Affordable Product Pricing

For the purpose of this analysis, affordable residential product is defined as those new homes which are priced to meet the financial qualifications of families whose incomes are up to 120 percent of the Oahu median, which in 1994 is assumed to be $53,000 for a family of four.

**Divisions within the Affordable Category.** In order to comply with City and County's draft unilateral agreement guidelines, the project's developer will make two divisions within the affordable product in the proposed development.

*Ten percent* of the development's product will be priced for families with income levels up to 80 percent of Oahu's median.

*An additional twenty percent* of the product will be priced to accommodate families in the 81-120 percent of median income brackets.

**Pricing Assumptions.** Draft pricing assumptions for unilateral agreements entered into by the City and County include:

1. A ten percent down payment.
2. Interest rate: one-year average of thirty-year U.S. Treasury bills plus one-half percent (currently calculated at 7.5 percent using this guideline).
3. If the developer secures lower interest rates than the above, the developer must adjust prices accordingly.
4. Thirty-three percent (33%) of the purchaser's gross monthly income allocated for housing payments (principal, interest, real property taxes, insurance, etc.).

(Source: Summary, Unilateral Agreements: Affordable Housing Rules [Draft], City and County of Honolulu, August 1994)

The developer's pricing is slightly more conservative. In addition to the above guidelines, Schuler Homes, Inc. has provided for an allowance of $200 per month above the 33 percent of income requirement. This extra allowance could be used to cover maintenance or community association dues for multifamily units. A minimum of two bedrooms per unit is also assumed by the developer for the affordable product.

Exhibit V-14, *Affordable Pricing Structure* shows the developer's assumed pricing of affordable product based on the guidelines discussed above for the East Kapolei Project. Prices are presented in 1994 dollars.

**Exhibit V-14**
**East Kapolei Project**

**Affordable Pricing Structure**

| Family Size | | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Percent of Median Annual Income | 80% | $33,920 | $38,160 | $42,400 | $45,792 | $49,184 | $52,576 | $55,968 |
| Home Prices | | $116,448 | $134,977 | $153,506 | $168,329 | $183,152 | $197,975 | $212,798 |
| Percent of Median Annual Income | 100% | $42,400 | $47,700 | $53,000 | $57,240 | $61,480 | $65,720 | $69,960 |
| Home Prices | | $153,506 | $176,666 | $199,827 | $218,356 | $236,885 | $255,414 | $273,942 |
| Percent of Median Annual Income | 120% | $50,880 | $57,240 | $63,600 | $68,688 | $73,776 | $78,864 | $83,952 |
| Home Prices | | $190,563 | $218,356 | $246,149 | $268,384 | $290,618 | $312,853 | $335,087 |

Source: Schuler Homes, Inc.
Assumes mortgage rate of 7.5%

## Market-Priced Product Pricing

Four types of market-priced residential units are planned for the subject property:

- *Single family homes* with an average of 1,500 square feet of living area, an average price of $285,000 and average density of 7 units per acre.

- *Townhomes* with an average of 1,200 square feet, an average price of $235,000 and density of 11 units per acre.

- *Low density multifamily homes* with 800-900 square feet, at $208,000 and constructed at a density of 15 units per acre.

- *Medium density multifamily homes* with 800 square feet, at $185,000 and density of 20 units per acre.

These products are included for illustrative purposes; actual products developed could vary significantly. These variances could be caused by a change in consumer style preferences and/or unforeseeable changes in the economic, market and financial conditions in the market area. All prices are expressed in 1994 dollars with no adjustment for inflation.

## ABSORPTION

Once the product types and target markets were identified for each of the neighborhood areas, a potential absorption schedule was prepared using the following assumptions:

- At least four different residential product types would be active at a time.

- As each product type is built out it would be replaced with a similar product.

The schedule for Phases I and II has been provided by the developer, Schuler Homes, Inc. The hypothetical absorption was based on both quantitative and qualitative factors presented in the following sections.

**Quantitative factors.** Analysis of potential absorption considered:

- Research of products which have been on the market for extended periods including Ewa developments presented above in Exhibit V-11;
- A cross-check of the overall sales rates of comparable master planned communities for the past six years obtained from Prudential Locations, Inc.; and
- Historical Oahu sales and construction performance of the subject project's developer, Schuler Homes, Inc.
- The build up and decline of sales velocity at the beginning and end of phases within a master planned community.

**Qualitative Factors.** Exhibit V-15, *Qualitative Evaluation,* provides an overall ranking of the East Kapolei Project vis-a-vis competitive developments. Factors evaluated include access to the property, views, neighborhood ambiance, on-site amenities and the diversity of home design choices offered.

**Exhibit V-15**
**East Kapolei Project**

**Qualitative Evaluation: East Kapolei Project vs. Competitive Master Planned Communities**

| Community | Access | Views | Neighbor-hood | Amenities | Design Choices | Overall Ranking |
|---|---|---|---|---|---|---|
| Ewa by Gentry | Similar | Similar | Slightly superior | Similar | Inferior | Slightly inferior |
| Makakilo | Inferior | Far superior | Similar | Similar | Slightly superior | Similar |
| Royal Kunia | Superior | Superior | Similar | Superior | Superior | Superior |
| Villages of Kapolei | Slightly superior | Similar | Slightly superior | Superior | Similar | Slightly superior |
| Waikele | Superior | Superior | Superior | Far superior | Similar | Superior |
| West Loch | Similar | Superior | Similar | Slightly superior | Similar | Slightly superior |

**Comparison to Ewa projects.** The subject development is likely to compare with other Ewa-area master planned communities as follows:

- The Ewa by Gentry project is expected to be particularly competitive with the proposed development. This assessment is based on its similarity to the subject parcel in terms of location, topography, climate and target markets. However, based on the previous analysis, the subject development may sell at a slight premium vis-a-vis the Ewa by Gentry project based on the greater diversity of product expected within the subject development.

- The Villages of Kapolei project also resembles the proposed development by virtue of its affordable component and diversity of product types. It is expected to offer similar retail amenities, but its golf course could cause the Villages of Kapolei to sell at a slight premium vis-a-vis the subject development.

- Additional competition is expected from single family and multifamily components of the Makakilo development. This development is qualitatively ranked "similar" to the East Kapolei Project.

- Although it is still actively selling, West Loch Estates is planned to be built-out before the subject property could commence.

**Comparison to Waikele and Royal Kunia.** The Central Oahu community of Waikele is likely to continue to outsell all current competitors within the market study area. It also is likely to outsell the subject property in the future. This is due to its favorable location, topography, views and exceptional amenities, including the Waikele Power Center retail complex and golf course.

Royal Kunia is likely to sell at a premium vis-a-vis the subject as well. This is due to its topography, climate, access to H-1 freeway, views and on-site amenities.

## Hypothetical Absorption Schedule

Exhibit V-16, *Hypothetical Absorption Schedule,* presents an absorption schedule based on the timing and absorption assumptions discussed above. Several caveats must be presented with regard to the hypothetical absorption schedule:

- The schedule represents only one of many potential scenarios which could actually occur.

- The actual schedule may differ significantly based on future market or financial conditions.

- The hypothetical absorption schedule reflects only market-related factors and does not account for soil conditions, financial optimization or engineering factors.

The schedule which follows is intended to reflect the build up and decline of absorption during the beginning and end of phases. This cycle of activity is typical in the construction of master planned communities.

# Exhibit V-16
# East Kapolei Project

## Hypothetical Absorption Schedule

| Product Type - Target Market | Density (units/ac) | Number of Units | Avg Price ($000) | Absorp per mo[1] | Absorp per yr | 1997 Yr 1 | 1998 Yr 2 | 1999 Yr 3 | 2000 Yr 4 | 2001 Yr 5 | 2002 Yr 6 | 2003 Yr 7 | 2004 Yr 8 | Total Ph 1 | 2005 Yr 9 | 2006 Yr 10 | 2007 Yr 11 | 2008 Yr 12 | 2009 Yr 13 | 2010 Yr 14 | 2011 Yr 15 | Total Ph 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Single Family - Market | 7 | 2,590 | $285,000 | 13 | 156 | 120 | 195 | 195 | 195 | 195 | 195 | 195 | 5 | 1295 | 115 | 195 | 195 | 195 | 195 | 195 | 205 | 1295 |
| Townhome - Market | 11 | 1,810 | $235,000 | 9 | 108 | 75 | 135 | 135 | 135 | 135 | 135 | 135 | 20 | 905 | 95 | 135 | 135 | 135 | 135 | 135 | 135 | 905 |
| Low Density - Market | 15 | 2,400 | $208,000 | 25 | 300 | 90 | 180 | 180 | 180 | 180 | 180 | 180 | 30 | 1200 | 120 | 180 | 180 | 180 | 180 | 180 | 180 | 1200 |
| Medium Density - Market | 20 | 200 | $185,000 | 2 | 24 | 5 | 15 | 15 | 15 | 15 | 15 | 15 | 5 | 100 | 20 | 15 | 15 | 15 | 15 | 15 | 5 | 100 |
| Medium Density - Affordable | | | | | | | | | | | | | | | | | | | | | | |
| Up to 80% of median | 20 | 1,000 | $133,000 | 3 | 36 | 35 | 75 | 75 | 75 | 75 | 75 | 75 | 15 | 500 | 50 | 75 | 75 | 75 | 75 | 75 | 75 | 500 |
| Up to 120% of median | 20 | 2,000 | $175,000 | 6 | 72 | 75 | 150 | 150 | 150 | 150 | 150 | 150 | 25 | 1000 | 100 | 150 | 150 | 150 | 150 | 150 | 150 | 1000 |
| | | 10,000 | | | | 400 | 750 | 750 | 750 | 750 | 750 | 750 | 100 | 5000 | 500 | 750 | 750 | 750 | 750 | 750 | 750 | 5000 |

[1] average monthly absorption = total per product/96 mo. in phase I

## RESIDENTIAL CONCLUSION

**Average Annual Absorption.** Based on the estimated 15-year sell out of the 10,000 residential units in the proposed development (which includes 9,250 units before 2010), an average annual absorption rate of between 600 and 700 units appears to be reasonable. This estimate compares favorably with the experience of other communities and with the developer's assessment of annual sales potential.

**Anticipated Capture Rates - Market Study Area.** In order to assess the subject development's potential to capture future residential demand, a comparative analysis was conducted using five-year sales performance of comparable master planned communities within the market study area (raw data source: Prudential Locations, Inc.). Projects included in this analysis included Ewa by Gentry, Makakilo, Waikele and West Loch Estates. The results of this investigation showed average project capture rates during active sales periods ranging from approximately 15 percent of new home sales within the market study area to approximately 44 percent.

The subject property's estimated capture rates for future housing demand in the market study area are estimated to range between 20 and 30 percent per year. Based on the capture rates of comparable developments (15 to 44 percent), the range of capture rates assumed for the proposed development appears to be conservative.

As shown below in Exhibit V-17, *Capture Rates for Future Demand*, a capture rate of 25% of the market study area would indicate sales of 9,510 units at the midpoint of population projections. This compares favorably to the 9,250 units proposed within the subject property by the year 2010.

**Exhibit V-17**
**East Kapolei Project, Capture Rates of Future Demand**

| | Low Point | Midpoint | High Point |
|---|---|---|---|
| Study area future demand (market study area demand less existing supply) | 36,070 | 38,477 | 40,883 |
| Study area capture rate @ 20% | 7,214 | 7,695 | 8,177 |
| Study area capture rate @ 25% | 9,018 | 9,619 | 10,221 |
| Study area capture rate @ 30% | 10,821 | 11,543 | 12,265 |

**Anticipated Capture Rates - Total Oahu Demand.** The estimated capture rate for the subject property falls within the 12 to 14 percent range of the total Oahu demand for new housing units in 2010.

# Section VI
# RETAIL

Section VI

# RETAIL

## INTRODUCTION

Projects of the size proposed for the subject property often require a retail component. The current draft site plan provides for the location of several retail uses within the proposed community. (To view this map, see Exhibit III-1, *East Kapolei Project - Location Map* located on page III-3.)

**Organization of this Section.** This section defines the retail trade area for potential neighborhood retail services located on the subject property. Further, it reviews current and future supply and demand conditions and outlines in general terms the possible retail tenants which could be located in retail facilities should they be developed on the subject property.

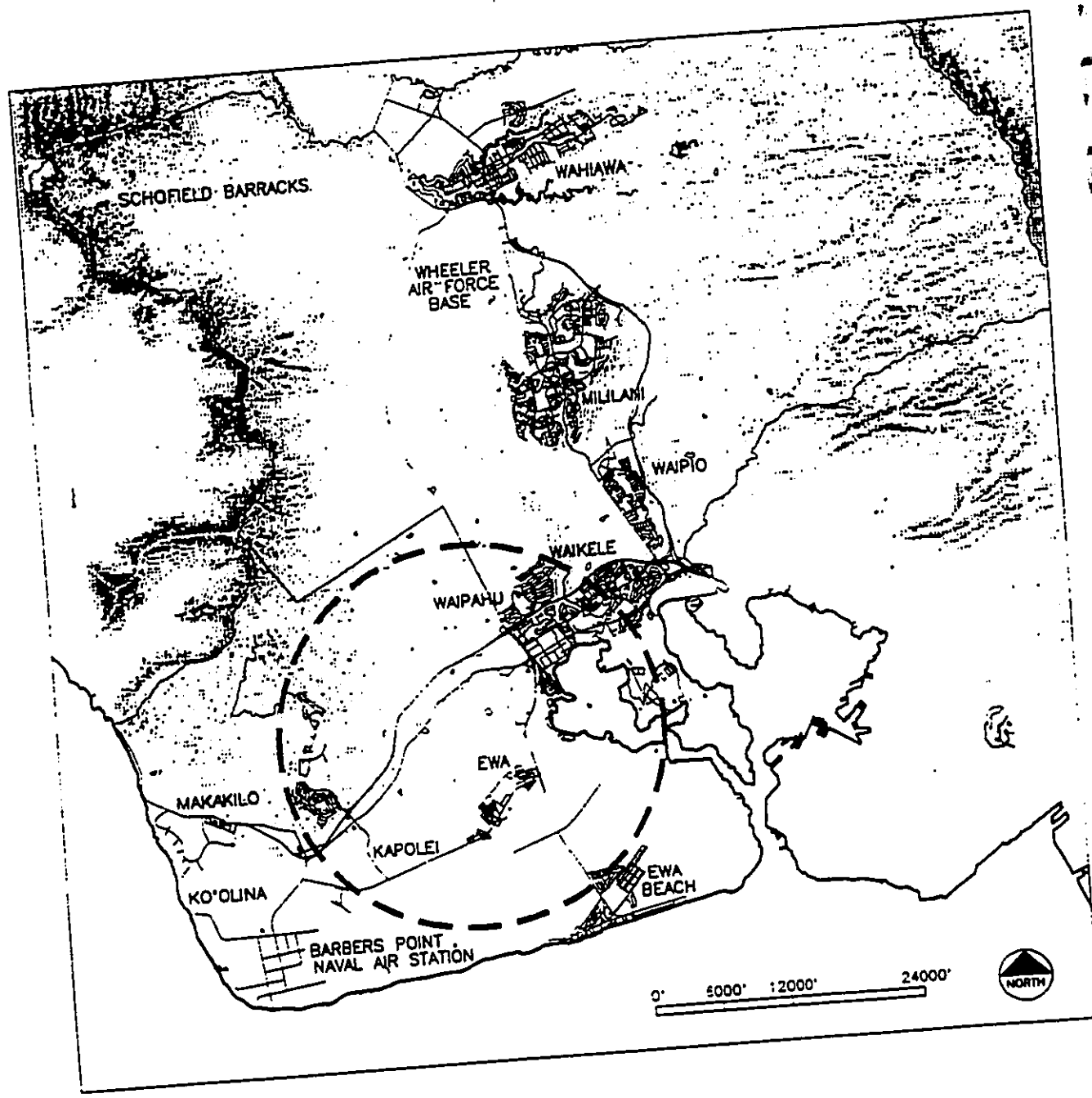
## RETAIL TRADE AREA DEFINITION

The trade area for neighborhood commercial uses proposed for the subject property was defined as a three-mile radius from the center of the parcel. Exhibit VI-1, *East Kapolei Project: Retail Trade Area* illustrates this area. It includes all or a part of the following communities:

- Ewa Villages
- Ewa by Gentry
- Royal Kunia
- Villages of Kapolei
- West Loch Estates
- Naval Air Station, Barbers Point (NASBP) (portion)
- Makakilo (portion)
- City of Kapolei (portion)

Although only portions of West Loch, NASBP, Makakilo and the City of Kapolei are considered within the trade area, all proposed housing units for those areas were included in the analysis.

**Exhibit VI-1**
**East Kapolei Project: Retail Trade Area**



# METHODOLOGY

The calculation of the need for support retail on the subject parcel is based on an analysis of the market forces of supply and demand. The analysis focuses purely on need for additional retail which is created by new housing.

- **Supply.** Estimation of supply is based on the existing and planned neighborhood shopping centers within the retail trade area. Existing supply is described for informational purposes.

- **Demand.** Future demand for neighborhood retail facilities within the subject parcel is based on growth in population within the retail trade area. It assumes that the existing population currently is having its needs met.

## SUPPLY

### Current Retail Supply

The existing supply of retail space within the defined trade area is quite limited, since its three-mile radius is largely undeveloped agricultural land or in residential use. The following retail establishments are currently doing business within the designated retail trade area and are presented for informational purposes:

- *The recently opened Kapolei Shopping Center, Phase I.* This center is located on the southern fringe of the retail trade area. This phase totals 140,000 square feet on 18.5 acres according to staff of The Estate of James Campbell.

- *The Ewa Villages neighborhood.* This older residential area has a few "mom and pop" convenience stores but no significant commercial area.

- *The town of Waipahu.* This area contains a mixture of commercial uses. Retail commercial in Waipahu which is

not associated with shopping center activity was excluded from relevant supply for the purpose of this analysis, as it is dissimilar to other competition. Only the expansion of the Waipahu Town Center was included in the estimate of future supply.

- *Makakilo strip center*. Currently there is limited retail for the convenience of local residents.

## Additions to Retail Supply

Exhibit VI-2, *Existing and Future Retail Supply - Trade Area* provides a summary of the additional retail planned within the subject property's trade area. The existing projects are included as an illustration of the limited retail supply currently within the trade area.

## Exhibit VI-2
## East Kapolei Project

### Existing and Future Retail Supply - Retail Trade Area

| Shopping Center | Square Feet | Acres |
|---|---|---|
| **Existing Supply (selected)** | | |
| Kapolei Shopping Center Phase I | 140,000 | 18.5 (given) |
| Waipahu Town Center | 160,000 | 11 (given) |
| **Future Supply** | | |
| Kapolei Shopping Center Phase II | 100,000 | 11.0 (given) |
| Kapolei Power Center | | |
| Phase I | 150,000[1] | 12.5[1] (given) |
| Phase II | 75,000[1] | 6.9[1] (derived) |
| Kapolei Entertainment Center Restaurant Pads | 12,000 | 1.5 acres[2] (estimate) |
| Villages of Kapolei | Unknown | 15 (estimate) |
| Laulani Retail Center | 150,000 | 20 (given) |
| Commercial proposed by The Estate of James Campbell | 230,000 | 27 acres[3] (given) |
| Additional Ewa by Gentry Commercial (tentative) | 50,000 | 4.6 (derived) |
| Waipahu Town Center Expansion | 80,000[4] (given) | 7.3 (derived) |
| Royal Kunia (Walmart and Times) | 165,000 (derived) | 15 acres (given) |
| **Total Future Supply in Acres (Retail Trade Area)** | | **121** |

Sources for "given": The Estate of James Campbell, Waipahu Town Center, Royal Kunia. "Derived" consultant estimates based on a lot coverage ratio of 0.25 and 43,560 square feet per acre; [1]Indicates that actual has been discounted by 50 percent due to lack of direct competitiveness to subject retail; [2]Total parcel is 8 acres. 1.5 acres represent three restaurant pads which are considered competitive with retail on the subject parcel. [3] Total parcel is 27 acres adjacent to subject parcel on Farrington Highway. [4]Waipahu Town Center will not actually expand its acreage, but the 80,000 square feet of retail would capture demand. For this reason, it was converted into an estimate of relative acreage based on the calculation described above.

## DEMAND

Demand for retail facilities located on the subject property will be a function of population growth and household formation which are translated into neighborhood shopping needs. Demand will be created by:

- Housing within the proposed development;
- Construction of the university campus across the North South Road from the project site; and
- Expansion of existing master planned communities within the retail trade area (particularly Ewa by Gentry, Villages of Kapolei, Ewa Villages and West Loch).

An estimation of the additional population expected within the trade area is shown in Exhibit VI-3, *Calculation of Additional Population to be Served.* This analysis indicates that approximately 107,000 additional persons will need to be served within the retail trade area by the year 2010.

## Exhibit VI-3
## East Kapolei Project

### Calculation of Additional Population to be Served

| Housing Units | 1995 | 2,000 | 2,005 | 2,010 |
|---|---|---|---|---|
| City of Kapolei - Makai | | 500 | 1,000 | 500 |
| City of Kapolei - Mauka | | 250 | 500 | |
| Ewa by Gentry | 1,069 | 4,050 | | |
| Ewa Villages | 113 | 1,603 | | |
| Ewa Fairways | | 360 | 720 | 220 |
| Kapolei Knolls | | 380 | | |
| Makakilo | 102 | 1,096 | 499 | |
| | 136 | 199 | | |
| | 172 | 230 | | |
| NASBP | 120 | | | |
| Royal Kunia - Ph 1 | 350 | 1,398 | | |
| Royal Kunia - Ph 2 | | 1,400 | 600 | |
| Villages of Kapolei | 993 | 2,211 | 949 | |
| West Loch | 175 | 1,200 | 3,000 | 3,000 |
| Subject | 0 | 2,650 | 2,850 | 3,750 |
| Total | 3,230 | 17,527 | 10,118 | 7,470 |
| Cumulative Residential Units | 3,230 | 20,757 | 30,875 | 38,345 |
| Population (units x household size of 2.8) | 9,044 | 58,120 | 86,450 | 107,366 |

## Calculation of Future Demand for Neighborhood Retail

The methodology shown in Exhibit VI-4, *Calculation of Future Demand,* was utilized to estimate demand for neighborhood commercial facilities within the retail trade area by the year 2010.

## Exhibit VI-4
## East Kapolei Project

### Calculation of Future Demand

| | 1995 | 2000 | 2005 | 2010 |
|---|---|---|---|---|
| **Step 1: Additions to population of retail trade area**<br>Method: multiply additional future units by household size of 2.8 to estimate population for the years 1995, 2000, 2005 and 2010<br>Source for population: Exhibit VI-3 | 9,044 | 58,120 | 86,450 | 107,366 |
| **Step 2: Total sales for the retail trade area**<br>Method: multiply the population in Step 1 by a factor of dollars spent per person ($11,463.24). Dollar estimate is based on a ratio of total 1992 retail sales by 1992 population of Oahu. Source of sales data: Urban Decision Systems, Inc. (UDS), 1992 | 100,446,101 | 645,498,363 | 960,146,551 | 1,192,447,595 |
| **Step 3: Total neighborhood retail sales in trade area**<br>Method: multiply total sales in Step 2 by the proportion of neighborhood-type retail sales to total sales. The percentage of neighborhood-type sales is then increased over time from a rural factor of 15% to a more urban factor of 30% to reflect urbanizing character of the retail trade area over time.<br>Source of neighborhood to total sales: UDS | 0.15<br>15,066,915 | 0.20<br>129,099,673 | 0.25<br>240,036,638 | 0.30<br>357,734,279 |
| **Step 4: Supportable rural shopping center area (square feet)**<br>Method: divide the sales in Step 3 by a rule-of-thumb factor of $200 per square foot of sales. | 75,335 | 645,498 | 1,200,183 | 1,788,671 |
| **Step 5: Acreage needed for neighborhood commercial in retail trade area**<br>Method: Divide the supportable square feet in Step 4 by a lot coverage factor of 0.25 and divide by 43,560 square feet per acre.<br>164 acres represents total new demand for neighborhood retail within the retail trade area by the year 2010 | 7 | 59 | 110 | 164 |

## SUPPLY AND DEMAND SUMMARY

As shown in Exhibit VI-5, *Supply and Demand Calculation*, the supply/demand calculation resulted in the conclusion that approximately 43 acres of neighborhood commercial could be

supported within the retail trade area. This would translate into a need of approximately 468,300 square feet of additional neighborhood commercial space within the retail trade area (based on lot coverage ratio of 0.25).

**Exhibit VI-5**
**Supply and Demand Calculation**

| Calculation | Acres | Reference |
|---|---|---|
| Future Supply | 121 | Exhibit VI-2 |
| Future Demand | 164 | Exhibit VI-4 |
| Need/(oversupply) | 43 | |

## MARKET POSITION

**Design Type: Neighborhood Center.** It is expected that the commercial land uses on the subject property will be limited to neighborhood "support" retail, most likely a neighborhood shopping center. Such shopping centers typically include the following:

- Supermarkets
- Drug stores
- Restaurants and/or bars
- Apparel shops
- Dry cleaners

Additional retail outlets serving the needs of university faculty and students should also be viable. Such uses could include bookstores, photocopiers and coffee shops.

**Deed Restriction.** A deed restriction in the land exchange and purchase agreements entered into by Schuler Homes, Inc. and The Estate of James Campbell places a limit on commercial within the project area of two acres for every 1,000 residential units. This would mean that a total of twenty acres of

commercial acreage could be developed on the subject property.

- At a lot coverage ratio of 0.25, a neighborhood shopping center of approximately 218,000 square feet could be developed by 2010.
- As shown by the analysis above, the estimate of demand for an additional 468,300 square feet within the retail trade area is in well excess of this number.

**Timing.** Absorption of retail space on the subject property is assumed to be through the sale of a parcel to an unrelated developer. This sale would be expected to take place at the end of the project's development period, circa 2010.

## RETAIL CONCLUSION

The proposed development appears to be well positioned to serve a variety of community retail needs. Tenants drawn to the subject property will primarily provide goods and services for its residents through neighborhood shopping center facilities to be developed at the end of the project's expected build-out in 2010-2011.

# Appendix A
# COMPETITIVE PRODUCT

# Appendix A

# COMPETITIVE PRODUCT

The following are descriptions of the history and current status of major competitive projects within the market study area and including over 1,000 units. Information is presented in the following order:


| Description | Page |
|---|---|
| 1. *The City of Kapolei* | *A-1* |
| 2. *Ewa by Gentry* | *A-2* |
| 3. *Ewa Marina* | *A-3* |
| 4. *Ewa Villages* | *A-4* |
| 5. *Ko Olina* | *A-6* |
| 6. *Makakilo* | *A-7* |
| 7. *Makaiwa Hills* | *A-8* |
| 8. *Royal Kunia* | *A-9* |
| 9. *Villages of Kapolei* | *A-10* |
| 10. *Waikele* | *A-12* |


## The City of Kapolei

The City of Kapolei is part of a phased commercial development plan that is planned to include seven million square feet of office, government, commercial and light industrial space. The City is intended to be a self-contained community that will provide a living as well as working environment for its residents.

**Phase I:** A total of 135 acres has been rezoned to B-2 Community Business District for the development of the City of Kapolei. The 135 acres involved two petitions to re-zone: Ordinance 90-30 (92.7 acres) and Ordinance 91-65 (42.3 acres). The State Boundary Amendment for the 135-acre site was approved in 1988.

**Phase II:** The State Land Use Commission approved urbanization of the remaining 586 acres in the City of Kapolei in June 1993.

Source: City and County of Honolulu, Department of Land Utilization, Director's Report File 85/Z-21, Developer Interview (The Estate of James Campbell)

## Ewa by Gentry

Ewa by Gentry is located three and one-half miles south of the H-1 freeway along Fort Weaver Road. This master planned community will encompass 1,005 acres for a total of 8,300 dwelling units. Residential construction began in 1988 with the Soda Creek project. At the time of the 1994 Development Plan Annual Report, an estimated 3,000 units had been completed. An additional 5,000 units is expected by the year 2000.

The master plan for the community of Ewa by Gentry includes an 18-hole golf course, an elementary school, two community parks and a neighborhood commercial center. This community includes both single- and multi-family homes, at affordable and market prices. The basic infrastructure necessary to sustain on-going and future residential development has been constructed by the developer.

The project has received zone changes incrementally since 1985. Stipulations for affordable housing have varied, depending on the timing of the request for zone change. These requirements are outlined below.

*Ordinance 84-94, 225 acres are rezoned, 2,465 units proposed:*

- 10 percent at or below 80 percent of median income housing.

*Ordinance 91-17, 224 acres rezoned, 2,835 units proposed:*

- 10 percent at or below the 80 percent of median income housing;
- 20 percent at 80 to 120 percent of median income; and
- 30 percent at the 120 to 140 percent of median income range.

*Ordinance 93-54, 11 acres rezoned, 322 units proposed:*

- 10 percent at or below 80 percent of median income housing.

*Ordinance 94-57, 486 acres rezoned, 1,480 units proposed:*

- 10 percent at or below 80 percent of median income housing; and
- 20 percent at 80 to 120 percent of median income.

Sources: City and County of Honolulu, 1993 Development Plan Review; Department of Land Utilization, Director's Report File 93/Z-10

## Ewa Marina

The Ewa Marina project is located in Ewa Beach and is accessible from H-1 via Fort Weaver Road. This 1,100-acre site has been master-planned as a mixed-use marina community. The project will have one mile of ocean frontage in the vicinity of the 30-acre Oneula Beach Park and includes plans for a 1,400-slip marina.

The Ewa Marina master plan calls for 4,850 residential units, 950 visitor units, specialty hotels, a 27-hole golf course, a health and fitness center, and a community-scale commercial project at the marina. Haseko (Ewa), Inc. is the developer.

The entire 1,100-acre site was designated for urban use by the City and County of Honolulu in 1993 and the State Land Use Commission in 1993. Final government approvals for the marina (Special Management Area and Conservation District Use permits) are pending. Upon substantial completion of the marina, residential construction is anticipated to begin. Full build-out is anticipated to require fifteen years.

The 1,100 acre project will be developed in two phases, with an estimated 2,000 units expected for completion by the end of the decade.

**Phase I** of the Ewa Marina project consists of an area containing approximately 707 acres, located between the Ewa Beach community and the Barbers Point Naval Air Station. It is planned to contain a mixture of uses, including residential, low

density apartment, medium density apartment, commercial, public facility (including the marina), park, and preservation (waterway and flood control areas). Stipulations on the residential units sold require that:

- 10 percent of the units sold or rented at 80 percent of the median income; and
- 20 percent of the units sold or rented at 80 to 120 percent of the median income.

**Phase II** is planned to consist of approximately 403 acres which includes a mixture of park/golf course, commercial-industrial mixed use and park uses. The 27-hole golf course with clubhouse and maintenance facilities is located on approximately 272 acres of land between Naval Air Station Barbers Point and Fort Weaver Road. The golf course will be integrated into the Ewa Marina residential community and will serve as a part of the Kaloi drainage system. Phase II also includes a mixed use commercial job center and visitor complex on approximately 114 acres of land between the golf course and the marina. This mixed use complex is planned to include 950 visitor accommodation and apartment units to complement the marina. A 17-acre gateway park will also be provided as a part of Ewa Marina Phase II.

Sources: City and County of Honolulu, Department of Land Utilization, Director's Report; Interview with developer (Haseko Hawaii).

## Ewa Villages

The Ewa Villages area is an existing cluster of neighborhoods including Ewa, Renton, Fernandes and Tenney Villages. Access to the existing villages is through Fort Weaver Road to the east. Access to H-1 is through the Fort Weaver Road interchange.

The City and County of Honolulu, through its Department of Housing and Community Development (DHCD), has adopted plans for both revitalization and further development of the existing Ewa Villages. An 18-hole municipal golf course is

nearly complete, and will be followed by additional uses, including:

- Revitalization of 273 existing homes;
- 957 additional residential units;
- Expansion of Ewa Elementary School;
- A district park;
- Commercial/retail center;
- Church parcels; and
- A business park.

This master-planned community is primarily a revitalization project, sponsored by the City and County of Honolulu, Department of Housing and Community Development. This effort began in the late 1970s, when Fernandez Village was identified by the City and County for revitalization.

The project will encompass a total of 600 acres at build-out. Of that, 242 acres will be residential and 350 acres will be for other uses. These uses include a 225-acre, 18-hole golf course (drainage), a 25-acre park, a school, etc. Development of this community has been expedited through the 201E application process.

There will be approximately 1,600 dwelling units total, of which 277 are existing and will be rehabilitated. (Some units may not be salvageable and will be destroyed.) Of these 1,600 units, 60% will be "affordable," sold at 120% or below the median income. Construction began in August 1994 for 113 affordable homes. Reservations for 283 market units are being accepted. Market units in the project will sell for approximately $350,000 to $450,000. Full build-out is expected to take until the end of the century.

Infrastructure for Tenney Village (the first project) is just starting. The existing infrastructure for this village will be upgraded to current standards. The main access route, Renton Road, will be expanded, and road construction is expected by December of 1995.

Source: Interview, City and County of Honolulu, Department of Housing and Community Development.

## Ko Olina

The Ko Olina development is accessible from the H-1 freeway. It is approximately 24 miles to the west of Honolulu. The project extends along 1.9 miles of shoreline in Ewa.

The developer, West Beach Estates, estimates that more than 8,700 condominium and single-family residences eventually will be built at Ko Olina. Final approval for the project was obtained from the City and County of Honolulu in 1986. Site work and infrastructure development began in March of 1987. Fully completed infrastructure includes facilities for sewers, water, drainage and streets.

The original proposals for Ko Olina included plans for two Phases:

**Phase I** of the Ko Olina Resort is master planned to be a 642-acre residential/resort community. The resort area along the shoreline is planned for just under 4,000 visitor units. Development projections also call for 5,200 housing units of which 3,700 units are intended to be medium density apartment units and 1,500 units low density units. Amenities include: four oceanfront sandy beach lagoons; a 170-acre, 18-hole golf course and clubhouse; a 450-slip marina; a Hawaiian cultural center; three public parks, which consist of two large beach parks and a community park; sites for a school, child care center, and fire station; beach and yacht clubs; tennis facilities; two commercial centers, including one theme shopping center; and several restaurants.

**Phase II** of the Ko Olina Resort project encompasses 372.6 acres of land. It is planned to include two additional 18-hole golf courses, commercial development in the eastern portion and a neighborhood park.

Stipulations for the development of the project required that 10% of the units to be sold to 80% or below the median income level.

To date, the project is far behind the original construction schedule. According to the Planning Department, additions to

the resort portion as well as residential construction have been delayed indefinitely. Although five hotel sites have been planned for and sold, only one is in operation -- the 387-room Ihilani luxury hotel and golf course. The planned beach lagoons are completed as well as the marina basin, but no piers have been built. At present reservations are being taken on a total of 280 condominium units. Prices range from $220,000 to $350,000.

Sources: City and County of Honolulu, Department of Land Utilization, Director's Report File 85/Z-3; Developer interview (West Beach Estates).

## Makakilo

This hillside community overlooks the Kapolei area. It is accessible from the H-1 freeway via Makakilo Drive. One of the Kapolei area's earliest residential developments, development of Makakilo began in the early 1960's. Today, there are more than 3,500 homes and a population of about 13,000. The development is more than 50 percent complete, with approximately 2,500 homes planned. Developer Finance Realty will continue Makakilo's development through the end of this decade, aiming at an eventual inventory of about 6,100 homes. Projects currently on the market include:

**Palehua Point:** There are 47 homesites available at Palehua Point from $220,500 with home and lot packages starting at $510,000.

**Makakilo Ridge:** There are 114 homesites and home and lot packages begin at $197,000 to $595,000.

**Royal Ridge:** Phase I of Makakilo's newest development, Royal Ridge, features 72 fee-simple, single family homes with prices starting at $330,000.

**West Hills:** West Hills offers 66 house lots available for purchase.

**Westview at Makakilo Heights:** Schuler Homes, Inc. is building 500 townhomes, about 10 percent of which are in the affordable category (80% or below the median income). The

first phase was completed in late 1993, with 148 units priced between $185,000 and $215,000.

Sources: Estate of James Campbell "Fact Sheet"; Planning Department Interview; Developer interview (Finance Realty, Ltd.); Department of Land Utilization Director's Report 82/Z-6.

## Makaiwa Hills

On the hillside to the west of Makakilo lies Makaiwa Hills, a project of the Estate of James Campbell. The Development Plan Annual Report, Fiscal Year 1994 indicates a total of 1,066 units by 2010 in Makaiwa Hills. The Planning Department's Land Use Model indicates a projection of 2,130 units by 2010, a figure which was used in this market assessment. Land Use Commission records indicate state-level approval of 1,700 acres for the Makaiwa Hills project. The proposed development received Development Plan approval in 1993, (Ordinance 93-114) and but the zoning has yet to be authorized. Consequently, infrastructure improvements have not begun.

The project master plan includes a variety of residential unit types and price levels. In addition, an off-site affordable rental housing program is proposed. The affordable housing program would be built in advance of the on-site project market units. The units would consist of 250 units for families earning 50 to 80 percent of the median income. Overall, 700 to 900 off-site rental units are planned and offered at rental prices to families whose income range is between 50 to 140 percent of median income.

The Makaiwa Hills development also includes a regional mall, a public district park, and preservation areas in the gulches of the project area.

Sources: Development Plan Annual Amendment Review, 1993; Planning Department interview.

## Royal Kunia

This project is expected to be developed on 1,000 acres north of the Village Park community on lands currently planted in sugarcane. The project will be a golf-oriented community accessible from H-1 via Kunia Road.

To date, the City has designated over 1,000 acres for urban use in Royal Kunia Phases I and II -- including approximately 358 acres for residential and apartment use. The first phase of the Royal Kunia project received DP approval for 2,050 residential units in 1988. Construction of Phase I infrastructure is ongoing and the golf course is substantially completed. According to Kunia Residential Partners (developer of Phase I), 1,748 units are scheduled to be delivered in a projected five-year build out. Of the total 1,748 units, approximately 350 units are scheduled to be delivered by the end of 1995.

Several stipulations were imposed on this phase of the development. Provisions were made for 150 units for the under 80 percent of median income bracket; 20 percent of these units are to be reserved for the elderly. Of the project's total units, 50 percent are to be in the affordable range. The 50 percent affordable component consists of:

- 10 percent at 80 percent of median income housing;
- 20 percent at 80 to 120 percent of median income; and
- 20 percent at the 120 to 140 percent of median income range.

During fiscal year 1992 a portion of the second phase of the Royal Kunia received Development Plan approval. This consisted of an additional 1,000 units on approximately 400 acres of land.

In both the 1992 and 1993 Development Plan Annual Amendment Reviews, the applicant requested increased acreage to be redesignated. Each request, however, was denied. In the 1994 Development Plan Annual Amendment Review, the applicant again requested redesignation of

approximately 114 acres. The Planning Department has recommended denial of the proposed amendment.

Source: Development Plan Annual Amendment Review, 1994.

## Villages of Kapolei

The Villages of Kapolei is a master planned community located on the eastern edge of the new City of Kapolei; a portion of the proposed University of Hawaii West Oahu campus will be located to the east. The 890-acre site is accessible from H-1 via Fort Barrette Road and Farrington Highway.

This community is a public/private cooperative housing venture involving the state Housing Finance and Development Corporation (HFDC), Honolulu Department of Housing and Community Development, The Estate of James Campbell and numerous private developers. Under agreement with HFDC, 60 percent of the homes must sell at affordable rates, while 40 percent may be sold at market prices set by the developer.

The Villages of Kapolei project is a community consisting of eight 'villages' with a mix of affordable and market housing types. Mixes of housing include single family and multi-family for sale; assisted, elderly, and family rentals; and owner/builder self-help lots. In addition, the villages will provide several recreation centers; a community and neighborhood park; two or three church and day care sites; two elementary schools; one intermediate school; a neighborhood commercial area at the village center; and a golf course with clubhouse. It is currently projected that at build-out, there will be approximately 5,000 residential units on 890 acres. Projects built and/or underway include:

**Village I (Kumu Iki):** This initial 71.3-acre phase of the Villages of Kapolei began in August 1989 and was completed by Castle & Cooke Properties, Inc. as a 519-unit village in 1991.

**Village II (Aeloa):** Site preparation by Watt Hawaii for this 571-unit mixed-density village began in 1994. Completion of the entire 70.67-acre project is scheduled for 1995. Affordable

units will begin at $140,000 and market-priced properties will range from $264,000 to $420,000-plus.

**Village III (Malanai):** At build-out Malanai will have 296 homes situated on 51.1 acres adjacent to the Kapolei golf course. Developer Watt Hawaii delivered the first homes in October 1992. Completion of the project is scheduled for 1994. The market-priced homes in this community range from $280,000 to $350,000 for properties along Kapolei golf course. Village III also includes the first multi-family project within the Villages of Kapolei. Located on a 5.16 acre-site between Malanai and the entrance to the Kapolei Golf Course, the 88 unit condominium project of Malanai Iki is being developed and priced between $96,000 and $126,000 for one, two, and three bedroom units.

**Village IV (Kekuilani):** A joint venture of M.M.C. Development and Stanford Carr Development Corp., the Kekuilani Development Corp. began construction in August 1993 on this 645-unit, mixed-density community. The 60.61 acre site along with Village IV, and Village II, will contain the remaining golf course frontage units of the Villages of Kapolei project. Prices range from affordable at $99,000 to $330,000 for golf course single-family homes. Completion of the project is anticipated in early 1996.

**Village V (Kulalani):** West Beach Estates is developing multi-family projects within Villages V and VI for a total of 1,200 units. Village V, Kulalani, is a 128 unit townhome project. Kulalani sits on approximately 7.5 acres and is located next to the Kapolei Elementary School. All of the units (100%) will be affordable units with prices targeted for 80 percent of the median income range. Additional units are planned for Village V, to eventually total 574.

**Village VI (Pae Ko Gardens):** West Beach Estates also is developing 128 affordable multifamily units in Village VI, targeted for 80 percent and below the median income range. The completion of the 7.5-acre project is estimated for year-end 1994.

**Villages VII and VIII:** An additional 1071 units are planned for Villages VII and VIII between 1996 and 2000.

The project's infrastructure is projected to be developed in six phases. The first five phases have been completed, including drainage improvements, mass grading and the golf course. The sixth and final phase will consist of off-site infrastructure construction that will include the widening of Fort Barrette Road and Farrington Highway.

In the 1994 Development Plan Annual Amendment Review, the applicant, (HFDC and various other owners) requested to amend the Ewa Development Plan Land Use Map to reflect existing construction and to recognize the Villages of Kapolei master plan as adopted by the HFDC's Board of Directors. After review, the Planning Department recommended the redesignation of approximately 482 acres from agriculture to low density apartment; and the redesignation of approximately 15 acres as the "Village Center" from agriculture to commercial emphasis mixed use.

Sources: Development Plan Annual Amendment Review, 1994; Housing Finance and Development Corporation publications; Estate of James Campbell Summary Fact Sheet.

## Waikele

This master planned community is being developed north of H-1 between the Waikele exit and Kamehameha Highway. Three developers have provided residential units within the Waikele community: Armstrong Builders, Castle & Cooke Homes Hawaii and Schuler Homes, Inc. The Waikele Power Center, a large commercial retail development, is a a major additional amenity to the community.

Castle & Cooke Homes Hawaii developed a project of 250 single-family homes. The Armstrong development included 82 single-family dwelling units, all of which have been sold. To date, the Schuler Homes, Inc. development at Waikele includes:

- 686 affordable units built;
- 204 gap-group units built;

- 478 market priced single-family units built or under construction;
- One 18-hole golf course; and
- One H-1 freeway ramp for ingress and egress.

Substantial stipulations on the pricing of the products to be offered at Waikele were imposed in the entitlement process, although all prices are allowed to rise with the Consumer Price Index. The stipulations on Waikele development include the following:

- 10 percent of the units are to be priced for 80 percent of median income or below bracket;

- 8 percent of the units are to be priced below $120,000, and reserved for six months for those earning less than 120 percent of median income level;

- 7 percent of the units are to be priced below $140,000, reserved similarly for the less than 140 percent bracket;

- 10 percent of the units are to be priced below $150,000, reserved similarly for the less than 150 percent of median income bracket; and

- 15 percent are to be priced below $170,000, reserved similarly for the less than 185 percent of median income level.

Waikele received Annual Development Plan Amendment Review approvals in 1985 and zoning approval in 1986. At the time of this analysis, close to 1,700 of the 2,915 planned units had been completed and an additional 1,000 units were anticipated to be completed by the year 2000. This development is expected to be built-out over the remainder of the decade.

The infrastructure for the development for Waikele was ninety percent complete as of August 1994. Off-site improvements

consist of an H-1 overpass at Manager's Drive, a water reservoir, roadways and utilities.

Sources: Market Assessment for the Wahiawa Lands (1992); Developer interview (Schuler Homes, Inc.)

# Appendix B
# REFERENCES

## Appendix B

# REFERENCES

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# Appendix C
# LIMITING CONDITIONS

## Appendix C

# LIMITING CONDITIONS

- The words "project," "projection" and "forecast" are not meant to follow the definition of any professional organizations.
- The consultant assumes no responsibility for economic, market or physical factors occurring after the last day of field work in September 1994, which may affect the opinions stated herein.
- No opinion is intended to be expressed for legal matters or that would require specialized investigation or knowledge beyond that ordinarily employed by a market consultant.
- No opinion as to title is rendered.
- No engineering reports or surveys have been prepared by or made available to the consultant.
- Maps and exhibits included herein are for illustration only, as an aid in visualizing matters discussed within the report. They should not be considered as surveys or relied upon for any other purpose.
- The estimates included in this report are utilized to assist in the market assessment of the property based on current market conditions, anticipated short-term supply and demand factors and a continued stable economy. Therefore, estimates are subject to changes in future conditions that cannot be accurately predicted by the consultant.
- The consultant is not qualified to detect the existence of potentially hazardous material which may or may not be present on or near the property. The client is urged to retain an expert in the field before making a business decision regarding the property.
- This report, or any portions therof, shall not be included in any public offering or financing document without the consultant's review and consent.

# Appendix D
# PROFESSIONAL QUALIFICATIONS

# GAIL W. ATWATER, AICP

Ms. Atwater is an experienced land use planning consultant serving both public and private sector clients. She specializes in market feasibility analyses, the application of strategic planning to land use, and facilitation of government and private sector executives in major planning efforts. She has been a land use consultant for the past seven years, both as an independent and as an associate of Deloitte & Touche Management Consulting. She also has six years of corporate managerial experience at GTE Hawaiian Tel.

## EDUCATION

Course work completed for Master in Urban and Regional Planning, with specialization in Land Use Planning, University of Hawaii
Master of Business Administration, Marketing, University of Hawaii
Master of Education, Counseling and Guidance, Florida Atlantic University
Bachelor of Arts, Literature, Wheaton College

## SELECTED CLIENTS

City and County of Honolulu, Building Department
City and County of Honolulu, Transportation Services Department
State of Hawaii, Department of Business, Economic Development and Tourism
State of Hawaii, Department of Land and Natural Resources
State of Hawaii, Department of Transportation
Schuler Homes, Inc.
Helber, Hastert & Fee
Hawaii Strategic Development Corporation
Chamber of Commerce of Hawaii
GTE Hawaiian Tel
Hawaiian Electric Company
Outrigger Hotels Hawaii
Estate of James Campbell
Blood Bank of Hawaii

## HIGHLIGHTS OF RELEVANT EXPERIENCE

Conducted the market assessment and analysis of employment generating opportunities for an 800-acre master planned community proposed for the Galbraith Trust Wahiawa Lands. This study was included in a Development Plan Amendment Application and Environmental Impact Statement.

For the City and County of Honolulu under Deloitte & Touche, analyzed the need for a Civic Center in Kapolei to provide Oahu's second city with civic services and facilities. Following a demographic study of projected

population and employment trends in Ewa and Central Oahu, analyzed the activities of each City department to determine the type and level of regional services needed and which departments could be relocated.

Co-authored analysis of supply and demand for industrial land on Oahu for the market assessment of Kapolei Business Park.

Assisted in preparing an economic impact study for the developer of Ko Olina Resort in West Oahu, including analysis of market opportunities and evaluation of fiscal impact.

For the State of Hawaii, Department of Land and Natural Resources, (DLNR), designed, facilitated and managed a major public/private effort to overhaul the regulation of the Conservation District.

Also for DLNR, managed completion of a project involving development and application of a strategic land management methodology for over 200,000 acres of state leased agricultural land. Developled strategic land use plans for four major parcesl totaling over 30,000 acres.

Facilitated top management in development of strategic plans for diverse private and public sector clients, such as the Chamber of Commerce of Hawaii, Blood Bank of Hawaii and Hawaii Strategic Development Corporation.

For the Governor's Office of Children and Youth, developed strategies for financing an envisioned optimal system for early childhood education in the year 2000, including 56 financing mechanisms and a proposed legislative agenda.

Developed three consecutive five-year strategic plans as consultant to GTE Hawaiian Tel. Analyzed Pacific Basin opportunities for worldwide operations of GTE.

## BUSINESS EXPERIENCE

| | |
|---|---|
| 1985 - Present | Planning Consultant, both independent and as subcontractor for Deloitte & Touche. |
| 1980 - 1985 | Service Office Administrator, GTE Hawaiian Tel, responsible for operational planning and project implementation, $7 million operating budget, and management of operational/financial planning and analysis group. |

1976 - 1980 Managed private Montessori preschools in Hawaii and on the Mainland; developed and managed statewide educational program for the State of Florida, involving 67 school districts.

## PROFESSIONAL AND CIVIC AFFILIATIONS

American Institute of Certified Planners: Member
Urban Land Institute: Associate Member
American Planning Association, Hawaii Chapter: Director at Large, winner of 1994 Distinguished Service Award, formerly Vice President, Public Information Officer and Housing Chair.
Hawaii Society of Corporate Planners: Past President and current Board member
Suzuki Association of Hawaii: Board of Directors member and Grant Writer
Aloha United Way: Allocations Panel, 1990-1991

# LIMITED SCOPE UPDATE
of the

# EAST KAPOLEI PROJECT MARKET ASSESSMENT

(Dated October 1994)

December 1995

by
Gail W. Atwater, MBA, MURP, AICP

The purpose of this Update is to report on revisions to the East Kapolei Project and its market area which have occurred between October 1994 and December 1995. The factors analyzed should affect the demand for and absorption of residential and retail development within the property. Due to the limited scope of this update, it must be reviewed in conjunction with the East Kapolei Project Market Assessment by the same author dated October 1994. The latter document is available as Appendix D of the Final Environmental Impact Statement for the East Kapolei Project (Helber Hastert & Fee Planners, April 1995).

LIMITED SCOPE UPDATE
of the
EAST KAPOLEI PROJECT
MARKET ASSESSMENT (October 1994)

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# I. EXECUTIVE SUMMARY

| | |
|---|---|
| **Property Location** | One of the last major agricultural regions remaining unplanned in Oahu's developing "second urban center" in Ewa. Major parcel bordered by Farrington Highway and surrounded by agricultural land, with nearby master planned communities of West Loch, Villages of Kapolei and Ewa Villages. |
| **Size** | Approximately 794 acres, including 52 acres of off-site infrastructure. |
| **Physical Attributes** | Gently sloping terrain from north to south on former coral plain which historically has been planted in sugarcane.<br><br>Good access via Farrington Highway and its H-1 interchanges at Makakilo Drive to the west and Fort Weaver Road to the east. Future access to planned North South Road and eventually Fort Weaver Road.<br><br>Sunny, leeward-type climate |
| **Market Study Area** | Master Planned Communities within the Ewa Development Plan Area and along the western H-1 corridor including the communities of Waikele and Royal Kunia. |
| **Economic** | Moderate near- and long- term growth trends in both commercial and residential indicators, with demonstrated pent-up residential and retail demand gradually subsiding during the 16-year build-out. |
| **Government Policy** | State and County governments have established population allocation policies. Additionally, these agencies have joined private developers in capital investments which support development of a second urban center and affordable housing in Ewa. |

**Residential**

| | |
|---|---|
| Supply/Demand Shortfall, 1994 - 2020, Market Study Area | 9,629 - 14,900 units |
| Supply/Demand Shortfall, 1994 - 2020, Ewa Dev. Plan Area Only | 8,100 - 12,500 units |

| | | |
|---|---|---|
| Demand for Additional Units, 1994 - 2020, Market Study Area (includes Ewa DP Area) | 38,329 - 43,600 units | |
| Demand for Additional Units, 1994-2020, Ewa DP Area Portion Only | 32,200 - 36,600 units | |
| Planned Units East Kapolei Project | 2,080 | Single Family - Market Priced |
| | 1,440 | Townhomes - Market Priced |
| | 1,920 | Multifamily - Low Density Units (DU) - Market |
| | 160 | Multifamily - Medium DU - Market |
| | 800 | Multifamily - Medium DU - Affordable (up to 80% of median household income) |
| | 1,600 | Multifamily - Medium DU - Affordable (81-120% of median) |
| | 8,000 | Total |
| Year Sales Begin / End | 1998 / 2013 (16-year build-out) | |
| Average Annual Absorption | 500 - 550 units | |
| Capture Rate of Market Study Area Residential Demand to 2020 | 25 to 30 percent | |
| Capture Rate of Oahu Residential Demand to 2020 | 13 to 14 percent | |
| **Retail** | | |
| Potential Need New Support Retail | Estimated future demand for 43 additional retail acres in the defined retail trade area exceeds the 16 acres allowed on the subject property by a deed restriction. Neighborhood retail only. | |
| **Target Tenants** | Supermarkets, drug stores, restaurants, surf and other small apparel shops, bars, dry cleaners. | |
| **Additional Uses** | Central community park and neighborhood parks. | |

## II. INTRODUCTION

**Purpose.** The purpose of this Update is to report on revisions to the East Kapolei Project and its market area which have occurred between October 1994 and December 1995. The factors analyzed should affect the demand for and absorption of residential and retail development within the property. Due to the limited scope of this update, it must be reviewed in conjunction with the East Kapolei Project Market Assessment by the same author dated October 1994. The latter document is available as Appendix D of the Final Environmental Impact Statement for the East Kapolei Project (Helber Hastert & Fee Planners, April 1995).

**Scope limitations.** The intent of this assignment was to provide information on changes affecting the subject property and its market area which have occurred since publication of the East Kapolei Project Market Assessment (Atwater 1994). The primary focus of this update was the analysis of residential supply, demand and absorption. Changes were based on currently-utilized population and housing unit forecasts, newly published policy documents and Development Plans, and updated housing supply and market performance information.

Field work on market performance was limited to review and spot verification of published sales data and selected on-site interviews with realtors and developers. Written realtor surveys were not conducted as had been performed for the 1994 Market Assessment. Area Review research was limited to interviews with top local analysts to confirm prior economic conclusions. The retail supply and demand analysis was not revised due to its continued relevance. Finally, the report format was scaled down to focus on incremental changes since publication of the 1994 Market Assessment.

**Revised Report Format.** This 1995 Update covers a variety of subjects, beginning with a brief conclusion for each section followed by supporting discussion. Exhibits are located at the end of the commentary.

## III. REVISED EAST KAPOLEI PROJECT SITE

**Conclusion**

The revised 794-acre project site is ideally situated to take advantage of the growth expected to occur in Oahu's second urban center at Kapolei. The project design is consistent with the vision for Ewa, desired direction of residential growth, and regional urban design criteria contained in the draft Ewa Development Plan Report (Planning Department, June 1995). Design changes and available acreage limit housing to 8,000 units, a small commercial area, and expand park space. While the project's physical characteristics have been modified, the only significant market impact of the locational

and physical changes is the questionable proximity and likelihood of development of the planned University of Hawaii at West Oahu.

**Supporting Discussion**

*Project size, location, and surrounding uses.* The revised project area consists of 794 acres at Kapolei, Ewa, Hawaii, of which 742 acres are subject to Development Plan land use amendment. The remaining 52 acres are for off-site infrastructure including development of a reservoir site and a 31-acre detention basin. There are two parcels targeted for development, with the largest area south of Farrington Highway and a second residential component north of the highway. See Exhibit 1, *Location Map.* These agricultural-zoned parcels and surrounding areas are in transition from sugar production to diversified agriculture. Nearby master planned communities include West Loch, Ewa by Gentry, Villages of Kapolei and Ewa Villages.

*Access to the project.* The northern boundary of the revised project site is formed by Farrington Highway, which will provide the community's primary access to Oahu's primary urban center. The project is linked to the H-1 Freeway via interchanges at Fort Weaver Road and Makakilo/Kapolei. Additional future access will include a primary connection to the planned North South Road and an eventual link to Fort Weaver Road.

*Market study area.* The market study area has not changed since the 1994 Market Assessment. This area includes the Ewa Development Plan Area, plus directly competitive projects within the Central Development Plan Area. The most notable of these Central projects are Waikele and Royal Kunia. Due to its physical and market characteristics this region is referred to as the H-1 corridor.

*Second city growth.* The project site is ideally situated to take advantage of the growth expected to occur in Oahu's second urban center. It supports General Plan population guidance directing growth toward Kapolei. The planned University of Hawaii at West Oahu, if developed, would likely contribute to activity and demand on the subject property. However, due to its uncertainty, university-generated demand has been excluded from the analysis of need for the project. This factor is discussed further in Section VI, *Future Residential Demand.*

## IV. REVISED PROJECT CONCEPT

**Conclusion**

The East Kapolei Project as revised reflects a neotraditional development concept featuring a centrally located retail and community recreation area with residential development emanating out from the core. This development concept is consistent with the regional urban design principles and guidelines in the draft Ewa Development Plan Report (Planning Department 1995).

**Supporting Discussion**
To be more in keeping with the proposed Ewa Development Plan, the project concept has moved from a decentralized suburban-style development to a community concept in the neotraditional style. In neotraditional town planning, a commercial town center and community recreation area are the activity centers and form the physical core of the community. They are surrounded by multifamily residences and, further out from the core, single family residential development. This concept will encourage a sense of inclusiveness and belonging to a town within the development and provide a human-scale, walkable environment for living.

The East Kapolei Project Plan includes 649 acres of residential land uses. These uses encompass 275 acres of single family detached housing and 374 of multifamily housing, including 120 acres of affordable homes. Supporting the residential development are 16 acres of commercial, 32 acres of parks and recreation and 25 acres for public and quasi-public facilities.

## V. AREA REVIEW AND CURRENT MARKET CONDITIONS

**Conclusion**
This section was updated based on the results of interviews with two notable local economists and one real estate analyst. Based on their comments, the general conclusion of the updated Area Review is that continued long-term support is indicated for this project through moderate but steady economic growth. Furthermore, demand is expected to continue for lower-end residential affordable and affordable product.

**Supporting Discussion**

Economic outlook. This assignment limited the Area Review economic update to interviews with two top Hawaii analysts: Paul Brewbaker, Chief Economist at Bank of Hawaii and Leroy Laney, Chief Economist at First Hawaiian Bank. Their conclusions are that:

- The State of Hawaii, especially the island of Oahu, has demonstrated substantial growth in all sectors of the economy over time, with a continuing expansion expected.
- The overall outlook for Hawaii's economy is for steady growth of about 2.5 percent per year, which is close to the projection for the nation as a whole. This growth will result in sustained demand for additional residential development.
- Pent-up demand and documented overcrowding of Oahu families will continue to drive the need for additional affordable and moderately priced housing.

- Inflation and cost of living factors in Hawaii have been declining in recent years, along with relatively sustained low interest rates. These factors will continue to increase the purchasing power of potential homebuyers.
- Home pricing is expected remain relatively stable on Oahu, with no major "spikes" in prices foreseen.
- Hawaii's pattern of real estate "peaks and plateaus" is favorable to "peaks and valleys" experienced in other markets. For example, economists noted that several locations on the Mainland have seen a 20 to 30 percent decline in real estate values in the last few years.

Review of Current Market Conditions. A review of the current market for new homes was conducted with realtors and developers actively selling in the market study area. Further, an interview was also conducted with Dr. Michael Sklarz, Hawaii real estate expert at Prudential Locations, Inc. The following observations were made during the course of this update.

- The new home market is currently experiencing a slow-down that appears to be more related to consumer confidence in the economy than a lack of demand. Since early 1995 when events such as the announcement of the State of Hawaii's budget shortfall occurred, sales of market-priced homes dipped and were sustained at lower levels than in early 1995. It appears that some buyers are holding back on large purchases, exhibiting a "wait and see" attitude.
- According to realtors, all new home buyers have become more discerning, especially with regard to developer incentives and the more widely available affordable product. See Exhibit 8, *Existing Residential Product, 1995* for updated details regarding currently-selling projects in the market study area.
- Dr. Sklarz had previously predicted the next Hawaii real estate cycle peak in 1996-97. According to a September 1995 interview with Dr. Sklarz, the next peak is now expected in a time frame closer to 1998, which is the targeted time frame for early market entry of the East Kapolei Project.

Market conditions conclusion. Real estate professionals and experts indicated the Oahu market is at or near the trough of the current real estate cycle. Long term economic indicators, however, appear to indicate a strong but more subdued residential market than that experienced in the early 1990s.

## VI. FUTURE RESIDENTIAL DEMAND

### Conclusion

The estimated demand for residential units within the market study area (Ewa Development Plan Area, plus the H-1 corridor developments of Waikele and Royal Kunia) by the year 2020 will be from 57,690 to 62,961 units, including 9,361 already

existing. Of those units, approximately 48,500 to 52,900 are estimated to be in the Ewa Development Plan Area.

**Methodology**

*Population and housing unit forecast.* The 1994 Market Assessment utilized the Land Use Model and General Plan projections to estimate future Oahu population and establish a range of population within the study area in the year 2010, respectively. Use of 2010 projections was appropriate for the 1994 Market Assessment because the project as then conceived was expected to be built-out by 2011. Further, those sources were the most widely used forecasts at the time. However, the reconceived project is expected to extend at least until 2013.

The Planning Department has issued a forecast for the year 2020 which they have called "an interim replacement for the [State of Hawaii] M-K projections" (Issue Paper on General Plan Population Distribution Policies, Planning Department, 1995). This Land Use Model forecast is currently being used for transportation planning by the Oahu Metropolitan Planning organization. As such, it is utilized in this update as the basis for estimating future population and housing units.

*Allocation of future Oahu population to the market study area.* The 2020 forecast provides an estimate of the Oahu population. These estimates must be allocated to the study area based on accepted population distribution policy. Consistent with the 1994 Market Assessment methodology, the General Plan allocation factor for the Ewa Development Plan was expanded to include future population of Waikele and Royal Kunia. The endpoints of the resulting range for the market study area are 14.23 percent of Oahu 2020 demand at the low end, to 15.53 percent at the high end, with a midpoint of 14.88 percent. See Exhibit 2, *Calculation of Demand.*

*Vacancy factor.* Accounting for vacancy is essential to the calculation of an appropriate level of housing stock. An adequate vacancy allowance provides the opportunity for population movement in and out of a community and within a community. This update calculates the same vacancy factor as the 1994 Market Assessment, or 5 percent. This factor is supported by a recent City and County planning document, which states: "a five to six percent vacancy rate is considered optimal, but Oahu has dropped from 4.2 percent vacant in 1980 to 2.5 percent today. This indicates a large pent-up demand for new housing units." (First Biennial Report on the Condition of the City and General Plan and Development Plans, Planning Department, 1995). See Exhibit 2, *Calculation of Demand.*

*Demand generated by the University campus.* The 1994 Market Assessment contained a small (300 unit) upward adjustment to future residential demand which recognized the expected impact of the adjacent University of Hawaii at West Oahu campus. This adjustment has been excluded from the Limited Scope Update demand calculations for several reasons. First, the locations of both the subject parcel and the university have

changed. Secondly, the university's location has not been formally approved. Finally, because the 300-unit adjustment represents less than one percent of estimated additional demand for the market study area, it is not expected to have a material impact on the market viability of the project.

## VII. FUTURE RESIDENTIAL SUPPLY

**Conclusion**
An adjusted supply of 48,061 units is expected within the study area in 2020. This reflects existing units, future construction estimates, and consultant adjustments to future supply of 5,543 and 2,710 units, to reflect delays in construction timing and resort occupancy of residential units, respectively. Percentage adjustments were comparable to the 1994 Market Assessment.

**Methodology**
*Estimation of future supply* was developed using the Construction Schedule for Housing Projects (Table II-3) in the Planning Department's Development Plan Annual Report, Fiscal Year 1995. According to the developers surveyed, a total of 36,953 units are expected to be built within the market study area between July 1994 and the time period designated "after 2005." This includes 31,546 units in the Ewa Development Plan Area. See Exhibit 3, *Future Additions to Supply, July 1994 to "After 2005"*. This estimate of future additions to supply should be regarded as an unlikely scenario, as it includes the full number of units reported by developers via survey *regardless of demonstrated progress.*

*Adjustment factors* for supply remain unchanged from the previous analysis. First, fifteen percent of future additions to supply were subtracted for slippage in timing given the progress of several major projects (-5,543 units, Exhibit 4, *Calculation of Supply*). This conservative estimate was based on the progress of several major projects.

City officials have taken notice of this lack of progress among major land use plans in Ewa. The Honolulu City Council is currently considering the implementation of a "use it or lose it" policy through its 1995 Resolutions 95-270 and 271. Under these proposals, as many as 7,300 units within the market study area could have their urban designation downgraded to a less intensive use because they have not shown adequate progress since receiving Development Plan approval (Planning Department 1995). The projects include the City of Kapolei housing areas (2750 proposed units), Ko Olina Phase II (3500) and Makaiwa Hills (1066). These future units are fully represented in the additions to future supply (Exhibit 3).

A second adjustment to supply was a deduction of twenty percent of the 13,550 future residential units estimated by the developers of resort communities at Ko Olina and

Ewa Marina (-2,710 units, Exhibit 4). This adjustment was made to account for the probable use of "residential" units by visitors via long-term rentals and others being left vacant by non-resident owners. As noted in the 1994 Market Assessment, interviews with property managers indicated that up to 80 percent of units being effectively removed from local residential supply due to non-resident occupancy in comparable situations. Thus a 20 percent deduction appears conservative.

## VIII. RESIDENTIAL DEMAND AND SUPPLY IMBALANCE AND MARKET POSITION

**Conclusion**

This analysis indicates that by 2020 there will be a shortfall of approximately 9,629 to 14,900 residential units within the market study area. Based on this range's midpoint of 12,265 units, there appears to be adequate demand for the 8,000-unit East Kapolei Project which would be built out by 2013. Approximately 8,100 to 12,500 of the estimated shortfall in market study area units will be within the Ewa Development Plan Area.

The developer intends to offer a variety of products which will cater to a wide range of buyers. Part of this mix would include 30 percent affordable units which is in keeping with City and County of Honolulu housing policies. The product mix will be similar to the 1994 project concept. This mix focuses on low- to medium-density multifamily residences.

Based on an analysis of historical residential sales and capture rates of market area projects offering similar product, the project should be able to achieve a 25-30 percent capture rate of the market study area. This capture rate reflects sales of 550 units per year during the most active sales period or an average of 500 units per year over the 16-year build-out period.

**Methodology**

*Supply and demand imbalance.* In order to determine the need for the project, the potential imbalance between supply and demand must be assessed. This is accomplished by subtracting total supply from total demand, yielding either a shortfall or oversupply of residential units. The East Kapolei project will fill a shortfall of approximately 9,629 to 14,900 residential units within the market study area. Of these, 8,100 to 12,500 are expected within the Ewa Development Plan Area. Exhibit 5, *Supply and Demand Summary*, details the methodology used to arrive at these estimates, which is comparable to that employed in the 1994 Market Assessment.

*Affordability, target markets, and product mix.* The project's affordability is consistent with the City and County of Honolulu's Rules for Unilateral Agreements Requiring

Affordable Housing (Department of Housing and Community Development, September 1994). The East Kapolei Project will offer 30 percent affordable homes: ten percent will be priced for families with income levels up to 80 percent of Oahu's median, with an additional twenty percent priced to accommodate families in the 81-120 percent of median income brackets. Planned pricing of affordable homes is shown as Exhibit 6, *Affordable Pricing Structure.*

Market-priced homes are expected to be offered at approximately $185,000 to $285,000 (*Exhibit 7, Hypothetical Absorption Schedule*). The target market for multifamily market-priced homes is expected to be a combination of first-time and move-up buyers aged 25 to 40. Single family market-priced homes are expected to attract primarily move-up buyers aged 30 to 45 years.

The planned product mix and densities for the revised parcel configuration are comparable to the 1994 Market Assessment. The East Kapolei Project plan includes a range of single family residences, townhomes, and both market-priced and affordable low density multifamily homes (Ewa Special Provisions define "low density" as up to 30 units per acre). It is assumed that at least four different residential product types would be active at any given time (Exhibit 7).

*Anticipated capture rates - market study area.* In order to assess the subject development's potential to capture future residential demand, a comparative analysis was conducted using seven-year sales performance of master planned communities within the market study area (raw data source: Prudential Locations, Inc.). Projects included in this analysis were Ewa by Gentry, West Loch, Makakilo, Waikele and Royal Kunia. The results of this investigation showed average project capture rates during active sales periods ranging from approximately 15 to 44 percent of new home sales within the market area.

An East Kapolei Project capture rate of 25 to 30 percent per year has been concluded upon. This capture rate is based on the above comparative analysis, recent sales at competitive projects, and market performance of Oahu projects by Schuler Homes, Inc. (Exhibit 8, *Existing Residential Products, 1995).* When compared to capture rates achieved by comparable developments (15 to 44 percent), the range established for the proposed development appears to be conservative (Exhibit 9, *Capture Rates of Future Demand*).

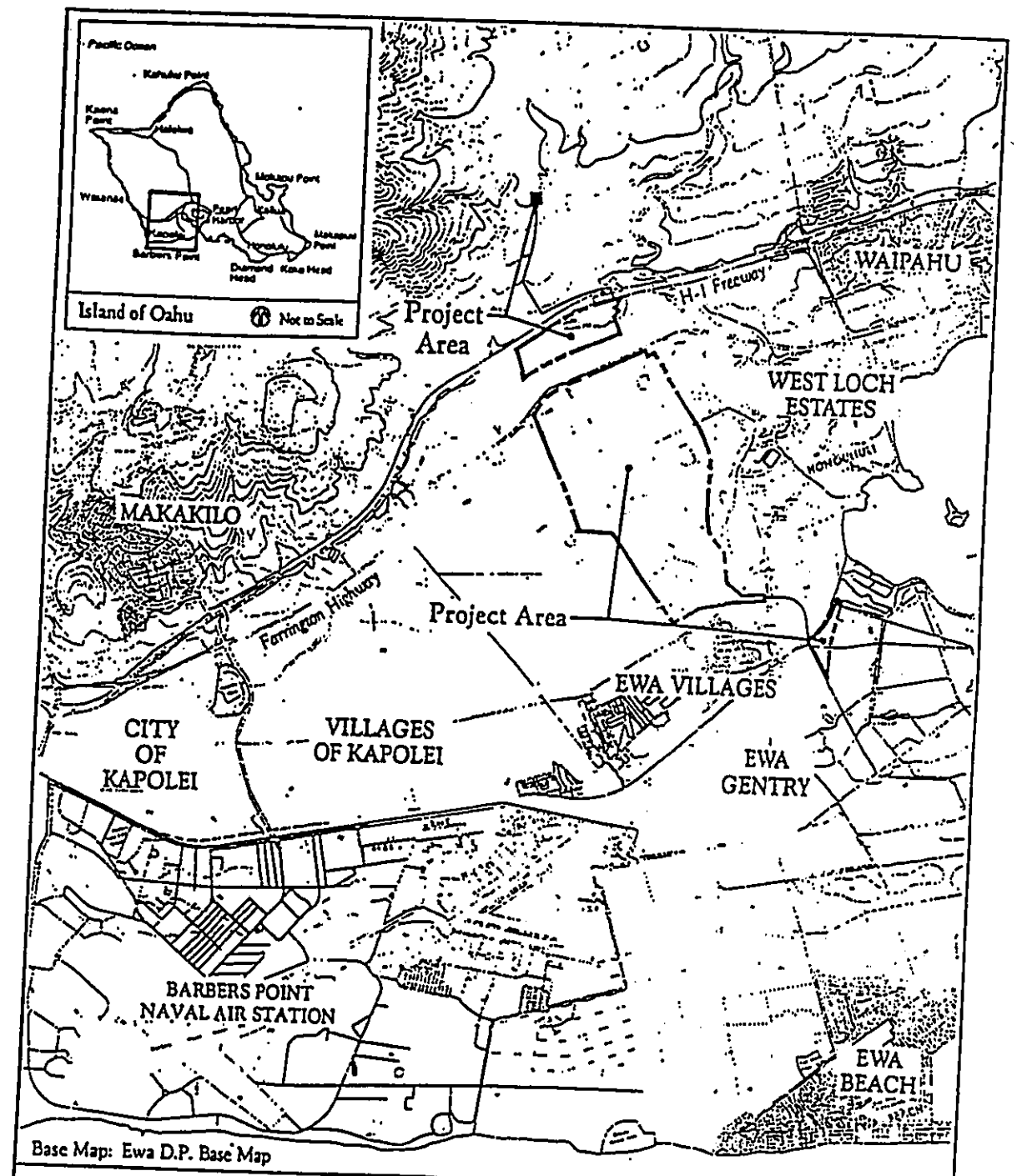
*Average annual absorption.* Exhibit 7, *Hypothetical Absorption Schedule,* reflects a mean annual absorption rate of 500 units per year, with absorption of the 8,000-unit project over 16 years. During the most active sales period, absorption rates of 550 units per year are expected. This estimate appears reasonable as it compares favorably with the recent and past sales experience of the other master planned communities and the developer's assessment of annual sales potential.

## IX. RETAIL

**Conclusion**

The East Kapolei Project will contain a 16-acre neighborhood commercial center whose size is limited by a deed restriction of two commercial acres for every 1,000 residential units. Planned retail is well within the demand for an additional 43 acres within the retail trade area that was estimated in the 1994 Market Assessment. As the factors affecting retail supply and demand have not materially changed, this conclusion still appears to be valid.

## Exhibit 1
## Location Map



## Exhibit 2
## Calculation of Demand

| | | | | |
|---|---|---|---|---|
| Oahu Housing Units - 2020 | 395,198 | | | Land Use Model |
| Oahu Occupied Units - 2020 | 386,108 | | | Net of 2.3 percent vacancy rate |
| Vacancy provision | 19,305 | | | Occupied units plus 5% vacancy provision<br>Refer to Section VI |
| Total Demand for Oahu - 2020 | 405,413 | | | Occupied units + vacancy provision |
| Study Area Allocation Factor<br>(% of Total Oahu) | 14.23%<br>Low End | 14.88%<br>Midpoint | 15.53%<br>High End | General Plan and Land Use Model |
| **Total Study Area Demand by 2020**<br>(includes 19,361 existing units) | 48,460 | 50,673 | 52,887 | Based on General Plan allocation to Ewa DP Area<br>Excludes provision of 300 additional units for university-generated demand |
| **Comparative Data** | | | | |
| **Net Additional Study Area Demand - 2020** | 38,329 | 40,964 | 43,600 | Total study area demand less existing units |
| **Net Additional Demand - EWA DP Area portion only - 2020** | 32,197 | 34,410 | 36,624 | Based on General Plan allocation to Ewa DP Area |

## Exhibit 3
## Additions to Residential Supply
## July 1994 - "After 2005"

**Additions to Residential Supply**
**July 1994 - "After 2005"**

| Project | Area | Total Units in Project | 7/1/94-6/30/95 | 1996 | 1997 | 1998-2000 | 2001-2005 | After 2005 |
|---|---|---|---|---|---|---|---|---|
| City of Kapolei | | | | | | | | |
| Makai | Ewa | 2,000 | | | | 500 | 1,000 | 500 |
| Mauka | Ewa | 750 | | | | 250 | 500 | |
| Ewa by Gentry | Ewa | 5,375 | 332 | 625 | 700 | 2,700 | 1,018 | |
| Ewa Marina | Ewa | 4,850 | | | 300 | 1,809 | 2,545 | 196 |
| Ewa Villages | Ewa | 1,480 | 113 | 133 | 327 | 907 | | |
| Ewa Fairways | Ewa | 280 | | 280 | | | | |
| Kapolei Knolls | Ewa | 418 | | | 100 | 318 | | |
| Ko Olina Fairways | Ewa | 280 | | 280 | | | | |
| Ko Olina, Phase 1 (rest) | Ewa | 4,920 | | | 500 | 675 | 3,145 | 600 |
| Ko Olina, Phase 2 | Ewa | 3,500 | | | | | | 3,500 |
| Makaiwa Hills, Phase 1 | Ewa | 1,066 | | | | | 1,000 | 66 |
| Makakilo | | | | | | | | |
| Post 1986 phases | Ewa | 1,697 | | | 40 | 70 | 600 | 987 |
| Makakilo Hts. (Palailai) | Ewa | 344 | | 38 | 62 | 104 | 140 | |
| Westview (Schuler) | Ewa | 352 | 172 | 90 | 90 | | | |
| Royal Kunia - Ph 1 | Central | 1,848 | 495 | 200 | 400 | 753 | | |
| Royal Kunia - Ph 2 | Central | 2,000 | | | | 1000 | 800 | 200 |
| Villages of Kapolei | Ewa | 4,059 | 760 | 844 | 168 | 731 | 1,556 | |
| Waikele | Central | 1,559 | 479 | 153 | | 927 | | |
| West Loch | Ewa | 175 | 175 | | | | | |
| **Total Additions[1]** | | **36,953** | | | | | | |

[1]Total units 7/1/94 - "After 2005"
Excludes military and Hawaiian Home Lands units
Source: Development Plan Annual Report, Fiscal Year 1995, Table II-3

**Exhibit 4**
**Calculation of Supply**

| | | |
|---|---|---|
| Existing Housing Inventory | 19,361 estimate | Planning Department |
| Additions to Future Supply | 36,953 | Exhibit 3 Future Additions to Supply |
| Deduction for Timing of Additions to Supply (15%) | -5,543 | 15% of 36,953 |
| Deduction for Non-Resident Occupancy | -2,710 | 20% of total future units at Ko Olina and Ewa Marina |
| | (13,550) | |
| **Adjusted Supply for the Year 2020 Market Study Area** | **48,061** | |

## Exhibit 5
## Supply and Demand Summary

| Demand Calculation | Low | Midpoint | High | |
|---|---|---|---|---|
| 1 **Total Demand - Market Study Area** | **57,690** | **60,326** | **62,961** | Exhibit 2<br>Includes 19,361 existing units<br>Excludes a provision of 300 additional units for university-generated demand |
| **Supply Calculation** | | | | |
| 2 Existing Inventory - Study Area | 19,361 | 19,361 | 19,361 | Planning Department estimate |
| 3 Additions to Future Supply | 36,953 | 36,953 | 36,953 | Exhibit 4 |
| 4 Deduction for Timing of Additions to Future Supply (15%) | -5,543 | -5,543 | -5,543 | Consultant Estimate<br>Refer to Section VII |
| 5 Deduction for Non-Resident Occupancy | -2,710 | -2,710 | -2,710 | Consultant Estimate (applies only to Ko Olina and Ewa Marina)<br>Refer to Section VII |
| 6 **Adjusted Supply for the Year 2020 - Market Study Area** | **48,061** | **48,061** | **48,061** | |
| **Conclusions** | | | | |
| 7 Total Market Study Area Demand (1994-2020) | 57,690 | 60,326 | 62,961 | Line 1 |
| 8 Total Market Study Area Supply (1994-2020) | 48,061 | 48,061 | 48,061 | Line 6 |
| 9 **Estimated Shortfall - Market Study Area (1994-2020)** | **9,629** | **12,265** | **14,900** | Line 1 less Line 6 |
| 10 Estimated Shortfall Ewa Development Plan Area only | 8,089 | 10,302 | 12,516 | Based on General Plan allocation to Ewa DP Area |
| 11 **Additional Demand - Market Study Area (1994-2020)** | **38,329** | **40,965** | **43,600** | Total demand (Line 1) less existing (Line 2) |
| 12 Additional Demand - Ewa Development Plan Area (1994-2020) | 32,197 | 34,410 | 36,624 | Excludes Royal Kunia, Waikele and existing units |

**Exhibit 6**
**Affordable Pricing Structure**

| Family Size | | 4 |
|---|---|---|
| Percent of Median Annual Income | 80% | $42,880 |
| Home Price | | $119,800 |
| Percent of Median Annual Income | 100% | $53,600 |
| Home Price | | $170,700 |
| Percent of Median Annual Income | 120% | $64,320 |
| Home Price | | $215,100 |

**Source: Schuler Homes, Inc., after State of Hawaii Housing Finance and Development Corp., 1995**
Assumes mortgage rate of 7.5%

## Exhibit 7
## Hypothetical Absorption Schedule

| Product Type - Target Market | Density (units/ac) | Number of Units | Avg Price ($000) | Absorp per mo[1] | Absorp per yr | 1998 Yr 1 | 1999 Yr 2 | 2000 Yr 3 | 2001 Yr 4 | 2002 Yr 5 | 2003 Yr 6 | 2004 Yr 7 | 2005 Yr 8 | 2006 Yr 9 | 2007 Yr 10 | 2008 Yr 11 | 2009 Yr 12 | 2010 Yr 13 | 2011 Yr 14 | 2012 Yr 15 | 2013 Yr 16 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Single Family - Market | 7 | 2,080 | $285,000 | 11 | 132 | 60 | 120 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 140 | 120 | 100 | 2080 |
| Townhome - Market | 11 | 1,440 | $235,000 | 8 | 96 | 36 | 60 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 80 | 64 | 1440 |
| Low Density[2] Type 1 - Market | 15 | 1,920 | $208,000 | 10 | 120 | 14 | 110 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 135 | 110 | 66 | 1920 |
| Low Density[2] Type 2 - Market | 20 | 160 | $185,000 | 1 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 160 |
| Low Density[2] Type 3 - Affordable | | | | | | | | | | | | | | | | | | | | | | |
| Up to 80% of median | 20 | 800 | $133,000 | 4 | 48 | 20 | 40 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 55 | 45 | 35 | 800 |
| Up to 120% of median | 20 | 1,600 | $175,000 | 8 | 96 | 40 | 80 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 110 | 90 | 70 | 1600 |
| | | 8,000 | | | | 180 | 420 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 550 | 455 | 345 | 8000 |

[1] average monthly absorption = total per product/16 year build-out
[2] Ewa Special Provisions allow up to 30 units per acre under the designation "low density"

## Exhibit 8
## Existing Residential Product, 1995

| Master Planned Community | Developer | Area | Type | Number | Monthly | Living Area (sq ft) | | | $(1,000s) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Subdivision | | | | | Absorp.* | Min | Max | Avg | Min | Max | Avg |
| **Ewa by Gentry** | | | | | | | | | | | |
| Fiesta (affordable)** | Gentry | Ewa | SFD | 171 | Lottery | 865 | 1260 | 1063 | 209 | 240 | 225 |
| Summerhill (market) | Gentry | Ewa | SFD | 305 | 11 | 1055 | 1648 | 1352 | 255 | 295 | 275 |
| Coronado (affordable) | Gentry | Ewa | SFA | 120 | Lottery | 407 | 710 | 559 | 105 | 150 | 128 |
| Currently offered - total project | | | | 614 | | | | | | | |
| **Villages of Kapolei** | | | | | | | | | | | |
| Iwalani (market) | HFDC/Stanford Carr | Ewa | SFD | 224 | 5 | 1141 | 1871 | 1506 | 285 | 332 | 309 |
| Iwalani (affordable) | HFDC/Stanford Carr | Ewa | SFD | 49 | Lottery | 1141 | 1530 | 1336 | 190 | 230 | 210 |
| Aeloa (market) | HFDC/Watt Hawaii | Ewa | SFD | 229 | 6 | 1118 | 1264 | 1191 | 275 | 398 | 337 |
| Aeloa (affordable) | HFDC/Watt Hawaii | Ewa | SFD | 103 | Lottery | 1117 | 1264 | 1191 | 190 | 230 | 210 |
| Aeloa Terrace (affordable) | HFDC/Watt Hawaii | Ewa | SFA | 96 | Lottery | 565 | 1039 | 802 | 120 | 168 | 144 |
| Currently offered - total project | | | | 701 | | | | | | | |
| **Makakilo** | | | | | | | | | | | |
| West Hills | Fin. Realty | Ewa | SFD | 96 | 5 | 1394 | 1787 | 1591 | 326 | 393 | 360 |
| Royal Ridge | Fin. Realty | Ewa | SFD | 48 | 1 | 1370 | 1818 | 1594 | 376 | 404 | 390 |
| Westview | Schuler Homes, Inc. | Ewa | SFA | 148 | 9 | 750 | 980 | 865 | 183 | 212 | 198 |
| Currently offered - total project | | | | 292 | | | | | | | |
| **Ko Olina** | | | | | | | | | | | |
| Fairways (market) | West Beach Estates | Ewa | SFD | 280 | 6 | 847 | 1264 | 1056 | 195 | 350 | 273 |
| **Royal Kunia** | | | | | | | | | | | |
| Phase I - SFD | Kunia Res'l Partners | Central | SFD | 366 | 23 | 800 | 2051 | 1426 | 250 | 400 | 325 |
| Phase I - (affordable) | Kunia Res'l Partners | Central | SFA/SFD | 248 | Lottery | 770 | 1000 | 885 | 183 | 205 | 194 |
| Currently offered - total project | | | | 614 | | | | | | | |
| **Waikele** | | | | | | | | | | | |
| Village on the Green (market) | Schuler Homes, Inc. | Central | SFA | 174 | 10 | 790 | 1445 | 1118 | 204 | 329 | 267 |
| Tropics (market) | Schuler Homes, Inc. | Central | SFD*** | 191 | 9 | 886 | 1376 | 1131 | 269 | 324 | 297 |
| Royal Pines (market) | Schuler Homes, Inc. | Central | SFD | 126 | 10 | 1183 | 1664 | 1424 | 309 | 325 | 317 |
| Signature (market) | Schuler Homes, Inc. | Central | SFD | 67 | 14 | 1329 | 1663 | 1496 | 356 | 437 | 397 |
| Champions (market) | Schuler Homes, Inc. | Central | SFD | 117 | 14 | 1336 | 1664 | 1500 | 355 | 445 | 400 |
| Highland View Estates (mark | Schuler Homes, Inc. | Central | SFD | 35 | 10 | | | | | | |
| Currently offered - total project | | | | 310 | | | | | | | |
| **Ewa Villages** | | | | | | | | | | | |
| Green View Villas | Armstrong Ewa | Ewa | SFD | 157 | 2 | 1296 | 2000 | 1648 | 300 | 450 | 375 |
| Tenney and Renton Villages | City and County of Honolulu | Ewa | SFD | 200 (new) (also 200 rehab) | Not avail. yet | 900 | 1250 | 1075 | 120 | 270 | 195 |

SFA= single family attached; SFD= single family detached; Fin. Realty= Finance Realty; HFDC=Housing Finance and Development Corporation; * based on realtor interviews **formally Sun Terra (market) ***Cluster
REFLECTS ONLY PROJECTS WITH MORE THAN 25 UNITS ACTIVELY SELLING

**Exhibit 9**
**Capture Rates of Future Demand**

| | |
|---|---|
| Study Area Future Demand (market study area demand less existing supply)* | 40,965 |
| Study area capture rate @ 20% | 8,193 |
| Study area capture rate @ 25% | 10,241 |
| Study area capture rate @ 30% | 12,289 |

* 40,965 represents the midpoint of Study Area Future Demand (Exhibit 5, Line 11)

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# Limiting Conditions

- This document is a market assessment and not an assessment of financial feasibility.
- The words "project," "projection" and "forecast" are not meant to follow the definition of any professional organizations.
- The consultant assumes no responsibility for economic, market or physical factors occurring after the last day of field work in December 1995, which may affect the opinions stated herein.
- No opinion is intended to be expressed for legal matters or that would require specialized investigation or knowledge beyond that ordinarily employed by a market consultant.
- No opinion as to title is rendered.
- No engineering reports or surveys have been prepared by or made available to the consultant.
- Maps and exhibits included herein are for illustration only, as an aid in visualizing matters discussed within the report. They should not be considered as surveys or relied upon for any other purpose.
- The estimates included in this report are utilized to assist in the market assessment of the property based on current market conditions, anticipated short-term supply and demand factors and a continued stable economy. Therefore, estimates are subject to changes in future conditions that cannot be accurately predicted by the consultant.
- The consultant is not qualified to detect the existence of potentially hazardous material which may or may not be present on or near the property. The client is urged to retain an expert in the field before making a business decision regarding the property.
- This report, or any portions thereof, shall not be included in any public offering or financing document without the consultant's review and consent.

# E

SOCIO-ECONOMIC IMPACT ASSESSMENT OF EAST KAPOLEI RESIDENTIAL PROJECT, NOVEMBER 1994.

COMMUNITY RESOURCES, INC.

SOCIO-ECONOMIC IMPACT ASSESSMENT OF EAST KAPOLEI RESIDENTIAL PROJECT, UPDATE MEMORANDUM, DECEMBER 1995.

COMMUNITY RESOURCES, A DIVISION OF SMS RESEARCH & MARKETING SERVICES, INC.

# SOCIO-ECONOMIC IMPACT ASSESSMENT OF EAST KAPOLEI RESIDENTIAL PROJECT

November 1994

Prepared for:
**Schuler Homes, Inc.**

Prepared by:
**Community Resources, Inc.**

# EXECUTIVE SUMMARY

The proposed East Kapolei project covers about 1,044 acres of land recently used for sugar cane cultivation. Schuler Homes, Inc. proposes a residential development for the site, to be built out in two phases over a period of 15 or more years.

The project site lies between the planned North-South road, to the west, Farrington Highway (to the north), the `Ewa Villages project (south or makai of the project) and the West Loch project. The first homes would be developed in the makai half of the project site, on land transferred to the Galbraith Estate by the State (Phase 1). Over time, the project would come to include, in both phases, some 10,000 housing units, land for two elementary schools and adjacent parks, and 20 acres of commercial space. (Land use permits are also being requested for another 27 acres of commercial area to be retained by the Estate of James Campbell.)

A market assessment for the project has indicated that project buildout could occur by 2011. At first, residents would reach their homes through a road running through the site to Farrington Highway. The North-South road would become the major roadway to the project, leading to Farrington Highway and to H-1.

The `Ewa Development Plan Area is slated for rapid urbanization. Major new residential areas have been planned, along with a city center in Kapolei. The area could potentially have a strong employment base, but employment center — above all, Barbers Point NAS and Ko `Olina may not generate as many jobs as expected, as fast as anticipated. Residents are concerned with the region's already limited infrastructure and traffic congestion. New public facilities and roadways are being planned to meet the needs of regional growth.

Knowledgeable community informants interviewed by Community Resources, Inc. in September 1994 tended to evaluate the proposed project in terms of the likelihood that it will add to or alleviate `Ewa's current traffic problems and lack of community facilities.

Project impacts include:

- **Employment.** Construction would support more than 13,000 person-years of direct employment over the entire construction period. The average number of direct jobs would be about 825 annually in 1996-2000, then rise to a high of 950 annually in 2006-2010. Construction spending would also support a total of 28,000 person-years of employment in indirect and induced jobs during the construction period.

Operations jobs would be created largely in the project commercial areas. Total on-site operations employment would amount to about 275 jobs by 2000, and reach a total of nearly 900 jobs at buildout. At buildout, an additional 525 indirect and induced jobs would be supported by project operations.

- **Population and Housing.** The project population is estimated as 6,100 in 2000, increasing to 24,500 in 2010. At buildout, the total population would be about 28,000. The population supported by operations-related jobs (including indirect and induced jobs statewide) could live in some 975 households — a small fraction of the 10,000 units in both phases of the project.

  Population growth in the `Ewa Development Plan Area (DPA) is likely to be much less rapid than City and County General Plan policy indicates. Project development would help to allocate expected population growth to `Ewa by 2010 in line with current policy, reducing somewhat the pressure for urban growth in other areas.

- **Government Revenues and Costs.** Project construction is estimated as yielding about $105 million (1994 dollars) in State taxes. City and County property taxes from the project would reach about $6.5 million annually at buildout (1994 dollars, at current tax rates), and continue at that level. The project would further contribute to lower government costs, in that the developer would participate in the development of infrastructure and facilities along with government agencies.

  The developer's participation in infrastructure planning can help infrastructure development occur more quickly and efficiently.

- **Social impacts** include:

  - Provision of additional housing for O`ahu residents, responding to the recognized islandwide need for additional housing.

  - Improved quality of life for residents newly able to own their homes, and for others to the extent that crowded conditions are alleviated.

  - Intensification of demand for regional infrastructure, facilities and services in `Ewa. This will likely involve competition for scarce resources and increased problems of traffic congestion in the short term, but is likely to lead to community pressure for timely construction of planned facilities and delivery of services. The greater the regional population, the more justification will exist for

expensive projects such as the North-South road or for locating social service providers in the proposed Kapolei Civic Center.

The project is likely to have little impact on police, fire, and medical services. Recreation impacts are contingent on the timing of developer's provision of park space.

Impacts on public education will be met in part by the provision of land for two elementary schools on the project site. However, students living in the project will also attend nearby intermediate and high schools in considerable numbers.

- Short-term irritants and potential health impacts due to construction dust and noise.

- Impact on the community character of nearby areas, to the extent that project design and scale is incongruous with them.

Possible mitigations for project impacts include:

- Coordinated planning for regional growth;

- Providing incentives for government agencies to develop community facilities in a timely manner;

- Support for community and/or neighborhood facilities in the East Kapolei project; and

- Community involvement and response, both to work for regional facilities and to respond to problems created by construction.

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# Section 1
# INTRODUCTION

## 1.1 PROJECT DESCRIPTION

The East Kapolei project is planned for approximately 1,044 acres of land in `Ewa District, O`ahu. The site lies makai and south of Farrington Highway, west of the West Loch developments on Fort Weaver Road, and north of the `Ewa Villages area along Renton Road. Its western boundary is the proposed North-South road, a major road linking central `Ewa to the H-1 Freeway. On the western side of the proposed road is State land, where construction of the future University of Hawaii, West O`ahu and Kapolei High School is planned. (Exhibit 1-A shows the site in relation to the Development Plan Areas of the City and County of Honolulu. Exhibit 1-B indicates the land uses around the site.)

The project has two parts or Phases, as shown in Exhibit 1-B:

- The Phase 1 land is currently owned by the State of Hawaii. The State has agreed with the Galbraith Trust (represented by Hawaiian Trust Company, Ltd.) to a land exchange. The State will gain some 2,200 acres of agricultural land in Central O`ahu in exchange for 500 acres of urbanized land in `Ewa. The Office of State Planning has petitioned the State Land Use Commission to designate the Phase 1 parcel as Urban. When that designation is made, the exchange can proceed.

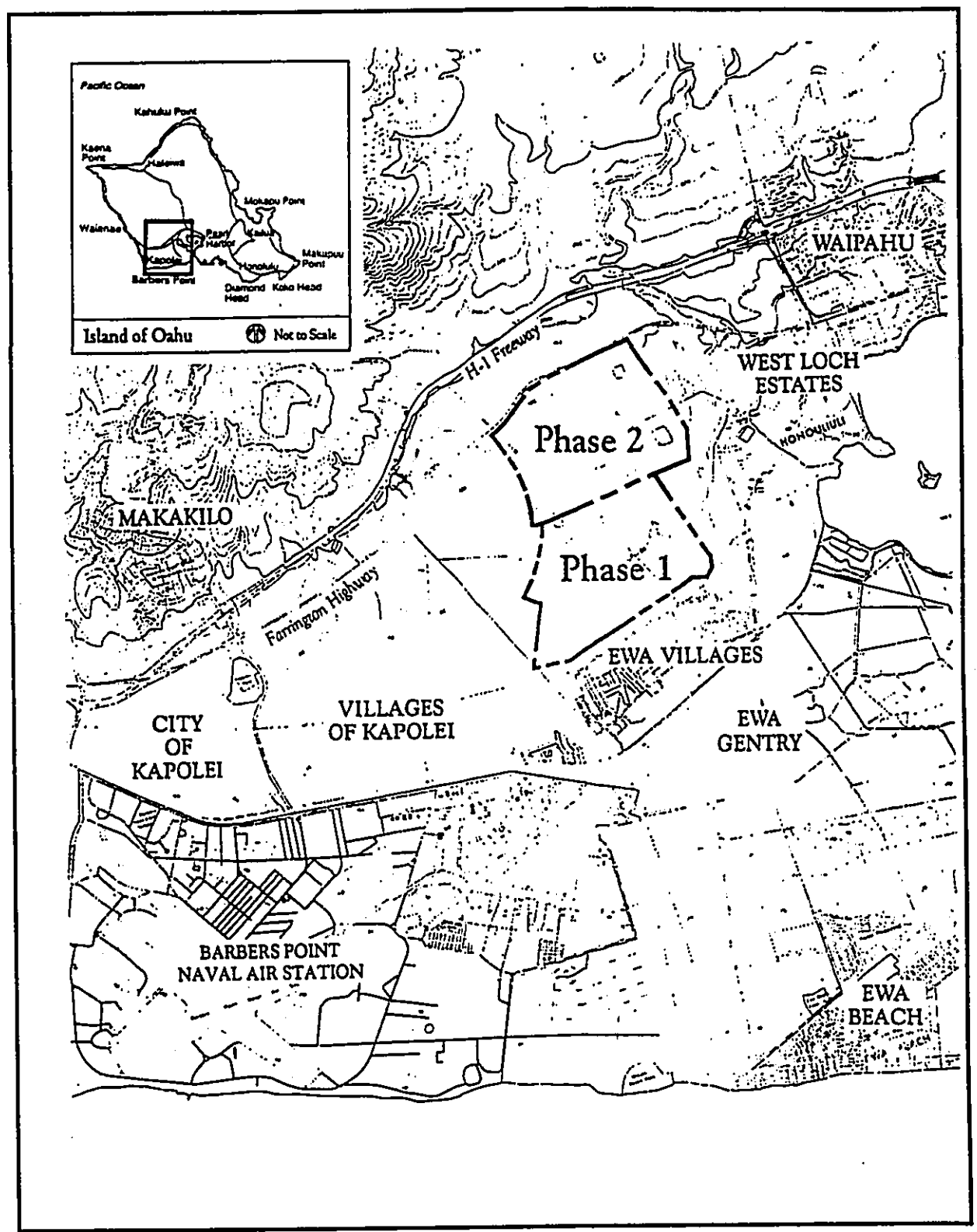
  The Galbraith Estate and Schuler Homes, Inc. have entered into an agreement to develop the Phase 1 land as a housing development.

- Phase 2 land is being bought by Schuler Homes, Inc. from the Estate of James Campbell. (While Exhibit 1-B shows the Phase 2 land as 544 acres in area, the exact size of the parcel is still being negotiated.)

The proposed development would consist of housing with supporting infrastructure and public facilities. Each phase would probably include:

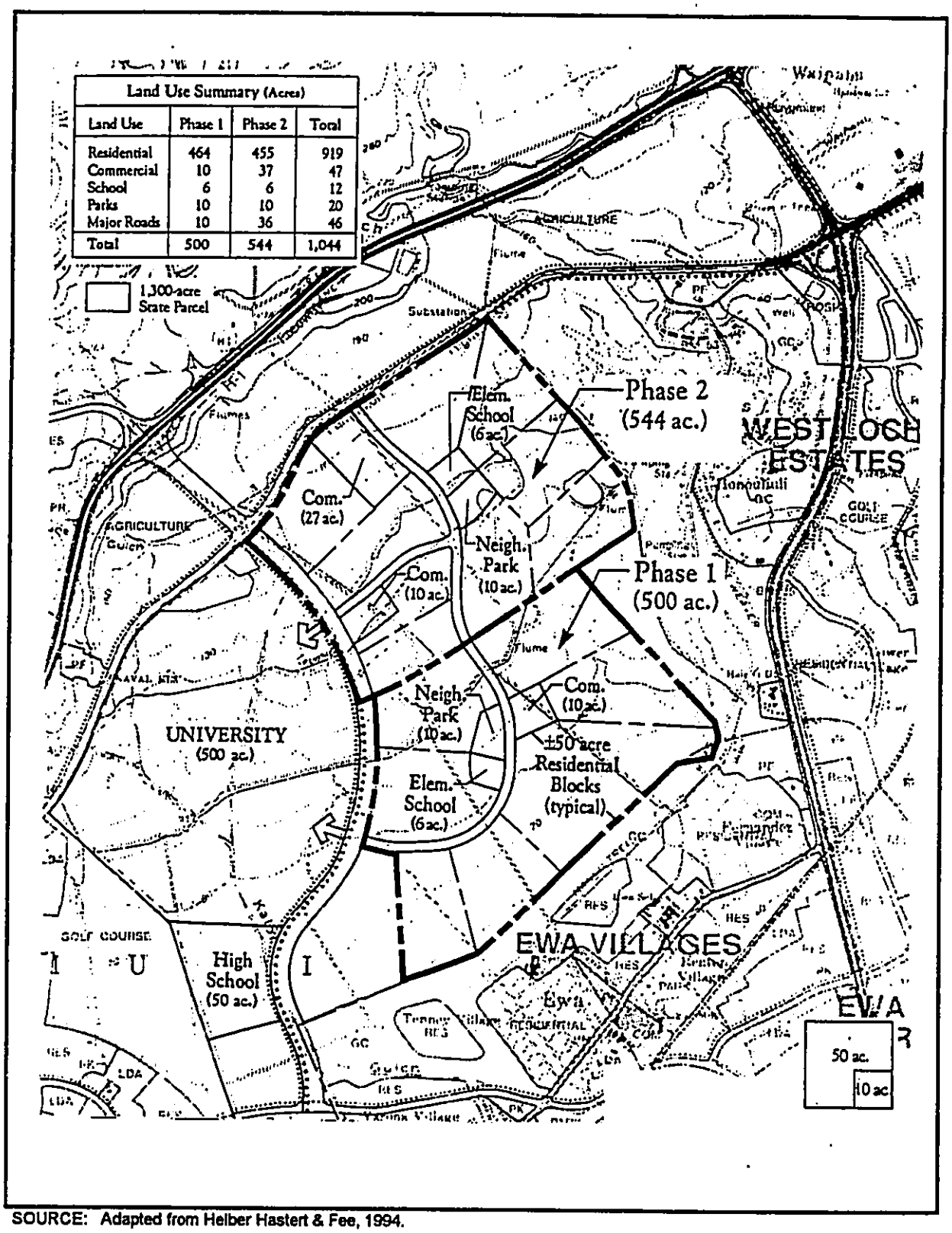
- About 5,000 units of housing, including multi-family and single-family units. These would be built for the resident market. In conformity with City and County policy, about 30% of units would be offered at "affordable" prices to buyers with household incomes ranging from 80% to 120% of the median. Other units would be sold at market prices, but would still be priced at levels comparable to those of nearby `Ewa and Central O`ahu projects.

**Exhibit 1-A**
**LOCATION MAP**




SOURCE: Adapted from Helber Hastert & Fee, 1994.

## Exhibit 1-B
## PRELIMINARY CONCEPT PLAN




| Land Use Summary (Acres) | | | |
|---|---|---|---|
| Land Use | Phase 1 | Phase 2 | Total |
| Residential | 464 | 455 | 919 |
| Commercial | 10 | 37 | 47 |
| School | 6 | 6 | 12 |
| Parks | 10 | 10 | 20 |
| Major Roads | 10 | 36 | 46 |
| Total | 500 | 544 | 1,044 |

SOURCE: Adapted from Helber Hastert & Fee, 1994.

- Land for an elementary school.
- Land dedicated to park use, adjacent to the school site.
- About 10 acres of land for neighborhood commercial development. That land is shown in Exhibit 1-B as a single parcel in each Phase. However, the acreage could be divided into separate lots, to serve smaller neighborhoods in each Phase.

In addition, a 27-acre parcel included in Phase 2 would be retained by the Estate of James Campbell for eventual development. It is slated for neighborhood commercial use. Because this parcel would not be developed by Schuler Homes, Inc. and no timetable for development has been set, it will not be discussed further in this socio-economic impact assessment.

At first, a road from Farrington Highway through Phase 1 will provide access to the property. When the North/South road is built, both Phase 1 and Phase 2 will have road links to this major road.

If infrastructure development begins in 1996, the first homes might be offered for sale in 1997. Schuler Homes expects to build housing at the site, at Phase 1 then at Phase 2, continuously thereafter. A market assessment for the project indicates that buildout of both phases — 10,000 units — could come as early as 2011. However, the construction period could take longer.

## 1.2 PURPOSE AND SCOPE OF THIS REPORT

This report assesses the socio-economic impacts of the proposed project. It takes into account both existing conditions and likely future trends in the area surrounding the project.

The report is intended to serve as an appendix to an Environmental Impact Statement being prepared by Helber, Hastert & Fee, Planners. Sections of a draft version of the report were provided for inclusion in an Environmental Assessment of the project.

The report is written to identify and disclose information that may be of use to decision makers and members of the general public as they evaluate the implications of the project. Discussions of the likely points of compatibility of the project with surrounding land uses, of potential impacts, and of steps which might mitigate unwanted impacts are intended to help in the EIS process and to contribute to community planning over the long term.

The sections of this report deal with:

- Introductory issues;
- Existing conditions and emerging trends in the area surrounding the project;
- Economic and demographic impacts of the project;
- Impacts on public facilities and services;
- Other social impacts; and
- Potential mitigation measures and processes that would appropriately respond to adverse impacts of project development.

# Section 2
# EXISTING AND EMERGING CONDITIONS IN THE SURROUNDING COMMUNITY

## 2.1 DEFINITION OF STUDY AREA

The project is located on the `Ewa Plain. Its location and the area affected by it could be defined in several different ways.

The site is within the State's `Ewa District and the City and County of Honolulu's `Ewa Development Plan Area (DPA). As a major housing project built in response to existing and anticipated demand, the project is intended to serve consumers from all areas of the island of O`ahu. It will compete for buyers with other projects in `Ewa and Central O`ahu. Finally, it will add to traffic on the H-1 Freeway, affecting residents of Wai`anae, who also depend on the western sections of this roadway, along with other `Ewa residents.

For this report, the `Ewa DPA is the Primary Study Area. It includes the land divisions of Hono`uli`uli and Pu`uloa. This region has been identified as a high-growth area of O`ahu, in which planned residential, commercial, industrial, and public developments are being proposed to form a Second City. (The State's `Ewa Judicial District is much larger, with boundaries running from Halawa in the east to Barbers Point in the west, as shown in Exhibit 2-A. That region is not usefully considered as a unit for the purposes of this report.)

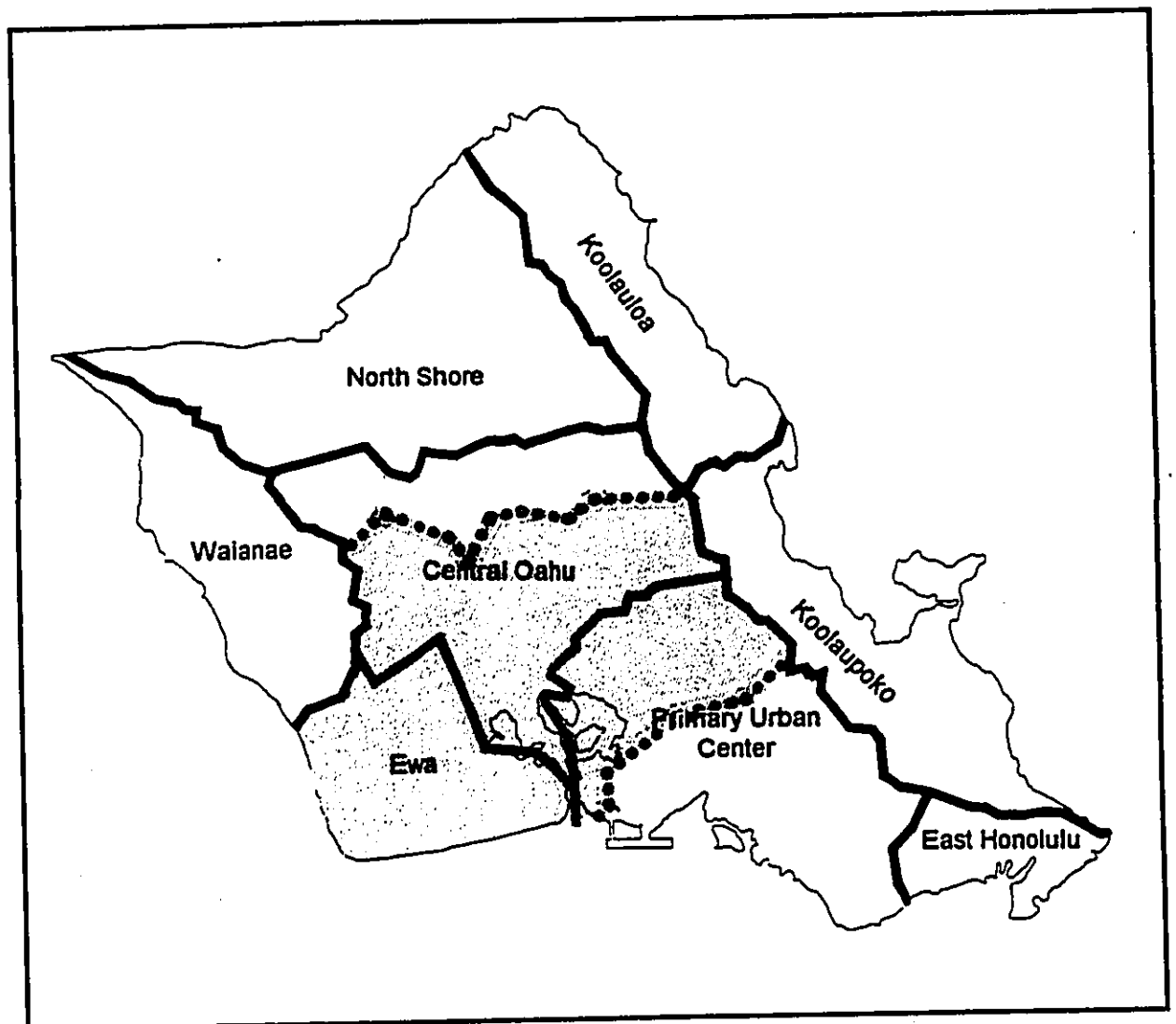
Because the project will have impacts on residents and housing projects in the DPAs adjoining `Ewa, the Wai`anae and Central O`ahu DPAs are considered Secondary Study Areas in this report.

## 2.2 PRIMARY STUDY AREA

### 2.2.1 Overview of `Ewa

`Ewa lies in the leeward district of O`ahu, to the west of Pearl Harbor. `Ewa means "crooked" or "ill-fitting." It is said that the gods Kane and Kanaloa once walked around O`ahu and threw stones to determine district boundaries. Where-ever the stone landed would become the boundary. However, when they came to present day `Ewa, they could not find the stone they threw and called that district "`Ewa." The story concludes that the strayed stone was later found at Pili o Kahe, a place at the present-day boundary of Wai`anae and `Ewa in Nanakuli.

**Exhibit 2-A**
**`EWA DEVELOPMENT PLAN AREA**




NOTE: Shaded area depicts boundary of `Ewa Judicial District.

SOURCE: Adapted from City & County of Honolulu Planning Department, 1992.

Kamehameha III awarded the `ahupua`a of Hono`uli`uli to Chief Miriam Ke`ahikuni Kekau`onohi in 1848. She in turn leased it to ranchers. James Campbell bought Hono`uli`uli from a rancher in 1878. Campbell had the first artesian well drilled on his ranch in 1879, and subsequently developed well systems which allowed the cultivation of sugar cane in Hono`uli`uli. Campbell leased about 2,000 acres of land to Castle and Cooke in 1890 to raise cane under the incorporation of Ewa Plantation Company. A plantation settlement was established around the mill site on Renton Road and `Ewa became a plantation community.

Castle and Cooke dissolved the Ewa Sugar Company in 1970 and sold its operations to AMFAC, thus merging Ewa Plantation with O`ahu Sugar Company (OSCo). Cane cultivation continued but processing was done at OSCo's Waipahu mill. OSCo's lease with Campbell Estate will end in 1995.

`Ewa is made up of many different and distinct communities. Old and new settlements stand in contrast. Although `Ewa Villages and `Ewa Beach, two older and major communities, are predominantly Filipino, Caucasians made up the major ethnicity (followed by Filipinos) in the `Ewa Development Plan area, in the 1990 Census (See Appendix A-1). The `Ewa Development Plan area (DPA) had a large proportion of young adults, aged 18 to 34 years old.

Some 21% of home owners in the `Ewa DPA paid 35% or more of their income for housing expenses, while the island-wide average was only 15%.

Due to the presence of the Barbers Point Naval Air Station (BPNAS) and the Iroquois Point housing area, the number of persons employed in the military was double that of Honolulu County. The number of men and women working in the civilian labor force was slightly higher than the island-wide population. (See Appendix A-5).

Although sugar has been the primary activity in `Ewa, BPNAS and James Campbell Industrial Park (JCIP) have provided an alternative industrial base. New office and commercial projects in Kapolei provide a basis for further diversification of the economy.

Regional population trends indicate that `Ewa's population will more than double by 2010 (Planning Department, City & County of Honolulu, April 1994). The average annual growth rate from 1980 to 1990 was 1.87%, and is forecast as about 4%, between 1990 and 2010. In 1990, `Ewa accounted for about 5% of O`ahu's population; in 2010, it is expected to account for about 9% of the total island population.

The anticipated population growth follows from the development of major new subdivisions. In the 20-year period from 1990 to 2010, `Ewa's housing stock is expected to increase by nearly 17,000 units, more than double the 1990 stock. (This estimate falls below earlier ones, that treated all permitted developments as built out by 2010. One count of permitted and proposed units in `Ewa included 13,975 existing units and 39,089 future units [Estate of James Campbell, 1993c.)

With urbanization, `Ewa's regional jobcount is estimated as reaching 48,552 jobs in 2010, nearly four times the 1990 figure. However, the speed of job-creation at Ko` Olina and at BPNAS (after the base closes in 1997) is uncertain. Kapolei will soon become the major employment center of the region. Campbell

Industrial Park and Barbers Point Deep Draft Harbor will function as industrial and maritime employment centers.

### 2.2.2 Geography

The project site is in the `ahupua`a of Hono`uli`uli.

The two major land forms in the `Ewa region are the `Ewa Plain and Makakilo upland. H-1 Freeway and Farrington Highway are the general boundaries of the two land areas. The cinder cones, *pu`u*, along the Wai`anae Mountain Range form the peaks of that region: Manawahua, Kapuai, Makakilo, Palailai, Kapolei.

`Ewa Plain is an elevated coral reef covered by alluvium. Elevations vary from about 50 feet above mean sea level (MSL) near the southern boundary at NAS Barbers Point, to 2,300 feet MSL at Pu`u Manawahua, the highest peak in the `Ewa region.

The climate is relatively dry in `Ewa. However, the land was arable in earlier times. There were once large terrace areas near West Loch, referred to as `Ewa taro lands. Hawaiians used the holes and pits in the coral for planting.

### 2.2.3 History and Current Conditions

James Campbell purchased 41,000 acres of land in Hono`uli`uli for $95,000 in 1877. He bought the dry ranch land from owner John Coney. Looking for a water source to cultivate sugar cane, Campbell hired John Ashley to drill for water. On September 22, 1879, Ashley tapped the first artesian well, named Wai`ani`ani, which continued to flow for 60 years.

Soon after the discovery of the artesian well, Benjamin Dillingham leased land from Campbell to cultivate sugar on a large scale. He sought out W.R. Castle's expertise in sugar cane cultivation, and shortly thereafter, the Ewa Plantation Company was chartered and incorporated. Dillingham also obtained permission from the Government of Hawai`i to construct O`ahu's first railroad — Oahu Railway and Land Company (OR&L). With water and transportation available, `Ewa was transformed into a plantation community in the 1890s.

`Ewa's sugar and plantation communities flourished for decades. After World War II, no new investment was made in the plantation villages. Sugar cultivation remained, but urban development began to encroach on sugar land on the `Ewa Plain in the 1980s. Now the area is largely planned for urbanization.

(See Appendix A-7 for an inventory of residential projects existing and/or planned in `Ewa.)

**Project Site.** The project site has been planted in sugar cane for most of this century. With the closing of Oahu Sugar Company (OSCo) slated for 1995, this The landowners have negotiated with truck farmers to continue agricultural use of the land in the next few years.

**Major Communities.** CRI compiled 1990 Census data for five `Ewa residential areas (`Ewa Villages, `Ewa Beach, `Ewa by Gentry, Barbers Point NAS, and Makakilo). Kapolei and West Loch are also notable developments as of 1994. These are discussed here in order of age:

- **`Ewa Villages.** Sugar mill construction commenced in 1891, and plantation villages sprouted up around the mill site over the next sixty years. The number of residential units amounted to over 1,200 during that era. The Ewa Sugar Company built most of the villages. At one time there were eight villages, housing immigrant plantation workers from Portugal, Spain, Korea, Japan, and the Philippines. Four of the newer villages — Renton, Tenney, Varona, and Fernandez — are still standing, while "C," Mill, Middle, and Lower Villages were razed

  Renton Village is the historic core of the Villages. It was built between 1913 and 1938. Much of the community's infrastructure and facilities were constructed during George F. Renton's tenure as plantation manager. Improvements to the area included: construction of most of the mill structures, a system of roads, installation of street lighting, water mains, service lines and plumbing, fire equipment, theaters, clubhouses, playgrounds, tennis courts, a swimming pool, administration building, and hospital.

  Although the villages were rather self-contained entities, a number of amenities served as the focal point and a gathering place for the entire area. These included the post office, general stores, churches, butcher shop, and a bank. Several churches and social halls are also still standing in the Villages.

  There has been no construction of new villages since the 1950s. Fernandez Village was redeveloped in the late '70s to early '80s, and the City is currently engaged in revitalizing the Villages in order to preserve the plantation character and heritage of the mill area.

  The `Ewa Villages population was 3,780 in 1990 (See Appendix A-8, Demographic Characteristics), and residents were primarily Filipino (67%). The median age was 32.4 years. Most of the Villages residents

were born in Hawai`i, while one-third were born in another country (Appendix A-9). About half of the residents were living in houses that were more than twenty years old (as shown in Appendix A-10), while about 40% had lived in their homes from two to 10 years. (Most of these households probably reside in Fernandez Village, which was redeveloped.) Two-thirds of the households were owner-occupants, while one-third were renters. The average household size — 4.19 persons per household in 1990 — was very high for O`ahu.

In 1990, almost half of the Village households received Social Security income, and one-third received retirement income (See Appendix A-11). Few Village residents (1%) lived in poverty, and the median household income was just above the island median.

The City Department of Housing and Community Development (DHCD) plan for revitalizing the `Ewa Villages calls for a number of improvements, including:

- developing some 957 affordable and market, single- and multi-family residential units, while also revitalizing 273 existing homes;
- expanding `Ewa Elementary School;
- creating a district park and an 18-hole municipal golf course;
- developing a commercial/retail center and a business park; and
- providing for existing churches (through land acquisition or relocation).

The plan calls for not only architectural renovation to preserve the historic character of the villages, but also rental and home ownership programs for Renton, Tenney, and Varona village residents.

The project is now scheduled for completion between 1997 and 1998, with homes rehabilitated by 1997. The golf course is presently under construction.

- **`Ewa Beach.** `Ewa Beach began as a weekend recreational area in the 1940s and eventually became a permanent residential community. There were 3,426 housing units reported in the 1990 Census.

  There were 14,315 people residing in `Ewa Beach in 1990 and residents were predominantly Filipino. The median age was 28.6 years (Appendix A-8). Households are very large, with an average size of

4.26 persons. People in `Ewa Beach were much more likely to be receiving public assistance for income than the other major communities in `Ewa (Appendix A-11).

- **Barbers Point Naval Air Station (BPNAS).** Originally known as Kalaeloa, this area in the south-central portion of Hono`uli`uli, was renamed Barbers Point after Captain Henry Barber wrecked his ship on a coral shoal in 1795. BPNAS was established during World War II as a major U.S. Navy aviation facility. The station comprises 3,700 acres and operates on a 24-hour basis. There are three 7,000-foot runways which allow operation of fixed-winged and rotary-winged aircraft.

  According to the 1990 Census, the air station had 2,218 residents. (In addition, the Iroquois Point military housing area, on the eastern side of `Ewa, houses about 5,000 persons.)

  Military personnel stationed on-base at BPNAS numbered 4,146 in 1990, while 1,619 civilians were employed there (from special Census runs for transportation analysis, for Traffic Advisory Zone 251). BPNAS is scheduled to shut down in 1997 as part of the national Base Realignment and Closure initiative. Plans for re-use are currently under way. Navy housing and recreation areas will be retained after the Naval aviation facility closes.

  In comparison to other `Ewa communities, Barbers Point residents were young with a median age of 24.7. Due to the low military wage structure, there was less difference between rich and poor at Barbers Point than in `Ewa Beach or Honolulu County as a whole (as shown by the interquartile income range, in Appendix A-11).

- **Makakilo.** Makakilo opened for occupancy in 1962, with single- and multi-family, mid-priced homes. Finance Realty is the major developer at Makakilo, which encompasses 1,202 acres. Development is more than halfway through and there will be 6,174 homes at full build-out.

  Makakilo had 9,828 residents in 1990. (See Appendix A-8.) Nearly half were Caucasian. Although people have lived in Makakilo since 1962, over two-thirds of the population were recent arrivals in 1990 — 64% had moved into their homes within the five years preceding the Census (Appendix A-9).

  Makakilo had higher household income levels than the other communities shown in Appendix A-11. However, costs were also high in Makakilo. Some 24% of homeowners spent 35% or more of their

incomes on housing costs, while 46% of renters spent similarly large shares of their income on housing.

- **Ewa by Gentry.** The first residents began moving into Soda Creek, the development's first subdivision, in 1988. The population of Ewa by Gentry was nearly 2,000 in 1990 (Appendix A-7). One-third of the residents were Caucasian, and about another third were Filipino. The median age was 28.4 years. Similar to Makakilo, almost 90% of Ewa Gentry residents had earned a high school diploma; 40% had a college degree.

  In 1990, there were 752 houses in Ewa by Gentry. Eighty percent of the homes were owner-occupied. Owners and renters alike in this development paid the most for housing costs, compared to the other `Ewa communities studied. Almost 40% of homeowners, and 78% of renters, paid more than 35% of their income for housing costs (Appendix A-11).

  Gentry Development Company plans to build about 8,300 homes over 1,000 acres of land in Hono`uli`uli. To date, about 3,500 units have been completed. The remainder of units are scheduled to be built through 1999. Planned community facilities are: an 18-hole golf course, elementary school, two community parks, and a neighborhood community center.

- **West Loch.** This DHCD project is situated on 491 acres in Hono`uli`uli on the western edge of Pearl Harbor's West Loch. The development consists of single- and multi-family homes; 60% are affordable and 40% are in the market range. Phase I was completed in 1990, with 593 homes. A total of 1,600 residential units will be built by the end of the project. Other planned features of the community include: a commercial center, church, child care facilities, Asing Community Park within the civic center, an 18-hole municipal golf course, and a 40-acre shoreline park.

- **Kapolei.** Kapolei, which was not even counted as a Census Defined Place in 1990, is to be the regional center for `Ewa and nearby areas.

  Campbell Estate has been involved in master planning its extensive property in the `Ewa region since 1955 when Harland Bartholomew and Associates prepared the first `Ewa master plan. The plan was revised in the early 1960s, and updated in 1974, during which the concept of a self-contained city evolved. In 1986, Campbell Estate proposed a detailed implementation plan for a city center, bordered by Makakilo, Campbell Industrial Park, and NAS Barbers Point, and renamed it

Kapolei. The city center concept accorded with General Plan policies to develop a secondary urban center in west O`ahu.

The Kapolei Area Long Range Master Plan defines the second city as consisting of: Kapolei Villages, Kapolei Town Center, Kapolei Regional Park, Kapolei Shopping Center, Ko `Olina resort, James Campbell Industrial Park, Barbers Point Harbor, and Makakilo. Finance Realty plans to develop Kapolei Knolls mauka of Kapolei Villages. To the east, the State has identified sites for the University of Hawaii, West O`ahu and for Kapolei High School. The East Kapolei project further extends the unofficial limits of the Second City, to cover nearly half of `Ewa.

The State Housing, Finance, and Development Corporation (HFDC) is developing Kapolei Villages in conjunction with DHCD. The first homes were completed in 1990. There will be about 5,000 residential units at build-out .

Kapolei also includes:

- Offices at Campbell Square;
- A shopping center with some 25 vendors, ranging from grocery markets, service outlets, specialty shops, and fast food eateries;
- A new elementary school; and
- Many additional components under construction (i.e., the Bank of Hawaii building, with space for some 1,200 employees; a 16-screen movie theater; part of the regional park; and a child care center.) Seagull Schools expects the center to be completed in April 1995. It will accommodate 280 children, from six weeks to five years old.

**Non-Residential Developments.** Major employment centers, in addition to BPNAS, are James Campbell Industrial Park, Barbers Point Harbor, and the Ko `Olina Resort:

- **James Campbell Industrial Park (JCIP).** Campbell Estate developed this park as a heavy industrial complex in 1959. The entire complex stretches across 1,367 acres. Major tenants include two oil refineries, a concrete manufacturing plant, cattle feed lot operation, large building material supply yards, numerous light industrial businesses, and the City's H-POWER plant. About 75% of the park is owned in fee by its tenants.

- **Barbers Point Harbor (BPH).** The new State-owned harbor is located at the northwestern edge of the Industrial Park. Campbell Estate dedicated 89 acres to the State for the harbor. Both BPH and Campbell Industrial Park are extensions of Foreign Trade Zone No. 9. The first increment of the development was completed in 1990, and ships now make regular calls at BPH. Facilities include 1,600 feet of pier and 30 acres of paved back-up area and related infrastructure. In addition, a bulk cargo ship unloader went into use in 1992.

  When harbor development is completed in the next 15 or 20 years, there will be a total of 237 acres of developed area surrounding the basin. BPH is being planned to accommodate O`ahu's shipping needs for the next 50 years.

- **Ko `Olina.** Ko `Olina is a planned resort community at the southwest end of the `Ewa region. Developer West Beach Estates has planned and created beaches and lagoons for a 1,000-acre resort. To date, one hotel and a golf course have been developed. Eventually , a maximum of 8,700 housing units could be built, and about 9,000 people employed (Personal communication: Ken Williams, West Beach Estates, August 1994). Medium-rise apartment-condominiums, low-density apartments near the golf course, and hotels are planned. The 350-400 slip marina has already been dug out and in-water facilities are to be built.

### 2.2.4 Community Issues and Concerns

Community Resources, Inc. reviewed Ewa Neighborhood Board Minutes from January 1992 to mid-1994, to identify recurring concerns of the `Ewa community. Major concerns expressed by Board members and the community included:

- **Development of the `Ewa Area.** This has involved discussion on the impacts of growth on the quality of life for existing communities, and promises made to those communities by developers, City, and State officials.

- **Public Infrastructure and Facilities.**

  - **Schools:** The community wants to ensure that DOE will live up to its promises to provide adequate facilities and services within a reasonable time period.

  - **Wastewater Management:** The Ewa Neighborhood Board does not have confidence in the City's prediction that the Hono`uli`uli

Sewage Treatment Plant can adequately support the planned developments in `Ewa.

- **GTE Hawaiian Telephone System:** The system does not currently have the ability to provide expanded services in the `Ewa area. GTE has promised these services by the end of 1995.

- **Traffic:** Traffic flow in and out of Leeward is hampered by the inadequate access roads (Fort Weaver Road, and the current H-1 freeway exits), and by the need for more traffic lights coming into and out of the development areas.

- **Crime.** Crime in `Ewa could be managed by the police substation in Kapolei and increased police services, according to Neighborhood Board members. Concerns included the increasing number of gangs, graffiti, and drug houses, that the Board feels could be handled by *expanding youth recreational facilities* and services.

- **Fire Protection.** This is in `Ewa is considered adequate, but the community would prefer that the fire station planned for Kapolei be positioned close to large development tracts, such as Ewa by Gentry. Until the new fire station is built, Kapolei is served by both the Makakilo and the Waipahu Fire Stations.

- **Parks.** A central district park is sought by members of the community. HFDC has developed a master plan for the Kapolei District Park, that Kapolei residents feel is inadequate unless both night time lighting and landscaping features are included in the plan. HFDC believes that these features should be purchased and added by Campbell Estates.

- **Naval Air Station Barbers Point.** Future use of the station is an area of concern. Many residents oppose the conversion of this area into an airport, and would like the beach area to be converted into park land.

Community Resources, Inc. conducted interviews of community leaders and other representatives in September 1994, to understand what issues and concerns were most pressing to them. For the most part, the interviewees' concerns tended to reflect discussions before the `Ewa Neighborhood Board. Three concerns were mentioned most often:

- **Traffic Congestion.** Congestion is especially during peak commute hours. Interviewees looked forward to the North-South Road as a reliever for Fort Weaver Road.

- **Timing and Coordination of Infrastructure, Public Facilities, and Commercial Development with Residential Development.** Two major issues raised under this concern were:

  - Park facilities — the need for more park space and facilities, and for properly maintained parks;

  - Schools — the need for another high school and other educational facilities to meet existing and future demands in a timely manner.

- **Uncertainty about Jobs.** Several wondered whether Kapolei will become another major financial district like downtown Honolulu as envisioned, and whether the re-use of Barbers Point will generate many jobs.

Other concerns that residents mentioned were:

- Uncertainty over how the neighborhood character would change with the influx of new residents;

- The desire for a sense of community, but with little time to create it;

- The perception of a lack of political equity between `Ewa and other regions of the island, as well as power differentials between `Ewa communities;

- The need for more organized youth activities and services; and

- The capacity of the Hono`uli`uli Sewage Treatment Plant to handle current and future processing.

## 2.3 SECONDARY STUDY AREAS

### 2.3.1 Central O`ahu Development Plan Area

Central O`ahu contains both established communities that have long served as plantation towns — Waipahu and Wahiawa — and new developments. Of the new developments, Mililani Town is a planned community, with homes, a light-industrial or technological park, and a major shopping center; and Waikele includes both extensive residential areas and a major shopping center. It is located between Waipahu and other subdivisions, not as a separate community.

While Central O`ahu is much more populous than `Ewa DPA, the two areas' populations are very similar. Differences largely follow from the existence of

plantation towns in Central O`ahu. (There is no military base in Central O`ahu, but 16% of the 1990 population age 16 and over was in the armed forces [compared to 17% for `Ewa]]. Central O`ahu lies between the major military bases of O`ahu, at Pearl Harbor, or Schofield Barracks, and it houses military personnel assigned to either.)

Central Oahu had more than 130,000 residents in 1990 (as shown in Appendix A-1). The age structure was very similar to that of `Ewa. As in `Ewa, about a quarter of the population was of Filipino ancestry. Caucasians formed the largest single ethnic group, but amounted to only 30% of the population (vs. 40% in `Ewa). Household incomes were slightly higher than for `Ewa households (as shown in Appendix A-4). The average household size — 33.49 persons per household — was slightly less than the `Ewa average, but still much higher than the islandwide average of 3.02 persons (Appendix A-3).

### 2.3.2 Wai`anae Development Plan Area

Wai`anae is relatively isolated, with one major roadway linking the region with the rest of O`ahu. Major land uses include military uses (at Lualualei and Makua valley), Hawaiian Homelands areas (in Nanakuli) and a resort in Makaha.

The region is known for a distinctive "country" lifestyle based in the Native Hawaiian culture of many residents. It stands out as more settled, with larger households than in nearby regions.

In 1990, Native Hawaiians made up 41% of the DPA population. About three-quarters of the population was born in Hawaii. The community was young, with a median age of 26.3 years. (For demographic characteristics, see Appendix A-1.)

Incomes tended to be low in the Wai`anae DPA. About a fifth of the population had incomes below the poverty line (Appendix A-4). Many renters (44%) paid a very large part of their incomes for housing costs. However, only 14% of homeowners paid over 35% of their incomes for housing, in contrast with the other DPAs under study. Unemployment was about twice as high as the islandwide average, and workers typically commuted 36 minutes to work (as shown in Appendix A-5).

## 2.4 EMERGING CONDITIONS

### 2.4.1 `Ewa in the Late 1990s

`Ewa's sugar lands are being replaced by urban development. Recent years have seen residential growth and modest retail development. However, plans call for a complete city, not a set of suburbs separated by grass lands.

The Kapolei Area Long Range Master Plan contains designs for a city similar in layout to Honolulu: a commercial and government center, surrounded by homes, with a resort area six miles from the urban center, and a commercial harbor in close vicinity.

Though projections indicate that `Ewa is the fastest growing region of all the Development Plan Areas (DPA) on O`ahu, there are several uncertainties that appear on the horizon of near-term (to 2000) and long-term (to 2010 and beyond) developments. The fundamental question is whether Kapolei will manifest as the second city.

**Population and Housing.** In 1990, 42,983 people, or 5% of the island's population, lived in `Ewa. As growth is directed away from the Primary Urban Center towards the Second City in leeward, forecasters predict that `Ewa's population will more than double over the next 15 years.

`Ewa is experiencing a boom in housing development. Residential construction projects began in the mid-1980s with the first phases of these projects: Ewa by Gentry, Villages of Kapolei, and West Loch. In 1990, there were 11,734 housing units. Residential construction increased in the early 1990s and will continue well into the early years of the next century. Major developments planned for the late 1990s to 2000 are:

| PROJECT | UNITS |
|---|---|
| Ewa by Gentry | 4,050 |
| Ewa Marina | 2,109 |
| Ewa Villages | 1,603 |
| Kapolei | 2,220 |
| Makakilo | 1,500 |

In `Ewa, there are about 32,000 housing units either proposed or committed by various developers through 2010. In line with predictions for the growing population, housing should increase four times faster than for all of O`ahu. Refer to Appendix A-7, for a summary of housing developments.

**Employment.** City planners hope for a high rate of growth in jobs for `Ewa in the next 15 years, as the Second City comes into being. The region's military facilities, tourism plant, and industrial area could provide a strong basis for jobs.

However, uncertainties loom over several projects in the area, which may affect `Ewa's employment growth projections:

- **Kapolei Civic Center.** The first Kapolei State office building is now scheduled for occupancy in early 1998 (personal communication: Joseph Earing, Department of Accounting and General Services, August 1994). Location of government offices will be phased in over the next decade or so, with substantial relocation expected by 2010. It is anticipated that civil service positions will comprise much of the 9,800 jobs projected for the Kapolei urban core (The Estate of James Campbell, October 1993).

- The **Naval Air Station at Barbers Point** is scheduled to close in 1997. Although the Navy plans to retain housing on the site, the installation's closing will result in the loss of most civilian jobs in support of existing military operations. In 1990, Barbers Point provided 56% of the jobs in the `Ewa DP area. In its new role, it is forecast to provide only about 18% of the jobs for `Ewa.

  The Barbers Point Naval Air Station Reuse Committee, a group comprised of government, business, and community leaders, was formed to consider possible uses of the site after the base closes, and to forward their recommendations to the Secretary of Navy. Once the Navy decides on the new federal uses, the remaining property will be declared surplus, and become available for other uses. Recently, the Reuse Committee voted in favor of a proposal to keep the Coast Guard air rescue operation there, rather than relocating it to the Marine Corps Base in Kane`ohe. Possible future uses of the base are as yet undetermined, so the number of jobs that will be generated cannot be estimated

  In any event, it is likely that there will be some dislocation of jobs for several years. Some jobs may be generated during the transition. These jobs are likely to be highly specialized in environmental protection and hazardous waste disposal.

- **Ko `Olina** is planned as a world-class resort community. City projections to 2010 indicate that Ko `Olina would provide 15% of the jobs in the `Ewa DP Area (Planning Department, April 1994). At build-out, the resort is supposed to employ 9,000 people.

  Development has lagged behind initial plans, and no firm dates are available for construction of additional hotels or most of the proposed residential stock. Consequently, Ko `Olina is unlikely to be a major employer in the region in the near term.

- **Ewa Marina** is a master-planned resort community on 1,100 acres with one mile of ocean frontage near `One`ula Beach Park. It is to include a 1,400-slip marina and comprise a mix of: residential units, visitor units, specialty hotels, a 27-hole golf course, health and fitness center, and community-scale commercial center. Developer HASEKO (Ewa), Inc. received designation of the property for urban use by the City and County and State Land Use Commission in 1993. Final government approvals for the marina are pending. Construction is expected to start up in 1995, with a projected fifteen years till full build-out. Construction will occur in two phases. Approximately 2,000 residential units are scheduled for sometime between 1996 to 2000 and about 2,700 more units between 2001 to 2010. At build-out, there will be more than 4,800 residential units and almost 1,000 visitor units.

  This timetable suggests that `Ewa Marina will generate many construction jobs in the rest of the 1990s, but few on-site operational jobs.

Until the Kapolei Civic Center, Ko `Olina, and `Ewa Marina are substantially built out and occupied, the ratio of jobs to housing in `Ewa will be low.

### 2.4.2 `Ewa around 2010

**Population and Housing.** The City and County's population projection for `Ewa in 2010 is 93,112 persons, 9.3% of the island's population.

Several of the housing developments will reach the middle or final increments by 2001. Hence, housing starts could be fewer from 2000 to 2010 than in the 1990s. Planned projects that will contribute significant increments of housing during the first decade of the 21st century are:

| PROJECT | UNITS |
|---|---|
| City of Kapolei — Makai | 1,000 |
| Ewa Marina | 2,335 |
| Makaiwa Hills | 1,000 |
| Villages of Kapolei | 949 |

**Employment.** For 2010, the City and County Planning Department expects that there would be some 31,312 jobs in `Ewa. The total number of jobs is small compared to Central O`ahu (projected as having 63,361 jobs in 2010), `Ewa is expected to have the highest employment growth rate of all the O`ahu DPAs (5.11% annually, as compared to 1.71% and .6% for Central O`ahu and the Primary Urban Center). This projection anticipates successful relocation of government offices to Kapolei Civic Center, formation of a strong employment

base by light and heavy industrial uses, full operation of maritime activity at Barbers Point Deep Draft Harbor, and replacement of the Barbers Point military base with a new job centers.

**Other Regional Forces for Change.** Two additional factors may affect the character of the region after 2000:

- **University of Hawai`i — West O`ahu (UHWO).** The University of Hawai`i (UH) Board of Regents approved the siting of the second University campus in the State's "land banked area," just west of the project area. The site encompasses 500 acres of land that is now in cane.

  Though the University of Hawai`i is just beginning the master planning process, a tentative timeline for development has been outlined (Atwater, September 1994; and personal communication: Clyde Akita, UH Facilities Planning and Management, September 1994):

  | | |
  |---|---|
  | 1996 - 1997: | Begin site preparation and infrastructure |
  | 2000 - 2001: | Complete planning, design, and site work |
  | 2000 - 2005: | Campus provides a four-year undergraduate in liberal arts with limited masters-level programs. It is expected that students will be net additions to the University of Hawai`i system. |
  | 2001 - 2045: | Campus will provide full bachelors and masters programs. |
  | 2006: | UHWO must have at least 2,650 students enrolled, or land will revert to Campbell Estate. |
  | 2010: | Enrollment of 4,000 students projected |
  | 2020: | Enrollment of 6,020 students, as projected by a City Planning Department study (Atwater, 1994). |
  | 2050 +: | The campus may have doctoral programs (Atwater, 1994). |

  UHWO will bring demand for on-campus student housing and off-campus housing for students and faculty. It will stimulate retail and other commercial activities, as well as create a number of jobs for the region.

- **Department of Hawaiian Home Lands (DHHL).** DHHL is working with Office of State Planning (OSP) and Department of Land and Natural Resources (DLNR) to identify public lands for transfer to their department, in order to make more developable lands available for homestead development. In `Ewa, two parcels are being considered for transfer (Office of State Planning, August 1994):

  1. A 67-acre parcel owned by Campbell Estate near the intersection of Malakole Street and Kalaeloa Boulevard (TMK 9-1-15:15); and

2. Some 200 landbanked acres presently under lease to OSCo in Kapolei (TMK 9-1-16:25). This area includes the 85 acres adjoining Phase 1 along the North-South road (in Exhibit 1-B) as well as land makai of the proposed Kapolei High School, west of the North-South road. This area could be developed while, or soon after, Phase 1 of the project is developed.

### 2.4.3 Community Facilities/Organization

Kapolei will become the focal point of the region, with its town center, shopping center, and regional park. Campbell Industrial Park will continue as one of O`ahu's major industrial parks, and will be complemented by the development of the Kapolei Light Industrial Park. The deep draft harbor at Barbers Point should be completed in the next 15 to 20 years and will be the second seaport along O`ahu's lee coast, becoming the focal point of maritime activity for `Ewa and west leeward communities.

As Kapolei becomes the regional hub, the surrounding `Ewa communities will become suburbs of Kapolei, not Honolulu, to an important extent. Each of the residential developments has a distinct character; and each community has its own issues, concerns, and needs.

In `Ewa, every residential area has a community association. Community associations of planned subdivisions are usually formed by the developer and turned over to the residents. The board of directors control and enforce the Declaration of Covenants, Conditions and Restrictions (CC&Rs), which specify standards for home maintenance and appearance in a development.

Community associations also try to spark communal life and encourage resident participation. Associations have formed Neighborhood Security Watches, graffiti removal task forces, craft fairs, pot lucks, *ho`olaule`a*, and youth activities and programs.

The `Ewa Neighborhood Board is the primary forum through which representatives of the different community associations interact to discuss local and regional issues. In recognition of the growing population of Makakilo and Kapolei, the Neighborhood Board Commission approved a resolution to reduce the jurisdiction of the `Ewa Neighborhood Board and establish Board 34, covering Makakilo, Kapolei, Barbers Point, and Honokai Hale communities (West Oahu Current, September 1994). The `Ewa Neighborhood Board will continue to represent `Ewa Beach, `Ewa Villages, Ewa by Gentry, and the West Loch projects.

Aside from Neighborhood Board participation, the communities now come together for an annual Christmas parade, which is sponsored by the `Ewa Beach Professional Business Association and the `Ewa Beach Community Association.

A proposed regional park at Barbers Point that is being considered as a possible re-use of the naval base could be an asset and major attraction of the region. The subcommittee on parks of the Barbers Point Re-use Committee has recommended that 1,200 acres of the naval air station be dedicated for a regional park. The Re-use Committee's planner has indicated that at least 800 acres could be dedicated to park use, whatever else is planned for Barbers Point (public communication: Mark Hastert, September 29, 1994). The park could permit diverse activities at ball fields, spaces for flying model airplanes and sailing model boats, and ocean recreation areas

A sense of regional identity will likely manifest as Kapolei emerges. Still, it is also likely that the various residential communities, both existing and upcoming, will retain separate and distinctive identities. The division of the Neighborhood Board into two boards and the limited cooperation achieved to date among local community associations suggest that `Ewa-wide community organization will be difficult.

Regional identity may also go beyond the limits of the `Ewa DPA. UHWO could be a focus for regional allegiance, especially if the University establishes an athletics program there. There is no reason, however, why Wai`anae and Waipahu residents would feel less a part of the UHWO community than `Ewa residents.

### 2.4.4 Neighboring Regions

**Central O`ahu.** The Central O`ahu DPA follows `Ewa as one of the leading growth areas on the island. The year 2010 population is forecast as above 169,000, or about 17% of the island's population.

Major growth areas are located near Mililani and on the mauka side of Waipahu. Near Mililani, Mililani Mauka is planned to include 6,600 units of which about 2,000 have been built. In Launani Valley, some 300 units have been built, of a planned total of 1,000. Nearby, the Mililani Technology Park is still being developed.

Near Waipahu, Waikele has permits to build 3,000 homes (of which 1,600 are now standing). The Royal Kunia project is planned to include eventually some 3,700 units, if permits are gained for both phases. At Waiawa Ridge, the Gentry Corporation proposes building some 2,675 units between 1996 and 2000.

AMFAC/JMB is proposing development of a light industrial park near the O`ahu Sugar Mill in Waipahu. This would likely bring more jobs to the area than OSCo now provides.

**Wai`anae.** Wai`anae's growth is forecast by the City as modest in comparison to `Ewa and Central O`ahu. By 2010, Wai`anae is expected to have about 5% of the island's population, with over 45,000 people. While this is a "country" area, new housing projects will house much of the regional population growth:

- **Ma`ili Kai.** Schuler Homes has zoning approvals to build some 1,300 homes in Ma`ili (of which about 160 have been built).

- **Village Poka`i Bay.** A total of about 510 single-family homes are planned for this Wai`anae `ahupua`a project. More than 150 of these units have already been built.

The City's forecasts for Wai`anae do not fully allow for historic patterns of natural increase and large households seen there in recent decades. Two other issues add to uncertainty in forecasting:

- **Department of Hawaiian Homelands (DHHL).** In Wai`anae, DHHL has over 1,600 acres, with about 3,400 house lots in varying stages of planning. About 2,200 of those house lots sit at the back of Nanakuli (Nanakuli Valley Estates), with the remainder in Wai`anae and Ma`ili. Some 420 lots are in projects for which infrastructure and home construction are under way. No timeframe is now available for development of the other lots (personal communication, Darryl Ing, Land Agent, Master-Planned Community Branch, DHHL, November 1994). Plans are conceptual at this stage, since the Department lacks funding. However, the Department could acquire new funds in the coming years.

  In addition, DHHL has identified almost 870 acres of grazing land in Wai`anae Valley and 15 acres in Nanakuli, that may be transferred over from the Department of Land and Natural Resources (Office of State Planning, August 1994).

- **Ko `Olina.** As noted earlier, it is uncertain when the bulk of this project, at the entry to the Wai`anae Coast, will be developed. The 9,000 jobs anticipated there are a significant resource for Wai`anae DPA residents as well as `Ewa. If resort development does not proceed, no major new job center will be closer to Wai`anae than to the housing areas of `Ewa.

# Section 3
# ECONOMIC AND DEMOGRAPHIC IMPACTS

After an introduction to the impact analysis, this section addresses questions concerning employment, income, population, housing, and fiscal impacts of the proposed project. More general socio-economic impacts (including impacts of locating the proposed population on site) are assessed in section 5.

Current plans call for construction of Phase I from 1996 through 2004 and production of Phase II homes between 2005 and 2011. Products proposed for the two phases are identical, so the cumulative employment, income, population, and fiscal impacts of each phase is half the total impact of the project. (As noted in Section 1, the 27 acres of commercial land in Phase 2, to be controlled by the Estate of James Campbell, are excluded from the analysis.)

Nearly all homes would be sold and occupied by 2012, as shown in Exhibit 3-A. By 2015, occupancy and resident population would peak.

The project would generate construction jobs and would provide a site for operations jobs, above all in the commercial areas. The project's impact on government revenues would be positive. The State would gain significant revenues from construction, while City and County revenues would continue after the project builds out. The developer expects to bear significant costs for off-site infrastructure. By shouldering its share of those costs, Schuler Homes, Inc. will help government agencies to develop nearby parcels dependent on the same or related infrastructure. Even if the developer's costs are calculated strictly in terms of the share of infrastructure to be used by project residents, the project's participation in infrastructure planning and development will lower government costs for development of the North-South road, UHWO, and Kapolei High School.

## 3.1 THE CONCEPT OF "IMPACT" AND THE EAST KAPOLEI PROJECT

In socio-economic impact analysis, **an impact is the difference between two possible futures, with and without the proposed project,** rather than the difference between present conditions and future ones with the project. Yet, for members of the surrounding community, the difference between the current situation and the future can profoundly affect perceptions of any project. Again, perceptions are often shaped by experience with recent projects, which may have little to do with the proposed action.

Impacts must be assessed in relation to context. A change brought by a project may be highly significant at a local level, yet small or a regional or county scale.

## Exhibit 3-A
## PROJECT CONSTRUCTION, SALES, & OCCUPANCY

| | 1997 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|
| UNITS BUILT | | | | | |
| During Year | 400 | 750 | 500 | 750 | 0 |
| Cumulative | 400 | 2,650 | 5,500 | 9,250 | 10,000 |
| Phase 1 | 400 | 2,650 | 5,000 | 5,000 | 5,000 |
| Phase 2 | 0 | 0 | 500 | 4,250 | 5,000 |
| UNITS SOLD (1) | | | | | |
| During Year | 200 | 736 | 381 | 749 | 0 |
| Cumulative | 200 | 2,155 | 5,206 | 8,750 | 10,000 |
| Phase 1 | 200 | 2,155 | 4,956 | 5,000 | 5,000 |
| Phase 2 | 0 | 0 | 250 | 3,750 | 5,000 |
| UNITS OCCUPIED (2) | | | | | |
| Cumulative | 0 | 1,348 | 4,584 | 7,601 | 9,500 |
| RESIDENT POPULATION (3) | 573 | 6,137 | 14,696 | 24,501 | 28,000 |
| Phase 1 | 573 | 6,137 | 13,990 | 14,000 | 14,000 |
| Phase 2 | 0 | 0 | 706 | 10,501 | 14,000 |

NOTES: (1) Estimated on assumption that 50% of units delivered in each year are sold in that year, and 75% of unsold inventory is sold in the year.
(2) Estimated on assumption that 95% of units sold through the end of the previous year will be occupied.
(3) Estimated from Planning Department analysis of 1990 and expected 2010 average household size for comparable developments — West Loch and Ewa by Gentry (2.90 in 1990, and 2.80 in 2010). This approach allocates population to all units, including vacant ones. After 2010, household size is held constant.

SOURCE: Honolulu Planning Department, 1993b.

It is useful to distinguish locational impacts from absolute ones. An absolute impact is a change that will occur with a project, but would not occur otherwise; a locational impact will occur, but would not occur at the site of a project, or would perhaps be dispersed over a large area, without the project.

The East Kapolei residential project responds to a recognized need on O'ahu for housing. From an economic perspective stressing the local economy, industries such as tourism bring new inputs into the economy which might otherwise go outside Hawaii; these are primary causes of change. With an economy supported by such primary industries, people may be housed in various ways, in different places — but they must be housed. The impact of a major residential project has to do with where people are housed, not whether there will be economic and population growth.

## 3.2 EMPLOYMENT

The project involves short-term jobs related to construction and long-term jobs associated with continuing operations. Employment impacts for both construction and operations are of three types:

- Direct jobs are immediately involved with construction of a project or with its operations. Direct jobs are not necessarily on-site: construction supports construction company personnel in offices and base yards, as well as on site.

- Indirect jobs are created as businesses directly involved with a project purchase goods and services in the local economy.

- Induced jobs are created as workers spend their income for goods and services.

Indirect and induced employment in Hawaii can be estimated using multipliers from a model of input-output relations in Hawaii's economy developed by State researchers.

**Exhibit 3-B**
**CONSTRUCTION EMPLOYMENT**

| | Annual Averages: 1996-2000 | 2001-2005 | 2006-2010 | 2011 | Cumulative, 1996-2011 |
|---|---|---|---|---|---|
| Construction Spending (Millions $s) (1) | $96.52 | $88.79 | $111.01 | $57.61 | $1,539.20 |
| Direct Jobs (2) | 824 | 758 | 947 | 492 | 13,134 |
| Indirect & Induced Jobs (3) | 1,783 | 1,640 | 2,051 | 1,064 | 28,431 |
| TOTAL CONSTRUCTION-RELATED JOB | 2,606 | 2,398 | 2,998 | 1,556 | 41,565 |

NOTES: (1) Estimate does not include land, planning, marketing, sales, and other costs.
(2) Estimated from relation between construction spending and workforce (on average, from 1993 construction put in place and construction workforce data) — 8.53 jobs per million dollars spent on construction.
(3) Estimated on basis of unpublished DBEDT Input-Output Model. Employment multiplier of 2.16 is a weighted average of multipliers for single-family (2.29), multi-family (2.17), heavy (1.97) and commercial (1.76) construction

SOURCES: Bank of Hawaii 1994; Unpublished tables, Department of Business, Economic Development and Tourism.

**Construction.** The East Kapolei project will support a large number of construction jobs from 1996 through 2011. (See Exhibit 3-B above.) The cumulative total for the entire 16-year period is about 13,100 direct full-time person-years of employment and some 28,400 person-years of indirect and

induced jobs. Direct construction jobs are estimated as averaging 750 or more full-time jobs annually through 2010.

(The number of construction jobs varies from day to day for any project, and from year to year as different phases of a project are built out. Construction jobs are estimated in terms of an average number of jobs supported over a period of time, and measured in person-years, since these jobs come to an end when the project is built. Indirect and induced jobs related to construction are similarly limited in duration, since project construction will no longer support these jobs after buildout.)

Since about 80% of construction jobs are, as a rule, located at the job site, the project would provide at least 600 full-time construction jobs on-site for nearly the entire construction period.

**Exhibit 3-C**
**OPERATIONS EMPLOYMENT**

| | 1997 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|
| DIRECT JOBS | | | | | |
| Real Estate Sales (1) | 20 | 50 | 29 | 50 | 0 |
| Property Management, Maintenance (2) | 8 | 53 | 110 | 185 | 200 |
| Commercial (3) | 87 | 174 | 436 | 610 | 697 |
| SUBTOTAL A | 115 | 277 | 575 | 845 | 897 |
| DIRECT JOBS, BY INDUSTRY (4) | | | | | |
| Finance | 24 | 76 | 84 | 142 | 100 |
| Agriculture (Landscaping) | 4 | 27 | 55 | 93 | 100 |
| Retail Trade | 70 | 139 | 348 | 488 | 558 |
| Automobile, Miscellaneous Services | 17 | 35 | 87 | 122 | 139 |
| INDIRECT & INDUCED JOBS ASSOCIATED WITH DIRECT JOBS IN: | | | | | |
| Finance | 24 | 76 | 84 | 142 | 100 |
| Agriculture (Landscaping) | 2 | 12 | 25 | 42 | 45 |
| Retail Trade | 40 | 79 | 199 | 278 | 318 |
| Automobile, Miscellaneous Services | 8 | 17 | 42 | 59 | 67 |
| SUBTOTAL B | 74 | 184 | 350 | 521 | 530 |
| TOTAL OPERATIONS-RELATED JOBS (A + B) | 189 | 461 | 925 | 1,366 | 1,427 |

NOTES: (1) Based on an estimated ten jobs per 100 unsold units in inventory.
(2) Based on an average of 2 jobs per 100 units built.
(3) Based on average of 4 jobs per 1,000 square feet of commercial space, assuming a net buildable area of 20% of the commercial acreage.
(4) Allocation of jobs to industry categories by Community Resources, Inc. Indirect and induced jobs supported by operations jobs from unpublished State Input-Output model Type II employment multipliers for these industries.

**Operations.** (See Exhibit 3-C above for details.) Most direct on-site operations jobs would be located in the commercial areas in the project. As

stores are built, the workforce would grow to about 900 workers. An additional 500 indirect and induced workers would be supported by spending by direct operations enterprises and workers.

The project will provide housing for Oahu residents, who will patronize local stores and shops wherever they live. Most of the operations jobs associated with project residents' spending would exist somewhere on Oahu in any event. They are not created by the project. Hence these operations jobs do not strictly speaking count as an "impact" on employment islandwide. However, the location of some of these jobs in `Ewa — jobs at the neighborhood commercial areas at the project (counted in Exhibit 3-C), and in other commercial areas, such as the Kapolei Shopping Center — is an impact of the project.)

### 3.3 INCOME

Personal incomes of the workforce associated with the project are estimated in Exhibit 3-D. Direct construction workforce incomes will average about $35 million annually from 1996 through 2010. Annual incomes from direct, indirect, and induced jobs associated with construction will average $75 million or more during this period. Direct operations incomes will grow to total over $10 million annually by 2010. These will be divided equally between operations in Phase I and Phase II.

**Exhibit 3-D**
**PERSONAL INCOME ASSOCIATED WITH PROJECT-RELATED JOBS**

| | Annual Average Income (Millions $s): | | | |
|---|---|---|---|---|
| | 1996-2000 | 2001-2005 | 2006-2010 | 2011-2015 |
| DIRECT JOBS | | | | |
| Construction (1) | $35.4 | $32.5 | $40.7 | $5.3 |
| Operations | $2.7 | $6.8 | $10.7 | $12.4 |
| INDIRECT AND INDUCED JOBS | | | | |
| Construction (1) | $48.0 | $44.1 | $55.2 | $7.2 |
| Operations | $2.9 | $7.8 | $12.4 | $14.6 |
| TOTAL PERSONAL INCOME | $88.9 | $91.2 | $118.9 | $36.9 |

NOTES: Income estimates from reports of statewide average income by industry, with jobs allocated by industry as shown in Exhibit 3-C. Average wages for 1992 increased in proportion to changes in CPI-U between 1992 and 1994, to estimate 1994 average wages. Indirect and induced employment wages estimated from statewide average annual wage, all covered employment

(1) With construction ending in 2011, the average construction income for the five-year period is lowered by four years without such income.

SOURCES: Hawaii Department of Labor and Industrial Relations, 1993; Bank of Hawaii, 1994b.

## 3.4 POPULATION AND HOUSING

**Residential Population.** The project will provide a mix of multifamily and single-family housing comparable to that found in other major new projects in Ewa and Central Oahu. Future population of the project can be estimated on the basis of the buildout schedule and estimates of average future household size. By 2000, the project is expected to house more than 6,000 persons in Phase I.

By 2010, the on-site residential population would climb to 24,500 — 14,000 in Phase I and 10,500 in Phase 2. At buildout, the total population would be about 28,000 in both Phases. (As noted in Exhibit 3-A, average household size is expected to be about 2.8 persons per household by 2010. No further reduction in household sizes after 2010 has been assumed.)

**De Facto Population.** The project does not include facilities to attract persons from other areas. Hence it would have few or no visitors, and the peak population on-site would be the resident population.

**Exhibit 3-E**
**POPULATION & HOUSING ASSOCIATED WITH PROJECT-RELATED JOBS**

| | 1997 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|
| OPERATIONS JOBS (1) | | | | | |
| Total Direct Jobs | 115 | 277 | 575 | 845 | 897 |
| Total Indirect & Induced Jobs | 74 | 184 | 350 | 521 | 530 |
| LEEWARD OAHU SHARE OF JOBS (2) | | | | | |
| Direct Jobs | 112 | 269 | 571 | 837 | 897 |
| Indirect & Induced Jobs | 15 | 40 | 87 | 147 | 171 |
| WORKFORCE-SUPPORTED POPULATION (3) | | | | | |
| Statewide | 391 | 954 | 1,914 | 2,827 | 2,953 |
| Leeward Oahu | 263 | 640 | 1,360 | 2,038 | 2,211 |
| WORKFORCE HOUSEHOLDS (4) | | | | | |
| Statewide | 130 | 316 | 634 | 936 | 978 |
| Leeward Oahu | 87 | 212 | 450 | 675 | 732 |
| EVENTUAL NEW HOUSING DEMAND (5) | | | | | |
| Low Range, Statewide | 19 | 47 | 95 | 140 | 147 |
| Low Range, Leeward Oahu | 13 | 32 | 68 | 101 | 110 |
| High Range, Statewide | 39 | 95 | 190 | 281 | 293 |
| High Range, Leeward Oahu | 26 | 64 | 135 | 202 | 220 |

NOTES: (1) From Exhibit 3-C.
(2) Estimated on assumption that 85% of real estate sales jobs are on site, and all other direct operations jobs are on site. Regional share of indirect and induced jobs is estimated as 20% at first, but as increasing to 32.4% in 2015. This increase in regional share (at a rate of 2.7% annually) derives from a weighted average of the Planning Department's projection of growth in support jobs in the region by 2010
(3) Assumes 2.07 persons per operations job, based on 1990 County average of 1.46 workers per household.
(4) Based on 1990 County average of 3.02 persons per household.
(5) Assuming that 15% of low range & 30% of high range worker households will eventually require new housing.

**Population Supported by Project-Related Jobs.** Project-related jobs would support nearly 3,000 persons statewide at buildout, most of whom would likely live in Leeward Oahu. By the buildout of both phases of the project, some 730 workforce households in Leeward Oahu — nearly 1,000 statewide — would be associated with direct, indirect, and induced project-related jobs. Housing for these workers, and "new" units for workers who are establishing new households, will amount to a small fraction of the housing to be supplied by the project.

(See Exhibit 3-E on preceding page for details. Demand for "new housing" is really for additional housing units, as workers form new households. The extent of new housing demand depends on housing prices and availability. Hence it is estimated here as a range between low and high points.)

**Population and Housing in Relation to City and County of Honolulu Policy.** Both the City and County of Honolulu and the State of Hawaii support the development of a Second City in `Ewa. Exhibit 3-F shows the population guidelines established by the City for the various DPAs. It reflects a policy of fast-paced growth for `Ewa, and slow growth or decline in population for most other regions.

The `Ewa DP Area is one of two in which substantial new housing is proposed in the coming years. Land has been designated for extensive new housing developments. However, development of several major projects has been much slower than proposed. City planners recognize that the population of the area is likely to fall well below the guidelines established in the General Plan for 2010:

**Year 2010 Population in `Ewa: Policy vs. Projection**

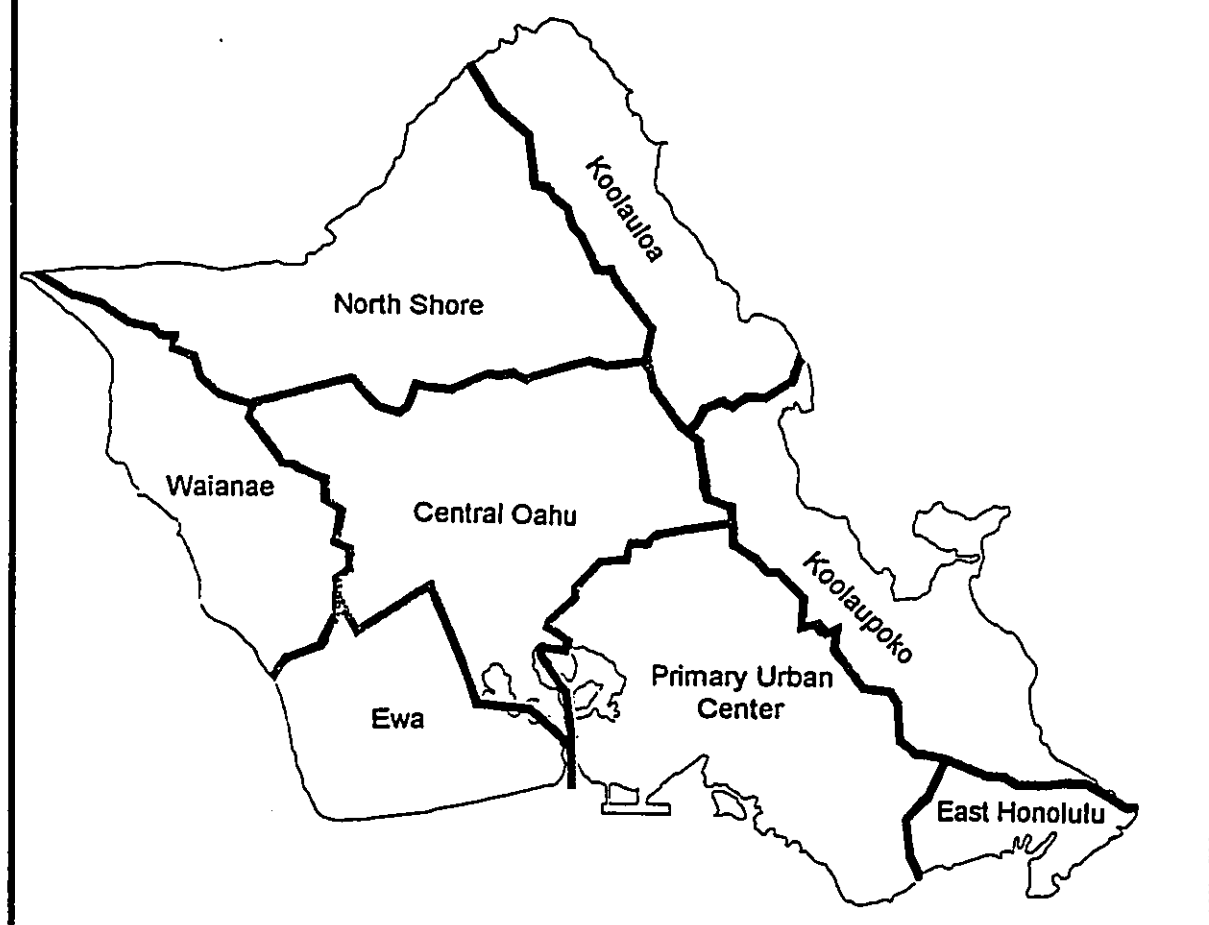
| | Share of Island Population | Yr. 2010 Population |
|---|---|---|
| General Plan Policy | 12.0% to 13.3% | 119,900 to 132,900 |
| Planning Department Forecast | 9.3% | 93,112 |
| Difference | | 26,788 to 43,788 |

SOURCE: Honolulu Planning Department, 1994.

The additional population anticipated with the project — 24,500 as of 2010 — would raise the `Ewa DP area population to a point near the General Plan guidelines. Hence the project would help to keep population growth in other areas, where population projections are higher than the General Plan guidelines, closer to the guideline levels.

## Exhibit 3-F
## TARGET POPULATIONS FOR DEVELOPMENT PLAN AREAS

| | 1990 Actual | | 2010 Targets | |
|---|---|---|---|---|
| | Resident Population | Actual % of Total | Projected Range of Population (1) | Target % of Total |
| OAHU TOTAL | 836,231 | 100.0% | 949,500 to 1,049,500 | 95.0% to 105.0% |
| Primary Urban Center | 432,023 | 51.6% | 450,800 to 497,800 | 45.1% to 49.8% |
| Ewa (2) | 42,983 | 5.1% | 119,900 to 132,900 | 12.0% to 13.3% |
| Central Oahu | 130,474 | 15.6% | 148,900 to 164,900 | 14.9% to 16.5% |
| East Honolulu | 45,654 | 5.5% | 53,000 to 58,000 | 5.3% to 5.8% |
| Koolaupoko | 117,694 | 14.1% | 109,900 to 121,900 | 11.0% to 12.2% |
| Koolauloa | 14,263 | 1.7% | 13,000 to 14,000 | 1.3% to 1.4% |
| North Shore | 15,729 | 1.9% | 16,000 to 18,000 | 1.6% to 1.8% |
| Waianae | 37,411 | 4.5% | 38,000 to 42,000 | 3.8% to 4.2% |




NOTES: (1) Population ranges based on target percentages specified in the General Plan and the Hawaii State DBED Series M-K population projection of 999,500 for the year 2010.
(2) Includes study area.

SOURCES: U.S. Bureau of the Census, 1991; Honolulu City & County, 1989.

**Response to Pent-Up and Continuing Housing Demand.** A separate market study (Atwater, 1994) has established that demand for the housing proposed in the project will be strong enough to build the entire project by the end of 2011. The project responds largely to islandwide demand, but also is situated to meet local demand for housing from University of Hawaii faculty and students.

## 3.5 IMPACTS ON GOVERNMENT REVENUES AND COSTS

The project is planned to provide housing for Hawaii residents. Hence it generates no new capital flows from out of state, and will not attract new residents to Hawaii. It is an indirect effect of the overall growth of the island and State economies, not a new stimulus. This means that the project's impact on government revenues and costs is limited to the effects of building the specific components of the project, and building them on its site.

Project-related additions to government revenues can be estimated in detail. The City and County will gain new property tax revenues amounting to over $6.3 million annually as of buildout, and the State will gain about $105 million in taxes from construction-related spending over the construction period. Government costs are much more difficult to estimate. Still, this project will so clearly help the State by lowering initial development costs of nearby State projects that the net cost of the project for government is likely to be minimal or nil. Hence the overall impact of the project will be to increase government revenues, as described below.

### 3.5.1 Revenues

**City and County of Honolulu.** City and County revenues from the project would mainly derive from real property taxes on developed land and buildings. Exhibit 3-G on the following pages provides an estimate of the tax revenues from the project By 2000, annual revenues would reach $1.8 million (1994 dollars). The annual tax revenues would climb to $6.0 million in 2010. and to $6.5 million at buildout. In contrast, only $171,000 could be raised in taxes annually from the property under its current use. At buildout, then, property taxes on the project would amount to a $6.3 million increase over current taxes.

(Exhibit 3-G derives from the construction and occupancy schedule in Exhibit 3-A. It calculates the land area developed, and then the value of developed and undeveloped land in the project. Development values are estimated from construction values and estimated sales value of this and similar projects. The estimated land value is adjusted to allow for owner-occupant exemptions, after which taxes are calculated on the basis of 1994-1995 tax rates.)

## Exhibit 3-G
## REAL PROPERTY VALUES & TAXES, SCHULER EAST KAPOLEI

| | 1994 (1) | 1997 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|---|
| **A. AREAS (Acres)** | | | | | | |
| ACREAGE TO BE DEVELOPED (2) | 875 | 837 | 642 | 394 | 68 | 0 |
| Unimproved Residential (Phase 1) | 437 | 399 | 204 | 0 | 0 | 0 |
| Agricultural (Phase 2) | 438 | 438 | 438 | 394 | 68 | 0 |
| NEWLY DEVELOPED ACREAGE (ANNUAL) | | | | | | |
| Improved Residential | | 17 | 28 | 16 | 28 | 29 |
| Apartment | | 19 | 36 | 25 | 36 | 36 |
| Commercial | | 3 | 0 | 3 | 0 | 3 |
| CUMULATIVE DEVELOPED | | | | | | |
| Improved Residential | | 17 | 101 | 201 | 341 | 370 |
| Apartment | | 19 | 127 | 267 | 449 | 485 |
| Commercial | | 3 | 5 | 13 | 18 | 20 |
| TOTAL AREA DEVELOPED | | 38 | 233 | 481 | 807 | 875 |
| **B. VALUES ($1,000s)** | | | | | | |
| ACREAGE TO BE DEVELOPED (2) | | | | | | |
| Unimproved Residential (Phase 1) | | $33,920 | $17,355 | $0 | $0 | $38 |
| Agricultural (Phase 2) | | $1,094 | $1,094 | $984 | $170 | $0 |
| ANNUAL NEW DEVELOPED LAND VALUE | | | | | | |
| Improved Residential | | $7,877 | $12,799 | $7,548 | $12,799 | $13,456 |
| Apartment | | $15,282 | $30,215 | $20,956 | $30,215 | $29,693 |
| Commercial | | $861 | $0 | $861 | $0 | $861 |
| CUMULATIVE DEVELOPED LAND VALUE | | | | | | |
| Improved Residential | | $7,877 | $46,274 | $92,549 | $156,546 | $170,001 |
| Apartment | | $15,282 | $105,928 | $222,681 | $373,756 | $403,449 |
| Commercial | | $861 | $1,722 | $4,306 | $6,028 | $6,889 |
| ANNUAL NEW IMPROVED VALUE | | | | | | |
| Improved Residential | | $26,323 | $42,776 | $25,227 | $42,776 | $44,969 |
| Apartment (New Units) | | $39,723 | $77,860 | $54,119 | $77,860 | $76,532 |
| Apartment (Buybacks) (3) | | $0 | $0 | $0 | $270 | $270 |
| Commercial | | $1,851 | $0 | $1,851 | $0 | $1,851 |
| CUMULATIVE IMPROVED VALUE | | | | | | |
| Improved Residential | | $26,323 | $154,651 | $309,301 | $523,179 | $568,149 |
| Apartment | | $39,723 | $273,302 | $574,069 | $964,308 | $1,041,110 |
| Commercial | | $1,851 | $3,703 | $9,257 | $12,959 | $14,811 |
| TOTAL VALUE (LAND + IMPROVED) | | $125,838 | $602,935 | $1,212,163 | $2,036,776 | $2,204,447 |

## Exhibit 3-G (continued)

| | 1994 (1) | 1997 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|---|
| **C. EXEMPTIONS ($1,000s) (4)** | | | | | | |
| VALUE | | | | | | |
| Improved Residential | | $4,800 | $28,200 | $56,400 | $95,400 | $103,600 |
| Apartment | | $11,200 | $77,800 | $163,600 | $274,600 | $296,400 |
| CUMULATIVE TAXABLE LAND VALUE | | | | | | |
| Improved Residential | | $3,077 | $18,074 | $36,149 | $61,146 | $66,401 |
| Apartment | | $4,082 | $28,128 | $59,081 | $99,156 | $107,049 |
| **D. TAXES ($1,000s)** | | | | | | |
| ACREAGE TO BE DEVELOPED (2) | | | | | | |
| Unimproved Residential (Phase 1) | | $133 | $68 | $0 | $0 | $0 |
| Agricultural (Phase 2) | | $10 | $10 | $9 | $2 | $0 |
| DEVELOPED LAND VALUE | | | | | | |
| Improved Residential | | $10 | $56 | $113 | $191 | $207 |
| Apartment | | $14 | $99 | $208 | $349 | $377 |
| Commercial | | $7 | $0 | $0 | $0 | $0 |
| IMPROVED VALUE | | | | | | |
| Improved Residential | | $103 | $606 | $1,212 | $2,051 | $2,227 |
| Apartment | | $140 | $962 | $2,021 | $3,394 | $3,665 |
| Commercial, Industrial | | $0 | $0 | $0 | $0 | $0 |
| TOTAL TAXES | | $417 | $1,802 | $3,563 | $5,987 | $6,476 |
| **E. INCREASE IN TAX REVENUES ($1,000s)** | | | | | | |
| TAX REVENUES BEFORE PROJECT (5) | $171 | | | | | |
| DIFFERENCE IN TAX REVENUES | | | | | | |
| Total Annual Taxes | | $246 | $1,631 | $3,392 | $5,816 | $6,305 |
| Total Cumulative Taxes | | $246 | $3,755 | $17,896 | $42,126 | $73,652 |

NOTES: All figures in thousands of dollars, except Areas (in acres).

(1) Acreage "to be developed" is taxable area, excluding schools, parks, roads. Analysis based on increase in value from time of acquisition by Galbraith Estate and Schuler Homes. Hence Phase 1 is treated as Unimproved Residential in 1994, rather than Agricultural, because Urban classification of that land is a precondition to the proposed State land exchange.

(2) Agricultural value for Phase 2 land estimated on assumption of use for diversified agriculture up to the time of development.

(3) Taxable value of low-income and gap-group units assumed to be constrained by buybacks for ten years, after which it would rise to market value.

(4) Standard homeowner's exemption ($40,000) assumed for all units.

(5) This calculation assumes that all project land is taxed, based on classification. This is an estimate of maximal tax revenues, since it assumes that taxes would be paid for Phase 1 as Urban, even though the State rather than a private taxpayer owns the land in 1994.

SOURCES: Honolulu City and County 1994-1995 real property tax rates; City and County tax records.

**State of Hawaii.** The State will gain revenues deriving from project construction. These revenues will average well over $6 million annually during the construction period, and add up to some $105 million (1994 dollars) as of buildout:

**Exhibit 3-H**
**STATE REVENUES ASSOCIATED WITH PROJECT CONSTRUCTION**

| | Annual Average Revenues (Thousands $s): | | | |
|---|---|---|---|---|
| | 1996-2000 | 2001-2005 | 2006-2010 | 2011 |
| EXCISE TAXES | | | | |
| Construction Spending (1) | $3,861 | $3,552 | $4,440 | $2,304 |
| Construction-Related Workforce Spending (2) | $1,077 | $991 | $1,239 | $643 |
| CORPORATE INCOME TAX (3) | | | | |
| Construction (3) | $241 | $222 | $278 | $144 |
| PERSONAL INCOME TAX (4) | | | | |
| Construction-Related Workforce Incomes | $1,429 | $1,314 | $1,643 | $853 |
| TOTAL TAXES | $6,608 | $6,079 | $7,600 | $3,944 |

NOTES: Cumulative total revenues, 1996-2011: $105.4 million

(1) Calculated at 4% of direct construction spending.
(2) Calculated at 4% of workforce income spent on taxable items. Disposable income estimated from 1988-1989 U.S. Bureau of Labor Statistics Survey.
(3) Calculated at 0.25% of construction spending, from 1989-1990 data on business receipts and corporate income taxes collected.
(4) Calculated at 4.04% of wages.

SOURCES: Hawaii Department of Business, Economic Development and Tourism, 1992; Hawaii Department of Taxation, 1992; Tax Foundation of Hawaii, 1992, 1991.

### 3.5.2 Costs

Because the project will not attract new residents, it will not add to the population served by the City and County. Hence it will have little or no impact on City and County operating costs.

Often, government personnel have expressed concern that new development can add to government costs due to: (a) demand for capital improvements; and (b) added costs in delivering services to out-of-the-way locations. The East Kapolei project will add few costs due to this sort of locational impact. Instead, its locational impact on government costs will be positive:

- As part of the planned development of `Ewa, the project will contribute to the funding of already-planned capital improvements, rather than force public funding of improvements which would otherwise be unneeded.

- By helping to bring the planned population to `Ewa, the project will help to make delivery of government services — many of which will be based in `Ewa, with or without the project — more cost-effective.

As a participant in planning and development of infrastructure for central `Ewa, the project will likely lower government costs. That is because the State is committed to major infrastructure improvements, notably the North-South road. The road must be built in the next few years if UHWO is to enroll 2,650 students on site by 2006 and thereby retain its land.

If the East Kapolei project were not proposed, and the project site remained undeveloped, the State would have to cover any costs of infrastructure development ascribable to the project site, and hope eventually to charge a future developer for those costs. The State would, at the very least, need to carry interest charges which would likely not be fully paid by a future developer.

Similarly, drainage problems affect State land, the project site, and DHCD's `Ewa Villages project. The project developer will have to address them now, making a coordinated approach to a regional problem possible.

The development costs at issue are significant. For example, the North-South road and its H-1 interchange have been estimated as costing $52.8 million (1991 dollars) (Pacific Planning and Engineering, 1992). The final cost will likely be greater than that figure. Hence the impact on State finances of the project developer's participation in regional development will be substantial.

# Section 4
# PUBLIC FACILITIES

This section describes existing and expected public services and facilities in the `Ewa vicinity. It then provides an analysis of the impact of the proposed development on:

- Public safety (police and fire services);
- Medical facilities and services;
- Recreation;
- Education; and,
- Libraries.

## 4.1 PUBLIC SAFETY

### 4.1.1 Police

**Existing Services and Facilities.** Currently, the Pearl City Police Station covers the area from Red Hill to Kahe Point in Honolulu Police Department's District 3. There are five beats in the `Ewa area with one officer per beat, 24 hours a day, seven days a week. One sergeant is included for each beat. The police officers assigned to the `Ewa area work with the community through two channels: the volunteer Neighborhood Security Watch and the Community Policing Team (CPT). The latter is a modern police effort to directly involve the community with police crime prevention efforts, such as painting over gang-related graffiti or referring families with potential abuse problems to appropriate services.

**Planned Services and Facilities.** The Captain of the Pearl City Station is confident that existing police services to the `Ewa area are sufficient at this time, given the current level of demand for services (personal communication, Captain Chastain, City and County Police Department, Pearl City Station, Administrative Captain and Executive Director, August 1994). However, because of the anticipated growth in the area, an additional substation will be added in the Kapolei area. In 1995-1996, the number of beats will be increased to nine, and the officers on duty will increase to 22.

Current crime problems include the following:

- Property crimes — burglary and theft; and
- Graffiti, which the Community Policing Team (CPT) is addressing with residents.

Crime in the `Ewa area includes gang-related incidents and some drug house problems. These crimes tend to be located in the older `Ewa Beach community.

**Impact of Project.** Captain Chastain does not expect the project to affect police services to this area, if police planning for increases in number of police beats to this area and an expanded Leeward Police Station is met. The Captain anticipates that another police district will be created by the time the proposed project reaches build-out. The new Kapolei Police Substation should meet any increased demand for police services in the project area. When the new police district is created, the current Wai`anae Station will serve `Ewa (Makakilo, Honokai Hale, `Ewa Beach, and Kapolei) and the Wai`anae Coast area. The Pearl City Station will then serve Halawa Heights to Waipahu.

### 4.1.2 Fire

**Existing Facilities.** `Ewa is served by three fire stations:

- Makakilo Station serves Makakilo, upper Kapolei, and Ko Olina Estates (Honokai Hale and Nanakai Gardens may call on either Nanakuli Fire Station or Makakilo);
- The Waipahu Station serves lower Kapolei, `Ewa by Gentry, and `Ewa area to Renton Road; and
- The `Ewa Beach Fire Station serves all of lower `Ewa Beach up to Renton Road.

The Waipahu Station has 23 fire fighters on a 24-hour rotating shift, with all equipment and trucks necessary for emergency calls. The Station Captains find they have sufficient resources to respond quickly to emergency calls. (Personal communication, Captain Souza, `Ewa Beach Fire Station and Captain Monayre, Waipahu Fire Station, August 1994.) The Waipahu Station assists the `Ewa Beach Station when needed.

Typical calls are for brush fires, property damage, and medical emergencies.

**Planned Services.** A new firehouse will be added to Kapolei in December 1994 to serve the `Ewa Plain. The fire station will be fully equipped and manned.

**Impact of Project.** According to the two captains interviewed, the increased need for fire services resulting from the proposed development will be easily managed by the planned Kapolei Fire station. Fire Department plans for increased service have taken into account proposed residential development in the `Ewa area.

## 4.2 MEDICAL FACILITIES AND SERVICES

**Existing Facilities and Services.** St. Francis-West is the full-service hospital closest to the proposed development. It is approximately five to 15 minutes from the project site, depending on traffic conditions. Ambulance service is coordinated with the City and County, and the hospital has a helipad. St. Francis-West offers a full range of hospital services, including emergency care, outpatient treatment, laboratory and X-ray facilities, and medical offices.

The hospital has 79 licensed beds available. The hospital anticipates expanding bed capacity to 84 beds. (Personal communication, Phil Baltch, St. Francis Medical Center-West, Chief Operating Officer, January 1994.) The hospital is operating at about 80% capacity. In a 20- to 30-minute drive, emergency services are also offered by Wai`anae Coast Comprehensive Health Center (which also has a helipad), Pali Momi Medical Center (a division of Kapiolani Women and Children's Hospital) at Pearl Ridge, and Wahiawa General Hospital.

Non-emergency services are provided by local general physicians and specialists in the area, as well as by three medical clinics: Kaiser Permanente at Punawai in Waipahu, West-Side Women's Health Care Clinic and `Ewa Beach Medical Clinic both located on Fort Weaver Road in `Ewa.

**Impact of Project.** According to St. Francis West, the demand for hospital services by residents of the Schuler development can readily be absorbed by the hospital, because of two factors: (1) the facility can be expanded — it currently uses only a small portion of its total 23 acres; (2) the length of hospital stay by traditional users (such as women giving birth) has been declining over recent years, and is projected to decline even further in the future. (Personal Communication, Phil Baltch, St. Francis Medical Center-West, Chief Operating Officer, August 1994).

## 4.3 RECREATION

**Existing Facilities.** Several parks and other recreational facilities are located in the general vicinity of the proposed development: `Ewa Mahiko Neighborhood Park, Pu`uloa Neighborhood Park, Makakilo Community Park, Geiger Park Gentry, West Loch 18-hole Municipal Golf Course, Asing Park (part of West Loch Estates), and the newly created Kapolei Park. Most of the beaches in `Ewa are not staffed by City and County lifeguards. These include Iroquois Beach, One`ula Beach, `Ewa Beach Park, West Loch Shoreline Park, and `Ewa Plantation Beach. Barbers Point Beach Park and Nimitz Beach are restricted to military use. `Ewa currently lacks a recreation director and after-school services on park grounds.

According to Parks Management, the provision of public parks lags behind the development of housing projects, infrastructure, and other public facilities. (Personal communication, Don Akiyama, City & County Department of Parks and Recreation, `Ewa Beach Complex Supervisor, August 1994).

**Planned Facilities and Services.** The City and County is planning to establish a district park either by expanding `Ewa Mahiko Park or creating one at Oahu Sugar Company's warehouse area in `Ewa Villages. (Personal communication, Ronald Wong, City and County Parks and Recreation District Manager, August 1994.) The proposal is part of the `Ewa Villages revitalization project. The Master Plan for `Ewa Villages also includes a municipal golf course (currently under construction).

Dedicated parks to be developed at some future time are: Asing Community Park, Iroquois Point Neighborhood Park, Geiger Community Park, Kapolei Community Park, and Makakilo Heights Neighborhood Park (personal communication, Jason Yuen, City and County Parks and Recreation Facilities Development Division, Parks Planner, October 1994). Geiger and Kapolei Community Parks have priority for development.

Barbers Point NAS includes extensive recreation areas, most of which the Navy plans to retain after the base closes. An agreement was recently reached between the Navy and the Department of Parks and Recreation outlining possible joint use of the shoreline at Barbers Point to accommodate both Navy and civilian needs. Under the agreement, the City would acquire and develop 38 acres of shoreline for beach park facilities and 15 acres to the east for shoreline fishing. The Navy would retain a total of 42 acres of beachfront at Nimiiz beach and White Plains Beach.

The City and County Parks Department and members of the community have been interested in creating a regional park at Barbers Point NAS. Preliminary planning indicates that land will be available for such a use. However, no definite

land allocation will be made until after a Master Plan and Environmental Impact Statement for the base closure are completed. The final allocation will be made by the Secretary of the Navy, after considering recommendations from the island-based Reuse Committee.

**Impact of Project.** According to the `Ewa Parks and Recreations Manager, the impact of the project on the existing parks and recreational facilities will be contingent on the coordination of new parks and home construction. If the construction of parks lags behind housing development, then the increased demand for park space will severely impact existing facilities.

## 4.4 EDUCATION AND LIBRARY SERVICES

### 4.4.1 Primary and Secondary Schools

**Existing Conditions.** According to the DOE, the rapid development in the `Ewa area has created a pressing need for additional schools and classroom space. Currently, Campbell High School is the only high school serving the area. (Personal communication, Ed Hasegawa, DOE Leeward District Business Office, Administrator, and Lester Chuck, DOE CIP Planner, August 1994.) The DOE has stated that Campbell High School is sufficient for the existing population until the turn of the century. However, many in the `Ewa community disagree with this timeframe, and have requested that the DOE plan for Kapolei High School to open sooner. The one intermediate school serving the area is `Ilima Intermediate, located in `Ewa Beach.

Kapolei Elementary opened recently and is now serving the Kapolei Villages, Makakilo, and Makaiwa Hills area. For the 1994 year, the elementary school had an enrollment of 350 students. However, once the school is completed by Fall of 1995, the DOE is projecting that between 800 and 850 students will be enrolled. (Personal Communication, Ed Hasegawa and Kapolei Elementary School, August 1994.)

`Ewa has a total of five elementary schools, each of which has a maximum capacity of 1,000 students: `Ewa, Mauka Lani, `Ewa Beach, Makakilo, and (as of 1995) Kapolei Elementary Schools. `Ewa Elementary is nearest to the project site.

**Planned Facilities.** Kapolei High School will serve 1,500 to 1,800 students from the Kapolei Villages, Makakilo, Makaiwa Hills, and Ko Olina Estates development areas by the 1998-1999 school year. Current plans call for it to be located next to the UHWO site, across the North-South road from Phase 1 of the project.

The DOE also plans to build elementary schools at `Ewa by Gentry and Ko Olina. An intermediate school is to be built in 1998-1999, to serve approximately 900 students. Also in the Leeward District, new elementary schools are planned for Waikele and Royal Kunia. Waikele and Royal Kunia Elementary students will feed into Waipahu Intermediate and Waipahu High School.

**Impact of Project.** As the East Kapolei project builds out, many children will need school facilities nearby. The project includes elementary school sites in each phase to accommodate some of that need.

The DOE has estimated that, at buildout, the project would house the following students (letter, Dr. Herman M. Aizawa, Superintendent, November 4, 1994):

**DOE PROJECTION OF ENROLLMENT — 10,000 HOUSING UNITS IN PROJECT**

| | Total | Ratio per 100 Units |
|---|---|---|
| Elementary (Grades K to 6) | 1,772 | 17.72 |
| Intermediate (Grades 7 to 8) | 500 | 5.00 |
| High (Grades 9 to 12) | 710 | 7.10 |

When the ratios shown above are used with the project construction schedule, estimated enrollments for the project can be derived (as shown in Exhibit 4-A). It indicates that project enrollments could well justify construction of an elementary school before the year 2000, and a second school in 2005 or soon afterwards. Project residents would significantly contribute to intermediate and high school populations.

## Exhibit 4-A
## ESTIMATE OF PROJECT'S DOE ENROLLMENTS

| | 1997 | 2000 | 2005 | 2010 | Buildout |
|---|---|---|---|---|---|
| UNITS BUILT (1) | 400 | 2,650 | 5,500 | 9,250 | 10,000 |
| DOE STUDENTS (2) | | | | | |
| Elementary (K to 6) | 71 | 470 | 975 | 1,639 | 1,772 |
| Intermediate (7 to 8) | 20 | 133 | 275 | 463 | 500 |
| High (9 to 12) | 28 | 188 | 391 | 657 | 710 |
| TOTAL | 119 | 790 | 1,640 | 2,758 | 2,982 |

NOTES: (1) From Exhibit 3-A.
(2) Based on the following number of students per 100 households, from the DOE, 1994:

| | |
|---|---|
| Elementary | 17.72 |
| Intermediate | 5.00 |
| High | 7.10 |
| TOTAL | 29.82 |

Exhibit 4-A follows DOE calculations. It is not an independent calculation of school impacts, in that it estimates enrollments, not impacts. To the extent that students living in the project are already in the DOE, and perhaps in the DOE schools serving project residents, impacts are minimized. This factor is important for intermediate and high schools, rather than elementary schools, since elementary students in the project are likely to attend new schools within the bounds of the project.

If no new school construction occurred, enrollments at schools near the project would soar far above capacity. The preliminary concept plan already shows two elementary school sites.

The DOE is requesting that the developer contribute two elementary school sites next to County parks and an intermediate school site within the East Kapolei project. In addition, the DOE indicates that it will request a contribution toward the construction of high school facilities.

The developer has entered into discussions with the DOE concerning possible contributions to offset the impact on the DOE of project development.

### 4.4.2 Post-Secondary Education

**Existing.** The nearest post-secondary school is University of Hawaii West Oahu, located in temporary quarters on the campus of Leeward Community College in Pearl City. UHWO also offers limited courses at their Wai`anae Coast campus. Various universities and colleges offer courses towards degree-granting programs at the Schofield Barracks complex in Wahiawa. The University of Hawaii at Manoa campus is a 45-minute to one-hour drive from the project, depending upon traffic.

**Planned.** The University of Hawaii Board of Regents selected a site near Kapolei for the proposed 500-acre University of Hawaii, West Oahu (UHWO). The Legislature has yet to approve construction funding for the campus.

**Impact of Project.** The project will contribute to development and operation of UHWO, notably by:

- **Participation in Regional Infrastructure Development.** This will help to speed infrastructure development and lower the cost to be borne by other landowners, including the State; and

- **Providing Convenient Housing.** The project will likely house many students, faculty, and staff of UHWO.

### 4.4.3 Library Services

**Existing.** Currently, `Ewa Beach School and Public Library serves `Ewa (`Ewa Beach, Village Park, West Loch, and Barbers Point), Makakilo, and Kapolei populations, as well as Campbell High School students. The total population served is close to 40,000. The combination school and public library is a full-service library, situated on Campbell High School grounds, with separate entrances for high school students and public patrons. There are two sets of staff to provide high school and public library services, although services often overlap. The public library staff consists of two full-time librarians, two library technicians, two circulation clerks, student volunteers, and a janitor. The current 1994 State hiring freeze has prevented hiring for two vacant positions. The Campbell High School library staff is under DOE jurisdiction and is comprised of two librarians, two library technicians, and one assistant. The library has a collection of 86,883 books, heavily concentrated in the children/youth and reference collections.

**Planned for the Near Future.** Plans include expansion of existing libraries and a major new library:

- **Expansion in the Secondary Study Area.** Plans to expand the Waipahu Library are in the design approval stage. Expansion is to be completed by fiscal year 1995-1996. The expanded library will occupy 15,500 square feet of land in Waipahu, and feature modern library services, including a drive-through book drop-off service. On the Wai`anae Coast, the Nanakuli Library is in its final stages for approval, and will enter design stage this year.

- **Kapolei.** The State plans to use part of 40 acres donated by Campbell Estate for the Kapolei Library. This will satisfy future regional demand. The Kapolei Library is projected to occupy at least 100,000 square feet. The facility will house a collection of approximately 400,000 to 500,000 books and other media, serving as the "second anchor" to Honolulu's Downtown library (Personal communication, Clyde Okinaga, Administrative Services Officer for the Hawaii State Library System, August 1994).

**Planned for the Long Term.** Library System staff feel that the `Ewa community's need for services can be met by the existing library, the proposed Kapolei Library, and those in neighboring districts. The long-term plan for the `Ewa Beach School and Public Library is to separate it into two facilities. The Library System intends to eventually separate all of the school-public libraries in the state.

**Impact of Project.** The plans to expand Waipahu Library, to build Kapolei Library, and to separate the 'Ewa School and Public Library into two facilities are expected to absorb any additional demand from the proposed residential development.

# Section 5
# FIT OF PROJECT WITH SURROUNDING COMMUNITIES

This section discusses the "fit" between the proposed Schuler project with its neighbors. It draws extensively on the views of key informants knowledgeable about the concerns of people in `Ewa. In Section 6, we go on to provide an independent consultant's assessment of impacts on social life.

Community members offered several suggestions for improving the project or benefiting the community. We mention some of these in this section and discuss mitigations of project impacts in Section 7.

## 5.1 APPROACH

### 5.1.1 "Fit" or Compatibility

How well the project fits into or is compatible with existing communities nearby is not fully predictable or guaranteed. Objective and subjective factors combine to make a project fit with its surroundings. Judgments about whether the project is in harmony with community character are based on people's personal viewpoints, their definition of community character, and own concept of what makes a project compatible. Also, residents' concerns change over time and new ones will likely emerge.

The context for this discussion is of a region in flux, where development and population changes are happening at a quick pace. Presently, `Ewa sits in a backwash of development; its residents, old and new, are adjusting to the fast-paced growth of residential communities that has continued since the mid-1980s, when the first phases of West Loch Estates and `Ewa by Gentry were built. Many `Ewa residents sought to advise Schuler Homes to learn well from the mistakes of other residential developments. The impact of growth on the quality of life has been a major issue of discussion for the `Ewa Neighborhood Board.

### 5.1.2 Sources

Community interviews provided the major source for learning about community character in the study area. During September 1994, Community Resources, Inc. (CRI) staff conducted interviews of community leaders, organizational representatives, and private citizens who were likely to know about issues and concerns of importance to various groups in `Ewa. The interview process focused on residents of the `Ewa Plain area, but also included the

perspectives of some members of neighboring communities, namely Makakilo and Kapolei. (See Appendix B for a list of interviewees.)

Interviewees were given a handout with project description and map (Appendix C). The interviews provided an occasion for people to discuss their concerns, opinions about regional growth, perceptions of potential impacts associated with the project, and possible mitigations. Appendix C-1 displays a list of major concerns and issues that surfaced during the interviews.

## 5.2 COMPATIBILITY

During the community interviews, several factors emerged which have bearing on residents' assessments of the project's compatibility with surrounding areas and activities.

Informants tended to evaluate the project first in terms of the likelihood that it will add to or alleviate `Ewa's current traffic problem and lack of community facilities. Many viewed the project both in relation to other communities and as part of a regional community.

In interviews, `Ewa residents often had ideas about specific ways Schuler Homes could, in their view, improve the project and contribute to `Ewa. (In CRI's experience, `Ewa residents are more apt than residents of other areas in Hawai`i to suggest physical improvements and contributions. This tendency probably reflects their recent experience with a variety of developments.)

Exhibit 5-A on the next page lists the factors used by interviewees to judge how the East Kapolei project would fit in with its surroundings. It indicates both judgments of the anticipated effect of the project and the (somewhat different) ways that people thought the developer could contribute to `Ewa, tending to make the project an integral part of the evolving region.

### 5.2.1 Views of Community Character

Residents recognize that `Ewa is in transformation. Some look forward to the urbanization, while others rue its coming. Many long-time residents wistfully anticipate the dissolution of the small town intimacy and rural lifestyle that once characterized `Ewa. On the other hand, there are residents who herald the coming of the Second City and eagerly look forward to enjoying the amenities that metropolitan life brings.

## Exhibit 5-A
## FACTORS IN COMMUNITY'S ASSESSMENT OF PROJECT "FIT"

| FACTOR | IMPORTANCE FOR "FIT" | |
|---|---|---|
| | Salience in People's Expectations of Project | Likely Eventual Importance |
| Traffic and Roadways | 1 | 2 |
| Regional Need for Community Facilities | 2 | 3 |
| Development of a Mixed-Income, Mixed-Aged `Ewa Community | 3 | 1 |
| Impact on Character of Older Communities | 4 | 4 |
| Desire for Open Space and/or Parks | 5 | 5 |
| Support of University Development | 6 | 6 |
| Regional (im)balance of Jobs and Housing | 7 | 7 |

NOTES: In judging "salience," CRI combines informants' ideas of (a) what is important and (b) what matters to many in the community with (c) whether factors were mentioned in many interviews or only a few. Lower numbers are used for the more important factors; higher numbers indicate that an issue was less important and/or less widely mentioned.

There is some disagreement, as to how the transformation into a second city will actually take shape — as to what is the character of the emerging `Ewa. Some residents characterize `Ewa as a patchwork of suburbs, with growing contrasts between older and newer communities. They see the Plain as being blanketed by large, self-contained communities. Yet others look toward the promise of urban life, and the development of industry and commerce, with educational and recreational activities in that region.

Several interviewees noted perceptions of division between existing communities. For example, some interviewees mentioned that Makakilo was distinctive from other `Ewa communities and went on to distinguish between "lower" and "upper" Makakilo neighborhoods. In the `Ewa Plain, the `Ewa Beach community tends to see itself as different from the other Plain communities. Part of this perception may be attributed to the ongoing debate within the Beach community over HASEKO'S `Ewa Marina development. Some `Ewa Beach people also regard `Ewa by Gentry with resentment.

In contrast, a number of interviewees from `Ewa expressed their consternation over the tendency for people from outside communities to confuse `Ewa with `Ewa Beach. They also felt that `Ewa has often been overlooked in terms of resource inputs, while power brokers have concentrated their investments in Kapolei and Makakilo.

### 5.2.2 Factors Shaping Community Views of Project Compatibility

**Traffic and Roadways.** Residents expressed grave concern about any addition to the region's traffic congestion, and applauded the project for helping to develop the North-South Road. Some wanted assurance that the North-South Road would have its own connection to H-1, and would not add to traffic on Farrington Highway.

*Comment*: At first, the project will be reached through a road from Farrington Highway. The North-South Road will in time be the major point of entry to the project. That road will have a H-1 interchange and a connection to Farrington Highway. Hence it will tend to lower the traffic volume on Farrington Highway and Fort Weaver Road by providing a new road into and out of the region, not by barring project traffic from Farrington Highway.

**Regional Need for Community Facilities.** Community informants emphasized recreation and religious facilities:

- **Park Space and Recreational Facilities.** With development comes the reduction in green space and open vistas. Residents feel particularly affected by the lack of park space and recreational facilities. This is a major issue for all `Ewa residents. Developers of new communities have been criticized for not providing parks with adequate facilities in a timely manner, and the City Parks Department has been criticized for not maintaining the parks satisfactorily.

  Although the East Kapolei proposal allocates space for two neighborhood parks, some of the interviewees wondered whether that would be enough park land. Based on recent experience with other residential communities, others expressed cynicism over the developer's ability to furnish park facilities. A few interviewees thought that the most appropriate use for the subject property is to remain as agricultural land for green space. Yet another few thought that the site is a prime location for a regional park.

  *Comment*: A regional park is a priority consideration for the Barbers Point Re-use Master Plan. Also, a district park is planned as part of the `Ewa Villages revitalization project. Kapolei Regional Park was developed on 28 acres of land that was once Fort Barrette. Campbell Estate donated an additional 44 acres for the park, which is soon to open.

- **Space for Churches.** Several interviewees remarked that the planned developments in `Ewa do not provide space on which religious

organizations can establish their churches, or too little space such as a community multi-purpose room that must be shared with other church groups. Interviewees pointed out the importance of having places to worship in the local community, and that quite often, churches serve as a safety net for the needy.

*Comment*: The Kapolei Long Range Area Master Plan provides for about six acres on which churches may locate. In addition, there are churches of different religions and denominations in the `Ewa Plain and Makakilo communities.

**Development of a Mixed-Income, Mixed-Age `Ewa Community.** Some interviewees thought that the East Kapolei project should assure a mix of housing types for people of different socio-economic levels. In their view, the development would be most compatible if it avoided being on either side of the continuum of housing: neither exclusively or primarily for the affluent large-lot "estate" homes nor for low-income people (low-income rentals). People warned against promoting a sense of exclusiveness, as in a gated community.

*Comment*: Of its total housing stock, Schuler Homes plans to build 30% as "affordable," multi-family units. The entire project will be designed for a middle-income homeowner market. No gated areas are planned.

**Impact on Character of Older Communities.** Some interviewees feel that `Ewa has become a disjointed array of walled-off residential communities, and lacks a focal point for pulling the communities together. The interviewees expressed hope that Schuler Homes will give thoughtful consideration to the design and configuration of the housing units. They thought that the homes should be appropriately designed for the leeward climate, as well as reflect a country feeling, perhaps basing the design on plantation style architecture. West Loch Estates was often cited as being well-designed, while `Ewa by Gentry was often criticized for its design and construction.

In addition, interviewees would like for Schuler to try to tie its development in with neighboring communities, by providing accessways like bike paths or common green space as buffer areas.

Interviewees felt that an influx of "outsiders" coming to settle in the East Kapolei project would likely change the character and lifestyle of the existing communities, particularly the older ones like `Ewa Villages and `Ewa Beach. A few wondered if the development would contribute to widening gaps between the old and new communities, and between "haves" and "have nots." On the other hand, one interviewee was happy to have more people coming to `Ewa, reasoning that the more residents there are, the more opportunities for friendship, participation in community organizations, and regional activities.

*Comment*: The project is expected to be highly competitive with `Ewa by Gentry and the Villages of Kapolei (Atwater, 1994). Buyers will likely resemble a cross-section of the residents of these projects.

**Support of University Development.** Several interviewees thought that the East Kapolei project would be compatible with the future University of Hawai`i West O`ahu (UHWO) proposed for an adjacent site, and be mutually advantageous as well.

*Comment*: Schuler Homes hopes to plan for the infrastructure needs of the region in cooperation with State and university representatives.

**Regional (Im)balance of Jobs and Housing.** Some interviewees thought that the location of the proposed project will help add to Kapolei's customer base, and be generally beneficial to local businesses in `Ewa. However, a number of other interviewees cautioned that Schuler could end up as another bedroom community if Kapolei falls short of becoming a major employment center for the region. Residents felt that the timing of the development of the homes with the University and Kapolei is a significant factor to be considered.

*Comment*: The East Kapolei project will support operational jobs in its neighborhood commercial area. Residents will likely shop at Kapolei commercial areas as well.

## 5.3 DEVELOPMENT OF "FIT"

Any large new project stands out simply by being new. Over time, it becomes a recognized, if not necessarily loved, part of its region. The Schuler project will affect the region in different ways over time. The importance of different compatibility issues will also change. CRI finds the following sequence likely:

- **Planning Phase.** The project stands out as a major addition to the `Ewa residential stock. With the new project, opportunities arise for sub-regional planning to deal with traffic and infrastructure.

- **Early Construction Period.** Cane land in Phase 1 will be cleared and site improvements begun. The project will start out small and be buffered from other areas by Phase 2 land, which will still be in agriculture, and by the golf course next to the `Ewa Villages. However, traffic on Farrington Highway will be heavier because of construction work on the project and at the adjacent UH West O`ahu site.

- **Midpoint of Development (Completion of Phase 1 of Project).** With 5,000 units in Phase 1, the project is larger and will feed into the North-South Road. Some Phase 2 land will be cleared, and construction of Phase 2 will begin. Traffic may increase at intersections along the North-South Road and Farrington Highway, and at the North-South Road and H-1 Freeway interchange.

  Students will go to schools on site for the elementary and intermediate grades, and then to regional intermediate and high schools. By this time, UH West O`ahu should have opened, and the project will serve its faculty and students. Westbound traffic to Kapolei should increase as the Civic Center, shopping, and recreational areas are nearly completed.

- **Buildout.** All 10,000 units are completed. The region will be fully urbanized. The project may attract young families and people involved in education, with new schools on or near the project site and UHWO nearby. The North-South Road will be a major roadway carrying much of `Ewa's local traffic flow. Schuler project residents will tend to be relatively isolated from the other `Ewa Plain communities, and more likely orient their activities and business towards Kapolei than makai communities.

# Section 6
# SOCIAL IMPACTS

## 6.1 OVERVIEW

This section describes potential impacts on lifestyle, family life, and community organization. It is an independent consultant's assessment, based on research conducted for this study, interviews with `Ewa residents and business leaders, and CRI's experience of communities and projects throughout Hawaii.

Social impacts are rarely automatic results of development. They are shaped by planning and design decisions, by interactions with the surrounding community, and by outside forces and events. The assessment of social impacts hence deals with tendencies, dangers, and opportunities, not inevitable consequences. Potential unwanted impacts and problems of compatibility can often be reduced or avoided. Section 7 discusses measures for mitigating potential adverse impacts.

**Social Impacts.** Major social impacts of the project are summarized as:

- Provision of needed housing for O`ahu;
- Increase in traffic and, until new roadways are built, congestion;
- Enhancement of Kapolei's customer base;
- Construction noise or dust;
- Competition for community resources and facilities, namely parks and schools; and
- Perpetuation of a growing sense of isolation between large-scale residential developments and older communities, and the transformation of `Ewa into a bedroom community.

Exhibit 6-A on the following pages provides a summary of potential impacts, which are discussed in more detail later in this section.

## Exhibit 6-A
## POTENTIAL SOCIAL IMPACTS OF PROJECT

| Area Potentially Affected | Planning 1995 | Early Construction 1996 - 2000 | Mid-Development Mid-2000s | Build-Out 2015 |
|---|---|---|---|---|
| 'EWA REGION | | | Loss of historical identity in 'Ewa | |
| | | | Intensified need for regional park development | |
| | | | Intensified need for community facilities | |
| | | | Intensified need for early childhood education and care | |
| PRIMARY STUDY AREA PROJECT SITE | | Provision of Needed Housing for O'ahu | | |
| | | Irritants/health hazards from noise and dust | | |
| | | Incomplete infrastructure affecting residents' quality of life | | |
| | | Lack of community amenities affecting residents' community life | | |
| | | Increased traffic on site from construction and new residents | If North-South Road is not completed, then aggravated traffic from housing, UH-WO, Kapolei High School. | |
| | Opportunity to plan for regional infrastructure needs | Orderly regional development | | |
| NEARBY Ewa Villages | | Irritants/health hazards from noise and dust | | |
| | | Increased traffic along Fort Weaver Road | Lack of architectural compatibility with historic preservation area | |
| | | Schools over capacity ('Ilima, 'Ewa -- if construction of school at project lags) | Regional project build-up lessens sense of historic place and identity in 'Ewa | |
| | | | Increased competition for public facilities | |

## Exhibit 6-A (continued)

| Area Potentially Affected | Planning 1995 | Early Construction 1996 - 2000 | Mid-Development Mid-2000s | Build-Out 2015 |
|---|---|---|---|---|
| Other Communities Along Fort Weaver Road | Reinforced perceptions of separation and "us vs. them" | Schools over capacity would affect West Loch | Increased competition for public facilities | |
| | | Increased local traffic on Fort Weaver Road and Farrington Highway | Traffic conditions to improve with North-South alternative road. | |
| Makakilo and Kapolei | | Enhance Kapolei customer base | | |
| | | Increased traffic along Farrington Highway and H-1, eastbound | Increased traffic on H-1, Farrington Hwy. to Kapolei Civic Center | |
| PLANNED<br>University of Hawai'i - West O'ahu (UHWO) | Opportunity to coordinate infrastructure development, enhancing efficiency in development and preventing potential conflicts | Increased traffic along Farrington Highway and North-South Road | | |
| | | | Convenient for university staff and faculty | |
| Kapolei High School | Increase demand for high school construction | Increased traffic along H-1 eastbound, Farrington Highway, North-South Road | Threats to students' pedestrian safety if no safe accessways from Phase I and II provided | |
| SECONDARY STUDY AREA<br>Wai'anae | | Increased traffic on H-1 and Farrington Highway | | |
| Central O'ahu | | Less competition for Central O'ahu housing market | | |

**Community Issues and Concerns.** Most of the potential social impacts cited by `Ewa residents during community interviews were inextricably tied to regional concerns over the adequacy of infrastructure and public facilities. People's experience of regional change has repercussions for the East Kapolei Project. Residents seemed to have lumped together perceptions of the East Kapolei project with the other residential developments. Consequently, impacts of the project were invariably voiced in terms of potential cumulative impacts on the region.

Based on the types of issues and concerns raised by the interviewees, some broad themes emerge around which the potential impacts can be grouped:

- **Quality of Life** — primarily infrastructure and other engineering issues which affect the quality of people's lives in a community.

- **Community Character** — elements of design, configuration, timing and coordination of the development, and community consultation processes which affect the project's compatibility with surrounding communities and land uses, and resident perceptions of whether that project is an asset to the region.

- **Community Involvement** — an expressed need for informational and cooperative problem-solving interactions between developer and community representatives, that seek pro-active mitigations of anticipated project impacts.

- **Health and Safety** — mainly issues related to protracted construction, cumulative effects of construction in the region, but also concerns that the developer give thoughtful consideration to providing safe accessways for pedestrians.

Distinctive concerns of particular communities are identified later in this section.

## 6.2 REGIONAL IMPACTS

The proposed development is the largest residential community in the region. Consequently, it may result in substantial impacts to the region. The impacts are discussed in relation to the phases of project development. (See Exhibit 6-A.)

- **Planning** — Opportunities exist to plan for regional infrastructure needs. The outcome could be faster and more orderly regional development, especially since Schuler and the UH will have overlapping construction schedules.

- **Mid-development and afterwards** — Housing construction should be well on its way by the mid-2000s. At this point, Phase 1 should be completed and Phase 2 started. Potential impacts related to this phase of development include:

  - The increased residential population will intensify the need for regional parks and community amenities.

- Loss of historical identity in `Ewa — Much of the former cane land in the landbanked area will have been transformed into housing. Much of the Plain area will have become urbanized, and existing pockets of plantation life may be dwarfed by the new developments.

- Increased population will intensify the need for early childhood education and care in the region. (Situated in Kapolei, Seagull Schools will be the major child care and education facility in the region.)

Potential increased demand for infrastructure, facilities, and services can mean greater competition for limited resources in the short term. In the long term, the greater the regional population, the more justification will exist for expensive projects such as the North-South road or for locating social service providers in the proposed Kapolei Civic Center.

## 6.3 IMPACTS ON NEARBY AREAS AND LAND USES

### 6.3.1 Project Site

The project will take 15 or more years to build. Residents will move in as housing construction continues until buildout.

*Impacts*:

- **Quality of Life.** The project will provide new housing for thousands of O`ahu residents. For many, this will be a first chance of home ownership. After years of interviews with Hawaii social service professionals, CRI finds that the provision of housing (and hence less crowding in existing neighborhoods) is strongly associated with lower stress and family problems. However, new homeowners typically pay a large share of their income to cover housing costs: homeownership does not relieve people of economic and social challenges so much as increase the benefits of meeting these challenges.

  Facilities that support social interaction and activities — social halls, churches, and parks — contribute to the vitality of neighborhood and community life. Limited availability of such spaces can minimize residents' involvement in community life.

- **Health and Safety.** Construction noise and dust are potential irritants or health hazards to project residents. Sites nearby completed homes

will be under construction and barriers such as shrubbery or landscaping may either be freshly or incompletely planted. In extreme cases, chronic exposure to construction conditions can have cumulative impacts to their health.

### 6.3.2 Communities along Fort Weaver Road

Fort Weaver Road links several communities: West Loch Estates, West Loch Fairways, Ewa Villages, `Ewa by Gentry, and `Ewa Beach.

**`Ewa Villages.** The `Ewa Villages lies southeast of the East Kapolei project site, and is the nearest neighbor to the project.

*Residents' Issues and Concerns.* Infrastructure issues — drainage and traffic above all — were mentioned by all informants. Some interviewees felt that the project would attract residents of a different socio-economic status, which would affect relations between new residents and long-time residents. Social tensions might be played out in common areas such as neighborhood parks.

Others felt that the development would widen the gap between rich and poor, thereby raising `Ewa's crime rate. It was thought that new residential developments present convenient targets for burglary.

One village resident was concerned that her property taxes would rise as a result of being near a new residential development.

*Impacts:*

- **Health and Safety.** Impacts from construction dust will likely be few and short-term. The `Ewa Villages golf course and, after a few years, much of Phase 1 of the project will separate the Villages from new construction sites.

  Potential project impacts on drainage — and hence on the flooding that occurs in `Ewa Villages apart from the project — are being addressed by project engineers, as reported elsewhere in the EIS for the East Kapolei project.

- **Community Character.** The large scale of the proposed East Kapolei Project could overwhelm the historic atmosphere of the rehabilitated `Ewa Villages. The addition of these units to the region may lessen residents' sense of historic place and identity in `Ewa. This incongruity may become magnified because `Ewa Villages will be situated between

two large-scale housing developments, East Kapolei and `Ewa by Gentry.

- **Quality of Life.** Construction of school facilities can take a number of years, depending on various factors, including the availability of State funds. `Ewa Elementary School would likely be over capacity if the elementary school for the Phase I development is not completed when residents move in. The school currently serves children living in the `Ewa Villages and the West Loch projects. The elementary school district will be re-districted in 1996 when Gentry Elementary comes on-line (DOE, 1994). `Ilima Intermediate could similarly face problems of capacity.

- **Economic Impact on Residents.** The East Kapolei project will have no impact on `Ewa Villages residential tax assessments. Tax assessors routinely treat new projects as separate "neighborhoods," and only treat adjoining areas as comparable if home sales indicate that people are willing to spend much the same amount for older and new homes.

**The Other Communities along Fort Weaver Road.**

*Residents' Issues and Concerns.* Residents from the West Loch, Gentry, and `Ewa Beach communities were concerned that the East Kapolei project might exacerbate existing regional conditions. They were most apprehensive about the development adding to what they feel are already intolerable traffic conditions along Fort Weaver.

Businesses along the road felt generally optimistic that the East Kapolei development would bring more customers.

*Impacts:*

- **Quality of Life.** West Loch students would also be affected, if `Ewa Elementary exceeds capacity because the elementary school in the Phase 1 development is not completed when residents move in. Again, `Ilima Intermediate could face problems of capacity, as well.

  During the early construction phase, local traffic will likely increase along Fort Weaver Road and Farrington Highway, until the reliever North-South Road is completed.

### 6.3.3 Makakilo and Kapolei

*Residents' Issues and Concerns.* Residents of Makakilo and Kapolei felt that their communities would be most impacted by increased freeway traffic from the project.

*Impacts*: The project will add to the customer base for Kapolei commercial areas. Project residents will add to regional highway traffic.

## 6.4 IMPACTS TO PLANNED LAND USES

### 6.4.1 University of Hawai`i - West O`ahu (UHWO)

A number of opportunities that could yield mutual benefits exist for Schuler Homes and the University of Hawai`i.

*Residents' Issues and Concerns.* Community interviewees recognized that the project could help to speed development of the North-South road, UHWO, and Kapolei High School.

*Impacts:*

- **Quality of Life.** Coordinated planning will speed development and can lower overall costs for UHWO construction. When UHWO is open, the project will provide housing and neighborhood commercial areas serving students, faculty, and staff.

- **Health and Safety.** By the time UHWO opens, project construction along the east side of the North-South road will likely be finished. Hence the project and the road will buffer UHWO from construction impacts.

### 6.4.2 Kapolei High School

The high school is supposed to be built before the year 2000. It will serve 1,500 to 1,800 students from Kapolei, Makakilo, Makaiwa Hills, and Ko `Olina Estates.

*Residents' Issues and Concerns*: Many residents have long-awaited a second high school for `Ewa.

*Impacts:*

- **Quality of Life.** The project will increase demand for high school construction.

- **Health and Safety.** The high school site is south and west of the project, and separated from it by both the North-South road and the new DHHL land. Hence few or no construction impacts are likely.

  Students living in the project could be at risk along the North-South road unless footpaths and pedestrian overpasses are provided between the project site and the high school. (This impact is cumulative, and more a consequence of road design than of the project.)

### 6.4.3 Site Transferred to DHHL

The 85-acre site recently transferred to DHHL is not yet a planned land use. However, it presumably will be used for housing. It will be far more easily developed with the project than without it. The savings on infrastructure planning noted earlier will likely benefit DHHL as well as others. Furthermore, DHHL can consider using the project's road to Farrington Highway as well as the North-South road for traffic to and from their site, if speedy development of the acreage is desired.

## 6.5 IMPACTS ON SECONDARY STUDY AREA

### 6.5.1 Wai`anae DPA

Most Wai`anae residents commute to Honolulu or to other areas of the island for work. Farrington Highway and H-1 Freeway are the only thoroughfares out of the region. The project will affect residents by adding traffic to the freeway.

### 6.5.2 Central O`ahu DPA

The project will compete with Central O`ahu housing developments as well as with `Ewa subdivisions for the resident housing market. As a result, it will tend to slow the buildout of those developments, and hence tend to slow the pace of growth in Central O`ahu.

# Section 7
# MITIGATION MEASURES AND COMMUNITY BENEFITS

In a region where several developers have been active, community representatives may expect community benefits as their due. Here a distinction is made between mitigation measures, which alleviate actual impacts of a project, and community benefits, which do not respond to specific project impacts but may have an indirect effect of improving relations with the surrounding community.

In this section, CRI identifies ways to mitigate adverse project impacts. This is an independent consultant's assessment, implying no commitment on the part of Schuler Homes, Inc. to undertake any of the steps mentioned. We further note possible community benefits, without implying in any way that provision of these benefits is necessary or obligatory.

To the extent that impacts affect people's sense of their lifestyles and community, mitigation of those impacts depends on their view of proposed solutions as appropriate. Community involvement in decision-making can be crucial to implementing mitigation measures that effectively respond to residents' needs and concerns. Accordingly, consultant recommendations are suggestions for further review by the project developer and community leaders, not prescriptions.

## 7.1 MITIGATION MEASURES

The project contributes to meeting the islandwide need for housing. It fits in with government policy encouraging growth in `Ewa. As a result, it contributes to the regional problem of coordinating development so that infrastructure, housing, and services are all provided efficiently. It can also contribute to the solution.

Potential adverse impacts of the project fall under three general headings, as shown in Exhibit 7-A on the next page.

- **Quality of Life.** Potential adverse impacts are inadequate regional physical and social infrastructure; limited community facilities on site for residents, and irritation due to traffic congestion.

  The problems of limited regional infrastructure and facilities (discussed in Section 6) can be addressed through:

  - *Coordinated planning among regional landowners for infrastructure development.* Schuler Homes, Inc. is already attempting such planning.

## Exhibit 7-A
## POSSIBLE MITIGATION MEASURES

| POTENTIAL IMPACTS | MITIGATION MEASURES |
|---|---|
| **QUALITY OF LIFE** | |
| Regional: inadequate physical and social infrastructure for growing community | ▪ Develop infrastructure for project in coordination with other regional developers<br>▪ Work with community groups and landowners to plan for regional facilities<br>▪ Provide incentives to agencies to develop needed facilities on time |
| On site: lack of child care; limited community space | ▪ Provide community facilities or support community associations' use of park space<br>▪ Allow family child care homes in CC+Rs |
| Irritation due to traffic congestion | ▪ Work for speedy development of North- South Road and other highway improvements |
| **HEALTH & SAFETY** | |
| Construction dust, noise | ▪ Follow City and State regulations governing construction<br>▪ Plan construction timing to limit duration of impact on adjoining areas<br>▪ Anticipate, respond to resident complaints |
| Students on North-South road | ▪ Work with government planners |
| **COMMUNITY CHARACTER** | |
| Loss of "country" character | ▪ Design sensitive to `Ewa Villages (in nearby sections of Phase 1) |

- *Continuing work with community associations, landowners and interest groups to plan for regional facilities.* Beyond infrastructure planning, `Ewa landowners and communities may seek to cooperate in identifying needed services in government centers to be developed in Kapolei. Again, cooperation will be needed to insure that regional park plans — in existing developments and at

Barbers Point NAS — respond to local needs and are developed as soon as needed.

- *Incentives to spur public agencies to develop facilities when needed.* While government policy supports new development in `Ewa, budgets are tight. Agencies and legislators may understandably delay construction of needed facilities in `Ewa. Campbell Estate's practice of making land donation contingent upon timely development of the land (as at the UHWO site) provides an example of how to offer an incentive to government to give priority to `Ewa's needs.

- The East Kapolei project consists at the moment of little more than a conceptual plan. As a result, provision of community facilities on site is only indicated by the allocation of park space. Two potential adverse impacts are visible:

  - *Community facilities and spaces.* Project plans include parks and schools as sites for neighborhood and community life, but no other community facility spaces have as yet been identified. While community halls may often not be well used, it is doubtful that open space in two parks will suffice to support an active and varied community life. Potential mitigations include (a) providing space for additional community or neighborhood social facilities and (b) supporting community groups to organize and use available park or school space.

  - *Child care needs.* While Kapolei will have a large child care center, project residents are likely to need additional services. In Hawaii, most working parents prefer to find child care in family home settings — with relatives, friends, or other providers — for children younger than three years old. Because of the distance between `Ewa and older urban areas, many families may find it impossible or impractical to take young children to relatives on a daily basis, and may need child care facilities nearby. Their needs can be met by skilled private providers in the project area so long as (a) the project CC+Rs allow family care homes and (b) child care providers and support services such as Traveling Preschools are allowed to use community parks.

In the near term, project contributions to regional traffic congestion will affect the quality of life of residents depending on Farrington Highway and the Fort Weaver Road interchange. The most effective mitigation strategy would be to work to encourage government agencies to

develop additional roadways — North-South road and its interchange with H-1, above all — as quickly as possible.

- **Health and Safety.** Two separate potential impacts are of concern:

  - *Construction impacts* are recognized irritants on the dry `Ewa Plain. The project can work to minimize construction dust and noise by (a) following government regulations and (b) planning the timing of construction so that adjoining properties are affected by project construction only for a limited period of time. Construction of Phase 1 blocks adjoining `Ewa Villages can be planned to limit the length of time than construction occurs near any particular village. Similarly, construction of blocks across the North-South road from the University site can be timed to occur before the University opens, minimizing potential impact on UHWO.

    In addition, the developer may consider establishing a hotline for complaints about construction impacts and delegating employees to respond to these. While this action is a form of community response, it also can help in monitoring the performance of construction crews, insuring that they meet standards needed to minimize construction impacts.

  - *Safety of children along the North-South road* is the responsibility of highway planners more than of the developer. The developer can work with government planners to see that pedestrian overpasses and walkways are provided, and children and traffic on this major regional road do not mix.

- **Community Character.** `Ewa is being urbanized, and the project cannot be held accountable for that fact. However, the project is situated next to `Ewa Villages, where an attempt is being made to preserve a plantation community and a "country" ambiance through restoration and design of new homes. In order to support this effort, some attention may be necessary to coordinate design of Phase 1 areas near `Ewa Villages with the Villages.

## 7.2 COMMUNITY OUTREACH AND BENEFITS

Community involvement is advisable to increase the fit of the project with surrounding areas, to encourage regional cooperation in planning, and to identify effective mitigations for local-level impacts. Such involvement, by the developer and by resident community groups, can further help to counter the regional trend

toward a split between old and new communities. The developer has begun community involvement through presentations to community groups and close communication with recognized community leaders.

Further steps toward cooperation and interaction could include:

- Planning paths, roads, and bikeways that link neighboring communities; and
- Encouraging inter-community activities through community associations, sports leagues, and regional events.

The project is currently separated from nearby communities by gullies and a proposed golf course. These limit the possibility of creating a continuous landscape, rather than a set of discontinuous subdivisions. Nonetheless, the project developer can consider landscaping and design choices that minimize incongruity between nearby areas. (First, however, it may be necessary to learn whether harmonious design is wanted or even thought possible. There may be little point in making parts of the project harmonize in design with the old plantation villages if the City's new development, surrounding those villages, does not.)

# APPENDIX A:

# DETAILED EXHIBITS ON EXISTING CONDITIONS

## Appendix A
## 1. DEMOGRAPHIC CHARACTERISTICS, SELECTED DP AREAS, 1990

| | Honolulu County | SELECTED DP AREAS | | |
|---|---|---|---|---|
| | | Ewa (1) | Central (1) | Waianae |
| **POPULATION** | 836,231 | 42,960 | 130,474 | 37,411 |
| ETHNICITY | | | | |
| Caucasian | 32% | 40% | 30% | 23% |
| Japanese | 23% | 9% | 20% | 6% |
| Filipino | 14% | 28% | 24% | 16% |
| Hawaiian | 11% | 10% | 8% | 41% |
| Other | 20% | 13% | 18% | 15% |
| AGE | | | | |
| Less than 5 years | 7% | 10% | 10% | 10% |
| 5 to 17 years | 17% | 21% | 20% | 26% |
| 18 to 34 years | 31% | 35% | 34% | 27% |
| 35 to 64 years | 34% | 29% | 29% | 30% |
| 65 or more years | 11% | 5% | 6% | 7% |
| Median age (years) | 32.2 | N/A | N/A | 26.3 |
| EDUCATION OF PERSONS AGED 25 & OVER (2) | | | | |
| High School Diploma (3) | 81% | 80% | 82% | 69% |
| College Degree (4) | 33% | 25% | 29% | 15% |
| PERSONS AGED 5 & OVER WHO SPEAK A LANGUAGE OTHER THAN ENGLISH AT HOME (2) | 26% | 24% | 26% | 19% |
| PERSONS WITH MOBILITY OR SELF-CARE LIMITATIONS (2) | | | | |
| % of persons aged 16 to 64 | 4% | 5% | 4% | 6% |
| % of persons aged 65 or more | 18% | 20% | 20% | 26% |

NOTES: (1) See Appendix A-6 for a detailed list of equivalent Census regions for these Development Plan Areas.
(2) Based on 15% sample; hence, figures represent estimates only.
(3) All persons with a high school diploma, including those with college education.
(4) Includes Associate, Bachelor's, and graduate degrees.

SOURCES: U.S. Bureau of the Census, 1992, 1991.

## Appendix A
## 2. GEOGRAPHIC MOBILITY, SELECTED DP AREAS, 1990 (1)

| | Honolulu County | SELECTED DP AREAS | | |
|---|---|---|---|---|
| | | Ewa | Central | Waianae |
| **PERSONS (2)** | | | | |
| PLACE OF BIRTH | | | | |
| Born in Hawaii | 54% | 46% | 51% | 74% |
| Other U.S.-born (3) | 30% | 38% | 35% | 18% |
| Foreign-born | 16% | 16% | 15% | 8% |
| RESIDENCE 5 YEARS PREVIOUS FOR PERSONS AGED 5 & OVER | | | | |
| Same house | 50% | 38% | 43% | 55% |
| Same county, different house | 26% | 29% | 27% | 33% |
| Same state, different county | 1% | 1% | 1% | 1% |
| Different state | 17% | 26% | 24% | 9% |
| Lived abroad | 5% | 6% | 6% | 2% |
| **HOUSEHOLDERS (2)** | | | | |
| WHEN HOUSEHOLDER MOVED INTO UNIT | | | | |
| In the last 5 years | 53% | 66% | 62% | 52% |
| 6 to 20 years ago | 29% | 26% | 26% | 35% |
| 21 to 30 years ago | 10% | 6% | 8% | 7% |
| 31 years ago or more | 8% | 3% | 4% | 6% |

NOTES: (1) Based on 15% sample; hence, figures represent estimates only.
(2) Base figures used in calculating these data may be different than in 100% count.
(3) Includes persons born in U.S. territories, and persons born abroad or at sea to American parents.

SOURCE: U.S. Bureau of the Census, 1992.

## Appendix A
## 3. HOUSING CHARACTERISTICS, SELECTED DP AREAS, 1990

| | Honolulu County | SELECTED DP AREAS | | |
|---|---|---|---|---|
| | | Ewa | Central | Waianae |
| **HOUSING UNITS** | 281,683 | 11,734 | 36,260 | 10,680 |
| TOTAL VACANT UNITS | 6% | 3% | 2% | 12% |
| Seasonal/recreational | 2% | 0% | 0% | 4% |
| AGE OF STRUCTURE (1) | | | | |
| 1 year | 2% | 7% | 3% | 1% |
| 2 to 10 to years | 14% | 15% | 28% | 13% |
| 11 to 20 years | 30% | 29% | 29% | 42% |
| 21 years or more | 54% | 48% | 40% | 44% |
| UNITS IN STRUCTURE | | | | |
| 1 unit | 55% | 80% | 65% | 70% |
| 2 to 4 units | 7% | 7% | 9% | 5% |
| 5 or more units | 36% | 11% | 24% | 23% |
| Trailer, other | 1% | 1% | 1% | 2% |
| NOT COMPLETE PLUMBING (1) | 1% | 0% | 0% | 1% |
| **HOUSEHOLDS** | 265,304 | 11,434 | 35,443 | 9,417 |
| HOUSEHOLD TYPE | | | | |
| 1 or more non-relatives | 12% | 12% | 10% | 15% |
| No non-relatives | 88% | 88% | 90% | 85% |
| TENURE | | | | |
| Owner-occupied | 52% | 53% | 55% | 52% |
| Renter-occupied | 48% | 47% | 45% | 48% |
| PERSONS PER HOUSEHOLD | 3.02 | 3.66 | 3.49 | 3.93 |
| CROWDED HOUSEHOLDS | | | | |
| Mildly crowded (2) | 8% | 11% | 10% | 16% |
| Very crowded (3) | 8% | 9% | 8% | 18% |
| MEAN VALUE (4) | $312,624 | $232,270 | $265,169 | $168,784 |

NOTES: (1) Based on 15% sample; hence, figures represent estimates only.
(2) Indicated by households with 1.00 to 1.50 persons per room.
(3) Indicated by households with 1.51 or more persons per room.
(4) For owner-occupied, non-condominium housing units.

SOURCES: U.S. Bureau of the Census, 1992, 1991.

## Appendix A
## 4. INCOME CHARACTERISTICS, SELECTED DP AREAS, 1990 (1)

| | Honolulu County | SELECTED DP AREAS | | |
|---|---|---|---|---|
| | | Ewa | Central | Waianae |
| **HOUSEHOLDS (2)** | | | | |
| INCOME LEVEL | | | | |
| Lowest (3) | 13% | 9% | 11% | 22% |
| Highest (4) | 17% | 12% | 15% | 9% |
| Mean Income (5) | $49,959 | $44,759 | $47,540 | $38,310 |
| Interquartile Range (6) | $43,154 | $36,073 | $39,906 | $35,239 |
| WITH SELECTED INCOME SOURCES | | | | |
| Social Security Income | 24% | 15% | 17% | 23% |
| Retirement Income | 20% | 17% | 17% | 21% |
| Public Assistance Income | 6% | 6% | 8% | 22% |
| OWNER HOUSING COSTS (7) | | | | |
| 35% or more of Household Income | 15% | 21% | 20% | 14% |
| Mean Monthly Costs | $909 | $968 | $1,041 | $607 |
| RENTER HOUSING COSTS (8) | | | | |
| 35% or more of Household Income | 34% | 36% | 37% | 44% |
| Mean Gross Rent | $711 | $810 | $717 | $617 |
| Mean Contract Rent (9) | $655 | $738 | $652 | $551 |
| **POPULATION (2)** | | | | |
| PERSONS BELOW POVERTY LEVEL | 7% | 5% | 7% | 19% |
| % of persons aged 18 to 64 | 6% | 4% | 5% | 15% |
| % of persons aged 65 or more | 8% | 4% | 9% | 14% |
| % of related children aged less than 18 | 10% | 5% | 10% | 26% |
| % of unrelated individuals | 19% | 17% | 18% | 33% |

NOTES:
(1) Based on 15% sample (except "Mean Contract Rent"); hence, figures represent estimates only.
(2) Base figures used in calculating this data may be different than in 100% count.
(3) Incomes of less than $15,000 (based on lowest 14.8% of incomes statewide).
(4) Incomes of $75,000 or more (based on highest 15.8% of incomes statewide).
(5) In 1989 dollars.
(6) A smaller range means less difference between rich and poor, while a larger range means a greater difference between rich and poor.
(7) Owner costs include (but are not limited to) mortgage, real property tax, property insurance, utilities, and fuels.
(8) Renter costs include (but are not limited to) rent, utilities, and fuels.
(9) Monthly cash rent only. Does not include other costs.

SOURCES: U.S. Bureau of the Census, 1992, 1991.

## Appendix A

## 5. LABOR FORCE CHARACTERISTICS, SELECTED DP AREAS, 1990 (1)

| | Honolulu County | SELECTED DP AREAS | | |
|---|---|---|---|---|
| | | Ewa | Central | Waianae |
| **POPULATION AGED 16 & OVER** | 651,920 | 30,788 | 94,346 | 24,973 |
| In Armed Forces | 8% | 17% | 16% | 2% |
| **POTENTIAL CIVILIAN LABOR FORCE** | 598,371 | 25,556 | 78,949 | 24,377 |
| In Civilian Labor Force | 69% | 71% | 72% | 62% |
| **CIVILIAN LABOR FORCE** | 410,023 | 18,081 | 57,071 | 15,107 |
| MALE | | | | |
| Labor force participation (2) | 75% | 79% | 79% | 71% |
| Unemployed | 4% | 5% | 4% | 8% |
| FEMALE | | | | |
| Labor force participation (2) | 63% | 64% | 67% | 53% |
| Unemployed | 3% | 5% | 4% | 8% |
| **EMPLOYED CIVILIAN LABOR FORCE** | 395,811 | 17,120 | 54,571 | 13,901 |
| BY SELECTED INDUSTRY | | | | |
| Agriculture, forestry, fisheries, mining | 2% | 2% | 2% | 4% |
| Construction | 7% | 8% | 8% | 12% |
| Manufacturing | 6% | 9% | 8% | 8% |
| Transportation | 7% | 7% | 7% | 7% |
| Retail trade | 19% | 20% | 19% | 17% |
| Finance, insurance, real estate | 8% | 7% | 7% | 4% |
| Personal, entertainment, recreation | 8% | 6% | 7% | 7% |
| Health, education, professional | 22% | 17% | 19% | 19% |
| Public administration | 9% | 11% | 12% | 9% |
| BY OCCUPATION | | | | |
| Managerial, professional | 28% | 18% | 23% | 17% |
| Technical, sales, support | 35% | 35% | 35% | 27% |
| Service | 17% | 18% | 17% | 18% |
| Farming, forestry, fishing | 2% | 2% | 2% | 4% |
| Precision, craft, repair | 10% | 13% | 12% | 14% |
| Operators, cleaners, laborers | 9% | 14% | 11% | 20% |
| COMMUTE TO WORK | | | | |
| More than 45 minutes | 16% | 21% | 20% | 40% |
| Mean travel time (minutes) | 25 | N/A | N/A | 36 |

NOTES: (1) Based on 15% sample; hence, figures represent estimates only.
(2) Calculated by dividing "Civilian Labor Force" by "Potential Civilian Labor Force."

SOURCE: U.S. Bureau of the Census, 1992.

## Appendix A
## 6. `EWA AND CENTRAL DP AREAS IN CENSUS TERMS

| Region | 1990 Population |
|---|---|
| **`EWA DP AREA** | 42,983 |
| APPROXIMATE CENSUS AREAS | 42,960 |
| Tract 83.01 | 5,786 |
| Tract 83.02 | 6,699 |
| Tract 87.98 (BG 9 only) | 826 |
| Tract 84 | 9,677 |
| Tract 85 | 4,529 |
| Tract 86.03 (all except BG 1) | 5,907 |
| Tract 86.04 | 4,015 |
| Tract 86.98 | 5,521 |
| DIFFERENCE | 23 |
| **CENTRAL DP AREA** | 130,474 |
| APPROXIMATE CENSUS AREAS | 130,474 |
| Tract 82 | 0 |
| Tract 86.03 (BG 1 only) | 602 |
| Tract 87.01 | 7,598 |
| Tract 87.02 | 4,161 |
| Tract 87.98 (all except BG 9) | 3,645 |
| Tract 88 | 6,172 |
| Tract 89.01 | 8,084 |
| Tract 89.04 | 5,183 |
| Tract 89.05 | 7,561 |
| Tract 89.06 | 4,025 |
| Tract 89.07 | 4,560 |
| Tract 89.08 | 6,688 |
| Tract 89.09 | 3,779 |
| Tract 89.10 | 10,444 |
| Tract 89.11 | 11,893 |
| Tract 89.12 | 2,193 |
| Wahiawa Division (1) | 43,886 |
| DIFFERENCE | 0 |

NOTE: (1) Comprised of Tracts 90, 91, 92, 93, 94, 95.01, 95.02, 95.03, 95.04, and 95.05

SOURCES: U.S. Bureau of the Census, 1992.
Steve Young, City & County Planning Department (`Ewa DP — 2/13/92; Central DP — 8/8/94).

## Appendix A
## 7. EXISTING & PLANNED RESIDENTIAL DEVELOPMENTS IN `EWA

| Existing & Planned Developments | | Units | | Year (to be) Completed |
|---|---|---|---|---|
| Description | Developer | Number | Type | |
| CITY OF KAPOLEI | | | | 1996 to 2010 |
| Mauka | | 750 | | |
| Makai | | 2,000 | | |
| `EWA BY GENTRY | Gentry Development Co. | 8,000 | | 2000 |
| 1,000 acres | | | | |
| Coronado | | 138 | 60% affordable | |
| Palm Court & Palm Villas | | 562 | multi-family | |
| Soda Creek I and II | | 2,100 | single- & | 1990 |
| Summerhill | | 305 | multi-family | |
| Sun Terra | | 240 | townhouse | |
| Sun Rise | | 386 | | |
| Sun Terra on the Park | | 184 | | |
| Sun Terra South | | 72 | | |
| The Arbors | | 280 | low-rise condo | |
| `EWA MARINA | HASEKO (`Ewa) Inc. | | | |
| 1,100 acres | | | | |
| Residential Units | | 4,850 | 10 to 30% affordable | Projected construction start-time is 1995 |
| *Visitor Units* | | 950 | | |
| *Marina* | | 1,400 | boat slips | 1995 to 2010 or 2015 |
| *27-hole Golf Course* | | | | |
| *Health/Fitness Center* | | | | |
| *Maritime Commercial Center* | | | | |
| EWA VILLAGES | DHCD (2) | | | 8-phase project 1997 to 2000 |
| 610 acres | | | | |
| Tenney Village | | 273 | revitalize existing | |
| Varona Village | | | | |
| Renton Village | | | | |
| New Residential Development | | 957 | 60% affordable 40% market | |
| *Elementary School* | | 17 acres | | |
| *Neighborhood Retail Center* | | 252 acres | | |
| *Parks/Recreation Facilities* | | | | |
| *18-hole Municipal Golf Course* | | | | Under construction |
| *Historical Buildings Restoration* | | | | |
| KAPOLEI KNOLLS | Finance Realty | | | |
| 79.5 acres | | 380 | single-family & market | 200 units, Dec. 1995 |
| KO `OLINA | West Beach Estates | | | Groundbreaking: 1986 |
| 1,000 acres | | | | |
| Phase I: | | | | |
| Residential Units | | 3,700 | apt./condo. med.-rise | |
| | | 1,500 | low-density/golf course | |
| *Visitor Units* | | 4,000 | | |
| *Marina* | | 350-400 | slips | |
| *18-hole Golf Course* | | | | Completed |
| *Clubhouse* | | | | |
| *'Ihilani Resort* | | 1 | | Open |
| *Sandy Beaches* | | 4 | | |
| *Hawaiian Cultural Center* | | | | |
| *Shopping Center* | | | | |
| *Restaurants* | | | | |

| Existing & Planned Developments | | Units | | Year (to be) Completed |
|---|---|---|---|---|
| Description | Developer | Number | Type | |
| Phase II: | | | | Undetermined |
| Residential Units | | 3,500 | | |
| *Hotels* | | 2 | | |
| *Local Commercial Center* | | | | |
| *18-hole Golf Course* | | | | |
| MAKAIWA HILLS | Campbell Estate | | market & affordable | Groundbreaking: 1996 |
| 2,000 acres | | 1,066 | single-/multi-family | 2001 to 2010 |
| Residential | | 1 M s.f. | | |
| *Regional Mall* | | | | |
| *Public Parks* | | | | |
| *Elementary School* | | | | |
| MAKAKILO | Finance Realty | 6,174 | | 1962 to 1999 |
| Cambridge Park | | 112 | affordable | |
| WestPark at Makakilo Heights | | 47 | lots | |
| Palehua Pointe | | 23 | affordable | |
| Palehua Nani & Palehua Villas | | 24 | | |
| Makakilo Cliffs | | 40 | | |
| Makakilo Cluster Park | | | | |
| Makakilo Ridge | | 72 | single-family, fee simple | |
| Royal Ridge | | 500 | townhomes, 10% afford. | Phase I, Nov. 1993 |
| Westview at Makakilo Heights | Schuler Homes, Inc. | | | 2005 |
| THE VILLAGES OF KAPOLEI | HFDC (3) | | | 1991 |
| 890 acres | Castle & Cooke Properties, Inc. | 519 | | late 1994 |
| V.1. Kumu 'Iki | Watt Hawai'i | 571 | mixed density | 1992 |
| V.2. A'eloa | Watt Hawai'i | 384 | | 1st delivery, 1994 |
| V.3. Malanai | Waieli Development Corp. | 645 | mixed density | Occupany July 1994 |
| V.4. Kekuilani | West Beach Estates | 128 | multi-family townhomes | Occupancy Dec. 1994 |
| V.5. Kulalani | Kumi Kei Development | 128 | multi-family townhomes | |
| V.6 Pae Ko Gardens | Watt Hawai'i | 492 | | |
| V.7 | Waieli Development Corp. | 618 | | 1993: Kapolei Elem. |
| V.8 | | 2 | | |
| *Elementary School* | | 1 | | 1998 school year |
| *Intermediate School* | | 1 | | |
| *High School* | | | | |
| *Commercial Services* | | | | |
| *Community Park* | | | | |
| *Recreation Center* | | | | |
| *18-hole Public Golf Course* | | | | |
| WEST LOCH SUBDIVISIONS | DHCD/West Loch, Inc. | | | |
| 500 acres | | 593 | | 1989 |
| Phase I subdivision | | | | |
| West Beach Estates | | 718 | single-/multi-family | 1994 |
| West Loch Fairways | | 136 | multi-family rental | 1993 |
| Townhomes Project | | | | |
| West Loch Village | Fletcher Pacific, Inc. | 150 | | 1993 |
| for the Elderly and Disabled | | | | |
| *Commercial Center* | | | | |
| *Church* | | | | |
| *Child Care Center* | | | | |
| *Asing Community Park* | | | | 1990 |
| *18-hole Municipal Golf Course* | | | | |
| *40-acre Shoreline Park* | | | | |

NOTES: (1) Inventory as of late 1994. Non-residential components shown in italics.
(2) DHCD = Department of Housing & Community Development.
(3) HFDC = Housing & Finance Development Corporation.

SOURCES: Calls to developers by CRI, 1994; Honolulu Planning Department, 1992, 1993; Atwater, 1994. The Estate of James Campbell, 1993a, 1993b, 1993c; Helber Hastert & Fee, Planners, 1992.

## Appendix A
## 8. DEMOGRAPHIC CHARACTERISTICS, SELECTED `EWA AREAS, 1990

| | Honolulu County | Barber's Point | `Ewa Beach | `Ewa Villages | Makakilo | `Ewa Gentry |
|---|---|---|---|---|---|---|
| **POPULATION** | 836,231 | 2,218 | 14,315 | 3,780 | 9,828 | 1,992 |
| ETHNICITY | | | | | | |
| Caucasian | 32% | 76% | 23% | 8% | 47% | 31% |
| Japanese | 23% | 1% | 9% | 14% | 10% | 18% |
| Filipino | 14% | 8% | 39% | 67% | 16% | 28% |
| Hawaiian | 11% | 1% | 17% | 5% | 13% | 7% |
| Other | 20% | 15% | 12% | 5% | 14% | 15% |
| AGE | | | | | | |
| Less than 5 years | 7% | 19% | 7% | 7% | 8% | 10% |
| 5 to 17 years | 17% | 10% | 23% | 21% | 19% | 15% |
| 18 to 34 years | 31% | 61% | 30% | 27% | 34% | 46% |
| 35 to 64 years | 34% | 9% | 33% | 30% | 36% | 27% |
| 65 or more years | 11% | 0% | 7% | 15% | 3% | 3% |
| Median age (years) | 32.2 | 24.7 | 28.6 | 32.4 | 29.8 | 28.4 |
| EDUCATION OF PERSONS AGED 25 & OVER (1) | | | | | | |
| High School Diploma (2) | 81% | 90% | 71% | 55% | 90% | 88% |
| College Degree (3) | 33% | 15% | 17% | 12% | 37% | 37% |
| PERSONS AGED 5 & OVER WHO SPEAK A LANGUAGE OTHER THAN ENGLISH AT HOME (1) | 26% | 15% | 29% | 46% | 16% | 24% |
| PERSONS WITH MOBILITY OR SELF-CARE LIMITATIONS (1) | | | | | | |
| % of persons aged 16 to 64 | 4% | 2% | 6% | 4% | 5% | 3% |
| % of persons aged 65 or more | 18% | 0% | 18% | 22% | 15% | 0% |

NOTES: (1) Based on 15% sample; hence, figures represent estimates only.
(2) All persons with a high school diploma, including those with college education.
(3) Includes Associate, Bachelor's, and graduate degrees.

SOURCES: U.S. Bureau of the Census, 1992, 1991.

## Appendix A
## 9. GEOGRAPHIC MOBILITY, SELECTED `EWA AREAS, 1990 (1)

| | Honolulu County | Barber's Point | `Ewa Beach | `Ewa Villages | Makakilo | `Ewa Gentry |
|---|---|---|---|---|---|---|
| **PERSONS (2)** | | | | | | |
| PLACE OF BIRTH | | | | | | |
| Born in Hawaii | 54% | 13% | 63% | 62% | 45% | 52% |
| Other U.S.-born (3) | 30% | 78% | 18% | 5% | 43% | 31% |
| Foreign-born | 16% | 9% | 20% | 33% | 12% | 17% |
| RESIDENCE 5 YEARS PREVIOUS FOR PERSONS AGED 5 & OVER | | | | | | |
| Same house | 50% | 2% | 61% | 43% | 40% | 2% |
| Same county, different house | 26% | 5% | 29% | 50% | 29% | 76% |
| Same state, different county | 1% | 0% | 1% | 1% | 1% | 2% |
| Different state | 17% | 79% | 6% | 3% | 25% | 16% |
| Lived abroad | 5% | 14% | 3% | 4% | 6% | 3% |
| **HOUSEHOLDERS (2)** | | | | | | |
| WHEN HOUSEHOLDER MOVED INTO UNIT | | | | | | |
| In the last 5 years | 53% | 99% | 39% | 56% | 64% | 100% |
| 6 to 20 years ago | 29% | 1% | 49% | 23% | 26% | 0% |
| 21 to 30 years ago | 10% | 0% | 8% | 3% | 10% | 0% |
| 31 years ago or more | 8% | 0% | 3% | 18% | 0% | 0% |

NOTES: (1) Based on 15% sample; hence, figures represent estimates only.
(2) Base figures used in calculating these data may be different than in 100% count.
(3) Includes persons born in U.S. territories, and persons born abroad or at sea to American parents.

SOURCE: U.S. Bureau of the Census, 1992.

## Appendix A
## 10. HOUSING CHARACTERISTICS, SELECTED `EWA AREAS, 1990

| | Honolulu County | Barber's Point | `Ewa Beach | `Ewa Villages | Makakilo | `Ewa Gentry |
|---|---|---|---|---|---|---|
| **HOUSING UNITS** | 281,683 | 866 | 3,426 | 939 | 3,050 | 752 |
| TOTAL VACANT UNITS | 6% | 1% | 2% | 4% | 2% | 6% |
| Seasonal/recreational | 2% | 0% | 0% | 0% | 0% | 0% |
| AGE OF STRUCTURE (1) | | | | | | |
| 1 year | 2% | 1% | 1% | 5% | 1% | 71% |
| 2 to 10 to years | 14% | 1% | 7% | 43% | 28% | 29% |
| 11 to 20 years | 30% | 5% | 41% | 1% | 44% | 0% |
| 21 years or more | 54% | 93% | 52% | 51% | 27% | 0% |
| UNITS IN STRUCTURE | | | | | | |
| 1 unit | 55% | 49% | 86% | 95% | 79% | 50% |
| 2 to 4 units | 7% | 19% | 4% | 2% | 7% | 5% |
| 5 or more units | 36% | 30% | 9% | 1% | 13% | 44% |
| Trailer, other | 1% | 2% | 1% | 3% | 1% | 1% |
| NOT COMPLETE PLUMBING (1) | 1% | 0% | 1% | 0% | 0% | 0% |
| **HOUSEHOLDS** | 265,304 | 854 | 3,355 | 902 | 2,978 | 708 |
| HOUSEHOLD TYPE | | | | | | |
| 1 or more non-relatives | 12% | 2% | 15% | 8% | 16% | 17% |
| No non-relatives | 88% | 98% | 85% | 92% | 84% | 83% |
| TENURE | | | | | | |
| Owner-occupied | 52% | 0% | 69% | 66% | 74% | 80% |
| Renter-occupied | 48% | 100% | 31% | 34% | 26% | 20% |
| PERSONS PER HOUSEHOLD | 3.02 | 2.52 | 4.26 | 4.19 | 3.30 | 2.81 |
| CROWDED HOUSEHOLDS | | | | | | |
| Mildly crowded (2) | 8% | 4% | 17% | 21% | 7% | 10% |
| Very crowded (3) | 8% | 1% | 15% | 21% | 5% | 7% |
| MEDIAN VALUE (4) | $283,600 | $275,000 | $216,900 | $116,500 | $246,600 | $277,600 |

NOTES:
(1) Based on 15% sample; hence, figures represent estimates only.
(2) Indicated by households with 1.00 to 1.50 persons per room.
(3) Indicated by households with 1.51 or more persons per room.
(4) For owner-occupied, non-condominium housing units.

SOURCES: U.S. Bureau of the Census, 1992, 1991.

## Appendix A
## 11. INCOME CHARACTERISTICS, SELECTED `EWA AREAS, 1990 (1)

| | Honolulu County | Barber's Point | `Ewa Beach | `Ewa Villages | Makakilo | `Ewa Gentry |
|---|---|---|---|---|---|---|
| **HOUSEHOLDS (2)** | | | | | | |
| INCOME LEVEL | | | | | | |
| Lowest (3) | 13% | 14% | 11% | 13% | 3% | 5% |
| Highest (4) | 17% | 1% | 16% | 8% | 20% | 8% |
| Median Income (5) | $40,581 | $23,908 | $45,184 | $40,924 | $50,284 | $45,824 |
| Interquartile Range (6) | $43,154 | $13,490 | $37,672 | $37,023 | $34,317 | $33,156 |
| WITH SELECTED INCOME SOURCES | | | | | | |
| Social Security Income | 24% | 3% | 23% | 47% | 10% | 7% |
| Retirement Income | 20% | 3% | 28% | 32% | 17% | 8% |
| Public Assistance Income | 6% | 1% | 14% | 5% | 3% | 3% |
| OWNER HOUSING COSTS (7) | | | | | | |
| 35% or more of Household Income | 15% | N/A | 16% | 12% | 24% | 38% |
| Median Monthly Costs | $1,121 | N/A | $910 | $710 | $1,268 | $1,393 |
| RENTER HOUSING COSTS (8) | | | | | | |
| 35% or more of Household Income | 34% | 15% | 31% | 5% | 46% | 78% |
| Median Gross Rent | $663 | $664 | $755 | $127 | $971 | $923 |
| Median Contract Rent (9) | $615 | $644 | $701 | $99 | $960 | $907 |
| **POPULATION (2)** | | | | | | |
| PERSONS BELOW POVERTY LEVEL | 7% | 1% | 7% | 1% | 3% | 6% |
| % of persons aged 18 to 64 | 6% | 1% | 6% | 1% | 3% | 4% |
| % of persons aged 65 or more | 8% | 0% | 4% | 3% | 4% | 0% |
| % of related children aged less than 18 | 10% | 2% | 7% | 1% | 4% | 8% |
| % of unrelated individuals | 19% | 0% | 29% | 20% | 6% | 8% |

NOTES:
(1) Based on 15% sample (except "Median Contract Rent"); hence, figures represent estimates only.
(2) Base figures used in calculating this data may be different than in 100% count.
(3) Incomes of less than $15,000 (based on lowest 14.8% of incomes statewide).
(4) Incomes of $75,000 or more (based on highest 15.8% of incomes statewide).
(5) In 1989 dollars.
(6) A smaller range means less difference between rich and poor, while a larger range means a greater difference between ric
(7) Owner costs include (but are not limited to) mortgage, real property tax, property insurance, utilities, and fuels.
(8) Renter costs include (but are not limited to) rent, utilities, and fuels.
(9) Monthly cash rent only. Does not include other costs.

SOURCES: U.S. Bureau of the Census, 1992, 1991.

## Appendix A
## 12. LABOR FORCE CHARACTERISTICS, SELECTED `EWA AREAS, 1990 (1)

| | Honolulu County | Barber's Point | `Ewa Beach | `Ewa Villages | Makakilo | `Ewa Gentry |
|---|---|---|---|---|---|---|
| **POPULATION AGED 16 & OVER** | 651,920 | 1,681 | 10,499 | 2,855 | 7,286 | 1,634 |
| In Armed Forces | 8% | 52% | 3% | 1% | 13% | 12% |
| **POTENTIAL CIVILIAN LABOR FORCE** | 598,371 | 802 | 10,221 | 2,831 | 6,306 | 1,443 |
| In Civilian Labor Force | 69% | 73% | 70% | 67% | 76% | 87% |
| **CIVILIAN LABOR FORCE** | 410,023 | 589 | 7,129 | 1,899 | 4,768 | 1,255 |
| MALE | | | | | | |
| Labor force participation (2) | 75% | 82% | 76% | 72% | 84% | 94% |
| Unemployed | 4% | 21% | 6% | 5% | 5% | 1% |
| FEMALE | | | | | | |
| Labor force participation (2) | 63% | 71% | 63% | 62% | 67% | 81% |
| Unemployed | 3% | 21% | 4% | 5% | 4% | 1% |
| **EMPLOYED CIVILIAN LABOR FORCE** | 395,811 | 466 | 6,773 | 1,808 | 4,541 | 1,243 |
| BY SELECTED INDUSTRY | | | | | | |
| Agriculture, forestry, fisheries, mining | 2% | 1% | 1% | 11% | 1% | 0% |
| Construction | 7% | 9% | 9% | 6% | 8% | 7% |
| Manufacturing | 6% | 3% | 8% | 13% | 9% | 10% |
| Transportation | 7% | 4% | 7% | 7% | 8% | 7% |
| Retail trade | 19% | 29% | 24% | 20% | 16% | 16% |
| Finance, insurance, real estate | 8% | 7% | 7% | 5% | 6% | 11% |
| Personal, entertainment, recreation | 8% | 4% | 7% | 8% | 4% | 7% |
| Health, education, professional | 22% | 20% | 15% | 10% | 20% | 16% |
| Public administration | 9% | 19% | 7% | 9% | 15% | 15% |
| BY OCCUPATION | | | | | | |
| Managerial, professional | 28% | 15% | 12% | 9% | 26% | 26% |
| Technical, sales, support | 35% | 39% | 34% | 27% | 36% | 36% |
| Service | 17% | 28% | 22% | 20% | 13% | 14% |
| Farming, forestry, fishing | 2% | 0% | 1% | 8% | 1% | 0% |
| Precision, craft, repair | 10% | 13% | 14% | 13% | 13% | 11% |
| Operators, cleaners, laborers | 9% | 5% | 17% | 23% | 10% | 12% |
| COMMUTE TO WORK | | | | | | |
| More than 45 minutes | 16% | 5% | 31% | 22% | 19% | 30% |
| Mean travel time (minutes) | 25 | 13 | 34 | 29 | 29 | 33 |

NOTES: (1) Based on 15% sample; hence, figures represent estimates only.
(2) Calculated by dividing "Civilian Labor Force" by "Potential Civilian Labor Force."

SOURCE: U.S. Bureau of the Census, 1992.

# APPENDIX B:

# KEY INFORMANTS

# Appendix B
## KEY INFORMANTS

The following list acknowledges persons interviewed by Community Resources, Inc. in September 1994, to learn of community expectations and concerns. Positions and/or organizational affiliations are mentioned to indicate the range and variety of interested parties. Interviewees were not asked to speak on behalf of their organizations.

| KEY INFORMANT | POSITION AND/OR ORGANIZATION |
|---|---|
| Jeffrey R. Alexander | President, Save `Ewa Beach `Ohana<br>`Ewa Neighborhood Board<br>`Ewa Beach Resident |
| Richard Beamer | President, `Ewa Beach Community Association |
| John Bickel | Former Chair, `Ewa Beach Neighborhood Board<br>Former Teacher, Campbell High School<br>Former `Ewa Beach Resident |
| Ka`uila Clark | President, West O`ahu Employment Corporation |
| Kathy Cozzens | Renton Village Resident<br>Board Member, Friends for `Ewa |
| Henry Eng | Manager, Land Planning, Estate of James Campbell |
| Sue Flint | `Ewa Beach Resident<br>Member, Save `Ewa Beach `Ohana |
| James Floody | President, `Ewa by Gentry Community Association |
| Cynthia Fu | Manager, `Ewa Beach Branch, First Hawaiian Bank<br>President, `Ewa Beach Shopping Center Merchants' Association<br>Member, `Ewa Beach Professional Business Association<br>Member, `Ewa Beach Community Association |
| David A. Gilbert | Chair, `Ewa Neighborhood Board<br>Makakilo Resident |
| Alan Gottlieb | Part-Owner, Kahua Nursery |
| LaVerne Hatch | President, Makakilo Community Association<br>President, Ahahui Siwila Hawai`i O Kapolei |
| Deborah Higa | Vice President, West O`ahu Employment Corporation |
| David Kawamura | Manager, Foodland at `Ewa Beach Shopping Center<br>Member, `Ewa Beach Business Association |
| Terri Kita | Assistant to the Manager, Villages of Kapolei Association<br>Kapolei Resid |
| Ellie Kupau | President, D.E. Thompson Senior Village<br>Trustee, `Ewa Villages Community Association |

| KEY INFORMANT | POSITION AND/OR ORGANIZATION |
|---|---|
| Florence Lomaoang | Member, 'Ewa Villages Non-Profit Development Corp.<br>Tenney Village Resident |
| Paula Loring | President, Kapolei Elementary School<br>Kapolei Resident |
| Richard Lyman | President, West Loch Fairways Community Association |
| Emogene Martin | President, Friends for 'Ewa<br>'Ewa Resident |
| Eric Murakami | Manager, Kapolei Safeway |
| Irene Nakamoto | Principal, 'Ewa Elementary School |
| Eleanor Niino | Fernandez Village Resident<br>Board Member, 'Ewa Villages Community Association<br>Volunteer, 'Ewa Elementary School |
| Jane Oamilda | Vice President, Friends for 'Ewa<br>'Ewa Beach Resident |
| Pastor David Parker | Pastor, Friendship Bible Church<br>Director, Friendship Youth Center |
| Rodolfo V. Ramos | President, 'Ewa Villages Community Association<br>Member, 'Ewa Neighborhood Board |
| Frances Rivero | Program Coordinator, Boys and Girls Club of 'Ewa Beach<br>Board Member, HASEKO 'Ewa Beach Coordinating Council<br>Board Member, 'Ewa Beach Community Association |
| Kari Tamura | Renton Village Resident |
| Arline E. West | Member, 'Ewa Neighborhood Board<br>Employment Counselor, DHS-JOBS Wai'anae<br>Makakilo Resident |
| Roy Wickramaratna | Makakilo Resident<br>President, Makakilo Senior Citizens Club<br>Member, Barbers Point Re-Use and Environmental Committees<br>Former President, Makakilo Community Association<br>Former President, Makakilo Gardens II Homeowners' Association |
| Michael K.H. Wong | Member, 'Ewa Neighborhood Board<br>Kapolei Resident |
| Robert Yu | President, West Loch Estates Community Association |

# APPENDIX C:

# COMMUNITY INTERVIEW GUIDE & HANDOUT

## Appendix C
## 1. COMMUNITY INTERVIEW GUIDE

### A: QUESTIONS FOR PARTICULAR INTERVIEWEES

**For Residents of a Particular Neighborhood**

1. How long have you lived in `Ewa?
2. How old is your neighborhood?
3. How long have your neighbors lived in this neighborhood?
4. How well do your neighbors know one another? Would you say there's a sense of "neighborhood" there?
5. What kinds of issues or problems has your neighborhood dealt with in the last one or two years? How were these issues or problems resolved? Does your neighborhood have a residents' association that addresses these types of issues?
6. Are there issues that your neighborhood is currently dealing with? What are they?

**For Community Associations of Residential Developments**

1. When was your community association formed?
2. What is the purpose of the community association?
3. Who can be a member of the association?
4. Currently, how many members are there?
5. What kinds of issues or concerns is the association presently addressing?
6. What kinds of supports — through volunteers, activities, dedicated space, equipment — does your association provide for residents of your development?

7. Does your association maintain any contact with other `Ewa community associations? Which ones? What kinds of things do you discuss with one another? Do the associations get together and talk about regional matters, or is that done only through the `Ewa Neighborhood Board?

8. Who in these associations can you suggest I talk to?

**For Local Businesses or Business Associations**

1. How long has your business been in `Ewa? Why did you decide to locate your business in `Ewa?

2. What issues or concerns must a business person in `Ewa confront? What are the top three issues that a business person in this region must address?

**For Civic Organizations**

1. When was your organization formed? What is its purpose/mission?

2. What does your organization do?

3. Who can join your organization?

4. What kinds of issues and concerns does your organization address?

5. What are the needs of people in the `Ewa region?

6. Do you see your organization helping to fulfill these needs? How so?

7. Does your organization ever team up with other groups in the `Ewa region? What kinds of things do you discuss or work on?

**For Human Services**

1. What is the mission of your organization?

2. How long has your organization been in the `Ewa region?

3. What kinds of programs and services does your organization offer?

4. Who can take part in them? (probe for criteria: age, income level, geographic boundary, referral sources, other)

5. Do you charge a fee for your programs or services?

6. About how many participants are there currently? Are most of them from the `Ewa region?

7. What kinds of needs do people in `Ewa have?

8. Does your organization have any plans to expand or upgrade your program(s) or facilities in that community?

9. Are there are other organizations in the community that you work with?

## B: QUESTIONS FOR ALL INTERVIEWEES

**Regional Change**

1. Is there anything about `Ewa that you wish would stay the same? What are some threats to the things you value about this place?

2. How have things changed in `Ewa?

3. What would you like to change?

4. What do you think `Ewa will be like in ten or twenty years?

5. What kind of future would you like for `Ewa?

6. What is needed to make this future come true? What are some present obstacles? What are the things (people, things, activities) right now that can make it happen?

   [Use Kapolei Area Long-Range Master Plan map to orient interviewee, if needed, for the following questions.]

7. What are your thoughts about `Ewa becoming a major urban center? What are your thoughts about the various planned projects and projects in development? Do you think it will make `Ewa a better place to live? (If so, how? If not, why not?)

8. How do you think these developments will change `Ewa? [For local businesses: How will regional development affect your business? Existing small businesses?]

9. The naval air station at Barbers Point is scheduled to close sometime 1997. How will `Ewa be affected by this closing?

**Project (Impacts and Mitigations)**

[Present map of Schuler project and briefly describe the proposed project, which is over 1,022 acres]

1. What kind of impacts do you expect from this project — for your neighborhood, for `Ewa, for the island [vary the order]? [Check for impacts to: infrastructure, traffic, social (affiliation, crime, need for services and other types of supports), education, other.]

2. How can the negative impacts be prevented or minimized?

   [Get at how the addition of 10,000 homes over 20 years will figure into the future-scape of `Ewa.]

3. How will `Ewa benefit from this project? How about the island? How about your neighborhood?

4. How well does the project "fit" with the other `Ewa communities?

## Appendix C
## 2. INTERVIEW HANDOUT

### PROJECT DESCRIPTION OF SCHULER EAST KAPOLEI PROJECT

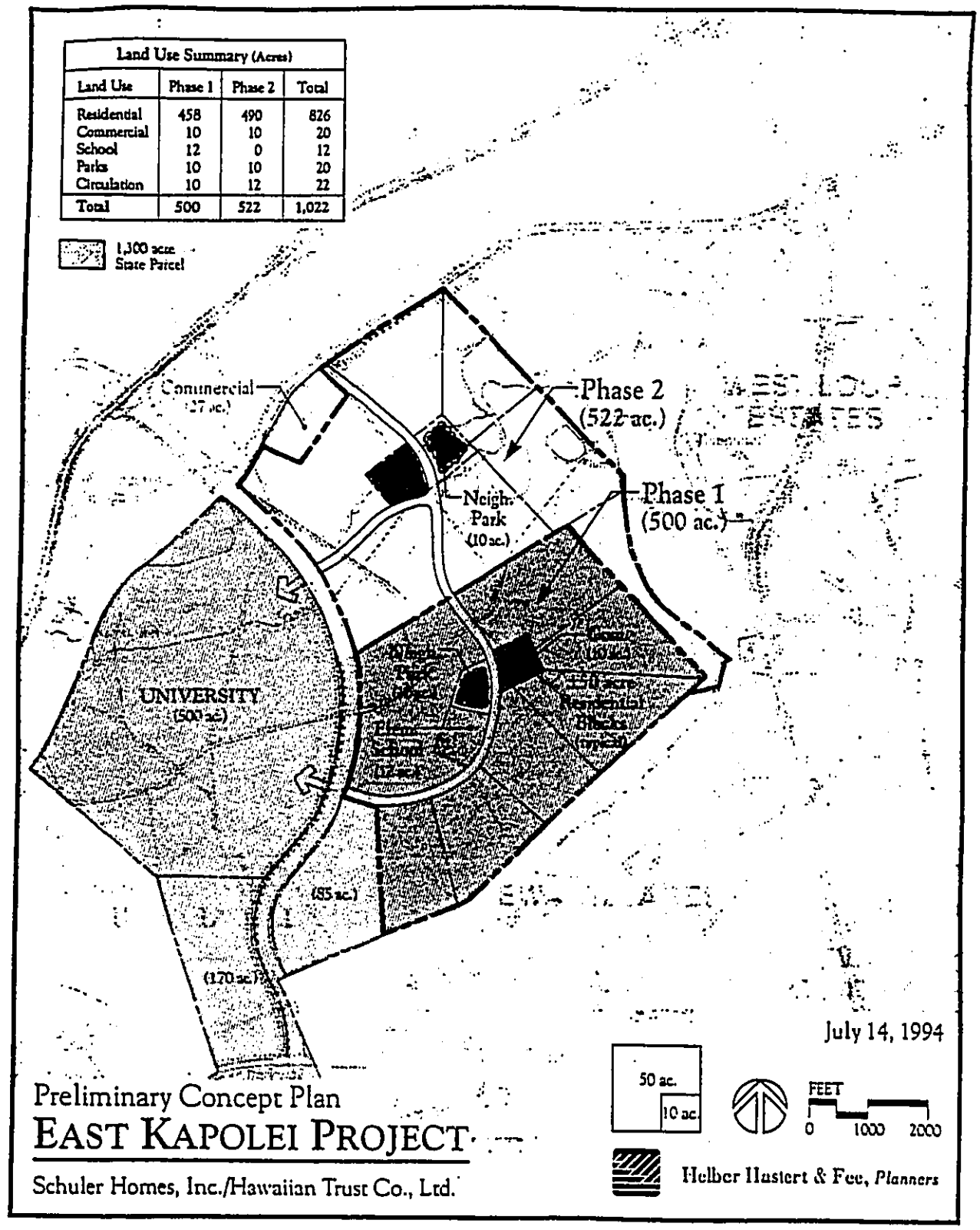
Schuler Homes, working with the Galbraith Trust, proposes to develop a residential area in `Ewa. The land was planted in sugar, but will otherwise be vacant when Oahu Sugar closes. The project includes homes, small parks, a school, and small commercial areas. The project would take quite a while to build out. The first house could be built by 1997, but the project still might not be finished until some time after 2020. Phase 1, on the south side of the project, would be built between 1996 and perhaps 2004. Only when it's finished would Schuler move on to the northern Phase 2 section.

Phase 1 would include about 5,000 housing units. These would be a mix of single-family and multi-family homes. The homes will be marketed to island residents, much as Schuler Homes' other projects are. Phase 2 would be similar in size to Phase 1.

(The Phase 1 land is being transferred to the Galbraith Estate by the State, in exchange for pineapple land up near Wahiawa. It's part of the agreement between Schuler Homes and the Galbraith Estate, that Phase 1 is developed first.)

* * *

Community Resources, Inc. is an independent consulting firm, working on a socio-economic impact assessment of the Schuler project. We will discuss the major findings of these interviews in our report, and will list the people we spoke with. We will not identify opinions as coming from any particular person.


Land Use Summary (Acres)
Land Use | Phase 1 | Phase 2 | Total
Residential | 458 | 490 | 826
Commercial | 10 | 10 | 20
School | 12 | 0 | 12
Parks | 10 | 10 | 20
Circulation | 10 | 12 | 22
Total | 500 | 522 | 1,022
1,300 acre State Parcel
Commercial
Phase 2 (522 ac.)
Phase 1 (500 ac.)
Neigh. Park (10 ac.)
UNIVERSITY (500 ac.)
(85 ac.)
(170 ac.)
July 14, 1994
50 ac.
10 ac.
FEET
0 1000 2000
Helber Hastert & Fee, Planners
Preliminary Concept Plan
EAST KAPOLEI PROJECT
Schuler Homes, Inc./Hawaiian Trust Co., Ltd.

# APPENDIX D:

# RESIDENTS' ISSUES & CONCERNS RELATED TO THE PROJECT

# Appendix D
## RESIDENTS' ISSUES & CONCERNS RELATED TO PROJECT

| ISSUE/CONCERN | COMMENT (1) |
|---|---|
| Traffic | Concerned that increase in resident population will aggravate existing traffic congestion. |
| Inadequate infrastructure:<br>Safe accesses for pedestrians | Assure that safe pedestrian accesses are constructed from project to adjacent properties along the North-South Road. |
| Inadequate facilities: | Great concern based on recent experiences with new residential developments. |
| Parks | Residents of project may have to use neighboring park facilities, aggravating the existing shortage of park space.<br>Loss of green space and views. |
| Schools | *Overtax existing school facilities.*<br>Development will attract more students to the private school. |
| Land for churches | |
| Community Character | Schuler development will reinforce the evolving bedroom character of `Ewa. |
| "Turf" Conflicts over Common Areas | Possible clashes between people (including youth) of different socio-economic groups on common areas such as neighborhood parks. |
| Inflated Property Taxes | Having a community of new homes next to an old neighborhood may increase property taxes for existing residents, who cannot afford the increase. |
| Early Childhood Education & Care | Increased need for quality child services. |
| Construction Dust | Construction dust may aggravate respiratory conditions. |
| Crime | The development will decrease youth gangs, because the poor people will be "squeezed out" of the region and the new residents will spur community action. |
| General Aviation Airport at Barbers Point | Possible alternatives of runway design may include flight path over project area, affecting the project (noise, risk to areas under a flight path). |
| Urbanization | Growth in `Ewa region will lead to the demise of agriculture and loss of rural identity. |
| | The development may escalate crime rates, by furthering the difference between the "haves" and the "have nots." |
| Housing in General | Will provide needed housing for O`ahu. |
| | Housing may not be affordable for many leeward residents, thus providing no relief of housing shortage for leeward. |
| More Community | New people will join the community associations and offer fresh input. |
| | More friendship and community activities. |
| Employment | Will increase short-term employment on construction jobs. |

NOTE: (1) Comments expand on interviewees' statements. These are not assessments by CRI.

# APPENDIX E:

# REFERENCES

## Appendix E
## REFERENCES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Research

Consulting

Financial Consulting

Training

Database Marketing

Socio-Economic Studies

# SOCIO-ECONOMIC IMPACT ASSESSMENT OF EAST KAPOLEI RESIDENTIAL PROJECT:

## UPDATE MEMORANDUM

**December 1995**

Prepared for:
**Schuler Homes, Inc.**

Prepared by:
**Community Resources, a division of SMS Research and Marketing Services, Inc.**

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This report provides an update of the socio-economic impact assessment (SIA) of the East Kapolei Project prepared by Community Resources, Inc. (1994). It refers to a new version of that project. The new version covers a smaller land area than that proposed earlier. (See Helber Hastert & Fee, 1995 for description and assessments.) With a total of 8,000 units at buildout, the new version of the project is smaller than that proposed earlier.

The report mentions changes in the project, its surroundings, and its impacts. It does not repeat the various findings of the original assessment if these remain true of the project.

## PROJECT

The proposed project covers some 794 acres in Kapolei, `Ewa District, O`ahu. The proposed project would include at buildout,

- Both single-family and multifamily residential units, occupying about 650 acres of land. A total of 8,000 units is planned. (In the earlier version of the project, 10,000 units were proposed.)
- Some 16 acres for neighborhood commercial development,
- A total of 25 acres for schools -- eight acres each for elementary schools, and a nine-acre contribution toward an intermediate school proposed for land abutting another future development area.
- Some 32 acres for parks, of which two eight-acre parcels would adjoin elementary schools.

Some 794 acres are in the East Kapolei project. Development of some 52 acres for off-site infrastructure (for water storage and drainage) is also proposed. The project itself occupies two parcels, separated by Farrington Highway and a site for a future commercial area, retained by the Estate of James Campbell. (Such a site was planned by the Estate in proximity to the earlier East Kapolei project.)

The land use allocation described here includes larger school and park dedications than were proposed earlier, along with smaller residential and commercial areas.

## EXISTING AND EMERGING CONDITIONS

As described in the preceding SIA, the project is planned as part of the "second city" of O`ahu at Kapolei, now beginning to emerge on the `Ewa Plain. The project responds to the recognized need on O`ahu for housing.

The last year has seen continuing growth in `Ewa District. Residential development continues to lead overall development, although the City of Kapolei has seen commercial development. In general, plans for development of the district have changed little.

Plans for educational institutions have changed. Kapolei High School has been moved back to the Villages of Kapolei. Consequently, development along the future North-South road is being deferred.

The Planning Department, City and County of Honolulu, has issued proposals for revising the `Ewa and Central O`ahu Development Plans. These have undergone public review, and will likely be forwarded to the City Council in 1996. The `Ewa plan (Honolulu Planning Department, 1995) presented a vision as follows:

> Ewa is seen as the site of a new second city, growing out of the former cane fields over the next 25 to 40 years.
>
> At the core of this development will be the City of Kapolei with an urban mix of commercial, office and residential uses. By 2020, it is projected that the City of Kapolei will house over 7,000 residents and provide work sites for 25,000 private jobs and 5,000 City and State jobs (located at the City's Civic Center). The City Center will become a regional commercial center, attracting customers from all parts of Oahu. . . .
>
> Substantial residential growth (almost 28,000 new units by 2020) will occur primarily in master planned communities including the City of Kapolei, East Kapolei, Ewa by Gentry, Ewa Marina, Ewa Villages, Laulani, Makaiwa Hills, Makakilo, and the Villages of Kapolei.

The Planning Department emphasizes job growth, open space, and greenways as part of `Ewa development.

## ECONOMIC IMPACTS

The East Kapolei project is expected to build out between 1998 and 2013. In most years, about 550 units would be produced. As shown in Exhibit A, the resident population would grow to about 22,400 when the project is fully built. This is 80% of the population anticipated for the earlier version of the project. (As a rule, the current proposal is for a smaller version of the earlier proposal. Differences in design and timing mean that the economic impacts calculated here are not all simply 80% of those shown in the previous version.)

Project construction would provide about 700 direct jobs annually, and support another 1,600 indirect and induced jobs each year during the construction phase. (See Exhibit B.) Operations jobs -- permanent jobs on-site -- would be few at first, and eventually grow to more than 700 jobs (as shown in Exhibit C). These in turn would support an additional 420 indirect and induced jobs in Hawaii.

Incomes associated with the project would reach a high of about $90 million annually (1994 dollars) after the year 2000, when construction remains at a high pitch but some operations jobs will have begun at the site. After buildout, the on-site jobs would support some $10 million in payrolls, and indirect and induced jobs associated with them would support another $10 million annually. (Exhibit D shows more detail concerning wages.)

Workers associated with project operations would occupy an estimated 586 households in Leeward `Oahu. (See Exhibit E for calculations.) Of those, some 80 to 171 units would amount to new demand, i.e., the residents would likely be forming new households, given their project-related jobs. These figures are far less than the total housing supply in the project.

Exhibits F and G itemize major government revenues associated with the project. Property tax revenues for the City and County of Honolulu would climb to about $5.4 million annually at buildout. (The cumulative increase in revenues by 2015 would reach $58 million.) State revenues associated with construction are projected as reaching about $85 million over the entire construction period.

## SOCIAL IMPACTS

Social impacts of the new East Kapolei project will closely resemble those anticipated in the previous SIA. Above all, the project will contribute toward relieving the limited supply and increasing cost of housing on O`ahu. As a result, the project will intensify demand for regional infrastructure, facilities, and services. Likely results include increased problems in the short run, leading to community pressure for timely construction of facilities and delivery of civic services. As the regional population grows, the pressure for expensive projects such as the North-

South Road will also grow. Over the long term, development of the project is expected to lead to construction of the infrastructure planned for `Ewa as an integrated urban area.

Impacts on public facilities will, as with the earlier version of the project, be light. No new medical, fire or police facility is needed in connection with the project. Recreational needs will be addressed in part by the developer, who plans to allocate 32 acres for recreation. In addition, the City is planning an extensive regional park at the Barbers Point Naval Air Station site. This park, which will likely take decades to develop, can provide a shared recreational focus for residents of the many planned communities of the `Ewa Plain.

The project residents will need schools. These are in large part planned as part of the project. Total enrollments in public schools will reach 2,400 at buildout. This figure includes elementary-school pupil counts greater than the total enrollment of a single school and counts of intermediate and high school students that are less than half the enrollment of such schools. (Exhibit H shows the growth of enrollments.)

Residents now dependent on Fort Weaver Road have expressed concern that congestion on this artery and its interchange with H-1 must be relieved immediately. The project's traffic will flow into Farrington Highway and Fort Weaver Road. When the North-South Road is built, project residents will be able to use this road and avoid Fort Weaver Road. Over the long term, the project will add to the volume of traffic that can use Fort Weaver Road. During the first years of project development, the project will depend overwhelmingly on the Fort Weaver interchange, adding to the difficulties that residents already face.

## MITIGATIONS

No additional mitigations are needed. The downsizing of the project and its location on land that will not affect Kaloi Gulch can be counted as mitigations of impacts of the initial project.

## Exhibit A: PROJECT CONSTRUCTION, SALES AND OCCUPANCY

| | 1998 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|
| Units Built | | | | | |
| During Year | 180 | 550 | 550 | 550 | 0 |
| Cumulative | 180 | 1,150 | 3,900 | 6,650 | 8,000 |
| Units Sold (1) | | | | | |
| During Year | 90 | 449 | 550 | 550 | 0 |
| Cumulative | 90 | 817 | 3,533 | 6,283 | 8,000 |
| Units Occupied (2) | | | | | |
| Cumulative | 0 | 349 | 2,834 | 5,447 | 7,600 |
| Resident Population (3) | 257 | 2,327 | 9,974 | 17,593 | 22,400 |

NOTES:

(1) Estimated on assumption that 50% of units delivered in each year are sold in that year, and 75% of unsold inventory is sold in the year.

(2) Estimated on assumption that 95% of units sold through the end of the previous year will be occupied.

(3) Estimated from Planning Department analysis of 1990 and expected 2010 average household size for the comparable developments -- West Loch and Ewa by Gentry (2.90 in 1990, and 2.80 in 2010). This approach allocates population to all units, including vacant ones. After 2010, household size is held constant.

SOURCE: Honolulu Planning Department, 1993b.

## Exhibit B: CONSTRUCTION EMPLOYMENT

| | Annual Averages: 1996-2000 | 2001-2005 | 2006-2010 | 2011-2015 | Cumulative, 1996-2015 |
|---|---|---|---|---|---|
| Construction Spending (1) (in Millions of $s) | $48.0 | $84.6 | $82.0 | $54.0 | $1,234.8 |
| Direct Jobs (2) | 410 | 722 | 699 | 460 | 10,537 |
| Indirect and Induced Jobs (3) | 887 | 1,563 | 1,514 | 997 | 22,809 |
| TOTAL EMPLOYMENT | 1,297 | 2,285 | 2,213 | 1,457 | 33,346 |

NOTES:

1. Estimate does not include land, planning, marketing, sales, and other costs.

2. Estimated from relation between construction spending and workforce (on average, from 1993 construction put in place and construction workforce data) -- 8.53 jobs per million dollars spent on construction.

3. Estimated on basis of unpublished DBEDT Input-Output Model. Employment multiplier of 2.16 is a weighted average of multipliers for single-family (2.29), multi-family (2.17), heavy (1.97) and commercial (1.76) construction.

SOURCES: Bank of Hawaii 1994; Unpublished tables, Department of Business, Economic Development and Tourism.

## Exhibit C: OPERATIONS EMPLOYMENT

| | 1998 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|
| A. DIRECT JOBS | | | | | |
| Real Estate Sales (1) | 9 | 33 | 37 | 37 | 0 |
| Property Management, Maintenance (2) | 4 | 23 | 78 | 133 | 160 |
| Commercial (3) | 0 | 70 | 279 | 418 | 558 |
| Total | 13 | 126 | 393 | 588 | 718 |
| DIRECT JOBS – BY INDUSTRY (4) | | | | | |
| Finance | 11 | 45 | 76 | 103 | 80 |
| Agriculture (Landscaping) | 2 | 12 | 39 | 67 | 80 |
| Retail Trade | 0 | 56 | 223 | 335 | 446 |
| Automobile, Misc. Services | 0 | 14 | 56 | 84 | 112 |
| B. INDIRECT AND INDUCED JOBS ASSOCIATED WITH DIRECT JOBS IN: | | | | | |
| Finance | 11 | 45 | 76 | 103 | 80 |
| Agriculture (Landscaping) | 1 | 5 | 18 | 30 | 36 |
| Retail Trade | 0 | 32 | 127 | 191 | 254 |
| Automobile, Misc. Services | 0 | 7 | 27 | 40 | 54 |
| TOTALOPERATIONS-RELATED EMPLOYMENT (A+B) | 24 | 214 | 641 | 952 | 1,141 |

NOTES:
(1) Based on an estimated ten jobs per 100 unsold units in inventory.
(2) Based on an average of 2 jobs per 100 units built.
(3) Based on average of 4 jobs per 1,000 square feet of commercial space, assuming a net buildable area of 20% of the commercial acreage.
(4) Allocation of jobs to industry categories by Community Resources, Inc. Indirect and induced jobs supported by operations jobs from unpublished State Input-Output model Type II employment multipliers for these industries.

## Exhibit D: PERSONAL INCOME ASSOCIATED WITH PROJECT-RELATED JOBS

| | ANNUAL AVERAGE INCOME ($ Millions) | | | |
|---|---|---|---|---|
| | 1996-2000 | 2001-2005 | 2006-2010 | 2011-2015 |
| DIRECT JOBS | | | | |
| Construction (1) | $18.2 | $32.1 | $31.1 | $15.3 |
| Operations | $0.8 | $4.4 | $7.4 | $9.9 |
| INDIRECT AND INDUCED JOBS | | | | |
| Construction (1) | $24.6 | $43.3 | $42.0 | $20.7 |
| Operations | $0.9 | $5.1 | $8.8 | $11.8 |
| TOTAL | $44.6 | $84.9 | $89.2 | $50.5 |

NOTES: Incomes estimates from reports of statewide average income by industry in 1994, with jobs allocated by industry as shown in earlier exhibits.
Indirect and induced employment wages estimated from statewide average annual wage, all covered employment

(1) With construction ending in 2013, the average construction income for the five-year period is lowered by two years without such income.

SOURCES: Hawaii Department of Labor and Industrial Relations, 1995.

# Exhibit E: POPULATION AND HOUSING ASSOCIATED WITH PROJECT-RELATED JOBS

| | 1998 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|
| OPERATIONS JOBS | | | | | |
| Total Direct Jobs | 13 | 128 | 393 | 588 | 718 |
| Total Indirect and Induced Jobs | 12 | 88 | 247 | 364 | 424 |
| LEEWARD OAHU SHARE OF JOBS (2) | | | | | |
| Direct Jobs | 1 | 12 | 388 | 582 | 718 |
| Indirect and Induced Jobs | 2 | 19 | 61 | 103 | 137 |
| POPULATION SUPPORTED BY WORKFORCE (INCLUDING WORKERS) (3) | | | | | |
| Statewide | 50 | 444 | 1,326 | 1,970 | 2,363 |
| Leeward | 28 | 290 | 930 | 1,419 | 1,789 |
| WORKFORCE HOUSEHOLDS (4) | | | | | |
| Statewide | 17 | 147 | 439 | 652 | 782 |
| Leeward | 9 | 96 | 308 | 470 | 586 |
| ESTIMATED EVENTUAL DEMAND FOR *NEW HOUSING* | | | | | |
| Low Range (5) | | | | | |
| Statewide | 2 | 22 | 66 | 98 | 11 |
| Leeward | 1 | 14 | 46 | 70 | 88 |
| High Range (6) | | | | | |
| Statewide | 5 | 44 | 132 | 196 | 235 |
| Leeward | 3 | 29 | 92 | 14 | 176 |

NOTES:

(1) From Exhibit 3-C.

(2) Estimated on assumption that 85% of real estate sales jobs are on site, all other direct operations jobs are on site. Regional share of indirect and induced jobs is estimated as 20% at first, but as increasing to 32.4% 2015. This increase in regional share (at a rate of 2.7% annually) from a weighted average of the Planning Department's projection of growth in support jobs in the region by 2010

(3) Assumes 2.07 persons per operations job, based on 1990 County average of 1.46 workers per household.

(4) Based on 1990 County average of 3.02 persons per household.

(5) Assuming that 15% of worker households will eventually require new

(6) Assumes that 30% of worker households will eventually need new

# Exhibit F: REAL PROPERTY VALUES AND TAXES, EAST KAPOLEI PROJECT

| | 1994 (1) | 1998 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|---|
| **A. AREAS (ACRES)** | | | | | | |
| ACREAGE TO BE DEVELOPED | 669 | 669 | 573 | 343 | 114 | 0 |
| Unimproved Res. | 0 | 669 | 573 | 343 | 114 | 0 |
| Agricultural | 669 | 0 | 0 | 0 | 0 | 0 |
| NEWLY DEVELOPED ACREAGE (ANN.) | | | | | | |
| Improved Residential | | 0 | 19 | 19 | 19 | 0 |
| Apartment | | 0 | 26 | 26 | 26 | 0 |
| Commercial | | 0 | 0 | 2 | 0 | 0 |
| CUMULATIVE DEVELOPED: | | | | | | |
| Improved Residential | | 0 | 40 | 135 | 231 | 277 |
| Apartment | | 0 | 54 | 183 | 313 | 376 |
| Commercial | | 0 | 2 | 8 | 12 | 16 |
| TOTAL AREA DEVELOPED | | 0 | 96 | 327 | 555 | 669 |
| **B. VALUES ($1,000s)** | | | | | | |
| ACREAGE TO BE DEVELOPED | | $56,893 | $48,740 | $29,141 | $9,711 | $0 |
| Unimproved Res. | | $0 | $0 | $0 | $0 | $0 |
| Agricultural | | | | | | |
| ANNUAL NEW DEVELOPED LAND VALUE | | | | | | |
| Improved Residential | | $0 | $9,326 | $9,326 | $9,326 | $0 |
| Apartment | | $0 | $22,234 | $22,234 | $22,234 | $0 |
| Commercial | | $0 | $0 | $703 | $0 | $0 |
| CUMULATIVE DEVELOPED LAND VALUE: | | | | | | |
| Improved Residential | | $0 | $19,499 | $66,128 | $112,756 | $135,646 |
| Apartment | | $0 | $46,489 | $157,660 | $268,831 | $323,405 |
| Commercial | | $0 | $703 | $2,813 | $4,219 | $5,626 |
| ANNUAL NEW IMPROVED VALUE | | | | | | |
| Improved Residential | | $0 | $31,429 | $31,429 | $31,429 | $0 |
| Apartment (New Units) | | $0 | $57,021 | $57,021 | $57,021 | $0 |
| Apartment (Buybacks) (2) | | $0 | $0 | $0 | $198 | $198 |
| Commercial | | $0 | $0 | $1,467 | $0 | $0 |
| CUMULATIVE IMPROVED VALUE | | | | | | |
| Improved Residential | | $0 | $65,716 | $222,862 | $380,009 | $457,154 |
| Apartment | | $0 | $119,226 | $404,330 | $689,848 | $830,799 |
| Commercial | | $0 | $1,467 | $5,867 | $8,801 | $11,734 |
| TOTAL VALUE (LAND + IMPROVED) | | $56,893 | $301,840 | $888,801 | $1,474,175 | $1,764,364 |

# Exhibit F (Cont.)

| | 1994 (1) | 1998 | 2000 | 2005 | 2010 | 2015 |
|---|---|---|---|---|---|---|
| C. EXEMPTIONS (3) | | | | | | |
| VALUE ($1,000s) | | | | | | |
| Improved Residential | | $0 | $11,960 | $40,560 | $69,160 | $83,200 |
| Apartment | | $0 | $34,040 | $115,440 | $196,840 | $238,800 |
| CUMULATIVE TAXABLE LAND VALUE | | | | | | |
| Improved Residential | | $0 | $7,539 | $25,568 | $43,596 | $52,446 |
| Apartment | | $0 | $12,449 | $42,220 | $71,991 | $86,605 |
| Commercial | | $0 | $1,467 | $5,867 | $8,801 | $11,734 |
| D. TAXES ($1,000s) | | | | | | |
| ACREAGE TO BE DEVELOPED | | | | | | |
| Unimproved Res. | | $223 | $191 | $114 | $38 | $0 |
| Agricultural | $5 | $0 | $0 | $0 | $0 | $0 |
| DEVELOPED LAND VALUE | | | | | | |
| Improved Residential | | $0 | $24 | $80 | $136 | $164 |
| Apartment | | $0 | $44 | $149 | $253 | $305 |
| Commercial | | $0 | $12 | $50 | $75 | $100 |
| IMPROVED VALUE | | | | | | |
| Improved Residential | | $0 | $258 | $874 | $1,490 | $1,792 |
| Apartment | | $0 | $420 | $1,423 | $2,428 | $2,924 |
| Commercial, Industrial | | $0 | $12 | $50 | $75 | $100 |
| TOTAL TAXES | | $223 | $961 | $2,739 | $4,495 | $5,385 |
| E. INCREASE IN TAX REVENUES (1,000s) | | | | | | |
| TAX REVENUES BEFORE DEVELOPMENT (4) | $5 | | | | | |
| DIFFERENCE IN TAX REVENUES | | | | | | |
| TOTAL TAXES: | | | | | | |
| Annual | | $218 | $955 | $2,734 | $4,490 | $5,379 |
| Cumulative | | $218 | $2,116 | $12,228 | $31,163 | $58,059 |

NOTES:
- * All figures in thousands of dollars, except Areas (in acres).
- (1) Acreage "to be developed" is taxable area, excluding schools, parks, roads. Analysis based on increase in value from time of initial agreements between Schuler Homes and Campbell Estate. Taxable value of low-income and gap-group units assumed to be constrained by buybacks for ten years, after which it would rise to market value.
- (2) Standard homeowner's exemption ($40,000) assumed for all units.

SOURCES: Honolulu City and County 1994-1995 real property tax rates; City and County tax records

## Exhibit G: STATE REVENUES ASSOCIATED WITH PROJECT CONSTRUCTION

| | ANNUAL AVERAGE REVENUES (Thousands $s) | | | |
|---|---|---|---|---|
| | 1996-2000 | 2001-2005 | 2006-2010 | 2011-2015 |
| EXCISE TAXES | | | | |
| Construction Spending (1) | $1,921 | $3,384 | $3,278 | $1,619 |
| Construction-Related Workforce Spending (2) | $554 | $976 | $946 | $467 |
| CORPORATE INCOME TAX (3) | | | | |
| Construction (3) | $120 | $212 | $205 | $101 |
| PERSONAL INCOME TAX (4) | | | | |
| Construction-Related Workforce Incomes | $735 | $1,295 | $1,255 | $620 |
| TOTAL | $3,330 | $5,868 | $5,684 | $2,807 |

NOTES: Cumulative total revenues, 1996-2015: $85.6 million

(1) Calculated at 4% of direct construction spending.

(2) Calculated at 4% of workforce income spent on taxable items. Disposable income estimated from 1988-1989 U.S. Bureau of Labor Statistics Survey.

(3) Calculated at 0.25% of construction spending, from 1989-1990 data on business receipts and corporate income taxes collected.

(4) Calculated at 4.04% of wages.

SOURCES: Hawaii Department of Business, Economic Development and Tourism, 1992; Hawaii Department of Taxation, 1992; Tax Foundation of Hawaii, 1991, 1992.

## Exhibit H: ESTIMATED DOE SCHOOL ENROLLMENTS, EAST KAPOLEI PROJECT RESIDENTS

| | 1998 | 2000 | 2005 | 2010 | Buildout |
|---|---|---|---|---|---|
| UNITS BUILT (1) | 180 | 1,150 | 3,900 | 6,650 | 8,000 |
| DOE STUDENTS (2) | | | | | |
| Elementary (K to 6) | 32 | 204 | 691 | 1,178 | 1,418 |
| Intermediate (7 to 8) | 9 | 58 | 195 | 333 | 400 |
| High (9 to 12) | 13 | 82 | 277 | 472 | 568 |
| TOTAL | 54 | 343 | 1,163 | 1,983 | 2,386 |

NOTES: (1) From Exhibit A.

(2) Based on average number of expected students per 100 households as calculated by the DOE (letter from Dr. Herman Aizawa, Superintendent, November 4, 1994).

## REFERENCES


Community Resources, Inc. Socio-Economic Impact Assessment of East Kapolei Residential Project. November 1994. IN Helber Hastert & Fee, Planners, Draft Environmental Impact Statement, East Kapolei Project, Ewa, Oahu, Hawaii. Prepared for Schuler Homes, Inc. Honolulu, HI, January 1995.

Honolulu, City and County, Planning Department. Ewa Development Plan: Public Review Draft. Honolulu, HI, 1995.

# F

ENVIRONMENTAL NOISE ASSESSMENT, EAST KAPOLEI PROJECT, SEPTEMBER 1994;

ENVIRONMENTAL NOISE ASSESSMENT, EAST KAPOLEI PROJECT (UPDATE), DECEMBER 13, 1995.

DARBY & ASSOCIATES

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#94-20

# ENVIRONMENTAL NOISE ASSESSMENT
# SCHULER-EWA DEVELOPMENT
# EWA, OAHU, HAWAII

SEPTEMBER 16, 1994

PREPARED FOR:
SCHULER HOMES
828 FORT STREET MALL
HONOLULU, HAWAII 96813

PREPARED BY:
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dba DARBY & ASSOCIATES
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## 1.0 SUMMARY

1.1 The proposed project site is currently exposed to low ambient noise levels of approximately 48 to 55 dBA which is typical of rural areas. The dominant noise sources include wind in foliage and occasional distant aircraft flyovers.

1.2 Nearby noise sensitive areas include the Ewa Villages which currently experiences low ambient noise levels of approximately 47 to 50 dBA.

1.3 Traffic noise level increases along Farrington Highway due to additional traffic generated by the project will be negligible at locations along Farrington Highway.

1.4 The dominant noise source during project construction will probably be earth moving equipment, such as bulldozers and diesel-powered trucks. Any noise impact on the Ewa Villages from such activity should, however, be relatively short-term.

1.5 The day-night average sound level, Ldn, at the project site due to aircraft operations is less than 55 dBA, thus compatible with the State DOT residential land use guidelines. Although at times audible, infrequent aircraft operations associated with HIA and BPNAS should not significantly impact the proposed development.

1.6 Results indicate that residences along the interior arterials should be exposed to Ldn levels less than 65 dBA which corresponds to HUD's "Acceptable" Site.

1.7 Residences along Farrington Highway and North-South Road may be exposed to future day-night average sound levels, Ldn, greater than the HUD recommended limit of 65 dBA due to traffic noise if located too close to the roadways. Noise mitigation should be implemented to conform with HUD noise exposure guidelines for housing.

## 2.0 PROJECT DESCRIPTION

The Schuler-Ewa Development project involves 1,022 acres of land in Ewa, Oahu, Hawaii. The project site is located makai of Farrington Highway as shown in Figure 1. Currently, the project area is used for agriculture, specifically sugarcane. The project site is bordered to the south by Ewa Villages, to the east by sugarcane fields, and to the west by sugarcane fields. Sugarcane operations are slated to be phased out within a few years. The current development plan includes 10,750 residential units, schools, and parks. It is assumed that Phase 1 will be completed in 2005 with 5,000 units, and Phase 2 will be completed in 2011 with an additional 5,750 units. The Schuler-Ewa Development Plan is shown in Figure 2.

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## 3.0 NOISE STANDARDS

Various local and federal agencies specify guidelines and standards in assessing environmental noise and set noise limits as a function of land use. A brief description of common acoustic terminology is presented in Appendix A.

3.1 State Department of Health - DOH specifies allowable property line noise levels that shall not be exceeded for more than 10% of the time during any 20-minute period [Reference 1]. These are enforced for any location at or beyond the property line. The specified noise limits vary depending on the land use and time of day as shown in Figure 3. DOH also specifies the following with respect to adjacent zoning and order of precedence.

> "Where the allowable noise level between two adjacent zoning districts differ, the lower allowable noise level shall be used. For example, the allowable noise level for the residential district shall be used at the property line between residential and business districts.
>
> The limits specified in the allowable noise levels table shall apply subject to the order of precedence in which uses were initiated after the effective date of this rule; provided that a new order of precedence is established when any use is discontinued. The initiation of use shall be measured by the date of rezoning. For example, if agricultural or industrial operations are conducted next to a lot used as residence, the agricultural or industrial limits would apply if the building permit for the residence was obtained after the agricultural or industrial operations had been initiated, after the effective date of this rule. Residential limits would apply if the building permit for the residence was obtained before agricultural or industrial operations had been initiated."

3.2 City and County of Honolulu Land Use Ordinance (LUO) - The Department of Land Utilization specifies maximum allowable levels at the property line [Reference 2]. The LUO criteria differ from those of the DOH in that they use octave band sound levels instead of A-weighted levels and no temporal factor is involved. LUO noise regulations are theoretically enforced by the Building Department, however, since they do not have noise measurement capability, noise complaints are usually handled by DOH.

3.3 State Department of Transportation, Airports Division - The Department of Transportation (DOT) specifies land use compatibility guidelines for aircraft noise exposure [Reference 3]. These guidelines are based on

maximum allowable yearly day-night average sound levels, Ldn, for various specified land uses. A residential land use, which is specified as single-family homes, apartments, hotels, and resorts, is compatible with an aircraft generated Ldn less than or equal to 60 dBA. However, DOT states,

> "Where the community determines that these uses must be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 Ldn or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure, plus air conditioning, may be required to provide additional outdoor to indoor NLR, and will not eliminate outdoor noise problems."

The DOT guidelines also specify 60 dBA as the maximum allowable Ldn level for school, day care center, and church uses without any mitigation measures. Commercial uses such as retail shops, restaurants, shopping centers, etc. are compatible with Ldn levels up to 65 dB without any mitigation measures. With noise mitigation measures implemented, such commercial uses are allowed in areas exposed to an Ldn as high as 75 dBA.

3.4 U.S. Federal Highway Administration - The Federal Highway Administration (FHWA) has established a set of design goals for traffic noise exposure [Reference 4]. The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, Leq. For example, Category B, defined as picnic and recreation areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior Leq of 67 dBA and a maximum interior Leq of 52 dBA. These limits are viewed as design goals, and all projects which are developed to meet these limits are deemed in conformance with the FHWA noise standards.

3.5 U.S. Department of Housing and Urban Development - The U.S. Department of Housing and Urban Development (HUD) has established Site Acceptability Standards for interior and exterior noise for housing [Reference 5]. These standards are based on day-night average sound levels, Ldn, and identify the need for noise abatement, either at the site property line or in the building construction. HUD Site Acceptability Criteria rank sites as Acceptable, Normally Unacceptable, or Unacceptable. "Acceptable" sites are those where noise levels do not exceed an Ldn of 65 dBA. Housing on acceptable sites do not require additional noise attenuation other than that provided in customary building techniques. "Normally unacceptable" sites are those where the Ldn is above 65 dBA, but does not exceed 75 dBA. Housing on normally unacceptable sites requires some means of noise abatement, either at the property line or

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in the building construction, to ensure the interior noise levels are acceptable. "Unacceptable" sites are those where the Ldn is 75 dBA or higher. The term "unacceptable" does not necessarily mean that housing cannot be built on these sites, but rather that more sophisticated sound attenuation would likely be needed.

3.6 U.S. Environmental Protection Agency - The U.S. Environmental Protection Agency (EPA) has identified a range of yearly day-night average sound levels, Ldn, sufficient to protect public health and welfare from the effects of environmental noise [Reference 6]. The EPA has established a goal to reduce exterior environmental noise to an Ldn not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to an Ldn not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as they have no authority to regulate noise levels, but rather these goals are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

## 4.0 EXISTING ACOUSTICAL ENVIRONMENT

4.1 General - Ambient noise measurements were conducted on September 8, 1994 to assess the existing acoustical environment within and adjacent to the project site. The noise measurement locations are shown in Figure 4. Noise level measurements were taken using a Larson-Davis Laboratories Model 700 Type 2 Integrating Sound Level Meter. The noise measurement results are expressed in terms of the 90-Percentile Exceedence Sound Level, L90, which represents a measure of the residual or background noise minimally influenced by nearby discrete events. A brief description of statistical noise levels commonly used to describe environmental noise is presented in Appendix A.

4.2 Project Site - The proposed project site, which is currently planted in sugarcane, experiences relatively low noise levels. The existing ambient noise level (L90) is approximately 48 to 55 dBA within the project site, which is typical of rural areas. Presently, the dominant noise sources include wind, traffic and occasional distant aircraft flyovers. An additional potential noise source within the project site is from sugarcane operations, however, no sugarcane operations were experienced during the field measurements.

4.3 Project Vicinity - The sugarcane fields surrounding the project site experience an acoustical environment similar to the project site with wind, traffic, and occasional distant aircraft being the dominant noise sources. Presently, the nearest residential area is the Ewa Villges south of the project site. The Ewa Villages experiences an ambient noise level (L90) of approximately 47 to 50 dBA.

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## 5.0 POTENTIAL NOISE IMPACT DUE TO PROJECT

5.1 Additional Traffic Generated by the Project - Measured traffic noise levels and predicted traffic volumes [Reference 7] were used in conjunction with the Federal Highway Administration (FHWA) Traffic Noise Prediction Model [Reference 8] to estimate the traffic noise increase as a result of the project. The traffic noise increase along Farrington Highway was predicted. The projected future (2005 and 2011) traffic noise level increases during peak traffic hours are summarized in Table 5.1.

TABLE 5.1
Projected Future (2005 and 2011) Traffic Noise Level
Leq or Ldn (dBA) Increases During Peak Traffic Hours
Along Farrington Highway

| | Without Project | With Project | Due to Project |
|---|---|---|---|
| Future 2005 Traffic Noise Level Increase (dBA) | | | |
| AM | 4.2 | 4.7 | 0.5 |
| PM | 3.4 | 4.1 | 0.7 |
| Future 2011 Traffic Noise Level Increase (dBA) | | | |
| AM | 4.7 | 4.7 | 0.0 |
| PM | 4.1 | 6.6 | 2.5 |

The predicted traffic noise level increases along Farrington Highway due to additional traffic generated by the project were less than or equal to 2.5 dB. Therefore, the traffic noise level increase due to project generated traffic may be perceptible by some people at noise sensitive locations along Farrington Highway.

5.3 Construction Noise - Development of the project will involve excavation, grading, and the construction of infrastructure and buildings. The various construction phases of the project may generate significant amounts of noise, which may impact the nearby residential areas south of the project site. The actual noise is dependent upon the methods employed during each stage of the construction process. Typical ranges of construction equipment noise are shown in Figure 5. Earthmoving equipment, such as bulldozers and diesel-powered trucks, will probably be the loudest equipment used during construction.

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In cases where construction noise exceeds, or is expected to exceed, the DOH's "allowable" property line limits, a permit must be obtained from the DOH to allow the operation of vehicles, construction equipment, power tools, etc. which emit noise levels in excess of the "allowable" limits. Required permit conditions for construction activities are:

> "No permit shall allow construction activities creating excessive noise...before 7:00 am and after 6:00 pm of the same day."
>
> "No permit shall allow construction activities which emit noise in excess of ninety-five dB(A)...except between 9:00 am and 5:30 pm of the same day."
>
> "No permit shall allow construction activities which exceed the allowable noise levels on Sundays and on...[certain] holidays. Activities exceeding ninety-five dB(A) shall [also] be prohibited on Saturdays."

In additional, construction equipment and on-site vehicles or devices requiring an exhaust of gas or air must be equipped with mufflers. Also, construction vehicles using traffic-ways must satisfy the DOH's vehicular noise requirements [Reference 9].

Blasting, if required, could also produce noise impacts. However, blasting at construction sites near populated areas is usually accomplished by using numerous small charges detonated with small time delays. Blast mats can also be used to assist in directing the explosive energy into the rock, controlling flying debris, and muffling the noise. Thus, with the appropriate blast design techniques, the noise from blasting can be controlled within acceptable limits at the closest noise sensitive locations.

## 6.0 POTENTIAL NOISE IMPACT ON THE PROJECT

6.1 Aircraft - The proposed project site is within approximately four to eight miles of Honolulu International Airport (including Hickam AFB) (HIA) and Barbers Point Naval Air Station (BPNAS). Due to the distance from the project site, the overall day-night average sound level, Ldn, due to air traffic associated with HIA and BPNAS will be less than 55 dBA at the project site [References 10 and 11], which is compatible with the State DOT residential guidelines. However, due to the vicinity of the project site to flight tracks associated with HIA and BPNAS infrequent aircraft flyovers may, at times, be audible at the project site. As shown in Figures 6 and 7, the project site is approximately 1.5 miles from HIA arrival flight track 17 & 18 & 20 and departure track 16 which conducts an average of approximately 120 general aviation aircraft

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operations per day (daytime only) [Reference 10]. As shown in Figure 8, the project site is near BPNAS flight track 22RHA1/04D1 which conducts an average of approximately 10 helicopter operations per day (daytime and nighttime) [Reference 11]. Although these aircraft flyovers may, at times, be audible, aircraft noise should not significantly impact the proposed development.

6.2 Traffic Noise - The proposed plan for traffic circulation within the project site is shown in Figure 9. The proposed residential areas within the project site will potentially be impacted by traffic noise. The Federal Highway Administration (FHWA) Traffic Noise Prediction Model has been using along with traffic data provided in the referenced traffic study to predict future traffic noise levels along Farrington Highway, North-South Road, and interior arterials. Traffic noise was predicted at the locations shown in Figure 9.

Future traffic noise levels along Farrington Highway were based on the predicted peak hour traffic volumes with a 2.5% medium truck and 1.5% heavy truck mix, a 35 mph posted speed limit, and a future expansion to a four-lane roadway. The day-night average sound levels, Ldn, were estimated from the peak hour equivalent-continuous noise levels, Leq, as specified by HUD [Reference 5]. Results at Location A indicate that residences less than approximately 74 ft from the centerline of the right-of-way (ROW) will be exposed to Ldn levels between 75 and 70 dBA (HUD "Normally Unacceptable" Site), and residences between approximately 74 and 219 ft from the centerline will be exposed to Ldn levels between 70 and 65 dBA (HUD "Normally Unacceptable" Site). These distances are based on a four-lane roadway without a median or center island between the direcitonal traffic. If the four-lane roadway will include a median, this analysis would require updating to account for the increased distance between the directional traffic. Similar results at Location B indicate that residences less than approximately 104 ft from the centerline will be exposed to Ldn levels between 75 and 70 dBA, and residences between approximately 104 ft and 299 ft from the centerline will be exposed to Ldn levels between 70 and 65 dBA. These results are summarized in Table 6.1 with respect to HUD criteria.

The project is bordered on the west by the proposed North-South Road. Future traffic noise levels along North-South Road were based on the predicted peak hour traffic volumes with a 2.5% medium truck and 1.5% heavy truck mix, a 35 mph posted speed limit, and a four-lane roadway. Results at Locations D and E are also sumamrized in Table 6.1.

Future traffic noise levels along the interior arterials were based on the predicted peak hour traffic volumes with a 2.5% medium truck and 0.5% heavy truck mix, a 25 mph posted speed limit, and a four-lane roadway. Results indicate that residences along the interior arterials should be exposed to Ldn levels less than 65 dBA (HUD "Acceptable" Site).

The minimum setbacks listed in Table 6.1 are worst cases and detailed analysis of specific building projects may allow smaller setbacks. For example, if the roadway is elevated above future housing, a barrier may effectively shield windows in second-floor units allowing substantially less setback if optimum planning, grading, and design are incorporated.

Table 6.1

Estimated minimum setback distances* for multi-story, naturally ventilated residences required by HUD traffic noise criteria

| Location | Roadway | HUD "Acceptable" Site | HUD "Normally Unacceptable" Site | | HUD "Unacceptable" Site |
|---|---|---|---|---|---|
| | | Ldn < 65 | Ldn 65-70 | Ldn 70-75 | Ldn >75 |
| A | Farrington Hwy | >219' | 219 to 74' | 74' to ROW | - |
| B | Farrington Hwy | >299' | 299 to 104' | 104' to ROW | - |
| D | North-South Rd | >220' | 220 to 80' | 80' to ROW | - |
| E | North-South Rd | >295' | 295 to 98' | 98' to ROW | - |

*Based on distance from right-of-way (ROW) centerline and 6.5 feet HUD requirement between noise level prediction location and the building setback line.

As previously discussed in Section 3.5, HUD has established Site Acceptability Standards for interior and exterior noise exposure at housing areas. These standards are based on Ldn levels and identify the need for noise abatement. Housing areas exposed to Ldn levels between 65 and 75 dBA require some means of noise abatement, either at the property line or in the building construction in order to meed HUD criteria and, thus, be eligible for potential HUD/FHA financing. Therefore, noise mitigation measures should be implemented to reduce the traffic noise exposure along Farrington Highway and North-South Road. HUD standards for residential developments exposed to Ldn levels between 65 and 70 dBA, require the building construction to provide a minimum of 5 dB attenuation in addition to "attenuation provided by buildings as commonly constructed in the area, and requiring open windows for ventilation". Similarly, HUD standards require a minimum of 10 dB additional attenuation for residential developments exposed to Ldn levels between 70 and 75 dBA.

Mitigation of traffic noise along Farrington Highway and North-South Road would include properly constructing a sound barrier along the roadway, such as a noise barrier wall and/or a landscaped earth berm, which clearly blocks the line-of-sight to the traffic. While a noise barrier along the roadway may provide adequate traffic noise attenuation at the first level of naturally ventilated residences, it may be impractical to construct a barrier tall enough to afford noise reduction at

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the upper levels of multi-story residences. Therefore, by HUD requirements, the upper-level units of the apartment buildings exposed to Ldn levels between 70 and 75 dBA, must provide an additional 10 dB interior attenuation. However, an additional 10 dB room attenuation is somewhat difficult to achieve with sound absorptive materials commonly used in noise sensitive living spaces. Therefore, the upper-level of the residences within the 70 to 75 Ldn zone should be air-conditioned to allow closed windows for noise reduction purposes. Similarly, by HUD requirements, the residences exposed to Ldn levels between 65 and 70 dBA, must provide an additional 5 dB room attenuation. Additional room attenuation is commonly achieved in naturally ventilated living spaces, such as bedrooms, by installing carpeting (with pad), louvered closet doors, and absorptive ceiling tiles (as opposed to the standard hard tile floors, solid-faced closet doors, and hard-surface ceilings, respectively).

6.3 Sugarcane Agriculture - Sugarcane agriculture involves activities such as land preparation, harvesting, hauling, etc., which are characterized by periods of intense activity with equipment operating 24 hours per day. Lands both west and east of the proposed project site are currently sugarcane. If nearby sugarcane operations continue beyond the completion of the proposed project, noise from agriculture activities may impact nearby noise sensitive residential areas.

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**REFERENCES:**


1. *Chapter 43 - Community Noise Control for Oahu*, Department of Health, State of Hawaii, Administrative Rules, Title 11, November 6, 1981.

2. *Section 3.11, Noise Regulations*, Land Use Ordinance, City and County of Honolulu, Oahu 22, 1986.

3. *Study Recommendations for Local Land Use Compatibility with Yearly Day-Night Average Sound Levels*, State Department of Transportation, Airports Division, Received August 1991, published in Reference 10.

4. *Department of Transportation, Federal Highway Administration Procedures for Abatement of Highway Traffic Noise*, Title 23, CFR, Chapter 1, Subchapter J, Part 772, 38 FR 15953, June 19, 1973, Revised at 47 FR 29654, July 8, 1982.

5. *HUD Environment Criteria and Standards*, 24 CFR 51, Federal Register, Volume 44, No. 135, July 12, 1979; Amended 49 FR 880, January 6, 1984.

6. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.

7. 2005 and 2011 Traffic Forecasts, Schuler-Ewa Development, Pacific Planning & Engineering, Inc., August 25, 1994.

8. *FHWA Highway Traffic Noise Prediction Model*, FHWA - RD - 77 - 108; U.S. Department of Transportation, December 1978.

9. *Chapter 42 - Vehicular Noise Control for Oahu*, Department of Health, State of Hawaii, Administrative Rules, Title 11, November 6, 1981.

10. *Honolulu International Airport Master Plan Update & Noise Compatibility Program*, State of Hawaii Department of Transportation, Airports Division, Vol. 2, October 1989.

11. *Naval Air Station Barbers Point Air Installations Compatible Use Zones (AICUZ) Noise Contours and Supporting Data*, Naval Facilities Engineering Command, Alexandria, VA, July, 1989.

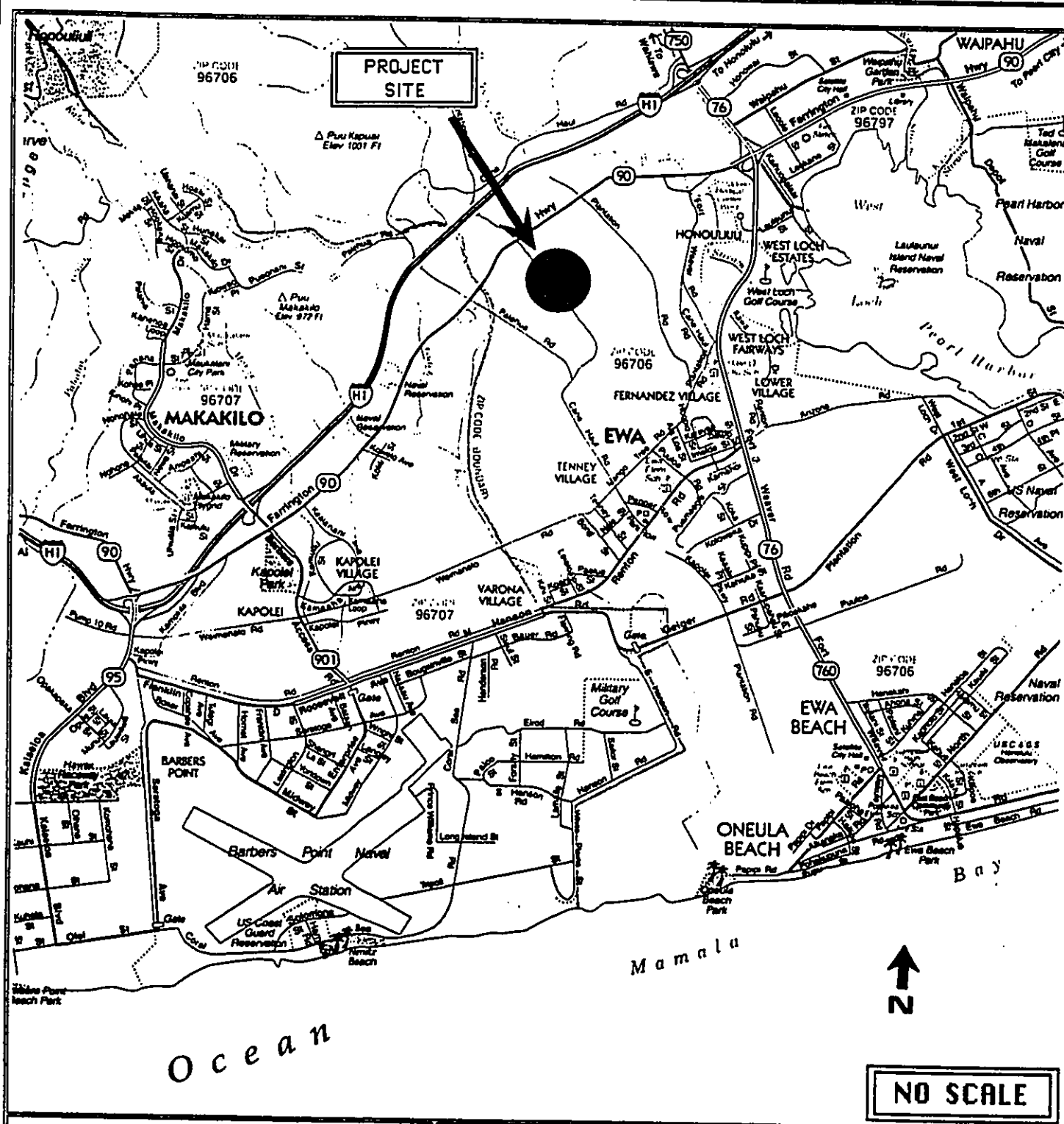


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FIGURE 1 - PROJECT SITE AND VICINITY

| Land Use Summary (Acres) | | | |
|---|---|---|---|
| Land Use | Phase 1 | Phase 2 | Total |
| Residential | 458 | 490 | 826 |
| Commercial | 10 | 10 | 20 |
| School | 12 | 0 | 12 |
| Parks | 10 | 10 | 20 |
| Circulation | 10 | 12 | 22 |
| Total | 500 | 522 | 1,022 |

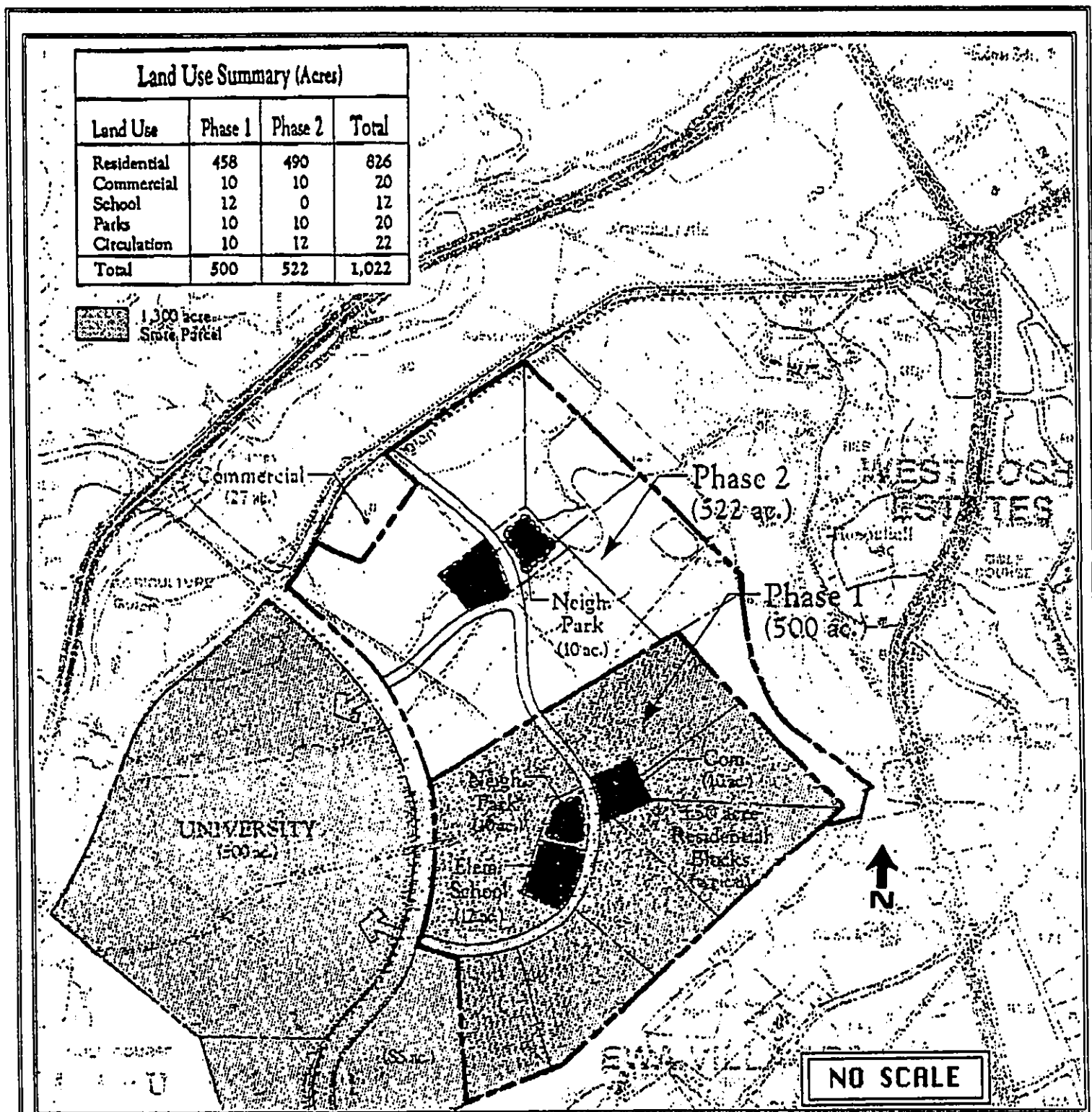


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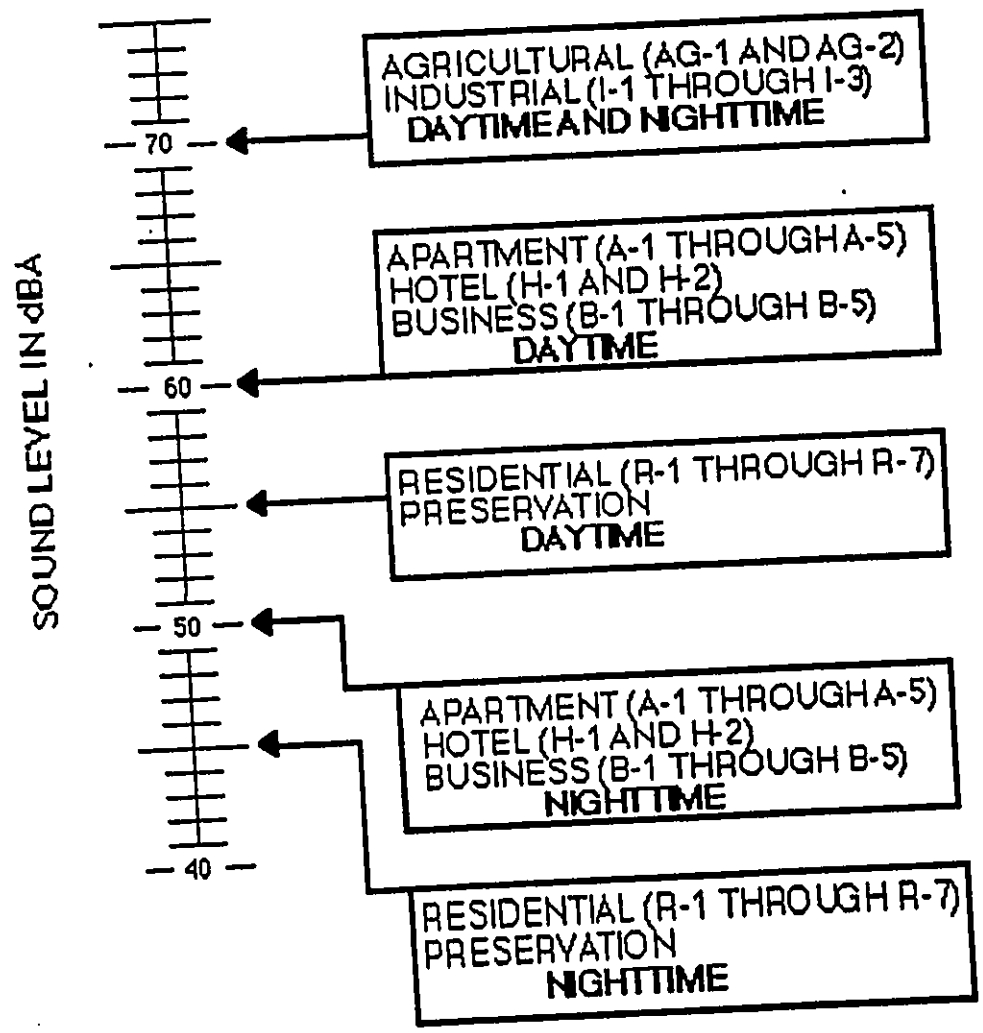
FIGURE 2 - SCHULER-EWA DEVELOPMENT PLAN




NOTE: LEVELS INDICATED BY ZONING DISTRICT ARE THE "ALLOWABLE" LEVELS THAT SHALL NOT BE EXCEEDED FOR MORE THAN TEN PERCENT OF THE TIME WITHIN ANY TWENTY MINUTE PERIOD DURING THE TIME PERIOD SHOWN (DAYTIME: 7:00 A.M. TO 10:00 P.M., NIGHTTIME: 10:00 P.M. TO 7:00 A.M.)

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FIGURE 3 - ALLOWABLE NOISE LEVELS FOR VARIOUS ZONING DISTRICTS (*COMMUNITY NOISE CONTROL FOR OAHU*, STATE OF HAWAII DEPARTMENT OF HEALTH)

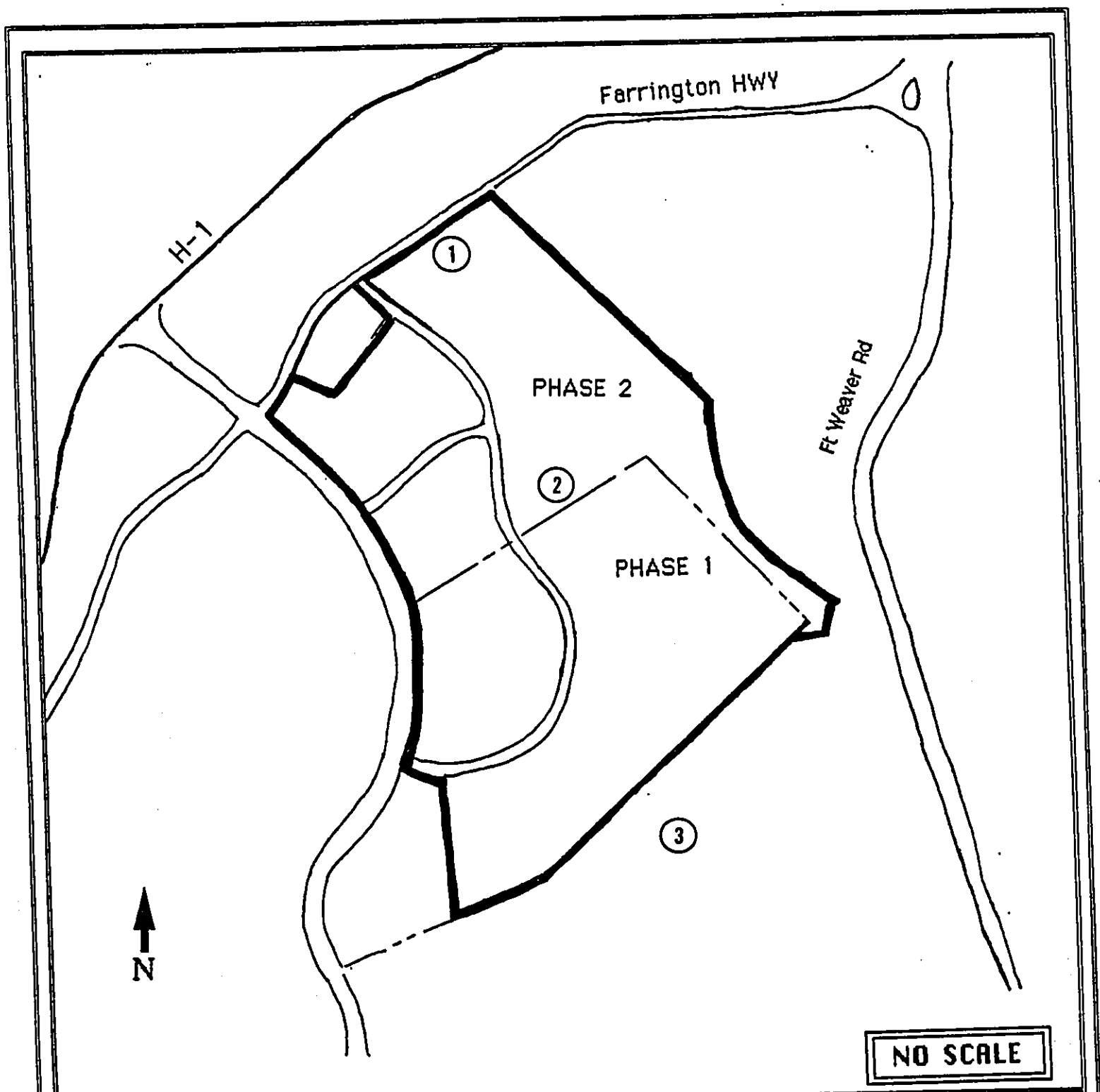


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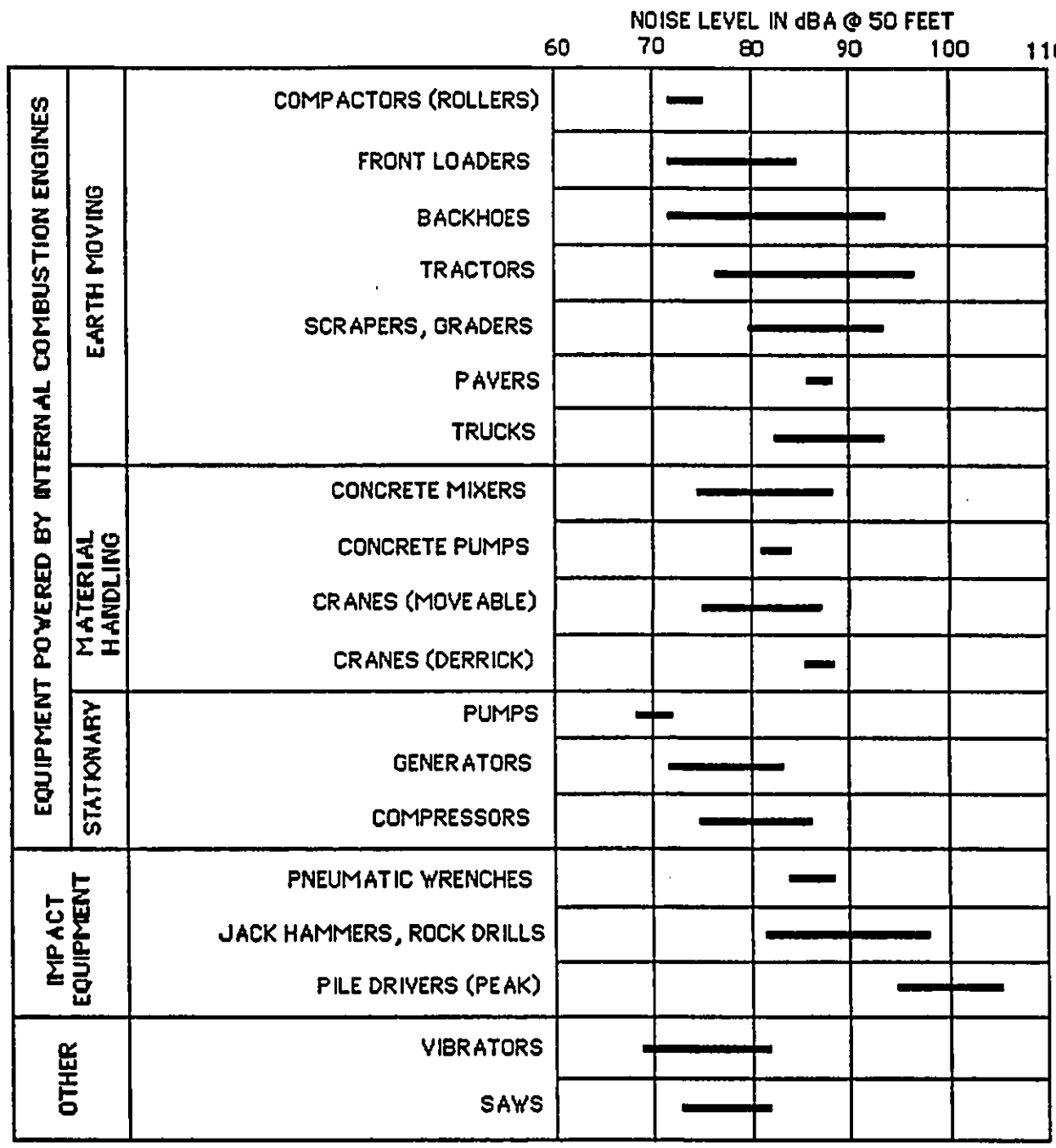
FIGURE 4 - AMBIENT NOISE MEASUREMENT LOCATIONS WITHIN AND ADJACENT TO PROJECT SITE




NOTE: BASED ON AVAILABLE DATA SAMPLES

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FIGURE 5 - TYPICAL SOUND PRESSURE LEVELS FROM CONSTRUCTION EQUIPMENT

SOURCE: U.S. ENVIRONMENTAL PROTECTION AGENCY 1972

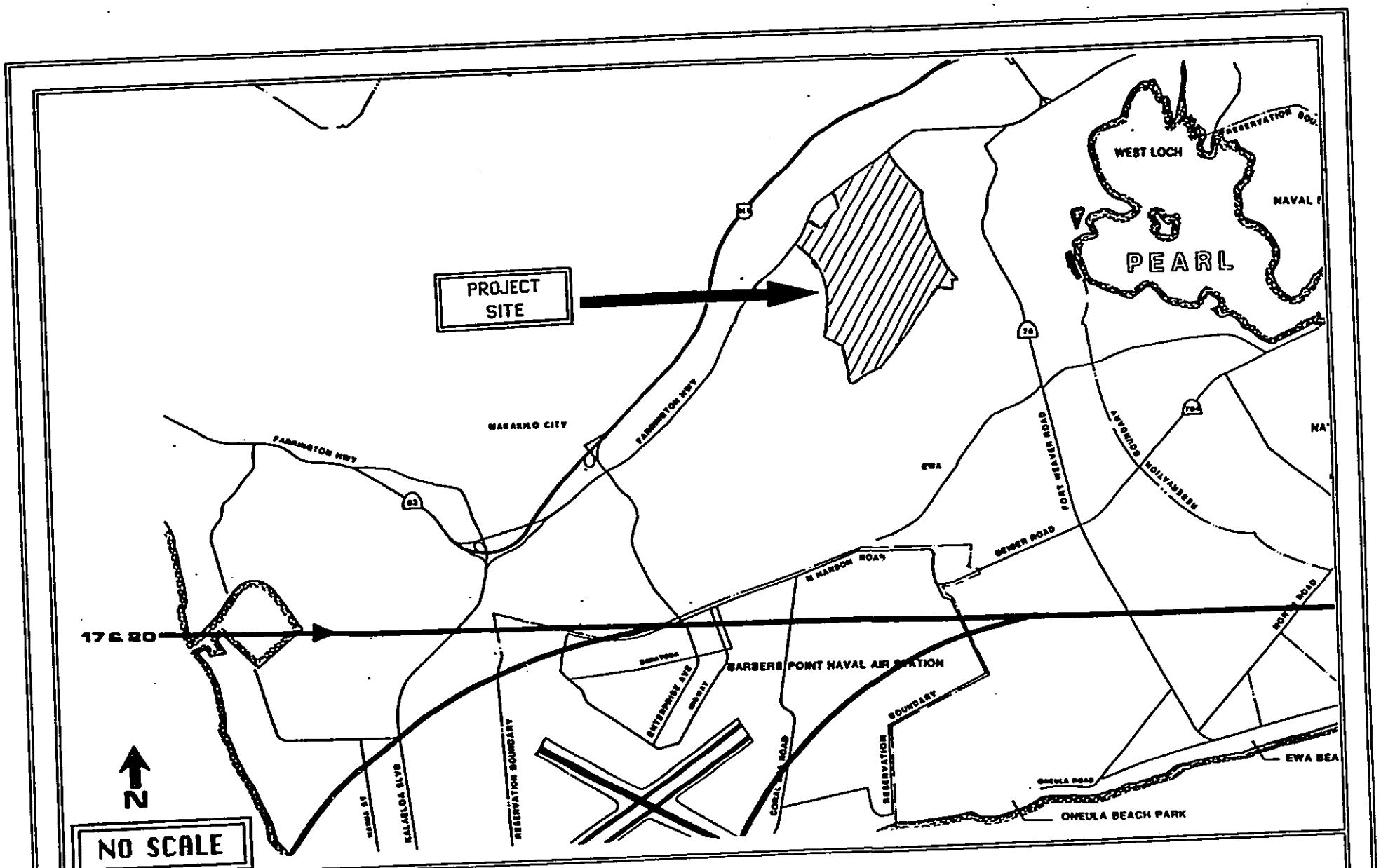


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FIGURE 6 - VICINITY OF HONOLULU INTERNATIONAL AIRPORT ARRIVAL FLIGHT TRACKS TO PROJECT SITE

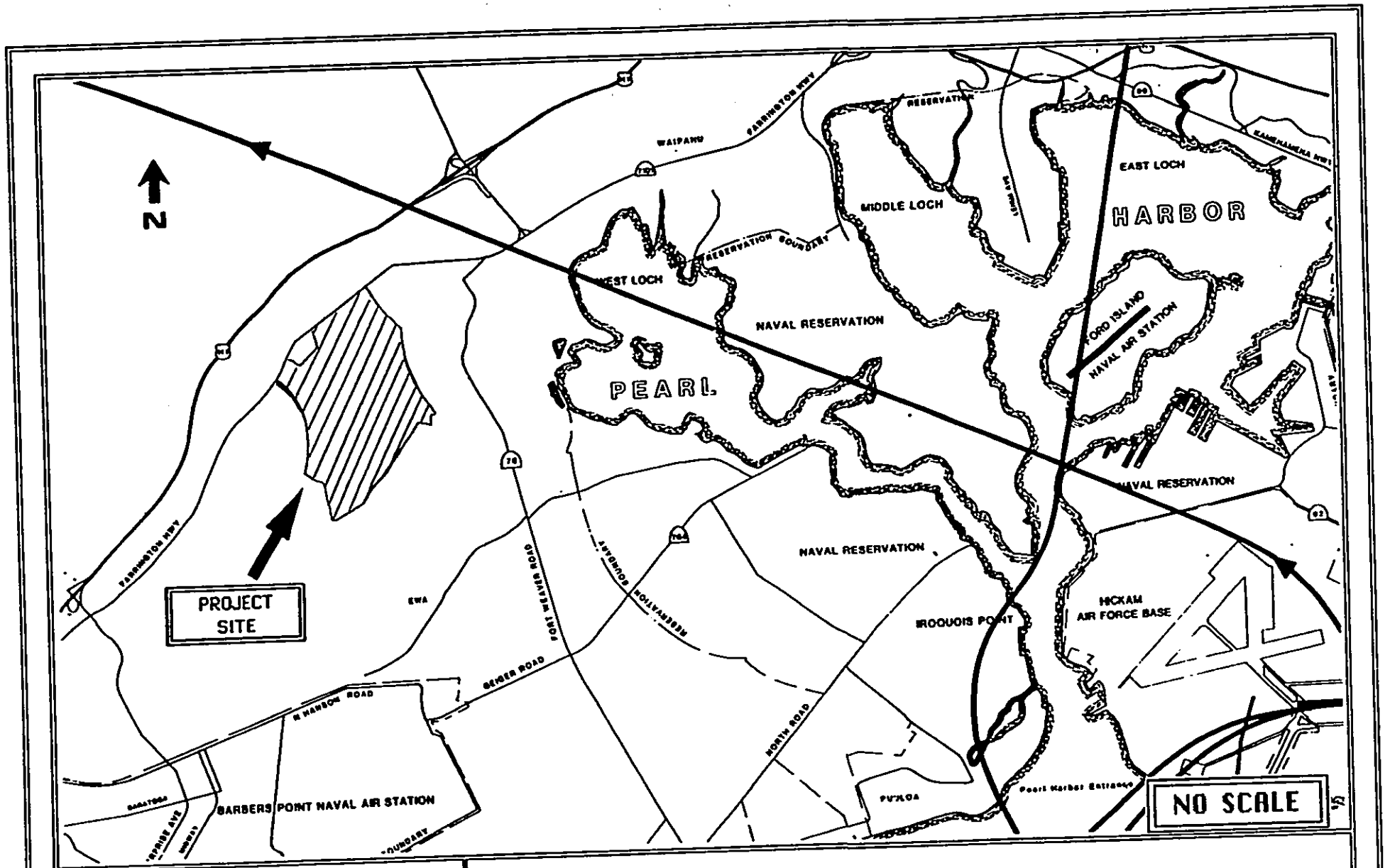


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FIGURE 7 - VICINITY OF HONOLULU AIRPORT DEPARTURE FLIGHT TRACKS TO PROJECT SITE

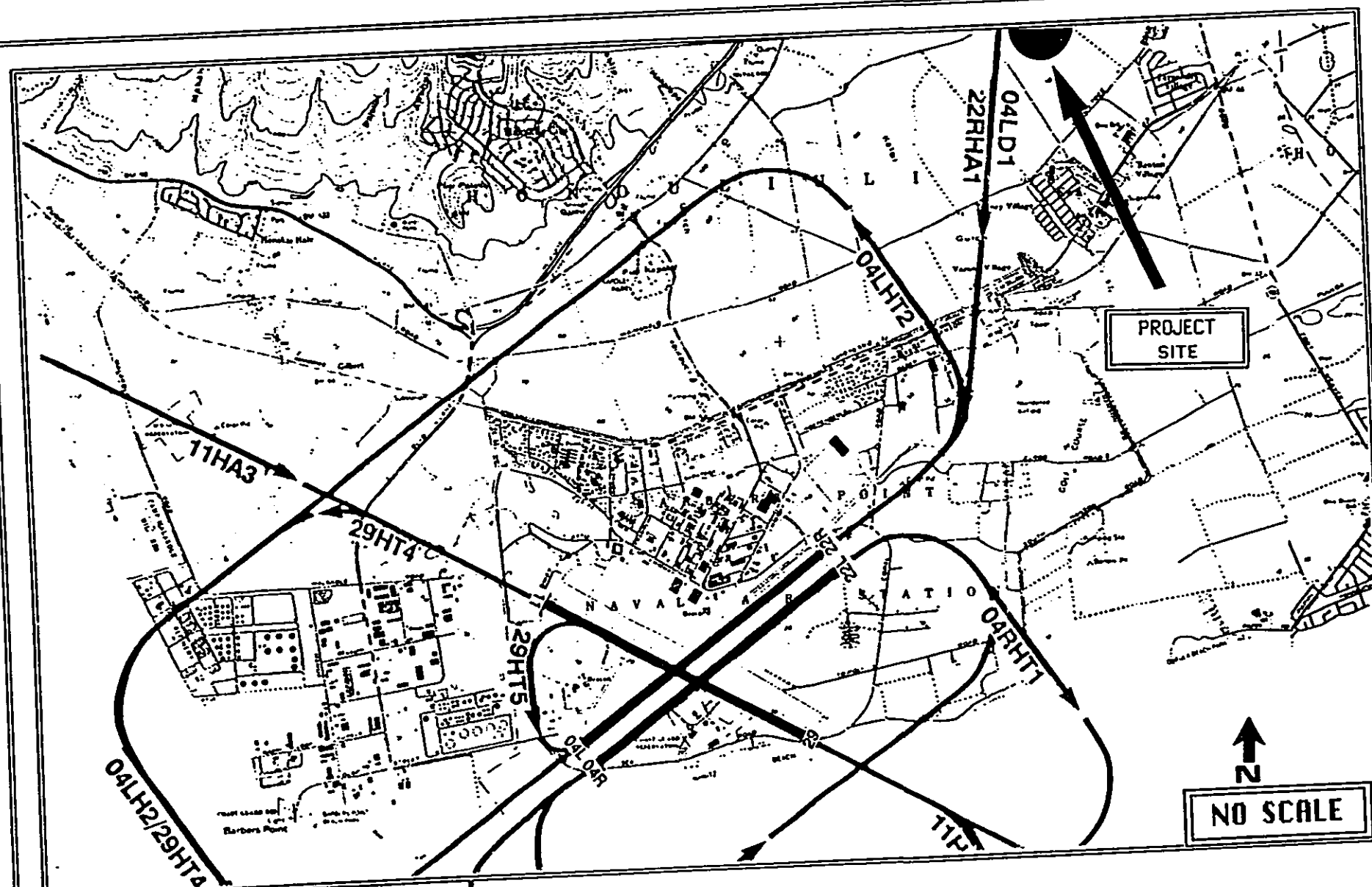


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FIGURE 8 - VICINITY OF BARBERS POINT NAS HELICOPTER FLIGHT TRACK TO PROJECT SITE

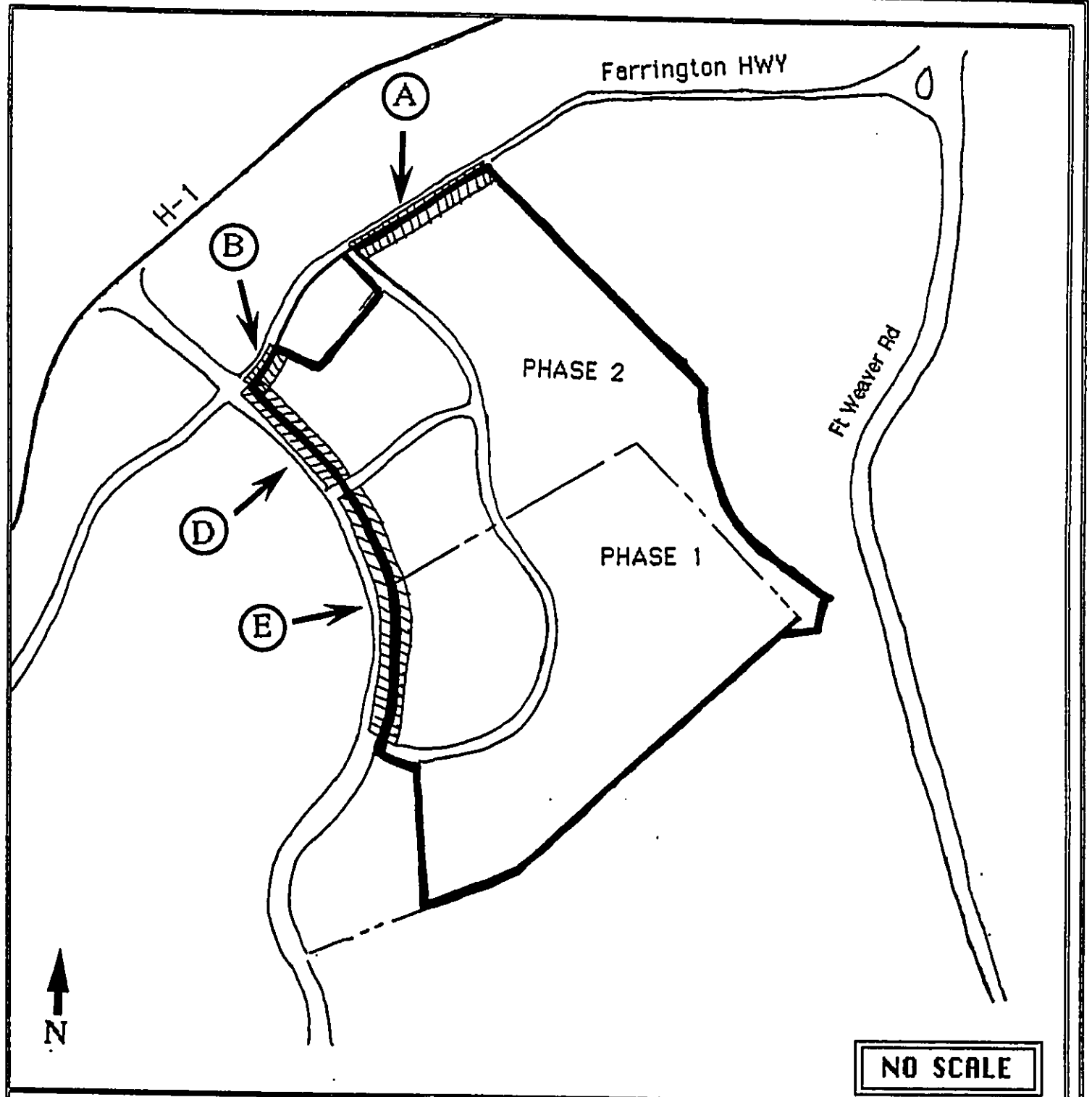


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FIGURE 9 - TRAFFIC NOISE ASSESSMENT LOCATIONS

# APPENDIX A

## ACOUSTICAL TERMINOLOGY

### Sound (Noise) Level

Sound or noise consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. It is measured in terms of decibels (dB) using precision instruments known as sound level meters.

Sound Level or Sound Pressure Level is defined as:

$$SPL = 20 \log (P/Pref) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and Pref is 20 micropascals, which is approximately the lowest sound pressure that can be detected by the human ear. For example, if P is 20 micropascals, then SPL = 0 dB, or if P is 200 micropascals, then SPL = 20 dB. The relation between sound pressure in micropascals and sound pressure level in decibels (dB) is shown in Figure A-1.

The sound level that results from a combination of noise sources is not the sum of the individual sound levels, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined level of 53 dB, not 100 dB; two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotion and expectations. However, in general, a change of 1 or 2 dB in the level of a sound is difficult for most people to detect, a 3 to 5 dB change corresponds to a small but noticeable change in loudness, and a 10 dB change corresponds to an approximate doubling or halving in loudness.

### A-Weighted Sound Level

The human ear is more sensitive to sound with frequencies above 1000 Hertz (Hz), than with frequencies below 125 Hz. Due to this type of frequency response, a weighting system, A-weight, was developed to approximate the frequency response of the human ear. A-weighted sound level (dBA) de-emphasizes the low frequency portion of the spectrum of a signal. The A-weighted (dBA) level of a sound is a good measure of the loudness of that sound, and so different sounds having the same A-weighted level sound about equally as loud. Typical values of the A-weighted sound level of various noise sources are listed in Figure A-1.

Appendix A
Acoustical Terminology
(Continued)

## Statistical Sound (Noise) Levels

The sound levels of long-term noise producing activities, such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, several statistical noise levels have been developed and instrumentation are available to measure them. Common statistical sound levels include Equivalent Continuous Noise Level, Leq, and Percentile Exceedence Level, Lx.

The Equivalent Continuous Noise Level, Leq, represents a constant level with the same amount of total acoustic energy as that contained in the actual time-varying sound being measured over a specific time period. Leq is commonly used to describe community noise, traffic noise, and hearing damage potential.

A Percentile Exceedence Level, Lx, represents the sound level which is exceeded for x% of the measured time period. For example, L10 = 60 dBA describes that over the measured time period, the measured noise exceeded 60 dBA for 10% of the time. Common Percentile Exceedence Levels include L1, L10, L50, and L90, which are widely used to assess community and environmental noise. Figure A-2 illustrates the relationship between selected statistical noise levels.

## Day Night Average Sound Level

The Day Night Average Sound Level, Ldn, is essentially the Equivalent Continuous Noise Level measured over a 24-hour period. However, in calculating the Ldn, 10 dBA is added to the noise levels recorded between 10 pm and 7 am to account for people's higher sensitivity to noise at night. The Ldn is a commonly used noise descriptor in assessing land use compatibility, and is used by federal and local agencies and standards organizations. Qualitative descriptions, as well as local examples of Ldn, are shown in Figure A-3.

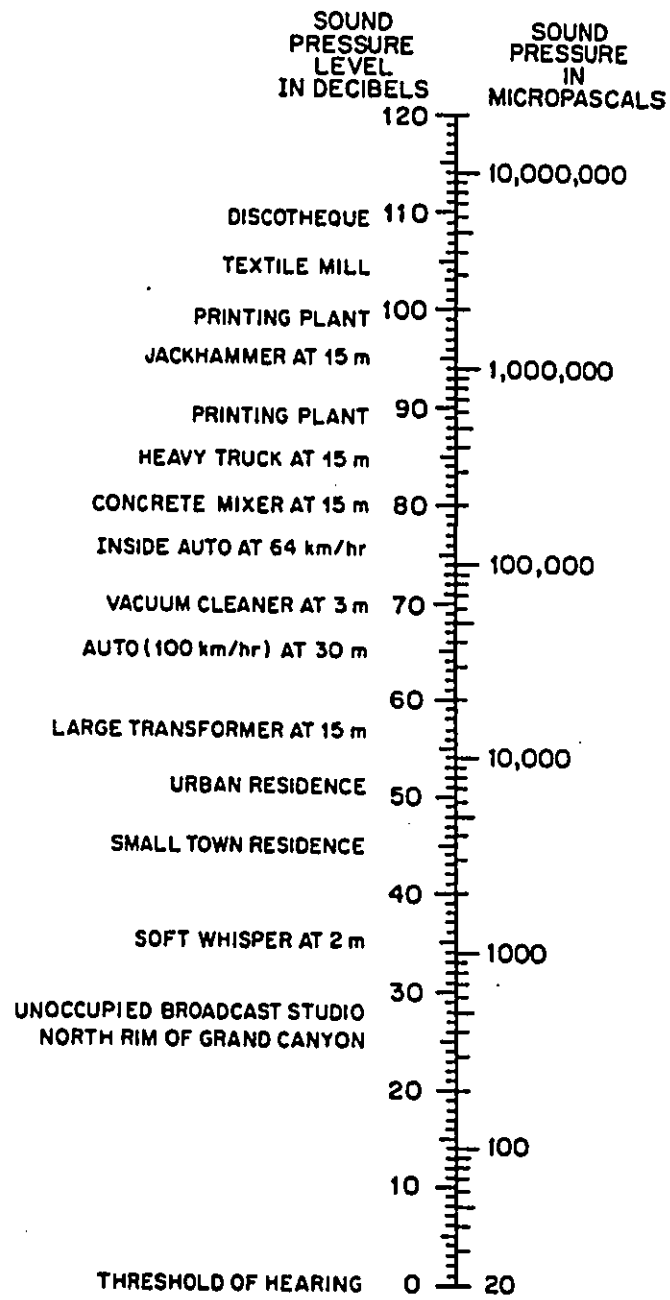


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FIGURE A-1 THE RELATION BETWEEN SOUND PRESSURE, P, AND SOUND PRESSURE LEVEL, SPL. ALSO SHOWN ARE TYPICAL VALUES OF A-WEIGHTED SOUND LEVELS OF VARIOUS NOISE SOURCES.

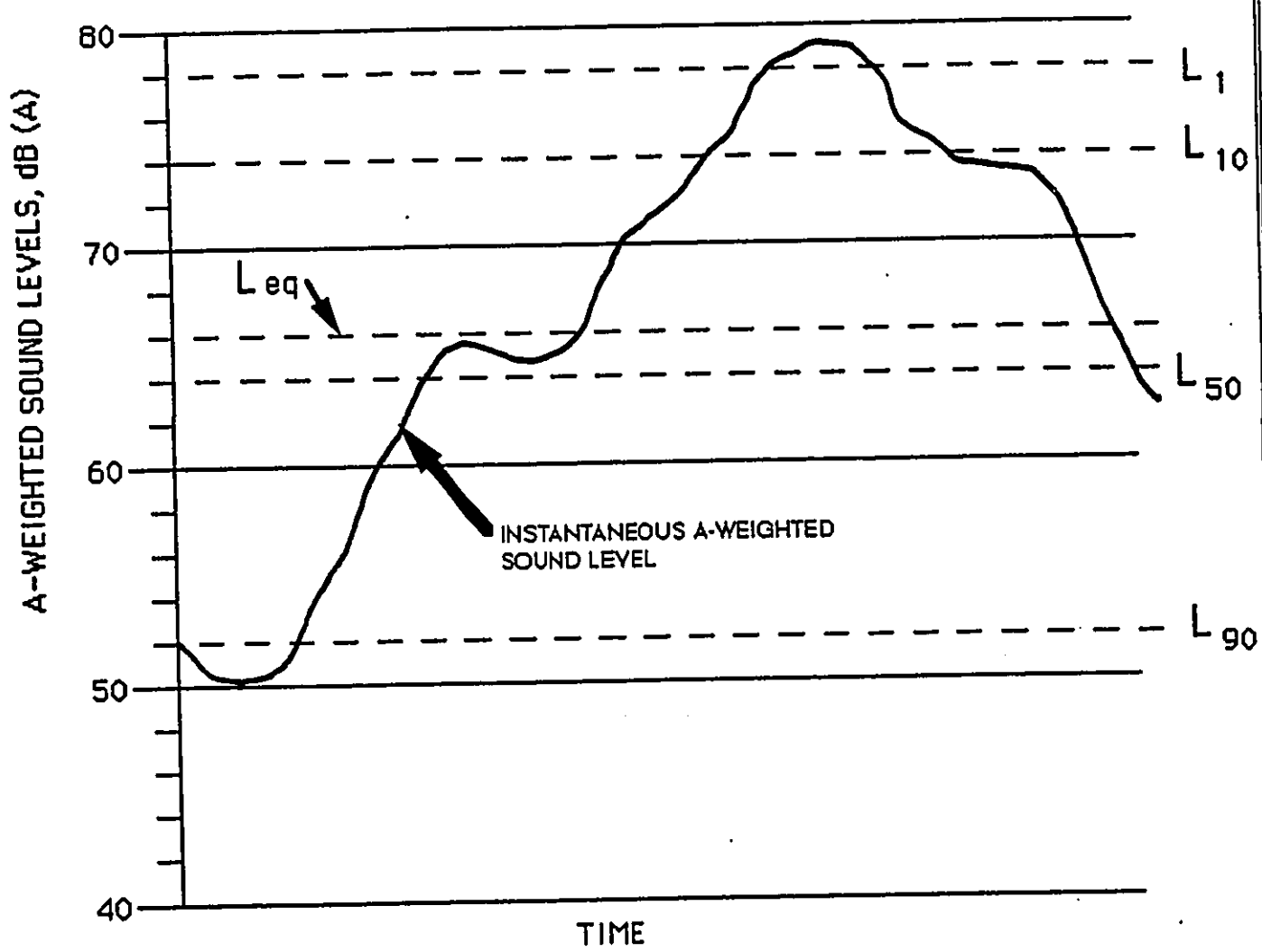


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FIGURE A-2 COMPARISON OF AN INSTANTANEOUS SOUND LEVEL AND THE CORRESPONDING STATISTICAL SOUND LEVELS

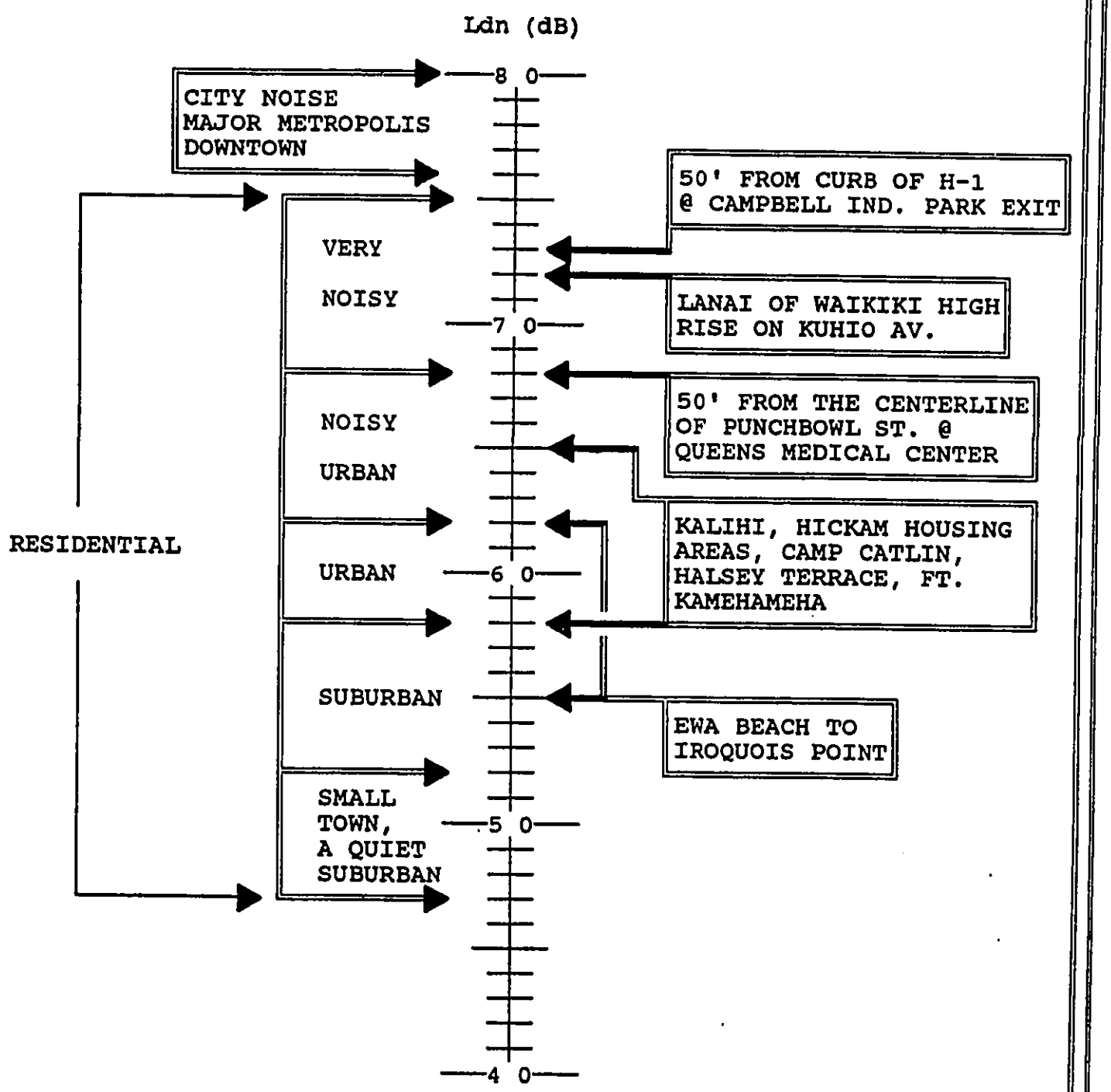


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FIGURE A-3 QUALITATIVE DESCRIPTION OF THE DAY-NIGHT SOUND LEVELS (Ldn) AND EXAMPLE Ldn's AT SELECTED LOCATIONS ON OAHU

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Project No. 94-20A

# ENVIRONMENTAL NOISE ASSESSMENT STUDY
# EAST KAPOLEI PROJECT
# KAPOLEI, EWA, OAHU, HAWAII

December 13, 1995

Prepared for
SCHULER HOMES, INC.
Honolulu, Hawaii

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## 1.0 SUMMARY

1.1 The East Kapolei Project involves development of 4 parcels and constructing several new roadways to and within two of the parcels. These two parcels of the Project are designated as the "application area." The current development plan for the "application area" includes residential units, commercial facilities, schools and parks.

1.2 The proposed East Kapolei "application area" is currently exposed to low daytime ambient noise level of approximately 48 dBA which is typical of rural areas. The dominant noise sources include traffic, wind-in-foliage and occasional distant aircraft flyovers or flybys.

1.3 Nearby noise sensitive areas include the Ewa Villages, a residential area which currently experiences low ambient noise level of approximately 47 dBA.

1.4 The predicted maximum traffic noise level increase along Farrington Highway due to additional traffic generated by the Project was determined to be 2.1 dB. A traffic noise level increase of 2.1 dB may be perceptible by some people at the noise sensitive locations along Farrington Highway, but to most people such a small increase would be imperceptible. Traffic noise increase along H-1 Freeway due to project generated traffic was estimated to be insignificant.

1.5 The dominant noise source during project construction will probably be earth moving equipment, such as bulldozers and diesel-powered trucks unless pile driving is necessary. Noise from construction activities should be relatively short-term, occur only during daytime hours, and must comply with DOH noise regulations.

1.6 Results indicate that traffic noise along North-South Road should not impact nearby residential areas based on the present development plan.

1.7 Residences along H-1 Freeway, Farrington Highway and the main interior arterials may be exposed to future day-night average sound levels, $L_{dn}$, greater than the HUD recommended limit of 65 dBA due to traffic noise if located too close to the roadways. Noise mitigation should be implemented to conform with HUD noise exposure guidelines for housing. Traffic noise level exposures of residences along these roadways vary with building setback, height of building and fenestration, local topography, foliage and possible shielding from neighboring structures.

1.8 The day-night average sound level, $L_{dn}$, at the project site due to aircraft operations is less than 55 dBA, and thus, compatible with the State DOT residential land use guidelines. Although at times audible, infrequent aircraft operations associated with HIA and BPNAS should not significantly impact the proposed development.

## 2.0 PROJECT DESCRIPTION

The East Kapolei Project involves four parcels of land totaling 794 acres of land in Kapolei, Ewa, Oahu, Hawaii. Two of these parcels, totalling 52 acres, are to be used for off-site infrastructure (water wells, detention basins, etc.) and are not considered significant to this noise study. Locations of the four parcels are shown in Figure 1. TMK Parcel: 9-1-17: por. 4 of the East Kapolei Project is in the same general location of the previous Ewa Development Project area for which an environmental noise assessment report was prepared in September, 1994 [Reference 1]. Due to changes in proposed acreage and land uses, the East Kapolei Project is an amendment of Ewa Development Project.

Currently, the majority of the East Kapolei "project area" is used for agriculture, specifically sugarcane. Sugarcane operations are slated to be phased out within a few years. The current development plan for the East Kapolei "application area," which consists of TMK Parcel: 9-1-18: por.1 and 9-1-17: por. 4, is proposed to have 8,000 residential units, commercial facilities, schools and parks as shown in Figure 2.

## 3.0 NOISE STANDARDS

Various local and federal agencies have established guidelines and standards for assessing environmental noise impacts and set noise limits as a function of land use. A brief description of common acoustic terminology used in these guidelines and standards is presented in Appendix A.

3.1 State Department of Health - The State Department of Health (DOH) specifies allowable property line noise levels that shall not be exceeded for more than 10% of the time during any 20-minute period [Reference 2]. These are enforced for any location at or beyond the property line. The specific noise limits which apply are dependant on the zoning and time of day as shown in Figure 3. DOH also specifies the following with respect to adjacent zoning and order of precedence.

> "Where the allowable noise level between two adjacent zoning districts differ, the lower allowable noise level shall be used. For example, the allowable noise level for the residential district shall be used at the property line between residential and business districts.
>
> The limits specified in the allowable noise levels table shall apply subject to the order of precedence in which uses were initiated after the effective date of this rule; provided that a new order of precedence is established when any use is discontinued. The initiation of use shall be measured by the date of rezoning. For example, if agricultural or industrial operations are

conducted next to a lot used as residence, the agricultural or industrial limits would apply if the building permit for the residence was obtained after the agricultural or industrial operations had been initiated, after the effective date of this rule. Residential limits would apply if the building permit for the residence was obtained before agricultural or industrial operations had been initiated."

3.2 City and County of Honolulu Land Use Ordinance - The Department of Land Utilization (LUO) specifies maximum allowable levels at the property line [Reference 3]. The LUO criteria differ from those of the DOH in that they use octave band sound levels instead of A-weighted levels and no temporal factor is involved. LUO noise regulations are theoretically enforced by the Building Department, however, since this Department does not have noise measurement capability, noise complaints are usually handled by DOH.

3.3 U.S. Federal Highway Administration - The Federal Highway Administration (FHWA) has established design goals for traffic noise exposure [Reference 4]. The FHWA defines four land use categories and assigns corresponding maximum hourly equivalent sound levels, $L_{eq}$. For example, Category B, defined as picnic and recreation areas, parks, residences, motels, hotels, schools, churches, libraries, and hospitals, has a corresponding maximum exterior $L_{eq}$ of 67 dBA and a maximum interior $L_{eq}$ of 52 dBA. These limits are viewed as design goals, and all projects which are developed to meet these limits are deemed in conformance with the FHWA noise standards.

3.4 U.S. Department of Housing and Urban Development - The U.S. Department of Housing and Urban Development (HUD) has established Site Acceptability Standards for interior and exterior noise for housing [Reference 5]. These standards are based on day-night equivalent sound levels, $L_{dn}$, and identify the need for noise abatement, either at the site property line or in the building construction. HUD Site Acceptability Criteria rank sites as Acceptable, Normally Unacceptable, or Unacceptable. "Acceptable" sites are those where exterior noise levels do not exceed an $L_{dn}$ of 65 dBA. Housing on Acceptable sites do not require additional noise attenuation other than that provided in customary building techniques. "Normally Unacceptable" sites are those where the $L_{dn}$ is above 65 dBA, but does not exceed 75 dBA. Housing on Normally Unacceptable sites requires some means of noise abatement, either at the property line or in the building construction, to ensure the interior noise levels are acceptable. "Unacceptable" sites are those where the $L_{dn}$ is 75 dBA or higher. The term "unacceptable" does not necessarily mean that housing cannot be built on these sites, but rather that more sophisticated sound attenuation would likely be needed.

3.5 State Department of Transportation, Airports Division - The Department of Transportation (DOT) specifies land use compatibility guidelines for aircraft noise exposure [Reference 6]. These guidelines are based on maximum allowable yearly

day-night equivalent sound levels, $L_{dn}$, for various specified land uses. A residential land use, which is specified as single-family homes, apartments, hotels, and resorts, is compatible with an aircraft generated $L_{dn}$ less than or equal to 60 dBA. However, DOT states,

> "Where the community determines that these uses must be allowed, Noise Level Reduction (NLR) measures to achieve interior levels of 45 $L_{dn}$ or less should be incorporated into building codes and be considered in individual approvals. Normal local construction employing natural ventilation can be expected to provide an average NLR of approximately 9 dB. Total closure, plus air conditioning, may be required to provide additional outdoor to indoor NLR, and will not eliminate outdoor noise problems."

The DOT guidelines also specify 60 dBA as the maximum allowable $L_{dn}$ level for school, day care center, and church uses without any noise mitigation. Commercial uses such as retail shops, restaurants, shopping centers, etc. are compatible with $L_{dn}$ levels up to 65 dBA without any noise mitigation. With noise mitigation, such commercial uses are allowed in areas exposed to $L_{dn}$'s as high as 75 dBA.

3.6 U.S. Environmental Protection Agency - The U.S. Environmental Protection Agency (EPA) has identified a range of yearly day-night equivalent sound levels, $L_{dn}$, sufficient to protect public health and welfare from the effects of environmental noise [Reference 7]. The EPA has established a goal to reduce exterior environmental noise to an $L_{dn}$ not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to an $L_{dn}$ not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

## 4.0 EXISTING ACOUSTICAL ENVIRONMENT

As stated previously, TMK Parcel: 9-1-17: por. 4 of the East Kapolei Project is in the general location of the Ewa Development Project area. Therefore, the ambient noise measurements obtained on September 8, 1994 for the Ewa Development Project are applicable to the East Kapolei Project. Additional noise measurements for the East Kapolei Project were conducted on November 27, 1995. The ambient noise measurement locations for the project are shown in Figure 4. Noise level measurements were taken using a Larson Davis Laboratories, Model 700, Type 2 Integrating Sound Level Meter. The following sound levels, expressed in units of A-weighted decibels (dBA) and in terms of the 90-Percentile Exceedence Sound Level, $L_{90}$, were measured:

| Measurement Location | $L_{90}$ (dBA) |
|---|---|
| 1 | 47.0 |
| 2 | 48.0 |
| 3 | 47.0 |

$L_{90}$ represents a measure of the residual or background noise minimally influenced by nearby discrete events. A brief description of statistical noise levels commonly used to describe environmental noise is presented in Appendix A.

Presently, the dominant noise sources at Locations 1 and 2 of the project area include wind, traffic on H-1 Freeway and Farrington Highway and occasional distant aircraft flybys. An additional noise source within the project area is from sugarcane operations; however, no sugarcane operations were experienced during the field measurements. The acoustical environment at Location 3 of the nearest residential area, Ewa Villages, is similar to that of the project area with wind, traffic and occasional distant aircraft flybys being the dominant noise sources.

## 5.0 POTENTIAL NOISE IMPACT DUE TO THE PROJECT AND NOISE MITIGATION

5.1 Additional Traffic Generated by the Project - Measured traffic noise levels and predicted traffic volumes [Reference 8] were used in conjunction with the Federal Highway Administration (FHWA) Traffic Noise Prediction Model [Reference 9] to estimate the traffic noise level increases as a result of the Project. Traffic noise level increases along Farrington Highway and H-1 Freeway with and without the Project were predicted. The projected future (2010) traffic noise level increases during peak traffic hours are summarized in Table 1. The predicted maximum traffic noise level increase along Farrington Highway due to additional traffic generated by the Project was determined to be 2.1 dB. A traffic noise level increase of 2.1 dB may be perceptible by some people at noise sensitive locations along Farrington Highway, but to most people such a small increase would be imperceptible. The traffic noise increase along H-1 Freeway due to project generated traffic, 0.2 dB, is considered insignificant.

5.2 Construction Noise - Development of the East Kapolei Project will involve excavation, grading, and the construction of infrastructure and buildings. The various construction phases of the project may generate significant amounts of noise, which may impact the nearby residential areas. The actual noise is dependent upon the methods employed during each stage of the construction process. Typical ranges of construction equipment noise are shown in Figure 5. Earthmoving equipment, e.g., bulldozers and diesel-powered trucks, will probably be the loudest equipment used during construction, assuming that pile driving will not be required.

In cases where construction noise exceeds, or is expected to exceed the DOH's "allowable" property line noise levels [Reference 2], a permit must be obtained from the DOH to allow the operation of vehicles, construction equipment, power tools, etc., which emit noise levels in excess of the "allowable" levels. Required permit conditions for construction activities are:

> "No permit shall allow construction activities creating excessive noise...before 7:00 am and after 6:00 pm of the same day."
>
> "No permit shall allow construction activities which emit noise in excess of ninety-five dB(A)...except between 9:00 am and 5:30 pm of the same day."
>
> "No permit shall allow construction activities which exceed the allowable noise levels on Sundays and on...[certain] holidays. Activities exceeding ninety-five dB(A) shall [also] be prohibited on Saturdays."

In addition, construction equipment and on-site vehicles or devices whose operations involves the exhausting of gas or air must be equipped with mufflers, and construction vehicles using traffic-ways must satisfy the DOH's vehicular noise requirements [Reference 10].

Blasting, if required, could also produce noise impacts. However, blasting at construction sites near populated areas is usually accomplished by using numerous small charges detonated with small time delays. Blast mats can also be used to assist in directing the explosive energy into the rock, controlling flying debris, and muffling the noise. Thus, with the appropriate blast design techniques, the noise from blasting can be controlled within acceptable limits at the closest noise sensitive locations.

## 6.0 POTENTIAL NOISE IMPACT ON THE PROJECT AND NOISE MITIGATION

6.1 Traffic Noise - The proposed plan for traffic circulation within the East Kapolei "application area" is shown in Figure 2. The proposed residential areas within these parcels could be impacted by traffic noise. The FHWA Traffic Noise Prediction Model was used along with traffic data provided in the referenced traffic study to predict future traffic noise levels along H-1 Freeway, Farrington Highway, North-South Road and interior arterials. Traffic-generated noise levels were predicted at the locations shown in Figure 6.

The future traffic noise levels were based on the predicted peak hour traffic volumes with the assumptions of truck mix percentage, posted speed limit and roadway characteristics summarized in Table 2. The day-night average sound levels, $L_{dn}$, were estimated from the peak hour equivalent-continuous noise levels, $L_{eq}$, as indicated by

HUD [Reference 5]. The results indicate that residences at the traffic noise assessment locations shown in Figure 6 will fall within the HUD "Acceptable" category at the estimated setback distances listed in Table 3. It should be noted that the estimated setback distances listed in Table 3 are worst cases. Detailed analysis of specific building projects may allow smaller setbacks. For example, if portions of specific roadways are elevated above the future housing, e.g., along the H-1 Freeway, a barrier may effectively shield windows of second floor units allowing substantially less setback, if optimum planning, grading and design are incorporated. In addition, if the 4-lane roadways assumed for Farrington Highway and North-South Road include a median or center island, the distance between directional traffic will increase and this analysis would require updating. In general, traffic noise level exposures vary with building setback, height of building and fenestration, local topography, foliage and possible shielding from neighboring structures.

In accordance with HUD standards, housing areas exposed to $L_{dn}$ levels above 65 dBA, but not exceeding 75 dBA, require some means of noise abatement either at the property line or in the building interior in order to be eligible for HUD/FHA financing. HUD standards for housing areas exposed to $L_{dn}$ levels between 65 and 70 dBA, require a minimum of 5 dB attenuation in addition to the "attenuation provided by buildings as commonly constructed in the area, and requiring open windows for ventilation." A minimum of 10 dB attenuation is required for housing areas exposed to $L_{dn}$ levels of 70 and 75 dBA. The standards also state, "Emphasis shall be given to noise sensitive interior spaces such as bedrooms."

An additional 5 dB of attenuation can usually be achieved by one of the following measures:

a) Constructing a noise barrier wall which blocks the line-of-sight between the noise source and the units' windows.

b) Installing carpeting with minimum 40 oz. padding, louvered closet doors, and/or absorptive ceiling tiles in the affected bedrooms.

An additional 10 dB of attenuation can usually be achieved by implementing both measures a) and b) above or providing air conditioning and using standard windows with good seals in conjunction with normal double wall construction with insulation. Jalousie windows should not be used in the impacted dwellings. Housing areas exposed to $L_{dn}$ levels exceeding 75 dBA would most often require high sound transmission loss glazing and air conditioning according to HUD.

6.2 Aircraft Noise - The proposed residential areas of the project are within approximately four to eight miles of Honolulu International Airport (HIA) and Barbers Point Naval Air Station (BPNAS). Due to the distance from the residential areas, the day-night average sound level, $L_{dn}$, due to air traffic associated with HIA and BPNAS will be

less than 55 dBA at the residential areas [Reference 11 and 12], which is compatible with the State DOT residential guidelines. However, due to the vicinity of the residential areas to flight tracks associated with HIA and BPNAS as shown in Figures 7, 8 and 9, infrequent aircraft flyovers or flybys may, at times, be audible in the residential areas. Although these aircraft operations may, at times, be audible, aircraft noise should not significant impact the proposed residential development.

6.3 Sugarcane Agriculture - Sugarcane agriculture involves activities such as land preparation, harvesting, hauling, etc., which are characterized by periods of intense activity with equipment operating 24 hours per day. Lands west of the East Kapolei "application area" are currently cultivated in sugarcane. If nearby sugarcane operations continue beyond the completion of the proposed project, noise from agriculture activities may impact nearby noise sensitive residential areas. However, sugarcane growing in the area is anticipated to end in the near future.

6.4 Hawaiian Electric Company (HECO) Station - A HECO substation is located southeast of the Project. Potential noise sources at the substation include transformers, radiators, and other stationary equipment. During typical traffic hours, traffic noise along Farrington Highway and H-1 Freeway will generally mask the noise produced by the substation. However, when the traffic volume is low, e.g., from midnight to 5 a.m., the noise sources at the station could be audible at nearby noise sensitive residential areas. Noise mitigation in the form of a barrier wall on the two sides of the substation facing Project residential areas would be effective.

6.5 Quarry Site - The Project is approximately 1 mile east of an existing rock quarry site. Noise produced by the activities at the quarry site should not significantly impact the nearby residential areas due to the distance between the site and the residential areas.

**REFERENCES:**


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3. *Section 3.11, Noise Regulations,* Land Use Ordinance, City and County of Honolulu, Oahu October 22, 1986.

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5. *HUD Environment Criteria and Standards,* 24 CFR 51, Federal Register, Volume 44, No. 135, July 12, 1979; Amended 49 FR 880, January 6, 1984.

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12. *Naval Air Station Barbers Point Air Installations Compatible Use Zone (AICUZ) Noise Contours and Supporting Data,* Naval Facilities Engineering Command, Alexandria, VA, July 1989.

# APPENDIX A

## ACOUSTICAL TERMINOLOGY

### Sound Pressure Level

Sound or noise consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. It is measured in terms of decibels (dB) using precision instruments known as sound level meters. Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/Pref) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and Pref is the reference pressure, 20 micropascals, which is approximately the lowest sound pressure that can be detected by the human ear. For example, if P is 20 micropascals, then SPL = 0 dB, or if P is 200 micropascals, then SPL = 20 dB. The relation between sound pressure in micropascals and sound pressure level in decibels (dB) is shown in Figure A-1.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound levels, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined level of 53 dB, not 100 dB; two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of a sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 5 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

### A-Weighted Sound Level

The human ear is more sensitive to sound in the frequency range of 250 Hertz (Hz) and higher, than in frequencies below 250 Hz. Due to this type of frequency response, a frequency weighting system, was developed to emulate the frequency response of the human ear. This system expresses sound levels in units of A-weighted decibels (dBA). A-weighted sound levels de-emphasizes the low frequency portion of the spectrum of a signal. The A-weighted level of a sound is a good measure of the loudness of that sound. Different sounds having the same A-weighted sound level are perceived as being about equally loud. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

## Statistical Sound Levels

The sound levels of long-term noise producing activities, such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels developed. It is known as the Exceedence Level, $L_n$. The Exceedence Level, $L_n$, represents the sound level which is exceeded for n% of the measurement time period. For example, $L_{10}$ = 60 dBA indicates that for the duration at the measurement period, the sound level exceeded 60 dBA 10% of the time. Commonly used Exceedence Levels include $L_1$, $L_{10}$, $L_{50}$, and $L_{90}$, which are widely used to assess community and environmental noise. Figure A-2 illustrates the relationship between selected statistical noise levels.

## Equivalent Sound Level

The Equivalent Sound Level, $L_{eq}$, represents a constant level of sound having the same total acoustic energy as that contained in the actual time-varying sound being measured over a specific time period. $L_{eq}$ is commonly used to describe community noise, traffic noise, and hearing damage potential. It has units of dBA and is illustrated in Figure A-2.

## Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, $L_{dn}$, is the Equivalent Sound Level, $L_{eq}$, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 pm and 7 am to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The $L_{dn}$ is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations. Qualitative descriptions, as well as local examples of $L_{dn}$, are shown in Figure A-3.

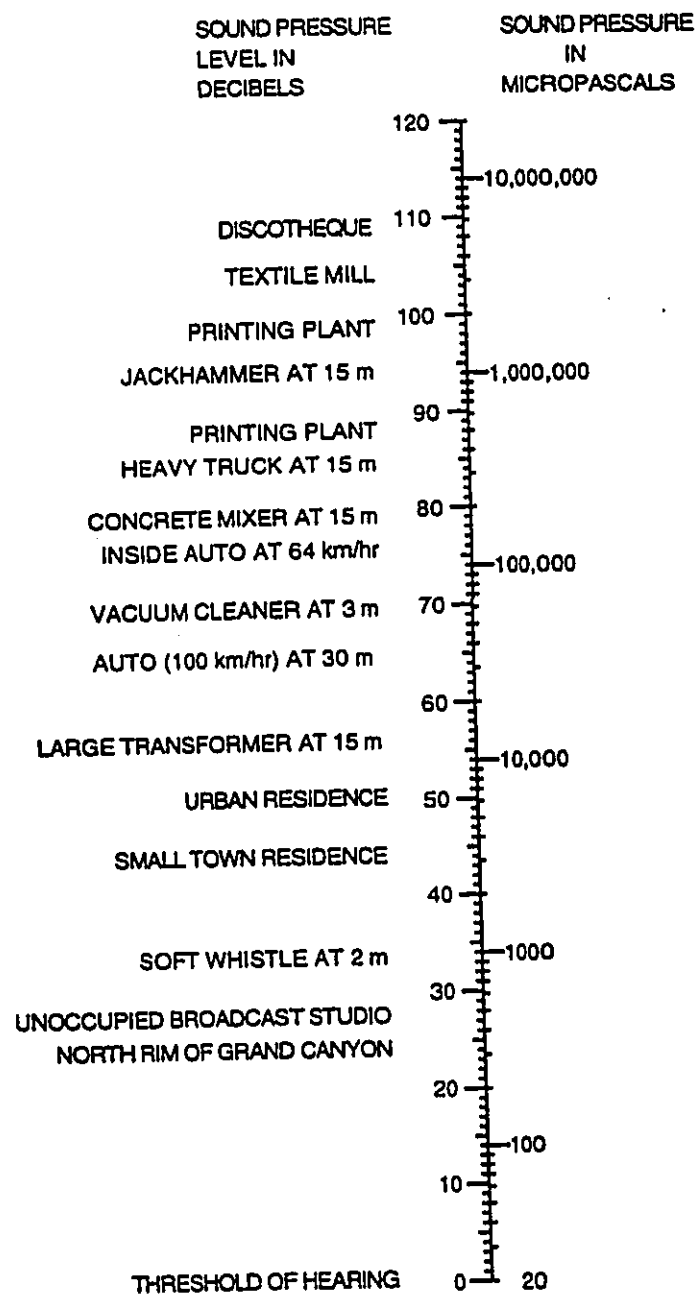


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FIGURE A-1 THE RELATION BETWEEN SOUND PRESSURE, P, AND SOUND PRESSURE LEVEL, SPL. ALSO SHOWN ARE TYPICAL VALUES OF A-WEIGHTED SOUND LEVELS OF VARIOUS NOISE SOURCES.

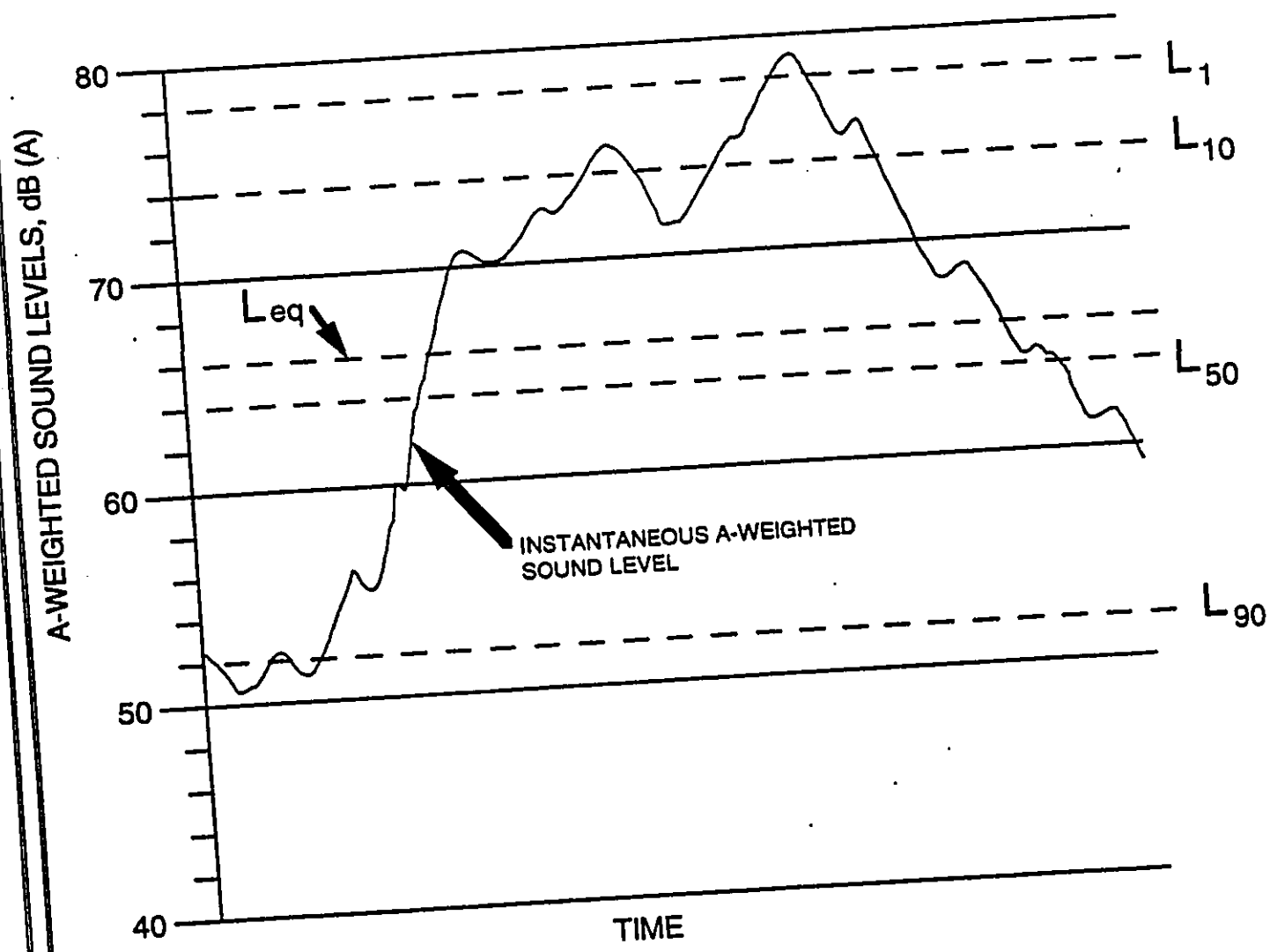


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FIGURE A-2 COMPARISON OF AN INSTANTANEOUS SOUND LEVEL AND THE CORRESPONDING STATISTICAL SOUND LEVELS

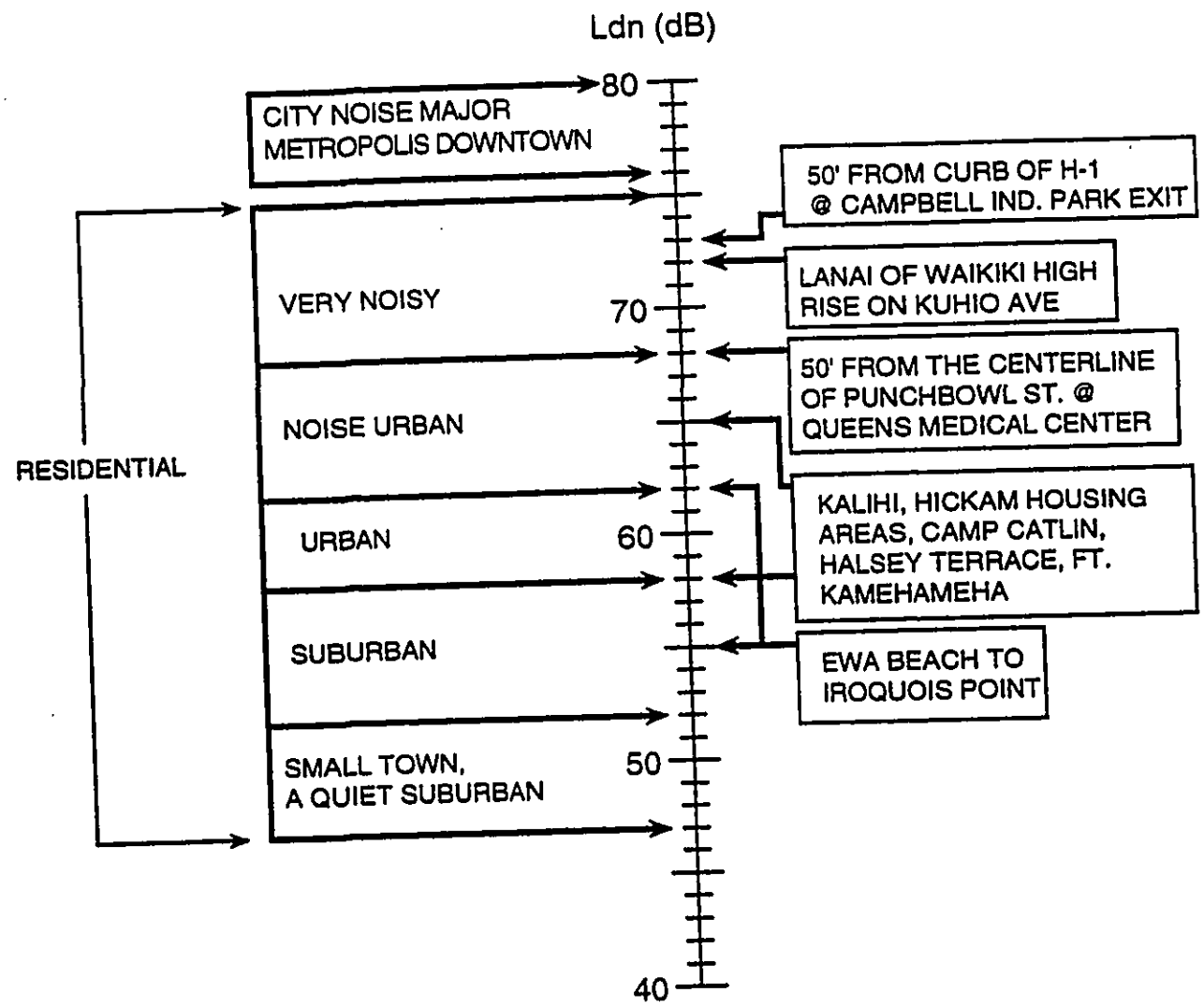


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FIGURE A-3 QUALITATIVE DESCRIPTION OF THE DAY-NIGHT SOUND LEVELS (Ldn) AND AND EXAMPLE Ldn's AT SELECTED LOCATIONS ON OAHU

TABLE 1
PROJECTED FUTURE (2010) TRAFFIC NOISE LEVEL
($L_{dn}$ in dBA) INCREASES DURING PEAK TRAFFIC HOURS

| Roadway | Without Project | | With Project | |
|---|---|---|---|---|
| | AM | PM | AM | PM |
| Farrington Highway | 3.1 | 0.2 | 3.3 | 2.3 |
| H-1 Freeway | 2.1 | 2.2 | 2.1 | 2.4 |

TABLE 2
ASSUMED TRUCK MIX PERCENTAGES
AND CHARACTERISTICS OF ROADWAY

| Location[1] & Roadway | Description | PSL[2] (mph) | Truck Mix % MT[3] | Truck Mix % HT[4] |
|---|---|---|---|---|
| 1 H-1 Freeway | 6-Lane Roadway With 20 ft. Median | 55 | 2.5 | 3.5 |
| 2 Farrington Hwy. | 4-Lane Roadway Without Median or Center Island | 35 | 2.5 | 1.5 |
| 3 Farrington Hwy. | Lane Roadway Without Median or Center Island | 35 | 2.5 | 1.5 |
| 4 North-South Rd. | 4-Lane Roadway Without Median or Center Island | 35 | 2.5 | 1.5 |
| 5 Interior Arterial | 4-Lane Roadway Without Median or Center Island | 25 | 2.5 | 0.5 |
| 6 Interior Arterial | 4-Lane Roadway Without Median or Center Island | 25 | 2.5 | 0.5 |
| 7 Interior Arterial | 4-Lane Roadway Without Median or Center Island | 25 | 2.5 | 0.5 |

(1) See Figure 6

(2) PSL = Posted Speed Limit

(3) MT = Medium Truck

(4) HT = Heavy Truck

TABLE 3
ESTIMATED MINIMUM SETBACK DISTANCES[1] (IN FEET) FOR
MULTI-STORY, NATURALLY VENTILATED RESIDENCES
AS REQUIRED BY HUD TRAFFIC NOISE CRITERIA

| Location[2] & Roadway | "Acceptable" $L_{dn}$ <65 | "Normally Unacceptable" $L_{dn}$ 65-70 | "Normally Unacceptable" $L_{dn}$ 70-75 | "Unacceptable" $L_{dn}$ >75 |
|---|---|---|---|---|
| 1 H-1 Freeway | >2235 | 2235 to 717 | 717 to 239 | 239 to ROW |
| 2 Farrington Hwy | > 291 | 291 to 100 | 100 to ROW | n/a |
| 3 Farrington Hwy | > 210 | 210 to 73 | 73 to ROW | n/a |
| 4 North-South Rd | > 210 | 207 to 74 | 74 to ROW | n/a |
| 5 Interior Arterial | > 39 | 39 to ROW | n/a | n/a |
| 6 Interior Arterial | > 62 | 62 to ROW | n/a | n/a |
| 7 Interior Arterial | > 57 | 57 to ROW | n/a | n/a |

(1) Based on the distance from the roadway centerline and the 6.5 feet HUD requirement between noise level prediction location and the building footprint.

(2) See Figure 6

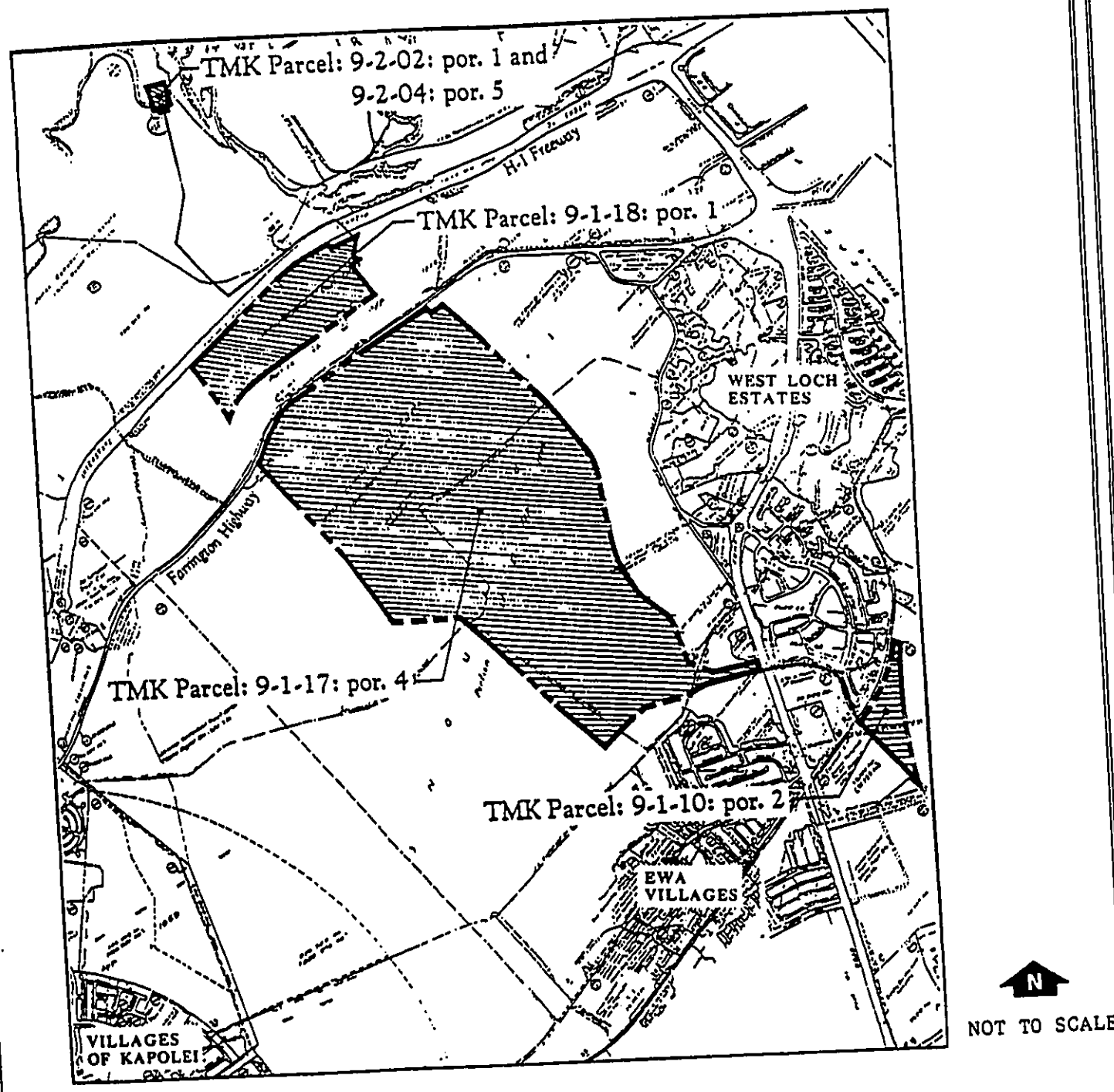


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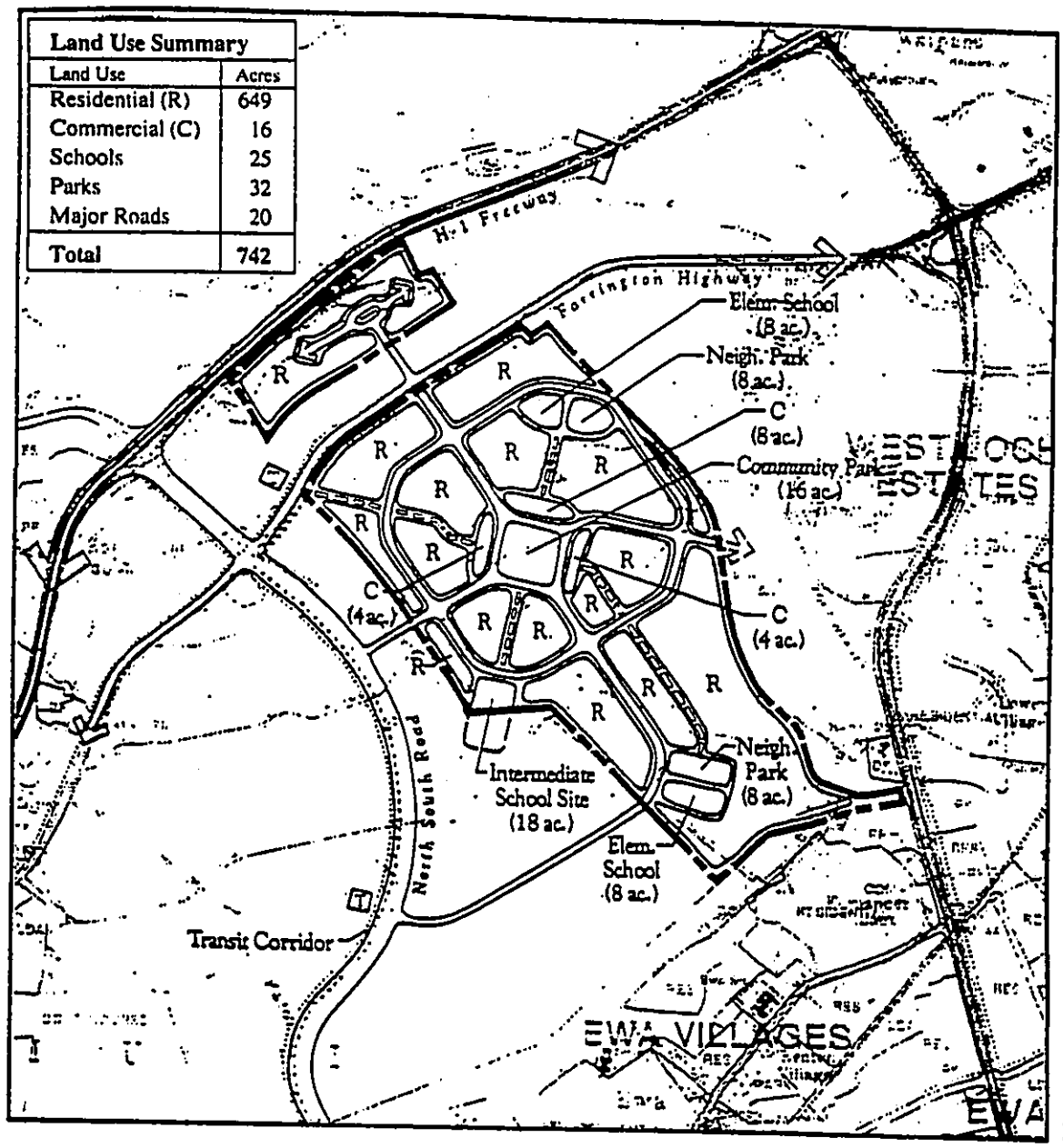
FIGURE 1 - PROJECT SITE AND VICINITY




| Land Use Summary | |
|---|---|
| Land Use | Acres |
| Residential (R) | 649 |
| Commercial (C) | 16 |
| Schools | 25 |
| Parks | 32 |
| Major Roads | 20 |
| Total | 742 |

N

NOT TO SCALE

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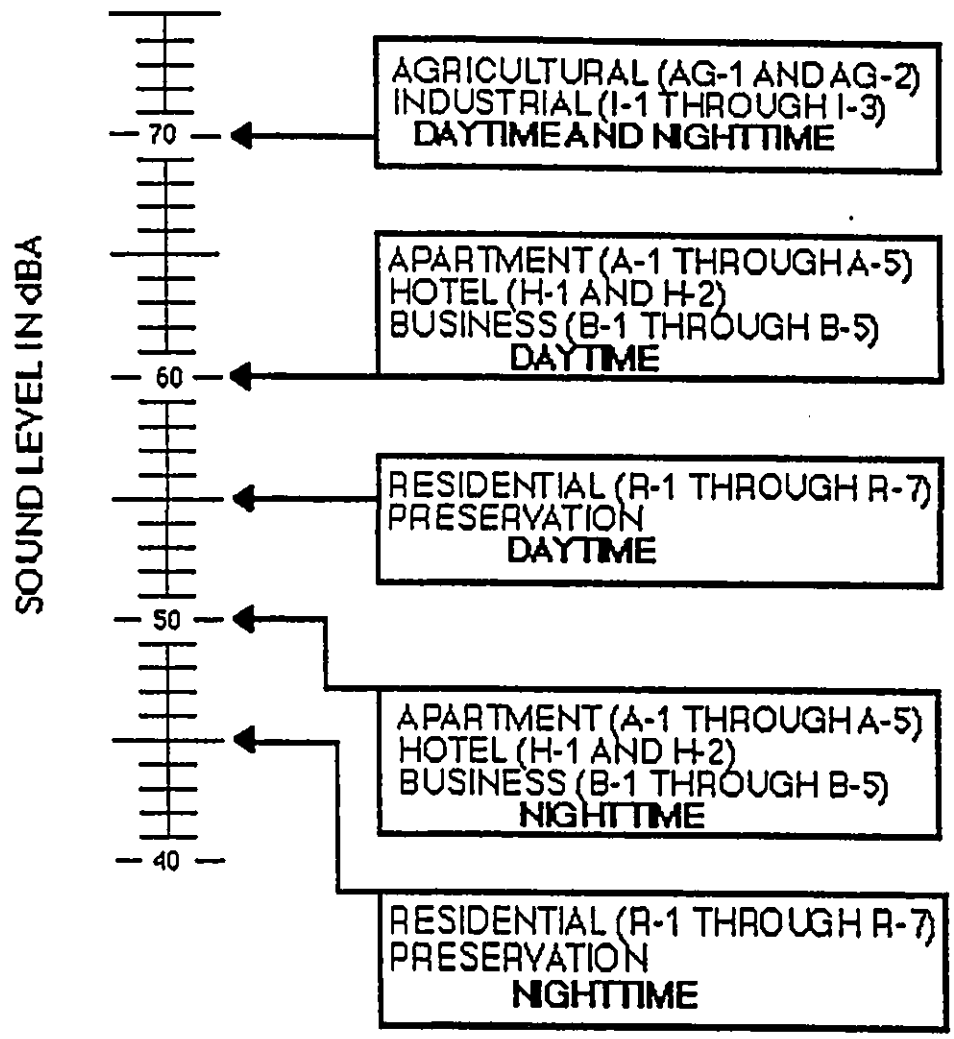
FIGURE 2 - DEVELOPMENT PLAN OF THE EAST KAPOLEI "APPLICATION AREA"




NOTE: LEVELS INDICATED BY ZONING DISTRICT ARE THE "ALLOWABLE" LEVELS THAT SHALL NOT BE EXCEEDED FOR MORE THAN TEN PERCENT OF THE TIME WITHIN ANY TWENTY MINUTE PERIOD DURING THE TIME PERIOD SHOWN (DAYTIME: 7:00 A.M. TO 10:00 P.M., NIGHTTIME: 10:00 P.M. TO 7:00 A.M.)

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FIGURE 3 - ALLOWABLE NOISE LEVELS FOR VARIOUS ZONING DISTRICTS

SOURCE: Reference 2

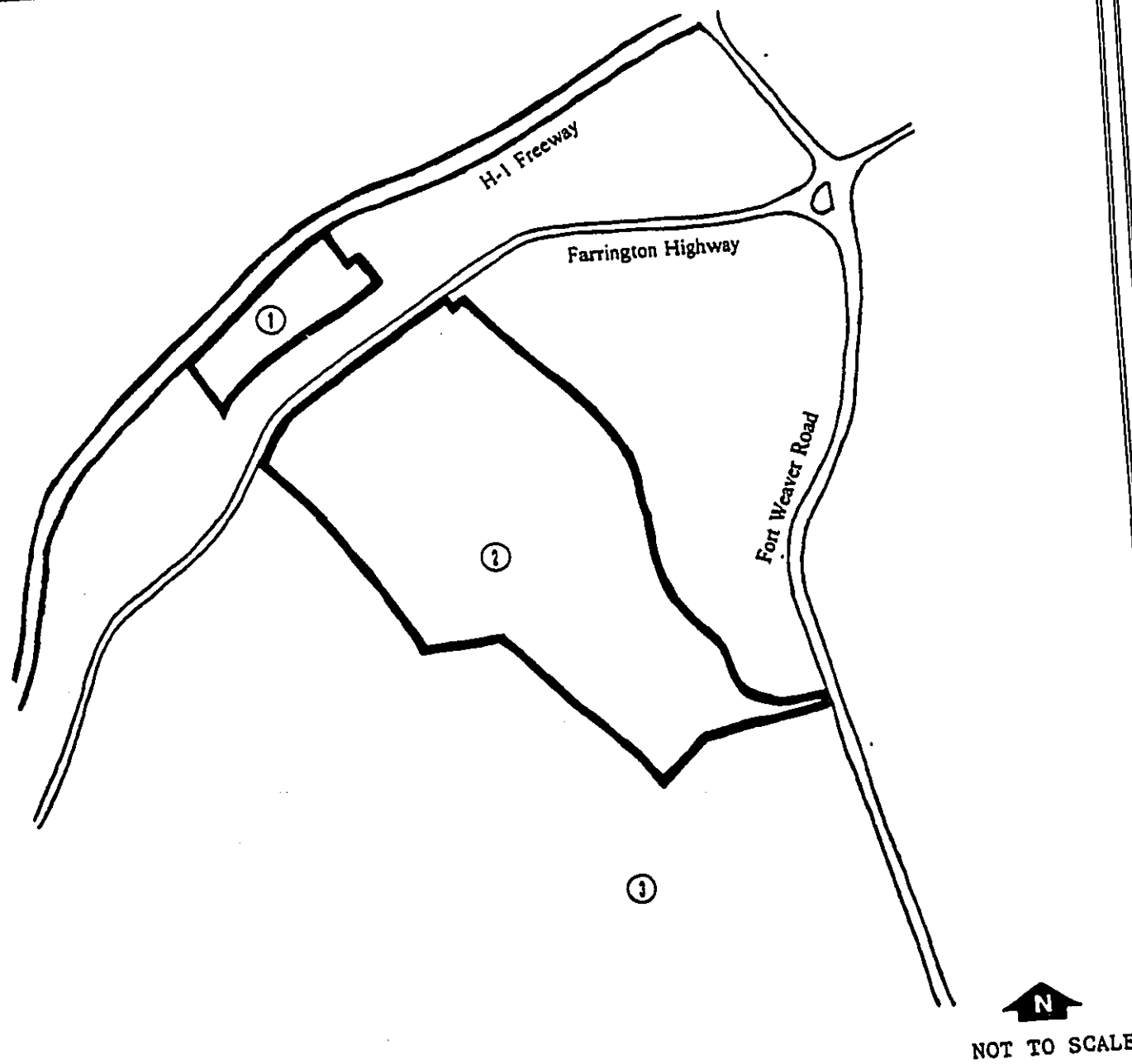


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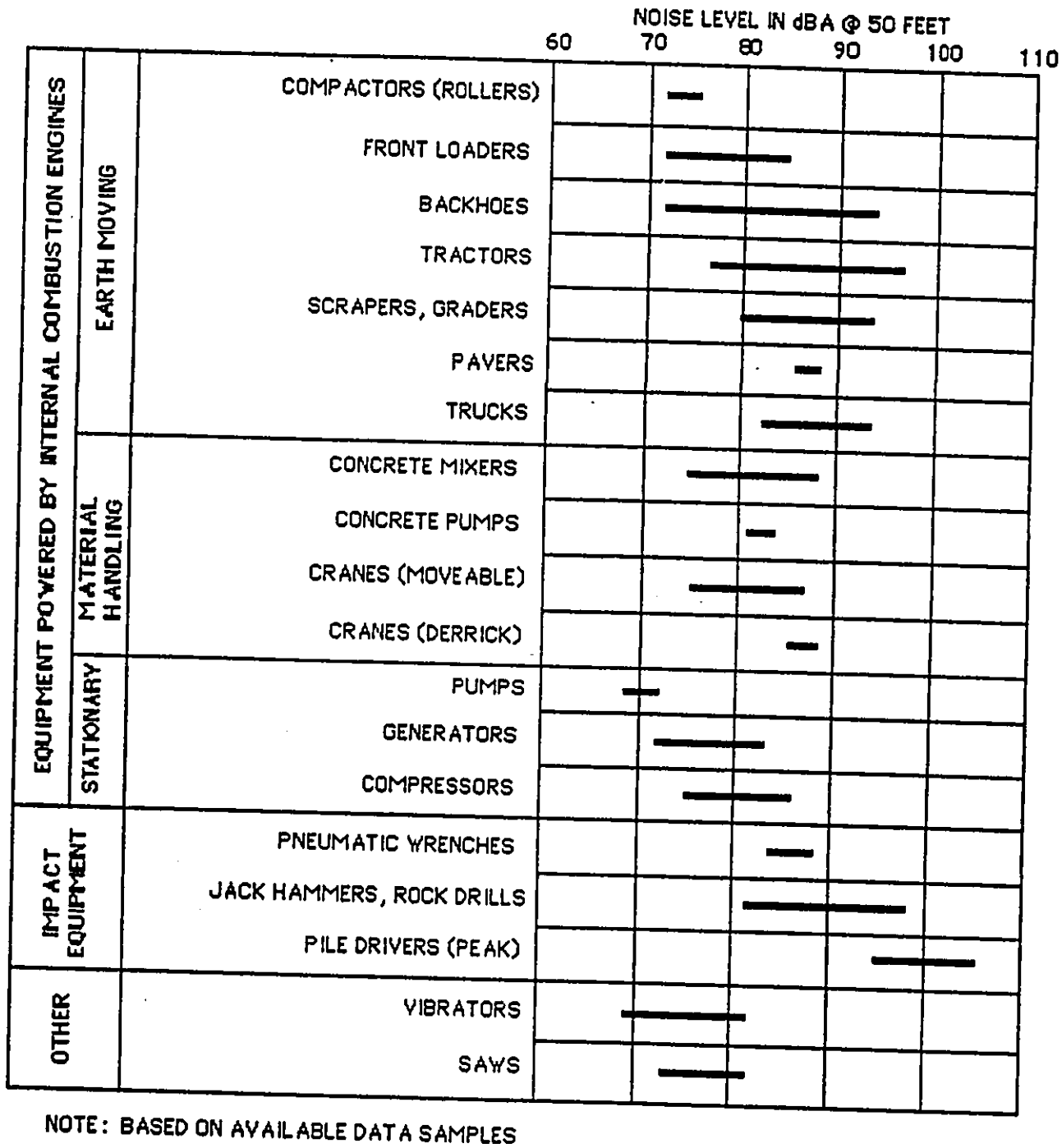
FIGURE 4 - AMBIENT NOISE MEASUREMENT LOCATIONS




NOTE: BASED ON AVAILABLE DATA SAMPLES

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FIGURE 5 - TYPICAL SOUND PRESSURE LEVELS FROM CONSTRUCTION EQUIPMENT

SOURCE: U.S. Environmental Protection Agency 1972

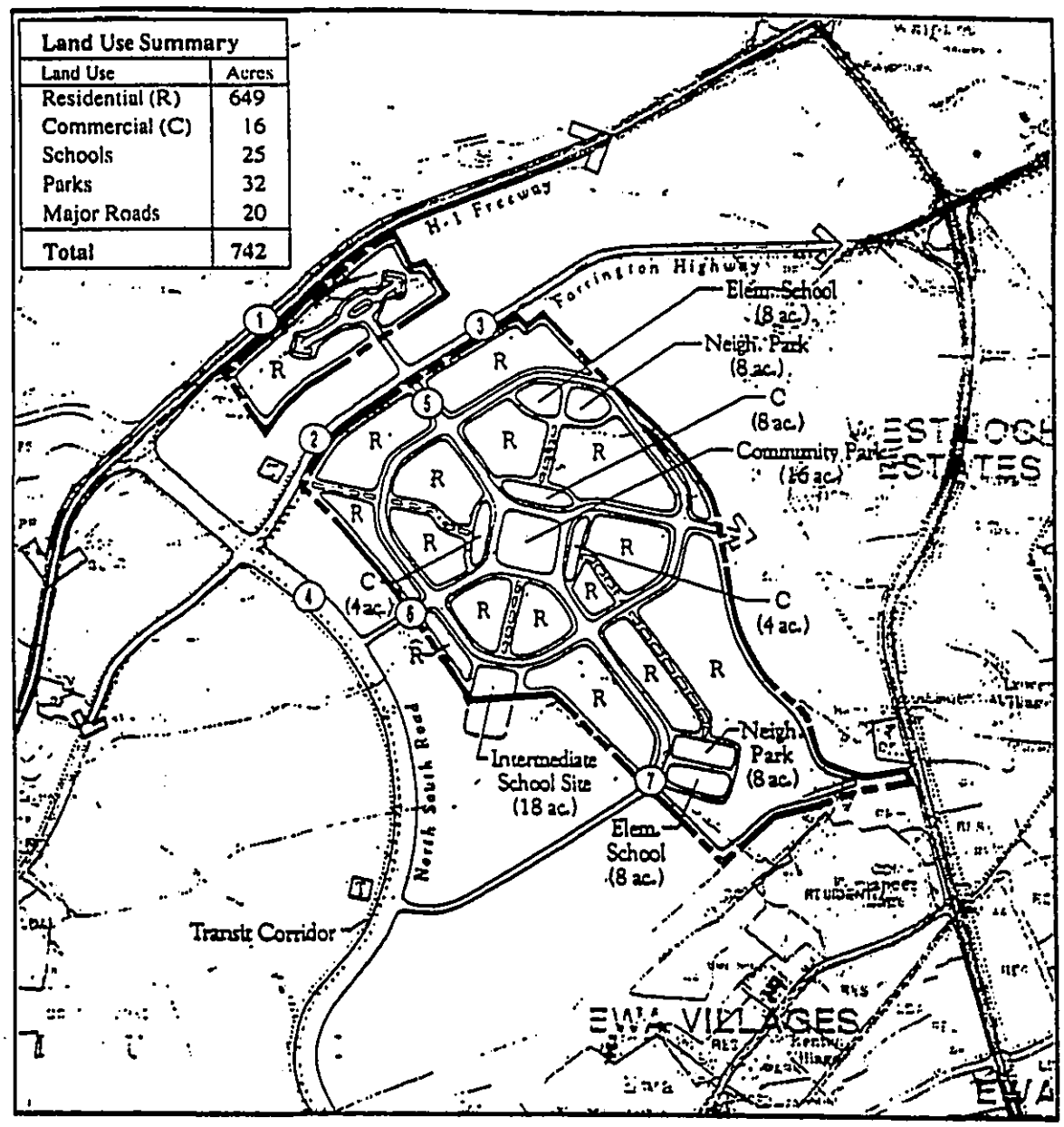


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FIGURE 6 - TRAFFIC NOISE ASSESSMENT LOCATIONS

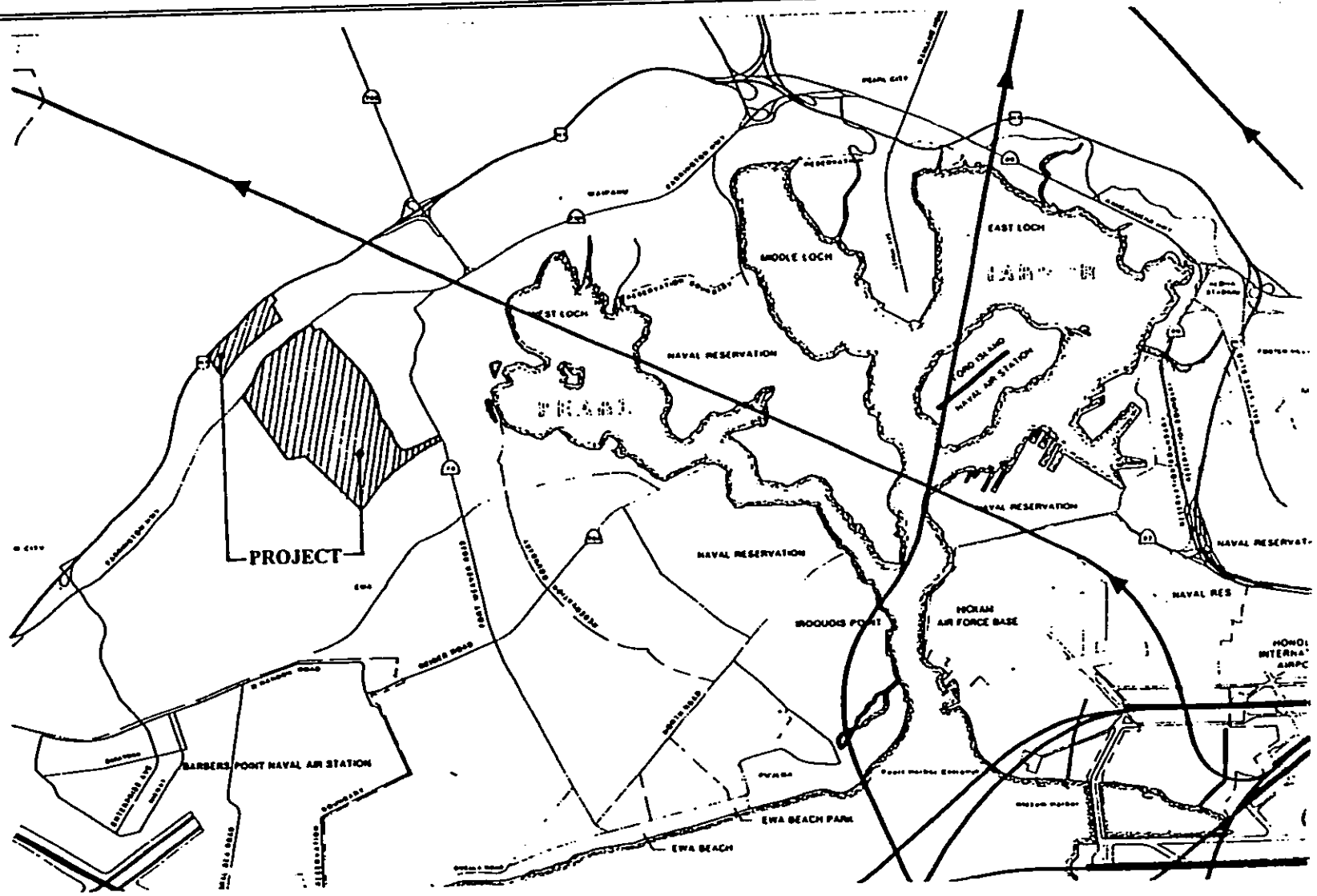


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FIGURE 7 – VICINITY OF HONOLULU INTERNATIONAL AIRPORT DEPARTURE FLIGHT TRACKS TO THE PROPOSED RESIDENTIAL AREA OF THE EAST KAPOLEI PROJECT

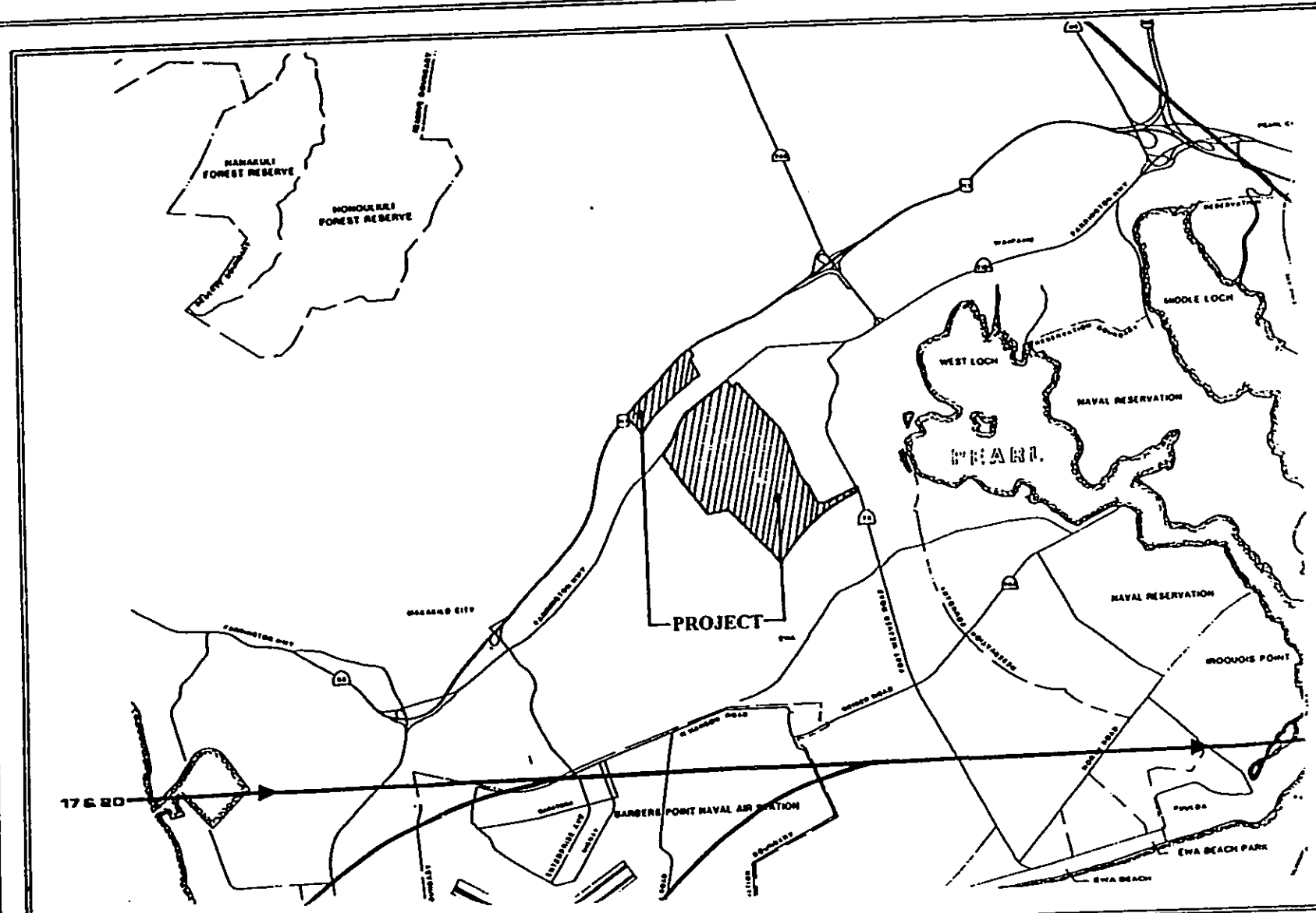


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FIGURE 8 - VICINITY OF HONOLULU INTERNATIONAL AIRPORT ARRIVAL FLIGHT TRACKS TO THE PROPOSED RESIDENTIAL AREA OF THE EAST KAPOLEI PROJECT

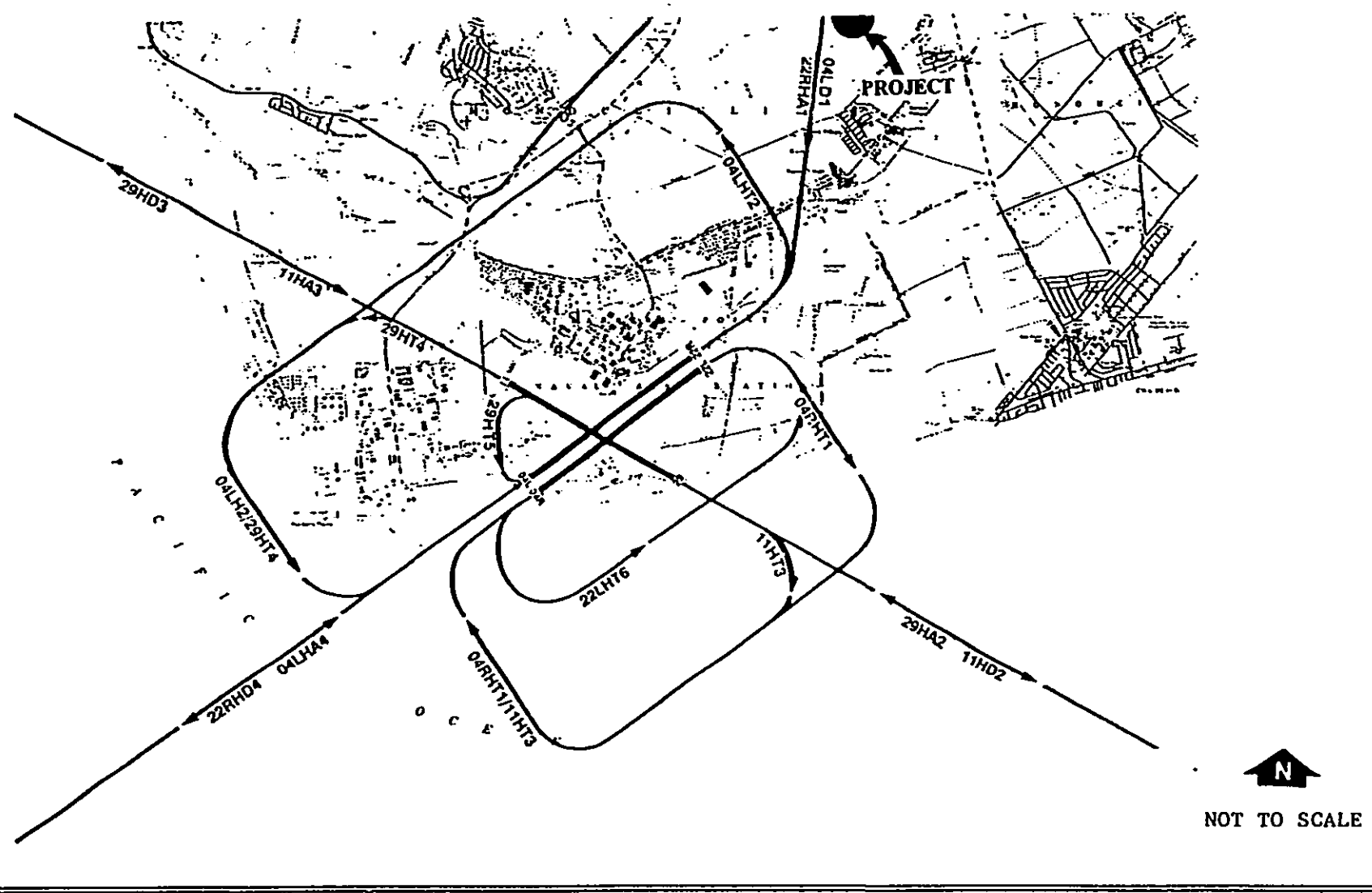


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FIGURE 9 - VICINITY OF BARBERS POINT NAS HELICOPTER FLIGHT TRACKS TO THE PROPOSED RESIDENTIAL AREA OF THE EAST KAPOLEI PROJECT

# G

## East Kapolei Project: Impact on Agriculture, September 1994; East Kapolei Project: Impact on Agriculture (Update), December 13, 1995

Decision Analysts Hawaii, Inc.

# EAST KAPOLEI PROJECT:
## *Impact on Agriculture*

*PREPARED FOR:*

**Schuler Homes, Inc.**

*PREPARED BY:*

**Decision Analysts Hawaii, Inc.**

**September 1994**

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# EXECUTIVE SUMMARY

The East Kapolei Project (the "Project") is a proposed 1,022-acre residential community that will be developed in the central portion of the Ewa Plain by Schuler Homes, Inc. Summarized below are the impacts on agriculture that will result from developing the Project.

## AGRONOMIC CONDITIONS

Assuming typical land rents for agriculture, nearly the entire Project area would be good for crop production. In fact, the lands would be among the best in the State for growing a variety of crops inasmuch as the area offers excellent agronomic conditions and is in a highly desirable location.

## IMPACT ON SUGARCANE OPERATIONS

The property is leased to Oahu Sugar Co., Ltd. (OSCo) until mid-1995, specifically for the cultivation of sugarcane. However, Amfac/JMB Hawaii (Amfac) has announced that it will close this unprofitable plantation in 1995 after the final harvest.

Inasmuch as OSCo is closing for reasons unrelated to the proposed development, and will close before development is scheduled to begin, the Project will have no impact on sugar operations.

## IMPACT ON PINEAPPLE OPERATIONS

The Project will be developed in two phases of 500 acres and 522 acres. The land for Phase I was obtained through an exchange with the State of Hawaii; for its part, the State received about 2,000 acres of land north of Wahiawa in the Poamoho area.

Poamoho has high-quality pineapple fields cultivated by Del Monte Fresh Produce (Hawaii) Inc. ("Del Monte"). In 1993, a residential community was proposed on nearly 900 acres of Poamoho land. This project would have required Del Monte to secure replacement fields, most likely on lands in Kunia that are being released from sugarcane cultivation by OSCo. Furthermore, Del Monte would have had to expend about $700,000 to reconfigure the fields and modify the irrigation system for pineapple cultivation, and would have had to change its planting schedule throughout its plantation to adjust to the fact that Poamoho fields produce summer fruit while Kunia lands produce winter fruit.

The Ewa/Poamoho land exchange was made in order to retain the Poamoho lands in agriculture while using other lands for much-needed housing. Consequently, the proposed Project and the underlying land exchange avoids the adverse impact that would have occurred had the original development proceeded at Poamoho. Del Monte will be able to continue to grow pineapple on the excellent Poamoho fields, thereby avoiding the cost and disruption of relocating a major portion of its farm operation from Poamoho to Kunia.

### INTERIM DIVERSIFIED-AGRICULTURE USE

As mentioned above, Phase I consists of 500 acres of land which was obtained from the State. Until construction begins, the State will make this land, or remaining undeveloped portions of it, available to farmers under short-term leases to grow seed corn and other diversified crops.

As noted below, however, an excess supply of agricultural land exists Statewide and on Oahu. Consequently, the temporary availability of the Project land for diversified crops is not expected to significantly affect the amount of agricultural activity Statewide or on Oahu. However, it may temporarily affect the location of some operations.

### IMPACT ON THE GROWTH OF DIVERSIFIED AGRICULTURE

Ample prime agricultural land will be available to easily accommodate requirements of diversified agriculture Statewide and on Oahu. This conclusion derives from

the following: (1) a vast amount of prime agricultural land and water is available, having been freed from sugar and pineapple production in recent years; (2) additional sugarcane acreage and water will be freed within the next few years; (3) some, if not most, of the sugar companies are willing to make their lands available for profitable replacement crops to the extent that such crops exist; and, in contrast, (4) land requirements for diversified agriculture are surprisingly modest.

As the above indicates, the limiting factor to the growth of diversified agriculture will *not* be the *land supply*, but rather the *size of the market* for those crops that can be grown profitably in Hawaii. The proposed East Kapolei Project involves far too little land to affect this conclusion, and will therefore not affect adversely the Statewide or Oahu growth of diversified agriculture.

# EAST KAPOLEI PROJECT:
# Impact on Agriculture

## INTRODUCTION

The East Kapolei Project (referred to as "the Project" in this report) is a proposed 1,022-acre residential community to be located in the middle of the Ewa Plain, south of both the H-1 Freeway and Farrington Highway, west of Fort Weaver Road, north of Ewa Villages, and east of the Village of Kapolei. The Project is to be developed by Schuler Homes, Inc. in two phases: Phase I, consisting of 500 acres obtained through a land exchange with the State of Hawaii, and Phase II, consisting of 522 acres purchased from The Estate of James Campbell. Sales are scheduled to begin in 1997 and continue through 2011.

This report addresses the impacts on agriculture that will result from developing the Project.

## AGRONOMIC CONDITIONS

### Soil Types[1]

The land within the Project area consists of seven soil types:

| | |
|---|---|
| EaB | Ewa silty clay loam, 3 to 6% slopes; |
| HxA | Honouliuli clay, 0 to 2% slopes; |
| HxB | Honouliuli clay, 2 to 6% slopes; |
| KyA | Kunia silty clay, 0 to 3% slopes; |
| WkA | Waialua silty clay, 0 to 3% slopes; |
| WzA | Waipahu silty clay, 0 to 2% slopes; and |
| WzB | Waipahu silty clay, 2 to 6% slopes. |

For each soil type, Table 1 shows the approximate acreage in both phases, the possible agricultural uses, and two soil ratings (explained below). The predominate soil types are HxA (616 acres, or 60% of the Project area), KyA (216 acres, or 21%), WzA (98 acres, or 10%), and WzB (73 acres, or 7%).

### Soil Characteristics

The Project area has soils which have moderate-to-good machine tillability, are not stony, are more than 30 inches deep, are level or gently sloping, and are either moderately well-drained or well-drained.[2]

Table 1.— EAST KAPOLEI PROJECT: SOIL TYPES, ACREAGES, AGRICULTURAL USES, AND SOIL RATINGS

| Soil Type | Acres Phase I | Acres Phase II | Agricultural Uses | SCS Rating[1] | LESA Rating |
|---|---|---|---|---|---|
| EaB | 0 | 1 | Sugarcane, truck crops, pasture | IIe | 85 |
| HxA | 446 | 170 | Sugarcane, truck crops, pasture | I | 87 |
| HxB | 0 | 4 | Sugarcane, truck crops, pasture | IIe | 85 |
| KyA | 5 | 211 | Sugarcane, pineapple[2] | I | 95 |
| WkA | 0 | 3 | Truck crops, pasture | I | 93 |
| WzA | 30 | 68 | Sugarcane | I | 92 |
| WzB | 17 | 56 | Sugarcane | IIe | 90 |
| Reservoirs | 2 | 9 | | — | — |
| TOTAL | 500 | 522 | | | |

1. Assuming irrigation.
2. As discussed in the text, the Project is at too low of an elevation and temperatures are too warm for pineapple production.

**Soil Ratings**

The soils within the Project 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 and summarized in Figure 1.

(1) *Land Capability Grouping by the United States Department of Agriculture Soil Conservation Service (SCS).*[1]

This classification system rates soils according to eight levels, ranging from the highest classification level, I, to the lowest level, VIII. Assuming irrigation, the SCS Rating for each soil type is shown in Table 1.

For each classification, the acreage, percentage of the Project area, and limitations are as follows:

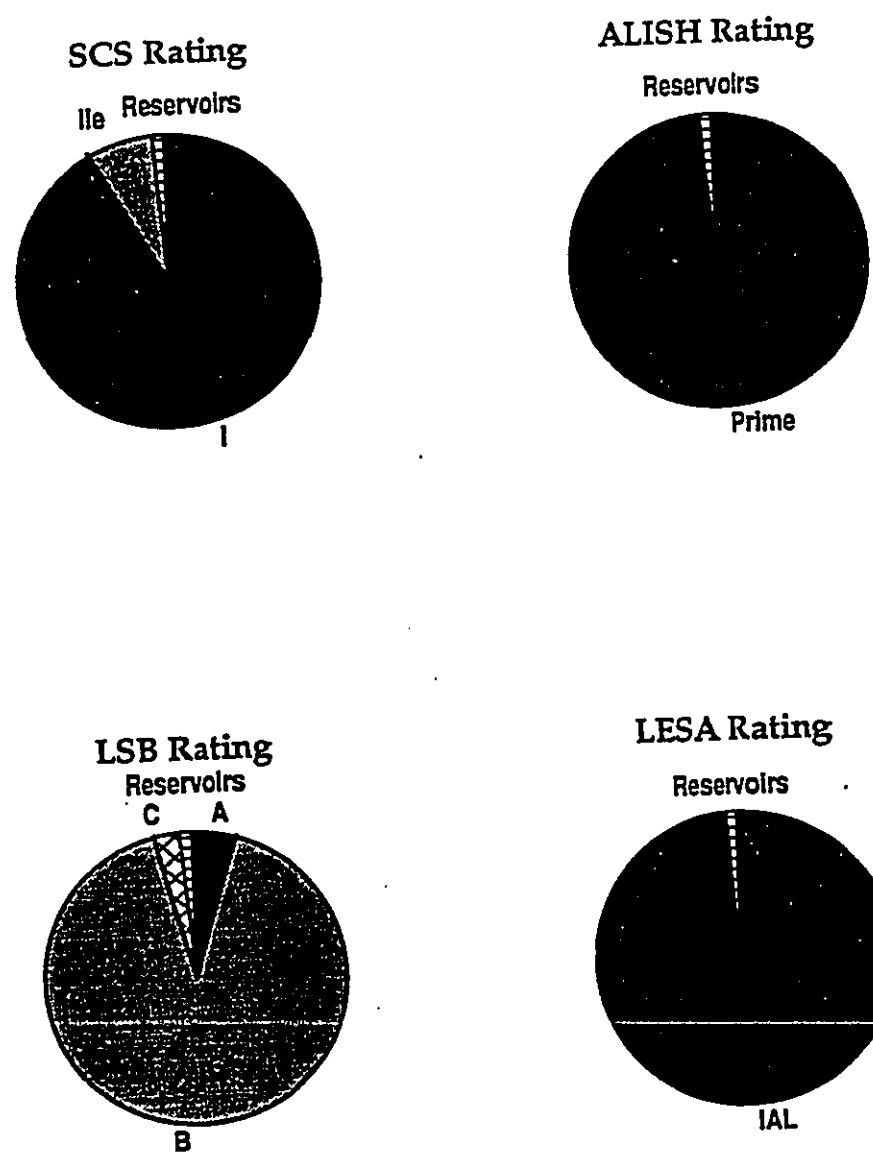
Class I: Class I soils amount to about 481 acres in Phase I and 452 acres in Phase II, for a total of 933 acres. This is about 91% of the entire Project area. Class I soils have few limitations that restrict their use.

Class IIe: Class IIe soils amount to about 17 acres in Phase I and 61 acres in Phase II, for a total of 78 acres. This is about 8% of the entire Project area. Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. The subclassification "e" indicates that the limitation is due to the risk of erosion.

(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.*[3]

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

Figure 1.— EAST KAPOLEI PROJECT: SOIL RATINGS



which is non-prime and non-unique agricultural land that is of importance to the production of crops.

All of the acreage in Phases I and II are rated "prime" except for the approximately 11 acres of reservoirs, which are unrated.

(3) *Overall Productivity Rating, by the UH Land Study Bureau (LSB).*[2]

This classification rates soils according to five levels, with "A" representing the class of highest productivity and "E" the lowest. For each rating and phase, acreages are:

| LSB Rating | Phase I | Phase II | TOTAL | |
|---|---|---|---|---|
| A | 0 | 49 | 49 | (5%) |
| B | 471 | 464 | 935 | (91%) |
| C | 27 | 0 | 27 | (3%) |
| Reservoirs | 2 | 9 | 11 | (1%) |

The "B" rating reflects moderate rather than good drainage, while the "C" rating reflects both moderate drainage and slopes in excess of 10%.

(4) *Proposed Land Evaluation and Site Assessment (LESA) System, by the State of Hawaii Land Evaluation and Site Assessment Commission.*[4]

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 in order that projected agricultural goals can be met. If the LESA classification approach were applied, the designated lands would be termed "important agricultural lands" (IAL), and would include all lands having a rating of 66 or above, out of a possible total of 100. The LESA rating for each soil type is shown in Table 1.

Based on the proposed ratings, all of the Project area would be designated as IAL.

Taking all four of the above soil-rating systems into consideration, all of the property is comprised of good soils.

### Soil Uses

Suitable agricultural activities associated with the affected soil types include sugarcane, pineapple and pasture (see Table 1). However, the fields are at too low of an elevation and temperatures are too warm for pineapple production; if grown at this location, the fruit would burn.

### Elevation and Terrain

Most of the terrain is nearly level or moderately sloped, and ranges in elevation from 50 feet to 170 feet altitude.[2] However, about 27 acres in Phase I has slopes between 11 and 20%.

### Climatic Conditions

The Project area is one of the sunniest areas on Oahu, having an average daily insolation of over 500 calories per square centimeter.[5] Rainfall averages just slightly over 20 inches per year.[6]

The average low temperature ranges from about 60° Fahrenheit in the winter to about 70° in the summer, while the average high temperature ranges from just under 80° in the winter to just under 90° in the summer.[6]

### Irrigation Water

The area has been irrigated with groundwater. Pumping costs are relatively low given the short lift.

### Improvements

The property is serviced with high-quality dirt roads, a drip irrigation system, and electrical power to drive large-volume pumps.

### Locational Advantages

The subject fields are a short trucking distance to:

—the large Honolulu consumer market,

—Honolulu supply markets,

—the airport for air-freighting produce to overseas markets,

—Honolulu Harbor and Barbers Point Harbor for surface shipping of produce to overseas markets, and

—research support from the Hawaiian Sugar Planters' Association and the University of Hawaii.

### Summary

Assuming typical land rents for agriculture, nearly the entire Project area would be good for crop production. In fact, the lands would be among the best in the State for growing a variety of crops inasmuch as the area offers excellent agronomic conditions and is in a highly desirable location. The major disadvantage is that labor costs for farming activities on Oahu are higher than those in some rural areas on the Neighbor Islands.

Because of relatively high sugarcane yields and low farming costs, the central portion of the Ewa plain was referred to as the "golden triangle."

## IMPACT ON SUGARCANE OPERATIONS

The property is leased to Oahu Sugar Co., Ltd. (OSCo) until mid-1995, specifically for the cultivation of sugarcane. However, Amfac/JMB Hawaii (Amfac), which owns OSCo, has announced that it will close this unprofitable plantation in 1995 after the final harvest.

Inasmuch as OSCo is closing for reasons unrelated to the proposed development, and will close before development is scheduled to begin, the Project will have no impact on sugar operations.

## IMPACT ON PINEAPPLE OPERATIONS

### The Ewa/Poamoho Land Exchange

The 500 acres of land in Ewa for Phase I of the Project were obtained through a land exchange with the State of Hawaii. For its part, the State received from the George Galbraith Trust about 2,000 acres of land north of Wahiawa in the Poamoho area. The exchange was made in order to retain these lands in agriculture while using other lands for much-needed housing.

Since the Poamoho lands are being cultivated in pineapple, the proposed Project indirectly affects pineapple operations; this is addressed below.

### Agricultural Quality of the Poamoho Lands

The Poamoho lands are well-suited for pineapple cultivation: soils are deep, well drained, and easy to work; large expanses of flat fields favor use of mechanized equipment; moderate rainfall eliminates the need for installing expensive drip irrigation and also reduces pumping costs for overhead spraying; and temperatures favor summer crops.[7]

However, the Poamoho fields are not favored for cultivating most other crops because of relatively low sunshine in the area and expensive irrigation water, particularly since most crops require far more water than does pineapple.[7]

### Del Monte Fresh Produce (Hawaii) Inc.

Del Monte Fresh Produce (Hawaii) Inc. ("Del Monte") traces its Hawaii roots back to 1898.[7] Currently, its plantation covers about 7,400 acres of leased land, including the Poamoho lands mentioned above and lands in upper Kunia. Nearly 4,800 acres in upper Kunia are leased from the Estate of James Campbell under a 14-year lease that was signed in May 1994.[8] Most of the remaining lands are leased from the State, including the Poamoho lands recently obtained from the George Galbraith Trust, and an additional 580 acres in upper Kunia.

Del Monte farms about 4,400 acres, including fields that are temporarily fallowed as part of the normal crop cycle.[8] Remaining lands include those which are used for its Kunia headquarters, plantation villages, and roads; gullies; and other lands that are unsuitable or uneconomical for mechanized farming.

Pineapple grown in Hawaii by Del Monte is destined for four markets: fresh whole pineapple, "fresh-chilled" pineapple (which is cut), frozen pineapple, and juice concentrate.[7] Del Monte no longer grows pineapple in Hawaii for the canned market because of the low cost of production in Asia and elsewhere.

The fresh-whole and fresh-chilled pineapple are marketed primarily on the U.S. mainland.[7] Nearly two-thirds of it is shipped by air and arrives at market within 48

hours of the time it leaves the fields, with the remainder being shipped in refrigerated cargo ships which arrive at west coast markets 6 to 10 days after harvesting. Juice concentrate and frozen pineapple are marketed on the mainland and in Asia, and are transported by cargo ship.

Fresh-pineapple production remains economically viable on Oahu because of the excellent air transportation to the mainland, thanks largely to Hawaii's visitor industry.[7] Flights to a number of major cities are frequent and reliable, and "back-haul" rates are favorable. In contrast, it is not practical to deliver a large volume of fresh pineapple within 48 hours to many U.S. markets from Maui, Mexico, Central America, the Caribbean, or Asia.

In 1993, Del Monte's Hawaii operation harvested nearly 100,000 tons of pineapple, and generated sales exceeding $54 million.[8] Del Monte has been only marginally profitable in recent years, but the company anticipates profitable operations based on its ability to produce high-value fresh-whole and fresh-chilled pineapple, and the potential with regard to production of other crops.

Del Monte is field testing potatoes, dry-land taro, onions, tomatoes, melons, green peppers, sweet corn, and eggplant. It is also field testing pineapple cultivation in lower Kunia on former OSCo lands.[8]

Del Monte's employment ranges from a low of about 630 workers during the winter months when planting is curtailed due to weather, to a high of about 690 workers in the summer at peak harvest, with an average over the year of about 650 jobs.[8] Current employment totals 690 workers including: 338 field workers; 313 workers in the packing plants; and 39 workers in engineering, operations, research, and sales.

The skills required vary from highly skilled workers (managers, agronomists, engineers, researchers), to skilled (supervisors, technicians, mechanics, equipment operators, journeymen, secretaries, etc.), to semi-skilled (field workers, fruit packers, clerical help, etc.). Hourly wage rates for laborers range from about $6 to over $11, depending on grade level. Salaries are higher for the skilled jobs.

In addition to the direct employment provided by Del Monte, the company indirectly supports about 750 jobs because Del Monte and its employees purchase goods and services.[9] Thus, total employment supported by the company amounts to about 1,400 direct and indirect jobs.

### Proposed Poamoho Development

In 1993, a residential community was proposed on nearly 900 acres of Poamoho land.[7] This project would have required Del Monte to secure replacement fields, most likely on lands in Kunia which are being released from sugarcane cultivation by OSCo.

Assuming replacement lands in this location, Del Monte would have had to expend about $700,000 to convert the Kunia lands from sugarcane to pineapple.[7] The fields would have had to have been laid out with proper spacing for Del Monte's harvesting equipment, and the existing drip irrigation system would have had to have been modified.

In addition, the planting schedule of fields throughout the Del Monte plantation would have had to have been modified, since Poamoho fields produce summer fruit while Kunia lands produce winter fruit.

### Impact of the Proposed Project on Pineapple Operations

The proposed Project, and the underlying Ewa/Poamoho land exchange between the State of Hawaii and the George Galbraith Trust, avoids the adverse impact that would have occurred had the original development proceeded at Poamoho. Del Monte will be able to continue to grow pineapple on the excellent Poamoho fields, thereby avoiding the cost and disruption of relocating a major portion of its farm operation from Poamoho to Kunia.

## INTERIM DIVERSIFIED-AGRICULTURE USE

### Short-Term Agricultural Plans for the Project Lands

Current plans call for Phase I of the Project to be developed in seven sections, with home sales starting as early as 1997 and continuing to about 2004. As mentioned previously, Phase I consists of 500 acres of land which was obtained from the State. Until construction begins on a given section, the State will make the land available to farmers under short-term leases to grow seed corn and other diversified crops. An additional 800 acres of State land planned for a new University of Hawaii campus and other projects will also be made available to farmers under short-term leases.

Although discussions have taken place with potential farmers, land rents, water rates and other lease terms have yet to be negotiated. Also, water delivery and other infrastructure problems are not resolved. Finally, the demand for the subject land has yet to be determined,

### Impact of the Short-Term Agricultural Plans on Agriculture.

Regarding the potential demand for this land, it should be noted that, because of the very substantial contraction of plantation agriculture in Hawaii, the supply of agricultural land available for diversified crops, both Statewide and on Oahu, *far* exceeds projected demand (see next section). Consequently, the temporary availability of the Project land for diversified crops will result in a comparatively small and temporary increase in what is already an excess supply of land for diversified agriculture, both Statewide and on Oahu.

In view of this excess supply, the temporary availability of the Project land for diversified crops is not expected to significantly affect the amount of agricultural activity Statewide or on Oahu. However, it may temporarily affect the location of some operations.

## IMPACT ON THE GROWTH OF DIVERSIFIED AGRICULTURE

The development of the Project area constitutes a commitment of 1,022 acres of agricultural land to a non-agricultural use. This land commitment raises the question of whether the Project area will affect adversely the growth of diversified agriculture—either immediately or over the long term. Before addressing this question, *potential crops, land requirements,* and the *availability of land* for diversified agriculture are discussed below.

### Potential Crops

Depending on lease rents and water costs, crops which could be grown profitably in the area for the Honolulu market include bananas, green beans, bittermelon, mustard cabbage, pak choy cabbage, sweet corn, cucumbers, daikon, dasheen, long eggplant, round eggplant, Manoa lettuce, lotus root, luau leaf, lychee, mango, dry onions,

green onions, parsley, Chinese peas, green peppers, pomelos, pumpkins, hechima squash, hyotan squash, Italian squash, sweet potatoes, tomatoes, watercress, watermelons, feed corn for green chop, flowers, potted foliage, and plants for landscaping.

Potential export crops would include flowers, potted foliage, seed crops, ginger root, and a few other crops.

A great many additional crops can be grown in Hawaii's year-round subtropical climate, but few can be grown profitably on a commercial scale. The primary reasons for this unprofitability are:

—Hawaii's subtropical climate is not well-suited to the commercial production of certain crops which grow better in the temperate mainland climates;

—for certain crops, special hybrids have not been developed that are adapted to Hawaii's subtropical climate;

—crop pests are more prevalent and more expensive to control in Hawaii than they are on the mainland, where the cold winters kill many pests;

—fruit-fly infestations prevent exports of many crops;

—Hawaii suffers from high farm-labor costs, largely because agriculture must compete for its labor against the visitor and related industries;

—high overseas transportation costs increase the cost of importing agricultural supplies and equipment;

—Hawaii's soils generally have low nutrient levels and therefore require high expenditures for fertilizer;

—Hawaii markets are easily glutted due to the comparatively small population (if just a few farmers grow the same crop, an oversupply to the market causes prices to fall, resulting in all of these farmers losing money);

—consumption volumes are too small to support large, efficient farms (i.e., Hawaii's population is too small to support farms that require economies of scale); and

—Hawaii farmers must compete against large mainland farms that can deliver produce to Hawaii more cheaply than it costs to produce the crop locally because these mainland farms (1) incur lower costs for land, labor, supplies, fertilizer, equipment, etc., and (2) produce high volumes that allow economies of scale.

### Land Requirements for Diversified Agriculture

Based on projections made in 1991 by the State Department of Agriculture (DOA), additional Statewide land requirements to accommodate the growth of diversified agriculture to the year 2010 will amount to approximately 41,000 acres.[10] The projections suggest that about 83% of this new acreage will be required for macadamia nut and coffee orchards, while about 7,000 acres will be required to accommodate the growth of other diversified-agriculture crops.

The projections indicate that most of this growth in diversified agriculture will occur on the Neighbor Islands, while Oahu will require only about 1,000 acres, of which about half would be for bananas.

### Supply of Land for Diversified Agriculture—Statewide

With regard to the Statewide supply of agricultural land, an enormous and growing supply of this land is available for diversified agriculture. Since 1968, about 190,000 acres of Hawaii's higher-quality agricultural land have been or will soon be released from sugar and pineapple production, including land that is being released from sugar plantations which are closing.[11-13] Including the acreage being released by OSCo, this is over five times the amount of sugar and pineapple land on Oahu—about 35,000 acres of plantation land which covers most of the Ewa Plain, Central Oahu, and the North Shore.

The amount of land released from sugar production will probably increase given that additional sugar plantations are struggling. Although a collapse of the sugar industry is not anticipated, further contraction of the industry will occur.

In addition, a portion of the existing sugarcane land is on hold awaiting the discovery of profitable replacement activities. This land also forms part of the supply of agricultural land available for profitable diversified-agriculture crops. Moreover, the greater the success of diversified agriculture, the greater the amount of land that will be released for diversified agriculture. Examples of sugarcane land being released for other crops include: macadamia nut orchards on land released from Mauna Kea Agribusiness Co., Inc.; macadamia nut and citrus orchards on land released from Ka'u Agribusiness Co., Inc.; macadamia nut orchards and pineapple operations on land re-

leased from Wailuku Agribusiness Co., Inc.; coffee orchards on land released by McBryde; seed corn and nursery operations on land released from HC&S; and seed corn operations on land released from Kekaha Sugar Co., Ltd.

Some of the land that has been—or soon will be—freed from plantation agriculture has been or is scheduled to be converted to urban, diversified-agriculture, and other uses. After making allowances for these conversions, uncommitted acreage which remains available for diversified agriculture amounts to over 150,000 acres.[14] Much of this land is or will soon be fallow, or used for grazing, or is in some other low-value land-holding operation. For perspective, this is over four times the amount of sugar and pineapple land on Oahu. Also, this acreage figure is expected to increase as more land is released from sugar production.

Many of the lands freed, to be freed, or which 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, particularly those which have been freed from sugar production.

Additional lands which have been made available for diversified agriculture are in government-sponsored agricultural parks throughout the State. 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 which 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.

## Supply of Land for Diversified Agriculture—Oahu

*Lands Available for Diversified Agriculture*

Truck farms on Oahu are located in Waimanalo (on former Waimanalo Sugar Co. lands), Waiahole and Waikane Valleys, Kahuku (on former Kahuku Plantation Co. lands), Waianae (some of which are on former Waianae Co. lands), and various other areas. These agricultural lands have yet to be fully utilized.

Existing and planned State agricultural parks located on Oahu include three existing projects and three planned ones:

| | Acres | Lots | Lot Size (Acres) | Use |
|---|---|---|---|---|
| Existing Ag Parks: | | | | |
| Waimanalo | 196 | 20 | 5 to 10 | Diversified crops |
| Waianae | 150 | 17 | 5 to 10 | Livestock, shade crops |
| Kahuku | 220<br>233 | 24 | 5 to 10 | Diversified crops, dairy |
| Planned Ag Parks: | | | | |
| Kunia | 150 | 20 | 5 to 15 | Truck crops |
| Waiahole | 379 | 45 | — | Diversified crops |
| Kahuku | 750 to 900 | — | — | Livestock |

*Lands Being Released by OSCo*

Because of the closure of OSCo, a dramatic increase in the supply of land available on Oahu for diversified agriculture is scheduled to occur. Approximately 10,500 acres will be released from sugar production over the 2 years from 1993 to 1995. However, over the next 20 years, as many as 3,500 acres of the OSCo lands may be urbanized, including the subject lands as well as lands to the west of Kapolei, to the south of Ewa Villages, and to the north of Royal Kunia up to the high-voltage power lines which cross Central Oahu.

This will leave approximately 7,000 acres available for agriculture. About 4,800 acres in Kunia and central Ewa are among the best agricultural lands in the State: agronomic conditions are excellent, water is inexpensive, and the location is excellent. The Navy lands in Ewa and on Waipio Peninsula, which total about 2,200 acres, share many of these same characteristics, although the soils are not as good.

In addition to the above, over 1,000 acres of fallowed land are in the foothills west of Kunia Road. OSCo stopped farming these fields in the early 1980s because of the high cost of pumping water to them.

Nearly all of the privately-owned Kunia and central Ewa lands are likely to remain available for agriculture far into the future because:

—landowners intend to keep this land in agriculture;

—development plans, for the most part, favor urbanizing lower-quality agricultural lands rather than the remaining Kunia and central Ewa lands;

—housing needs can be accommodated far into the future by the existing, planned and potential developments (assuming continued and new development approvals for the East Kapolei Project, Kapolei, West Loch, Ewa Gentry, Waiawa Gentry, Ewa Marina, Laulani/Fairways, Ko Olina, Makakilo, Makaiwa, Royal Kunia Phases I and II, Waikele, Mililani Mauka, etc.); and

—use of Waiahole Ditch water on crops in Kunia would enable valuable water systems to be maintained, and a portion of the water would continue to seep down and recharge the groundwater supply.

*Potential Release of Additional Land for Diversified Agriculture*

Waialua Sugar Co., Inc. (WSCo), which has been unprofitable for a number of years, has also announced that it may close. Such a closure would release additional land for diversified agriculture; in 1991, WSCo farmed slightly more than 12,000 acres.[12]

## Outlook for Diversified Agriculture

Based on the above assessment, ample prime agricultural land will be available to easily accommodate the Statewide and Oahu requirements of diversified agriculture. This conclusion derives from the following: (1) a vast amount of prime agricultural land and water is available, having been freed from sugar and pineapple production in recent years; (2) additional sugarcane acreage and water will be freed within the next few years; (3) some, if not most, of the sugar companies are willing to make their lands available for profitable replacement crops to the extent that such crops exist; and, in contrast, (4) land requirements for diversified agriculture are surprisingly modest.

**Impact of the East Kapolei Project on the Growth of Diversified Agriculture**

As the discussion above indicates, the limiting factor to the growth of diversified agriculture will *not* be the *land supply*, but rather the *size of the market* for those crops that can be grown profitably in Hawaii. The proposed East Kapolei Project involves far too little land to affect this conclusion, and will therefore not affect adversely the growth of diversified agriculture, Statewide or on Oahu.

## CONSISTENCY WITH STATE AND COUNTY PLANS

The *Hawaii State Constitution*, the *Hawaii State Plan*, the *State Agriculture Functional Plan*, and the *General Plan of the City and County of Honolulu* call for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture (see Table 2). To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to *plantation agriculture*, development of the Project will have no impact on the sugar industry since sugar operations in the area are closing for reasons unrelated to the Project. However, the Project and the underlying Ewa/Poamoho land exchange will indirectly benefit the pineapple industry. Because the original project at Poamoho will not proceed and the Poamoho lands have been transferred to the State, Del Monte will be able to continue to grow pineapple on these excellent fields, thereby avoiding the cost and disruption of relocating a major portion of its farm operation from Poamoho to Kunia.

With regard to *diversified agriculture*, there will be a temporary benefit in that the 500 acres in Phase I will be made available for diversified crops until the land is needed for development. Over the longer term, development of the Project will not limit the growth of diversified agriculture since far more agricultural land has been released from plantation agriculture than has been absorbed by other activities; growth of diversified agriculture will be limited by the size of the market, not the land supply.

In view of these findings, the Project will not conflict with the major thrust of the diversified-agriculture portion of State and County Plans.

The Project is consistent with population-growth and housing policies which call for "non-essential agricultural lands" to be made available for "low- and moderate-income and gap group housing" and "appropriate urban uses."

Regarding policies "...to preserve and protect agricultural lands," discussions in the Agriculture portion of the *State Functional Plan* recognize that redesignation of lands from Agriculture to Urban should be allowed "... upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in ..." agriculture; that is, when an "overriding public interest exists."[15] The enormous contraction in plantation agriculture—resulting in the supply of agricultural land, water and labor far exceeding projected demand—constitutes a major change in economic and social conditions. Furthermore, the proposed development of homes will provide significant social benefits.

## Table 2.—SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS

HAWAII STATE CONSTITUTION (Article XI, Section 3):

> ...to conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands...

HAWAII STATE PLAN (Chapter 226, Hawaii Revised Statutes, as amended):[16,17]

**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) Viability in Hawaii's sugar and pineapple industries.

(2) Growth and development of diversified agriculture throughout the State.

(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.

(b) To achieve the agricultural objectives, it shall be the policy of the State to:

(2) Encourage agriculture by making best use of natural resources.

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

(16) Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.

## Table 2.—SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS (continued)

**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.

(10) Support the continuation of land currently in use for diversified agriculture.

**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.

**Section 226-106 Affordable Housing**

Priority guidelines for the provision of affordable housing:

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

Table 2.—SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS
(continued)

**AGRICULTURE STATE FUNCTIONAL PLAN (1991)[15]**
(Functional plans are guidelines for implementing the State Plan. They are approved by the Governor, but not adopted by the State Legislature.)

Objective H: Achievement of Productive Agricultural Use of Lands Most Suitable and Needed for Agriculture.

Policy H(2): Conserve and protect important agricultural lands in accordance with the Hawaii State Constitution.

Action H(2)(a): Propose enactment of standards and criteria to identify, conserve, and protect important agricultural lands and lands in agricultural use.

Action H(2)(c): Administer land use district boundary amendments, permitted land uses, infrastructure standards, and other planning and regulatory functions on important agricultural lands and lands in agricultural use, so as to ensure the availability of agriculturally suitable lands and promote diversified agriculture.

**CITY AND COUNTY OF HONOLULU**
**GENERAL PLAN, Objectives and Policies (Resolution No. 87-211)[18]**

**Economic Activity**

Objective C. To maintain the viability of agriculture on Oahu.

Policy 4. Provide sufficient agricultural land in Ewa, Central Oahu, and the North Shore to encourage the continuation of sugar and pineapple as viable industries.

Policy 5. Maintain agricultural land along the Windward, North Shore, and Waianae coasts for truck farming, flower growing, aquaculture, livestock production, and other types of diversified agriculture.

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# EAST KAPOLEI PROJECT:

## *Impact on Agriculture*

# *EAST KAPOLEI PROJECT:*
## *Impact on Agriculture*

*PREPARED FOR:*

**Schuler Homes, Inc.**

*PREPARED BY:*

**Decision Analysts Hawaii, Inc.**

**December 1995**

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# EXECUTIVE SUMMARY

The East Kapolei Project (the "Project") is a proposed 794-acre residential community that will be developed in the central portion of the Ewa Plain by Schuler Homes, Inc. Summarized below are the impacts on agriculture that will result from developing the Project.

### AGRICULTURAL CONDITIONS

Nearly all of the Project area would be good for cultivating crops inasmuch as the area offers favorable agronomic conditions and is in a desirable location.

### IMPACT ON EXISTING AND NEARBY AGRICULTURAL OPERATIONS

The Project would have no impact on existing or nearby agricultural operations because the fields on the property, as well as the surrounding fields, are fallow.

### IMPACT ON THE AGRICULTURAL-LAND RESOURCE

The Project may precipitate the development of approximately 63 additional acres of land which separates the two sections of the Project. Eventually this land, which fronts Farrington Highway on the north side, would be suitable for commercial development. The affected acreage has favorable conditions for cultivating crops.

### IMPACT ON THE GROWTH OF DIVERSIFIED AGRICULTURE

Ample prime agricultural land will be available to easily accommodate the projected growth of diversified agriculture Statewide and on Oahu. This conclusion derives from the following: (1) a vast amount of prime agricultural land and water currently is available, having been freed from sugar and pineapple production in

recent years; (2) additional sugarcane acreage and water will be freed in coming years; (3) some of the sugar companies, if not most of them, are willing to make their lands available for profitable replacement crops to the extent that such crops exist; and, in contrast, (4) projected land requirements for diversified agriculture are surprisingly modest.

As the above indicates, the limiting factor to the growth of diversified agriculture will *not* be the *land supply*, but rather the *size of the market* for those crops that can be grown profitably in Hawaii. The proposed East Kapolei Project involves far too little land to affect this conclusion, and will therefore not affect adversely the growth of diversified agriculture, Statewide or on Oahu.

# EAST KAPOLEI PROJECT:
# Impact on Agriculture

## INTRODUCTION

The East Kapolei Project (referred to as "the Project" in this report) is a 794-acre residential community proposed for development by Schuler Homes, Inc. It will be located in the middle of the Ewa Plain, south of the H-1 Freeway, west of Fort Weaver Road, north of Ewa Villages, and east of the Villages of Kapolei. The Project contains two areas which are separated by Farrington Highway and a strip of land fronting the highway on the north side. Also, a drainage basin for the project lies below Renton Road on the East side of Fort Weaver Road.

This report addresses the impacts on agriculture that will result from developing the Project. The analysis covers the 779-acre portion (referred to as "the Project area") which will contain the planned community and the nearby drainage basin. The remaining 15 acres which are not included in this analysis involve land for a water tank that will be north of the Project, an easement for a water pipe to the Project, an easement for a drainage pipe, and access roads to the Project.

## AGRICULTURAL CONDITIONS

### Soil Types[1]

The land within the Project area consists of nine soil types:

| | |
|---|---|
| EaB | Ewa silty clay loam, 3 to 6% slopes; |
| EmA | Ewa silty clay loam, 0 to 2% slopes; |
| HxA | Honouliuli clay, 0 to 2% slopes; |
| HxB | Honouliuli clay, 2 to 6% slopes; |
| KyA | Kunia silty clay, 0 to 3% slopes; |
| MnC | Mamala stony silty clay loam, 0 to 12% slopes; |

| | |
|---|---|
| WzA | Waipahu silty clay, 0 to 2% slopes; |
| WzB | Waipahu silty clay, 2 to 6% slopes; an |
| WzC | Waipahu silty clay, 6 to 12% slopes. |

For each soil type, Table 1 shows the approximate acreage, the possible agricultural uses, and two soil ratings (explained below). The predominate soil types are HxA, KyA and WzA which, collectively, cover 642 acres, or 82% of the Project area.

**Soil Ratings**

The soils within the Project 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 and summarized in Figure 1.

(1) *Land Capability Grouping by the United States Department of Agriculture Soil Conservation Service (SCS).*[2]

This classification system rates soils according to eight levels, ranging from the highest classification level; I, to the lowest level, VIII. Assuming irrigation, the SCS Rating for each soil type is shown in Table 1.

For each classification, the acreage, percentage of the Project area, and limitations are as follows:

Class I: Class I soils amount to about 642 acres, or about 82% of the Project area. Class I soils have few limitations that restrict their use.

Class IIe: Class IIe soils amount to about 120 acres, or about 15% of the Project area. Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices. The subclassification "e" indicates that the limitation is due to the risk of erosion.

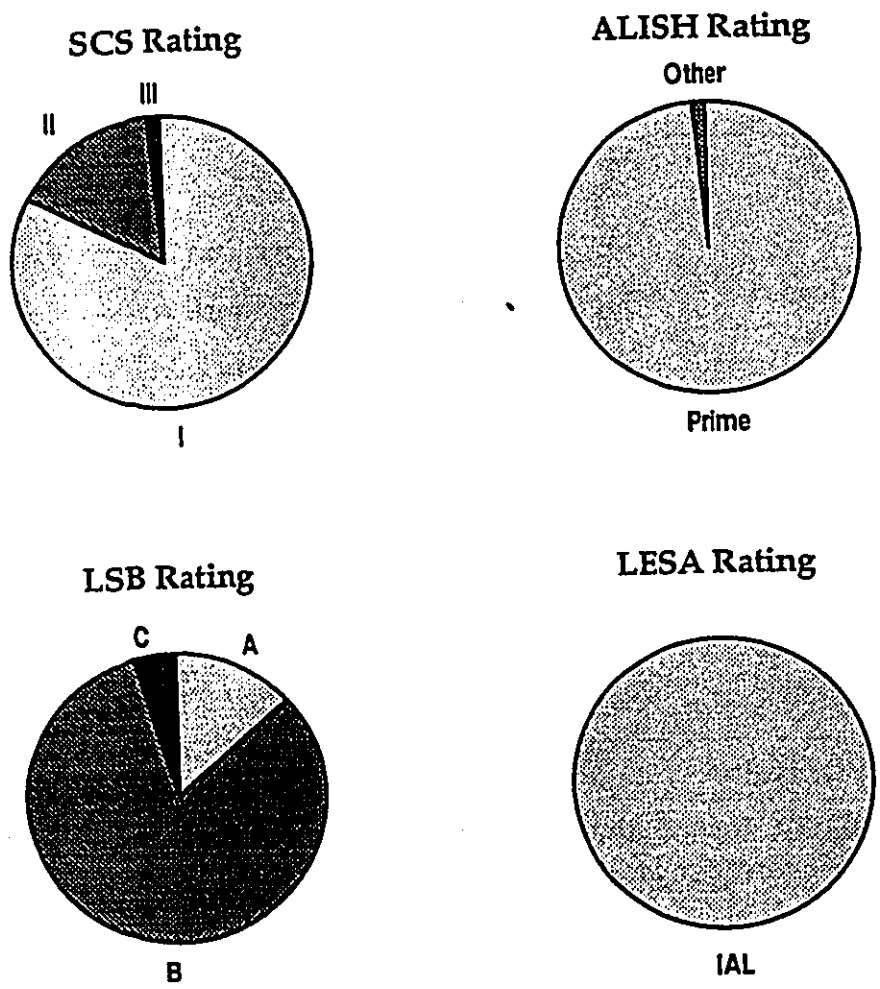
Class IIs: Class IIs soils amount to about 5 acres, or about 0.6% of the Project area. The subclassification "s" indicates that the limitation is due to stoniness, unfavorable texture, shallowness, or low water-holding capacity.

Table 1.— EAST KAPOLEI PROJECT: SOIL TYPES, ACREAGES, AGRICULTURAL USES, AND SOIL RATINGS

| Soil Type | Acres | Agricultural Uses | SCS Rating[1] | LESA Rating |
|---|---|---|---|---|
| EaB | 36 | Sugarcane, truck crops, pasture | IIe | 85 |
| EmA | 5 | Sugarcane, truck crops, pasture | IIs | 74 |
| HxA | 251 | Sugarcane, truck crops, pasture | I | 87 |
| HxB | 1 | Sugarcane, truck crops, pasture | IIe | 85 |
| KyA | 253 | Sugarcane, pineapple[2] | I | 95 |
| MnC | 1 | Sugarcane, truck crops, pasture | IIIs | 66 |
| WzA | 138 | Sugarcane | I | 92 |
| WzB | 84 | Sugarcane | IIe | 90 |
| WzC | 10 | Sugarcane | IIIe | 74 |
| TOTAL | 779 | | | |

1. Assuming irrigation.
2. As discussed in the text, the Project is at too low of an elevation and temperatures are too warm for pineapple production.

Figure 1.— EAST KAPOLEI PROJECT: SOIL RATINGS



Class IIIe: Class IIIe soils amount to about 10 acres, or about 1% of the Project area. Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both. The subclassification "e" indicates that the soils are subject to severe erosion if they are cultivated and not protected.

Class IIIs: Class IIIs soils amount to about 1 acre, or about 0.1% of the Project area. The subclassification "s" indicates that the limitation is due to stoniness, unfavorable texture, shallowness, or low water-holding capacity.

(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.*[3]

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 768 acres (99%) of the Project area are rated "prime," while 11 acres (1%) are rated "other."

(3) *Overall Productivity Rating, by the UH Land Study Bureau (LSB).*[4]

This classification rates soils according to five levels, with "A" representing the class of highest productivity and "E" the lowest.

Approximately 109 acres (14%) of the Project area are rated "A," 635 acres (81%) are rated "B," and and 35 acres (5%) are rated "C."

(4) *Proposed Land Evaluation and Site Assessment (LESA) System, by the State of Hawaii Land Evaluation and Site Assessment Commission.*[5]

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 in order that pro-

jected agricultural goals can be met. If the LESA classification approach were applied, the designated lands would be termed "important agricultural lands" (IAL), and would include all lands having a rating of 66 or above, out of a possible total of 100. The LESA rating for each soil type is shown in Table 1.

Based on the proposed ratings, all of the Project area would be designated as IAL.

Taking all four of the above soil-rating systems into consideration, all of the property is comprised of good soils.

### Soil Uses

Suitable agricultural activities associated with the affected soil types include sugarcane, pineapple, truck crops and pasture (see Table 1). In the case of pineapple, however, the fields are at too low of an elevation and temperatures are too warm for producing this crop; if grown at this location, the fruit would burn.

### Soil Characteristics

Most of the Project area has soils which have moderate-to-good machine tillability, are not stony, are more than 30 inches deep, are level or gently sloping, and are either moderately well-drained or well-drained.[4]

### Elevation and Terrain

Most of the terrain is nearly level or moderately sloped, and ranges in elevation from 30 feet to 230 feet altitude.[4] However, about 10 acres have slopes between 6 and 12%.

### Climatic Conditions

The Project area is one of the sunniest areas on Oahu, having an average daily insolation of about 500 calories per square centimeter.[6] Rainfall averages just slightly over 20 inches per year.[7]

The average low temperature ranges from about 60° Fahrenheit in the winter to about 70° in the summer, while the average high temperature ranges from just under 80° in the winter to just under 90° in the summer.[7]

### Irrigation Water

The area has been irrigated with groundwater. Pumping costs are relatively low given the short lift.

### Improvements

The property is serviced with high-quality dirt roads, a drip irrigation system, and electrical power to drive large-volume pumps.

### Locational Advantages

The subject fields are a short trucking distance to:

—the large Honolulu consumer market,

—Honolulu supply markets,

—the airport for air-freighting produce to overseas markets,

—Honolulu Harbor and Barbers Point Harbor for surface shipping of produce to overseas markets, and

—research support from the Hawaiian Sugar Planters' Association and the University of Hawaii.

### Summary

Nearly all of the Project area would be good for cultivating crops inasmuch as the area offers favorable agronomic conditions and is in a desirable location.

## Agricultural History

For the better part of a century until the 1995 closure of Oahu Sugar Co., Ltd., the Project area was cultivated in sugarcane.

## Impact on Existing and Nearby Agricultural Operations

The Project would have no impact on existing or nearby agricultural operations because the fields on the property, as well as the surrounding fields, are fallow.

## Impact on the Agricultural-Land Resource

The Project may precipitate the development of approximately 63 additional acres of agricultural land which separates the two sections of the Project. Eventually this land, which fronts Farrington Highway on the north side, would be suitable for commercial development. The affected acreage has high-quality soils, nearly level terrain, favorable climatic conditions for crops, and a good location for serving the Honolulu market.

Thus, the Project may result in the eventual loss of a total of about 842 acres of good agricultural land: 779 acres for the Project area, plus the additional 63 acres which may be developed for commercial use.

## Impact on the Growth of Diversified Agriculture

The development of the Project constitutes a commitment of approximately 842 acres of good agricultural land to a non-agricultural use. This land commitment raises the question of whether the Project area will affect adversely the growth of diversified agriculture—either immediately or over the long term. Before addressing this question, *potential crops, land requirements,* and the *availability of land* for diversified agriculture are discussed below.

### Potential Crops

Crops grown for the *Hawaii market* which are climatically suited to low-elevation areas in Hawaii and which have been profitable for some Hawaii farmers, include: bananas, green beans, bittermelon, mustard cabbage, pak choy cabbage, sweet corn, cucumbers, daikon, dasheen, long eggplant, round eggplant, Manoa lettuce, lotus root, luau leaf, lychee, mango, dry onions, green onions, parsley, Chinese peas, green peppers, pomelos, pumpkins, hechima squash, hyotan squash, Italian squash, sweet potatoes, tomatoes, watercress, watermelons, feed corn for green chop, flowers, potted foliage, and plants for landscaping.

Potential low-elevation crops grown for the *export market* include: tropical fruits (if no fruit-fly infestation exists), a few vegetables grown for the winter market, flowers, potted foliage, seed crops, ginger root, and a few other crops.

A great many additional crops can be grown in Hawaii's year-round subtropical climate, but few can be grown profitably on a commercial scale. The primary reasons for this unprofitability are:

—Hawaii markets are easily glutted due to its comparatively small population (if just a few farmers grow the same crop, an oversupply to the market causes prices to fall, resulting in all of these farmers losing money).

—Consumption levels are too small to support large, efficient farms (i.e., Hawaii's population is too small to support farms that require economies of scale).

—Hawaii farmers must compete against large mainland farms that can deliver produce to Hawaii more cheaply than it costs to produce the crop locally because these mainland farms (1) incur lower costs for land, labor, supplies, fertilizer, equipment, etc., and (2) produce high volumes that allow economies of scale.

—Hawaii's subtropical climate is not well-suited to the commercial production of certain crops which grow better in the temperate mainland climates.

—For certain crops, special hybrids have not been developed that are adapted to Hawaii's subtropical climate.

—Crop pests are more prevalent and more expensive to control in Hawaii than they are on the mainland, where the cold winters kill many pests.

—Fruit-fly infestations prevent exports of many crops.

—Hawaii suffers from high farm-labor costs, largely because agriculture must compete for its labor against the visitor industry and related industries.

—Hawaii's soils generally have low nutrient levels and therefore require high expenditures for fertilizer.

—High overseas transportation costs increase the cost of importing agricultural supplies and equipment and, for export crops, shipping produce to market.

### Land Requirements for Diversified Agriculture

Based on projections made in 1991 by the State Department of Agriculture (DOA), additional Statewide land requirements to accommodate the growth of diversified agriculture to the year 2010 will amount to approximately 41,000 acres.[8] The projections

suggest that about 83% of this new acreage will be required for macadamia nut and coffee orchards, while about 7,000 acres will be required to accommodate the growth of other diversified-agriculture crops.

The projections indicate that most of this growth in diversified agriculture will occur on the Neighbor Islands, while Oahu will require only about 1,000 acres, of which about half would be for bananas.

Although it is not addressed in the DOA projections, the relocation of farm operations to Oahu from Molokai and other Neighbor Islands may add to the demand for agricultural land on Oahu by as much as 2,000 acres.

### Supply of Land for Diversified Agriculture—Statewide

With regard to the Statewide supply of agricultural land, an enormous and growing supply of this land is available for diversified agriculture. Since 1968, about 215,000 acres of Hawaii's higher-quality agricultural land have been or will soon be released from sugar and pineapple production, including land that is being released from sugar plantations which are closing.[9-11]

The amount of land released from sugar production will probably increase given that additional sugar plantations are struggling.

In addition, a portion of the existing sugarcane land is on hold awaiting the discovery of profitable replacement activities. This land also forms part of the supply of agricultural land available for profitable diversified-agriculture crops. Moreover, the greater the success of diversified agriculture, the greater the amount of land that will be released for diversified agriculture. In the past, operating plantations released some of their lands for such crops as macadamia nuts, coffee, citrus, seed corn, truck crops, and nursery products.

Some of the land that has been—or soon will be—freed from plantation agriculture has been converted or is scheduled to be converted to urban, diversified-agriculture, and other uses. After making allowances for these conversions, uncommitted acreage which remains available for diversified agriculture amounts to about 177,000 acres.[12] Much of this land is fallow, used for grazing, or is in some other low-value land-holding operation. Also, this acreage figure is expected to increase as more land is released from sugar production.

Many of the lands freed, to be freed, or which 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—particularly those which have been freed from sugar production.

Additional lands which have been made available for diversified agriculture are in government-sponsored agricultural parks throughout the State. Also, lava lands in Puna are particularly well-suited for growing papaya.

## Supply of Land for Diversified Agriculture—Oahu

Because of the closure of sugar operations on Oahu, a dramatic increase in the supply of land available for diversified agriculture has occurred.

### *Lands Released by Oahu Sugar Co., Ltd.*

Some of the best lands in the State for diversified agriculture are the 10,500 acres recently released by Oahu Sugar Co., Ltd.[10] Most of these fields have good soils, the areas is sunny, and irrigation costs are low.[13] Furthermore, the lands are a short trucking distance to the large Honolulu market and, for export markets, to the Honolulu International Airport and Honolulu Harbor. However, over the next 20 years, as many as 3,500 acres of the OSCo lands may be urbanized.[12]

### *Lands Released by Waialua Sugar Co., Inc.*

Most of the 12,000 acres being released by the closure of Waialua Sugar Co., Inc. are also of high quality.[10] However, these lands are a longer trucking distance to the Honolulu markets.

### *Other Lands Available for Diversified Agriculture*

Agricultural lands have yet to be fully utilized in Waimanalo, Waiahole Valley, Waikane Valley, Kahuku, Waianae and at the three existing State agricultural parks on Oahu.

In addition, the State plans to develop three more agricultural parks on Oahu: Kunia Ag Park for truck crops (150 acres, 20 lots of 5 to 15 acres); Waiahole Ag Park for diversified crops (379 acres, 45 lots); and Kahuku Ag Park for livestock (750 to 900 acres).

### Outlook for the Diversified Agriculture Land Market

Based on the above assessment, ample prime agricultural land will be available to easily accommodate the projected growth of diversified agriculture Statewide and on Oahu. This conclusion derives from the following: (1) a vast amount of prime agricultural land and water currently is available, having been freed from sugar and pineapple production in recent years; (2) additional sugarcane acreage and water will be freed in coming years; (3) some of the sugar companies, if not most of them, are willing to make their lands available for profitable replacement crops to the extent that such crops exist; and, in contrast, (4) projected land requirements for diversified agriculture are surprisingly modest.

### Impact of the East Kapolei Project on the Growth of Diversified Agriculture

As the discussion above indicates, the limiting factor to the growth of diversified agriculture will *not* be the *land supply*, but rather the *size of the market* for those crops that can be grown profitably in Hawaii. The proposed East Kapolei Project involves far too little land to affect this conclusion, and will therefore not affect adversely the growth of diversified agriculture, Statewide or on Oahu.

## Consistency with State and County Plans

The *Hawaii State Constitution*, the *Hawaii State Plan*, the *State Agriculture Functional Plan*, and the *General Plan of the City and County of Honolulu* call for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture (see Table 2). To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured.

With regard to *plantation agriculture*, development of the Project will have no impact on the sugar industry since sugar operations in the area were closed for reasons that are unrelated to the Project.

With regard to *diversified agriculture*, development of the Project will not limit the growth of diversified agriculture since far more agricultural land has been released from plantation agriculture than has been absorbed by other activities; growth of diversified agriculture will be limited by the size of the market, not the land supply.

In view of these findings, the Project will not conflict with the major thrust of the diversified-agriculture portion of State and County Plans.

The Project is consistent with population-growth and housing policies which call for "non-essential agricultural lands" to be made available for "low- and moderate-income and gap group housing" and "appropriate urban uses."

Regarding policies "...to preserve and protect agricultural lands," discussions in the Agriculture portion of the *State Functional Plan* recognize that redesignation of lands from Agriculture to Urban should be allowed "... upon a demonstrated change in economic or social conditions, and where the requested redesignation will provide greater benefits to the general public than its retention in ..." agriculture; that is, when an "overriding public interest exists."[14] The enormous contraction in plantation agriculture—resulting in the supply of agricultural land, water and labor far exceeding projected demand—constitutes a major change in economic and social conditions. Furthermore, the proposed development of homes will provide significant social benefits.

## Table 2.—Selected State and County Objectives, Policies, and Guidelines Related to Agricultural Lands

HAWAII STATE CONSTITUTION (Article XI, Section 3):

> ...to conserve and protect agricultural lands, promote diversified agriculture, increase agricultural self-sufficiency and assure the availability of agriculturally suitable lands...

HAWAII STATE PLAN (Chapter 226, Hawaii Revised Statutes, as amended):[15,16]

**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) Viability in Hawaii's sugar and pineapple industries.

(2) Growth and development of diversified agriculture throughout the State.

(3) An agriculture industry that continues to constitute a dynamic and essential component of Hawaii's strategic, economic, and social well-being.

(b) To achieve the agricultural objectives, it shall be the policy of the State to:

(2) Encourage agriculture by making best use of natural resources.

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

(16) Facilitate the transition of agricultural lands in economically nonfeasible agricultural production to economically viable agricultural uses.

Table 2.—SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS
(continued)

**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.

(10) Support the continuation of land currently in use for diversified agriculture.

**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.

**Section 226-106 Affordable Housing**

Priority guidelines for the provision of affordable housing:

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

Table 2.—SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS
(continued)

**AGRICULTURE STATE FUNCTIONAL PLAN (1991)[14]**
(Functional plans are guidelines for implementing the State Plan. They are approved by the Governor, but not adopted by the State Legislature.)

Objective H: Achievement of Productive Agricultural Use of Lands Most Suitable and Needed for Agriculture.

Policy H(2): Conserve and protect important agricultural lands in accordance with the Hawaii State Constitution.

Action H(2)(a): Propose enactment of standards and criteria to identify, conserve, and protect important agricultural lands and lands in agricultural use.

Action H(2)(c): Administer land use district boundary amendments, permitted land uses, infrastructure standards, and other planning and regulatory functions on important agricultural lands and lands in agricultural use, so as to ensure the availability of agriculturally suitable lands and promote diversified agriculture.

**CITY AND COUNTY OF HONOLULU**
**GENERAL PLAN, Objectives and Policies (Resolution No. 87-211)[17]**

**Economic Activity**

Objective C. To maintain the viability of agriculture on Oahu.

Policy 4. Provide sufficient agricultural land in Ewa, Central Oahu, and the North Shore to encourage the continuation of sugar and pineapple as viable industries.

Policy 5. Maintain agricultural land along the Windward, North Shore, and Waianae coasts for truck farming, flower growing, aquaculture, livestock production, and other types of diversified agriculture.

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# H

## OAHU BIOLOGICAL RESOURCES SURVEY REPORT, JULY 1994; ADDENDUM, 1995

EVANGELINE FUNK, PH.D.

# BIOLOGICAL RESOURCES SURVEY REPORT FOR SCHULER HOMES EAST KAPOLEI PROJECT, EAST KAPOLEI, OAHU HAWAII

FOR
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# BOTANICAL SURVEY REPORT FOR SCHULER HOMES EAST KAPOLEI PROJECT SITE

## INTRODUCTION

A botanical survey of the proposed Schuler Homes East Kapolei Project Site, East Kapolei, Oahu, Hawaii was undertaken in July, 1994. The purpose for the survey of this 1000 acre site was to collect data for the preparation of a species list; to describe the vegetation of the site; and to ascertain if any proposed or listed, threatened or endangered plants are growing in the area (USFWS 1993).

## METHODS

The walk-through method was used during the data collection phase of the survey. All parts of the site were examined except the interior portions of the producing sugar cane and corn fields.

## BOTANICAL HISTORY

In 1971 the first environmental impact statement for a site in the Ewa District was submitted to the Planning Commission by the Hawaii Housing Authority (HHA 1971), for a project known as Ewalani Village. It appears that, at that time, information on either the flora or fauna of the study site was not required because none was included. It wasn't until 1976 that an environmental impact statement for a project in the Ewa area included the reports and observations of environmental specialists who had been engaged especially to inventory the natural resources of project sites. The pioneer work was commissioned by the U. S. Army Corps of Engineers and carried out by Derral Herbst (Herbst 1976). Dr. Herbst's report alerted the community to the presence of endangered plant species in the area. This pioneer work is still consulted by naturalists interested in the flora of the Ewa Plains.

Since 1976, more that twenty-eight environmental impact statements for projects in the area have been prepared and are on file at the Environmental Center of the University of Hawaii. In spite of this large body of biological information, nothing has been published on either the botany or the avifauna of the area considered herein.

## ENDANGERED SPECIES

The endangered species found by Herbst in 1976 were *Achyrantes splendens* var. *rotundata* HBD and *Euphorbia skottsbergii* var. *kalaekoana* Sherff (USFWS 1989). These are listed endangered species. They have been reported from Barber's Point Naval Air Station and near the Deep Draft Harbor (Herbst 1976, Funk 1984). During this survey no proposed or listed, threatened or endangered species were found on the proposed Schuler Homes East Kapolei Project Site (USFWS 1993).

## RESULTS

Three vegetation types can be found in the study area. They are Ruderal or Wayside Vegetation, Koa Haole/Grass, and Agricultural Fields. None of these vegetation types contained endemic (native only to Hawaii), or indigenous (native to Hawaii and other places) plant species in great numbers. In fact, the only indigenous taxa found are 'Ilima (*Sida fallax* L.), Popolo (*Solanium americanum* Mill.) and 'Akulikuli (*Sesuvium portulacastrum* (L.) L.). These plants appear most commonly in the Ruderal or Wayside Vegetation along the cane haul roads and irrigation ditches.

A. Ruderal or Wayside Vegetation Community. This vegetation type is found along all the major and minor roadways and along the flumes and irrigation ditches of the site. It is composed almost entirely of introduced forbs (herbs) and grasses, except for the species mentioned above. The

plants which make up the Ruderal or Wayside Vegetation Community are almost all annuals, that is, they come up, flower, and produce seeds in a single, short growing season. The plants of this vegetation community are important because considerable time and money is spent by sugar growers in an effort to control them. In many parts of the study site the Ruderal or Wayside Community had been treated with herbicide and dead skeletons of the plants remain.

B. Koa Haole/Grass. The second vegetation type, Koa Haole/Guinea Grass is found along the western boundary of the study site where it abuts Kaloi Gulch. The berms on either side of the gulch are two to three meters above the level of the cane fields and the gulch varies from three to four meters across. Both berms are lined with small koa haole trees (*Leucaena leucocephala* (Lam.) deWit) which average three to five meters in height. The understory is a dense growth of guinea grass. In the few openings in the guinea grass, large castor bean (*Ricinus communis* L.) and cocklebur (*Xanthium saccharatum* Wallr.) bushes thrive. This vegetation type is noteworthy only because of the high number and variety of common bird species which inhabit the koa haole trees and feed on the grass seeds.

C. Sugar Cane Fields. The Sugar Cane fields are single species monocultures of *Saccharum officinarum* L. Some of the cane fields of the study site are in production and support a thriving crop. These areas are currently being watered. Other fields appear to support a volunteer crop of cane and still others are fallow. In one field near Kaloi Gulch a large, experimental crop of several varieties of sweet corn (*Zea maize* L.) is being cultivated.

At the edges of the cultivated fields, where water is available, the

grasses and weeds are thriving. Common among them are stargrass (*Chloris divaricata* R. Br.), goose grass (*Elusine indica* (L.) Gaertn., sprangletop (*Leptochloa uninervia* (K.Presl) Hitchc.), spiny amaranth (*Amaranthus spinosus* L.), balsam apple (*Momordica charantia* Crantz Urban), and ivory gourd ( *Coccinia grandis* (V.) Voight).

In fallow fields and in those in which a volunteer crop has been allowed to grow up, weedy plants, the seeds of which are spread about by the bulbuls and by the wind are the most common. Balsam apple and ivory gourd vines produce fruits which are eaten by bulbuls and these plants are found in all parts of the site. The wind distributed African tulip tree (*Spathodea campanulata* Beauv.), is also thriving.

This land has been under cultivation for a long, long time and the native plant community has completely disappeared.

## CONCLUSIONS

The flora of the proposed Schuler Homes East Kapolei Project site is composed almost entirely of introduced species. There are no endemic plant species in the area. The three indigenous plants, 'Ilima, Popolo, and 'Akulikuli found on the site are still very common in the coastal lowlands of most of the Hawaiian Islands. The remaining botanical resources of this site are introduced plants, most of which are considered to be weeds, Therefore, future development of the site will not have a significant impact on the flora of the area. Vegetation similar to that found on this site is common throughout the islands.

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SPECIES LIST OF ALL PLANTS

FOUND ON THE SCHULER HOMES EAST KAPOLEI PROJECT SITE

The plant families in the following species list have been alphabetically arranged within two groups, Monocotyledons, and Dicotyledons. The genera and species are arranged alphabetically within families. The taxonomy and nomenclature follow that of St. John (1973) and Wagner, Herbst and Sohmer (1990). For each taxon the following information is provided:

1. An asterisk before the plant name indicates a plant introduced to The Hawaiian Islands since Cook or by the aborigines.
2. The scientific name.
3. The Hawaiian name and or the most widely used common name.
4. Abundance ratings are for this site only and they have the following meanings:

   Uncommon = a plant that was found less than five times.

   Occasional = a plant that was found between five to ten times.

   Common = a plant considered an important part of the vegetation

   Locally abundant = plants found in large numbers over a limited area. For example the plants found in grassy patches.

This species list is the result of an extensive survey of this site during the hot, dry summer season (July 1994) and it reflects the vegetative composition of the flora during a single season. Minor changes in the vegetation will occur due to introductions and losses and a slightly different species list would result from a survey conducted during a different growing season.

CHECKLIST

| Scientific Name | Common Name | Abundance |
|---|---|---|
| **MONOCOTYLEDONES** | | |
| AGAVACEAE - Agave Family | | |
| **Cordyline fruticosa* (L.) A. Chev. | Ti | Uncommon |
| CYPERACEAE - Sedge Family | | |
| **Cyperus rotundus* L. | Nut grass | Common |
| POACEAE - Grass Family | | |
| **Cenchrus ciliaris* L. | Buffel grass | Locally abundant |
| **Cenchrus echinatus* L. | Sandbur grass | Locally abundant |
| **Chloris barbata* Swartz | Swollen fingergrass | Locally abundant |
| **Chloris divaricata* R. Br. | Occasional | Common |
| **Cynodon dactylon* (L.) Pers. | Bermuda grass | Common |
| **Digitaria adscendens* (HBK) Henr. | Henry's crabgrass | Occasional |
| **Digitaria insularis* (L.) Mez | Sourgrass | Occasional |
| **Eleusine indica*(L.) Gaertn. | Wiregrass | Common |
| **Eragrostis cilianensis* (All.) Link | Stinkgrass | Occasional |
| **Eragrostis tenella* (L.)Beauv.R.&S. | Japanese lovegrass | Locally abundant |
| **Leptochloa uninervia* (K.Presl) Hitchc. | | Uncommon |
| **Panicum maximum* Jacq. | Guinea grass | Common |
| **Rhynchelytrum repens* C.E.Hubb | Natal redtop | Common |
| **Saccharum officinarum* L. | Ko or sugar cane | Common |
| **Setaria gracilis* Kunth | Yellow Foxtail | Locally abundant |
| **Setaria verticillata* (L. P.Beauv | Bristly Foxtail | Locally abundant |
| **Sorghum halpense* (L.) Pers. | Johnson grass | Occasional |
| **Zea maize* L. | Sweet Corn | Locally abundant |
| **DICOTYLEDONES** | | |
| ACANTHACEAE - Acanthus Family | | |
| **Asystasia gangetica* (L.) T. Anders | Chinese violet | Common |
| AIZOACEAE - Fig-marigold Family | | |
| *Sesuvium portulacastrum* (L.) L. | 'Akulikuli | Occasional |
| **Trianthema portulacastrum* L. | | Common |

| Scientific Name | Common Name | Abundance |
|---|---|---|
| AMARANTHACEAE - Amaranth Family | | |
| **Alternanthera pungens* Kunth | Khahi | Locally abundant |
| **Amaranthus spinosus* L. | Spiny amaranth | Common |
| **Amaranthus viridis* L. | Slender amaranth | Occasional |
| **Gomphrena celosioides* Mart. | Globe amaranth | Uncommon |
| ANACARDIACEAE - Mango Family | | |
| **Mangifera indica* L. | Mango | Uncommon |
| **Schinus terebinthifolius* Raddi | Christmas berry | Uncommon |
| APIACEAE - Parsley Family | | |
| **Daucus pusillus* Michx. | American carrot | Locally abundant |
| ASTERACEAE - Sunflower Family | | |
| **Bidens pilosa* L. | Spanish needle | Common |
| **Calyptocarpus vialis* Less. | | Occasional |
| **Conyza canadensis* Cronq. | Canadian fleabane | Occasional |
| **Echinachloa colona* (L.) Link | Jungle-rice | Locally abundant |
| **Emilia sonchifolia* (L.) DC | Flora's paintbrush | Common |
| **Emilia fosbergii* Nicolson | Pualele | Common |
| **Lactuca scariola* L. | Wild lettuce | Common |
| **Pluchea indica* (L.) Less. | Indian pluchea | Common |
| **Pluchea symphytifolia* (L.) Cass. | Sourbush | Occasional |
| **Sonchus olerarceus*L. | Pualele | Occasional |
| **Synedrella nodiflora* (L.) Gaertn. | Synedrella | Locally abundant |
| **Tridax procumbens* L. | Coat buttons | Locally abundant |
| **Verbesina encelioides* Cav. | Golden crown-beard | Occasional |
| **Vernonia cinerea* (L.) Less. | Little ironweed | Occasional |
| **Xanthium saccharatum* Wallr. | Cocklebur | Uncommon |
| BIGNONIACEAE - Bignonia Family | | |
| **Spathodea campanulata* Beauv. | African tulip tree | Occasional |
| BORAGINACEAE - Heliotrope Family | | |
| **Heliotropium procumbens* Mill | | Occasional |
| CAPPARIS - Caper Bush Family | | |
| **Cleome gynandra* L. | Wild spider flower | Locally abundant |
| CHENOPODIACEAE - Goosefoot Family | | |
| **Atriplex semibaccata* R. Br. | Australian saltbush | Occasional |
| **Chenopodium anbrosioides* L. | Mexican tea | Occasional |
| **Chenopodium murale* L. | Lambs quarters | Uncommon |

| Scientific Name | Common Name | Abundance |
|---|---|---|
| CONVOLVULACEAE - Morningglory Family | | |
| **Ipomoea obscura* (L.) Ker-Gawl | | Occasional |
| **Ipomoea triloba* L. | Little Bell | Occasional |
| **Merremia aegyptia* Urban | Hairy merremia | Common |
| CUCURBITACEAE - Cucumber Family | | |
| **Coccinia grandis* (L.) Voight | Ivory gourd | Common |
| **Cucumis dipsaceus* Ehranb. ex Spach | Hedgehog Gourd | Abundant |
| **Momordica charantia* Crantz | Balsam apple | Common |
| EUPHORBIACEAE - Spurge Family | | |
| **Euphorbia cyathophora* Murr. | Mexican fire plant | Locally abundant |
| **Chamaesyce glomerifera* L. Wheeler | Graceful spurge | Locally abundant |
| **Chamaesyce hirta* L. | Hairy spurge | Common |
| **Chamaesyce prostrata* (Ait) Millsp. | Prostrate spurge | Occasional |
| **Ricinus communis* L. | Castor bean | Locally abundant |
| FABACEAE - Bean Family | | |
| **Chamacrista nictitans* (L.) Moench | Japanese tea | Occasional |
| **Crotalaria incana* L. | Fuzzy rattle-pod | Occasional |
| **Crotalaria mucronata* L. | Smooth rattle-pod | Common |
| **Desmanthus virgatus* Willd. | Virgate mimosa | Occasional |
| **Indigofera spicata* Frosk. | Indigo | Occasional |
| **Indigofera suffruticosa* Mill. | Indigo | Occasional |
| **Leucaena leucocephala* Lam deWit | Koa-haole | Common |
| **Macroptilium atropurpureum* (DC) Urb. | | Locally abundant |
| **Macroptilium coccineus* L. | Scarlet runner | Common |
| **Pithecellobium dulce* Benth. | Madras thorn | Occasional |
| **Prosopis pallida* HBK | Kiawe, algaroba | Occasional |
| **Vigna sesquipedalis* Wight | Long beans | Uncommon |
| LABIATAE - Mint Family | | |
| **Leonotis nepetaefolia* Ait | Lion's-ear | Uncommon |
| MALVACEAE - Hibiscus Family | | |
| **Abutilon grandifolium* Sweet | Hairy abutilon | Uncommon |
| **Malvastrum coromandelianum* Garcke | False marrow | Common |
| **Sida fallax* Walp. | 'Ilima | Common |
| **Sida rhombifolia* L. | Cuba jute | Occasional |
| **Sida spinosa* L. | Prickly sida | Occasional |

| Scientific Name | Common Name | Abundance |
|---|---|---|
| NYCTAGINACEAE - Four o'clock Family | | |
| **Boerhavia coccinea* Mill. | | Common |
| PASSIFLORACEAE - Passion Flower Family | | |
| **Passiflora foetida* L. | Love-in-a-mist | Occasional |
| PORTULACACEAE - Portulaca Family | | |
| **Portulaca oleracea* L. | Pigweed | Common |
| SOLANACEAE - Tomato Family | | |
| **Datura stramonium* L. | Jimson weed | Occasional |
| **Lycopersicon esculentum* Mill | Tomato | Locally abundant |
| **Lycopersicon pimppinellifolium* (Jusl.) Mill | Currant tomato | Common |
| **Nicandra physalodes* (L.) Gaertn. | Apple of Peru | Common |
| **Nicotiana glauca* R.C. Graham | Tree tobacco | Occasional |
| *Solanium americanum* Mill. | Popolo | Occasional |
| STERCULIACEAE - Stink tree Family | | |
| **Waltheria indica* L. | Hi'aloa, uha-loa | Locally abundant |
| ZYGOPHYLLACEAE - Tribulus Family | | |
| **Tribulus terrestria* L. | Puncture vine | Common |

# FAUNA SURVEY REPORT FOR THE PROPOSED SCHULER HOMES EAST KAPOLEI PROJECT

## Introduction and Methods

This report summarizes the results of a fauna survey of the 1000 acre proposed Schuler Homes East Kapolei Project Site which was conducted in July, 1994. Since 1971 more than twenty-eight environmental impact statements have been written for projects proposed for the Ewa area. All of these reports have contained faunal reports of one sort or another, yet virtually nothing has been published on either the birds or the mammals of the region. The standard references for birds of Hawaii (Munro 1944, Berger 1981, Hawaii Audubon Society 1984) do not specify the area in their distribution of species.

Two circular plot censuses and eight fixed station observation points (20 minutes at each station) were carried out during early and late daylight hours in order to take advantage of the higher activity levels of both birds and mammals during cooler parts of the day.

## Results

Mammals - Only one species of mammal was found during the survey. That was a Mongoose (*Herpestes auropunctatus*) seen at the junction of Kaloi Gulch and Farrington Highway. The mongoose was introduced to Hawaii and is not considered to be endangered or threatened in any way.

Birds - Because the entire site has been extensively modified from its original state, it has almost no value as native bird habitat. However, it does support a variety of non-native species. The two most important bird observation areas in the study site were along the flumes and water ways and in the Koa haole/Grass vegetation type found along Kaloi Gulch.

The flumes and ditches are favored because they provide a source of water

in this otherwise parched area. The Koa haole/grass vegetation type provides a rich source of food for seed eating birds. Two of the bird species reported here were only seen overflying the site, cattle egrets and pigeons.

## SPECIES LIST

Fourteen species of birds were found on and around the study site. No threatened or endangered species were found. The annotated checklist follows the nomenclature of Pratt, Bruner and Berrett (1987).

Family Zosteropidae: White-eyes

*Zosterops japonicus*

White-eyes are one of the most widespread introduced bird species in Hawaii. Although their preferred habitats are wetter than the study area, they were found in the Bluffs vegetation in low numbers.

Family Passeridae: Old World Sparrows

*Passer domesticus* (House sparrow)

House sparrows are sometimes called feathered mice. These streaky brown and gray birds are a familiar commensal species and were found near the flumes and pump stations in the weedy scrub.

Family Estrildidae: Waxbills, Mannikins and Parrotfinches

*Estrilda astrild* (Common Waxbill)

The common waxbill is a small, red-billed finch with a prominent red streak from its bill to its eye. Waxbills have a long tail and brown rump. They feed on grass seeds. Several large coveys of waxbills were seen feeding on the grass heads.

*Lonchura malacca* (Chestnut Mannikin)

These are tiny, small, dark birds with large, light colored bills.

Chestnut mannikins are one of most common bird on this site. The coats of the males appear red in the early morning light. Chestnut mannikins were seen in large numbers along the cane haul roads and on grass heads near drainage ditches.

*Lonchura punctlata* (Nutmeg Mannikin)

These nervous, little birds have dark bills and heads. Their alternate black and white breast feathers appear gray. On the Schuler Site, Nutmeg Mannikins were often seen in company with the Waxbills feeding in grassy thickets.

Family Emberizidae: Emberizine Finches

*Paroaria coronata* (Brazilian or red crested cardinal)

Several adult pairs, and many juvenile brazilian cardinals were seen in the big trees of the Bluff vegetation. The bright red heads of this species make them very easy to recognize.

*Cardinalis cardinalis* (Northern cardinal)

A pair of northern cardinals inhabit the opiuma trees near the north east corner of the site. The bright red coloring of the male bird make him easily recognizeable. The call of these birds is very distinctive.

Family Pycnonotidae: Bulbuls

*Pycnonotus cafer* (Red-vented bulbul)

Many of these large, raucous birds inhabit the study site. They were common along the roads, in the sugar cane, on power lines and in the large trees. Bulbuls are conspicuous for their noisy call and the bright red feathers beneath their tails. They are fruit eaters and they may be responsible for the spread of ivory gourd (*Coccinia grandis* (L.) Voigt), the large, dark green cucurbit vine which bears bright red fruits, and is common throughout the site.

Family Ardeidae: Herons, Egrets and Bitterns

*Bubulcus ibis* (Cattle egret)

Several of these large, white birds were seen flying above the sugar fields.

Introduced in 1957 to help control cattle insect pests, cattle egrets have proliferated and are now pests themselves.

Family Fringillidae: Cardueline Finches

*Carpodacus mexicanus* (House finch)

The house finch is a small, sparrowlike bird with a streaked appearance. The head, throat and breast of male birds may vary from dull yellow to bright red. The females and the bodies of males are similar with gray to black streaks of color.

Introduced into Hawaii during the last century, the house finch has adapted and is now widespread throughout the islands. Many pairs of birds were seen around the pumping stations , in the mango tree and along Kaloi Gulch.

Family Columbidae: Pigeons and Doves

*Streptopelia chinensis* (Spotted Dove)

The spotted dove is a large bird which is grayish brown with rosy blushed breast feathers. At the sides and back of the neck is a patch of black with white spots. The low, repetitive cooing of the spotted dove was heard throughout the site. Many pairs and individuals were seen in the young cane fields.

*Geopelia striata* (Zebra Dove)

This ground dwelling, seed eating dove is smaller and even more abundant than the spotted dove. Zebra doves were found in similar densities

as the spotted dove in the open weedy places, but were most common along the roads.

*Columba livia* (Rock Dove)

A large flock of mixed plumage rock doves over fly the study sight during the early morning hours on week-ends. They approach the site from the Honouliuli area and disappear into the same area.

Family Sturnidae: Starlings and Mynas

*Acridotheres tristis* (Common Myna)

The ubiquitous myna is a plump brown bird with a black head and tail. It has a white belly, tail tip and wing patches, and bright yellow legs, feet, bill, and eye liners. Only two mynas were seen near Fernandes Village.

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# ADDENDUM TO THE BIOLOGICAL RESOURCES SURVEY REPORT FOR SCHULER HOMES EAST KAPOLEI PROJECT, EAST KAPOLEI, OAHU HAWAII

FOR
SCHULER HOMES, INC.
828 FORT STREET MALL, 4TH FLOOR
HONOLULU, HAWAII 96813

BY
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BOTANICAL CONSULTANTS
1995

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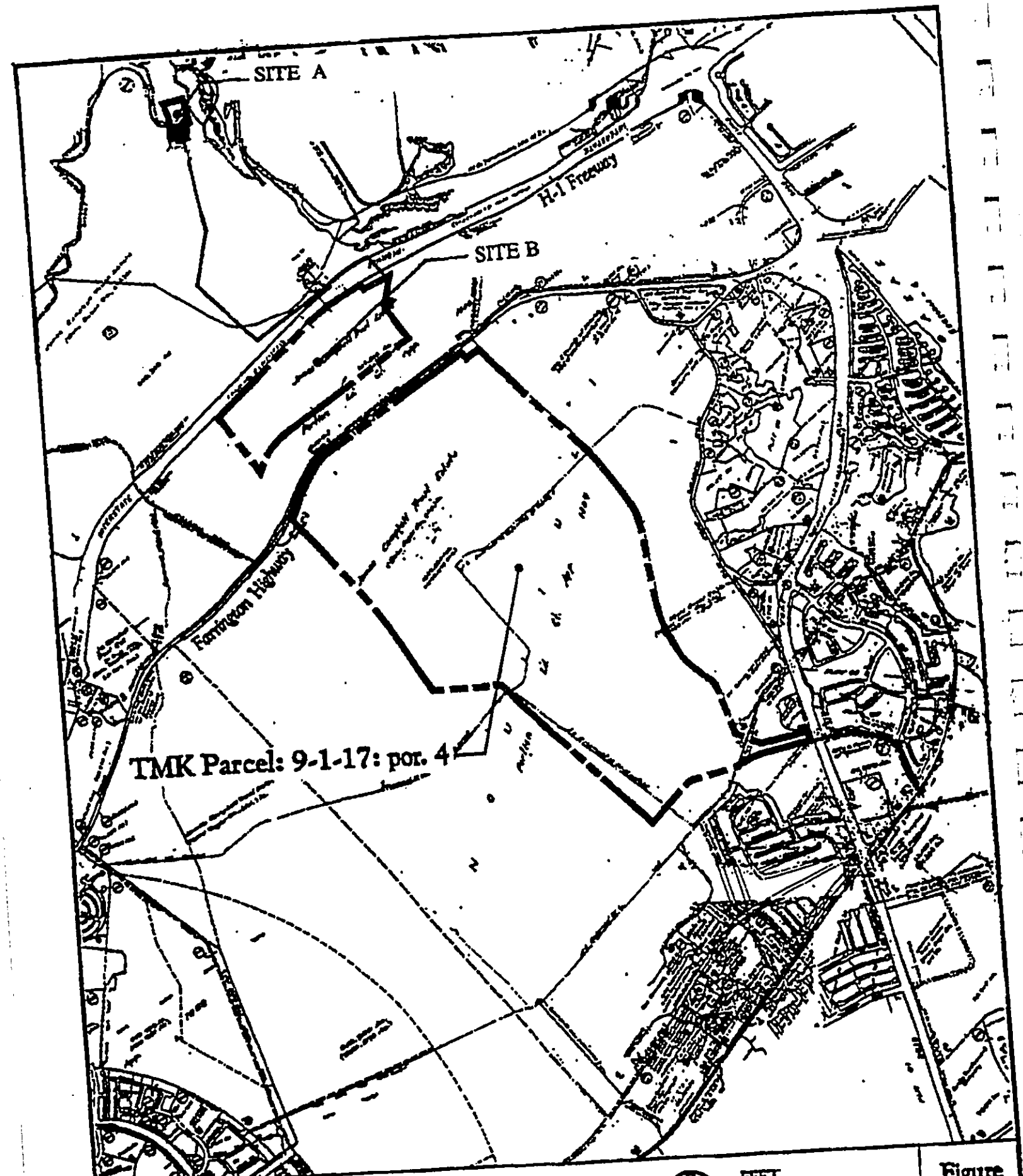
## INTRODUCTION

The original Biological Resources Survey Report for the Schuler Homes East Kapolei Project dealt with the flora and fauna of a single, one thousand acre site in East Kapolei, Oahu, Hawaii. Currently two additional areas are to be made part of this project (Figure 1). Area A in Figure 1 is a proposed reservoir site and Area B consists of eighty-two acres which are proposed for further residential development. Brief Biolgical Survey Reports for each of these sites are herewith submitted. A biological history of the area, a description of the data collection methods, and an explanation of the species list symbolism and caveates can be found in the original survey report.

## VEGETATION OF SITE A

Site A is the location of the proposed reservoir. It is located on the eastern flank of Pu'u Kapuai at approximately four hundred forty feet elevation at the western edge of Honouliuli Gulch. This general area was formerly used for the cultivation of sugar cane and is presently being used as pastureland. The steep sides of Honouliuli Gulch consist of frequent rock outcrops and a scant cover of Koa haole scrub (*Leucaena leucocephala* Lam deWit). The Koa haole scrub is from one to fifteen feet in height. At this time many of the shrubs were festooned with dead Love-in-a-mist (*Passiflora foetida* L.), and morning glory vines (Ipomoea spp.) and living Ivory gourd vines (*Coccinia grandis* (L.) Voight). The ground cover consists of hummocks of dry buffel grass (*Cenchrus ciliaris* L.), and Guinea grass (*Panicum maximum* Jacq.).

The most common vegetation on the rolling slopes is abandoned Ko or sugar cane (*Saccharum officinarum* L.). Since the recent rains, a variety of weed species have begun to emerge. A list of all plant species found in this area is provided.




**Biological Survey Sites**

**EAST KAPOLEI PROJECT**

Schuler Homes, Inc.

FEET 0 1000 2000

Helber Hastert & Fee, Planners

Figure 1

## LIST OF ALL PLANT TAXA FOUND ON SITE A

| Scientific Name | Common Name | Abundance |
|---|---|---|
| **MONOCOTYLEDONES** | | |
| CYPERACEAE - Sedge Family | | |
| **Cyperus rotundus* L. | Nut grass | Common |
| POACEAE - Grass Family | | |
| **Cenchrus ciliaris* L. | Buffel grass | Locally abundant |
| **Chloris divaricata* R.Br. | Stargrass | Occasional |
| **Digitaria adscendens* (HBK) Henr. | Henry's crabgrass | Occasional |
| **Panicum maximum* Jacq. | Guinea grass | Common |
| **Rhynchelytrum repens* C.E.Hubb | Natal redtop | Common |
| **Saccharum officinarum* L. | Ko or sugar cane | Common |
| **Setaria gracilis* Kunth | Yellow Foxtail | Locally abundant |
| **DICOTYLEDONES** | | |
| AMARANTHACEAE - Amaranth Family | | |
| **Amaranthus spinosus* L. | Spiny amaranth | Common |
| ASTERACEAE - Sunflower Family | | |
| **Bidens pilosa* L. | Spanish needle | Common |
| **Conyza canadensis* Cronq. | Canadian fleabane | Occasional |
| ASTERACEAE - Sunflower Family con't | | |
| **Pluchea symphytifolia* (L.) Cass. | Sourbush | Occasional |
| **Tridax procumbens* L. | Coat buttons | Locally abundant |
| BIGNONIACEAE - Bignonia Family | | |
| **Spathodea campanulata* Beauv. | African tulip tree | Occasional |
| BUDDLEIACEAE - Butterfly Family | | |
| **Buddleia asiatica* Lour. | Dog tail | Occasional |
| CONVOLVULACEAE - Morningglory Family | | |
| **Ipomoea triloba* L. | Little Bell | Occasional |
| **Merremia aegyptia* Urban | Hairy merremia | Common |
| CUCURBITACEAE - Cucumber Family | | |
| **Coccinia grandis* (L.) Voight | Ivory gourd | Common |
| **Momordica charantia* Crantz | Balsam apple | Common |

| Scientific Name | Common Name | Abundance |
|---|---|---|
| EUPHORBIACEAE - Spurge Family | | |
| **Ricinus communis* L. | Castor bean | Locally abundant |
| FABACEAE - Bean Family | | |
| **Crotalaria incana* L. | Fuzzy rattle-pod | Occasional |
| **Desmanthus virgatus* Willd. | Virgate mimosa | Occasional |
| **Leucaena leucocephala* Lam deWit | Koa-haole | Common |
| LABIATAE - Mint Family | | |
| **Leonotis nepetaefolia* Ait. | Lion's-ear | Uncommon |
| NYCTAGINACEAE - Four o'clock Family | | |
| **Boerhavia coccinea* Mill. | | Common |
| PASSIFLORACEAE - Passion Flower Family | | |
| **Passiflora foetida* L. | Love-in-a-mist | Occasional |
| SOLANACEAE - Tomato Family | | |
| **Lycopersicon pimppinellifolium* (Jusl.) Mill | Currant tomato | Common |
| STERCULIACEAE - Cacao Family | | |
| **Waltheria indica* L. | 'Uhaloa | Occasional |

## FAUNA OF SITE A

The Fauna survey of Site A was carried out just after the first fall rains when most of the vegetation was still in the seedling stage. In addition, Site A is more than one mile from the nearest habitation. Both of these factors contribute to the dearth of food sources utilized by the seed eating commensal birds species common to this part of the island. As a result, only two species of doves were found in low numbers.

Family Columbidae: Pigeons and Doves

*Streptopelia chinensis* (Spotted Dove)

The spotted dove is a large bird which is grayish brown with rosy blushed breast feathers. At the sides and back of the neck is a patch of black with white spots. The low, repetitive cooing of the spotted dove was heard only occasionally in this area. Only three individual spotted doves were seen in the abandoned cane fields.

*Geopelia striata* (Zebra Dove)

This ground dwelling, seed eating dove is smaller and more abundant than the spotted dove. Zebra doves were seen in low densities along the dirt track that passes through Site A and in the pastureland.

Because seedlings of the ivory gourd vine are very common on this site and seeds of this plant are known to be spread about by both red-vented and red-whiskered bulbuls, it is assumed these species must frequent this area although they were not seen during this survey.

## VEGETATION OF SITE B

Site B consists of eighty-two acres of abandoned sugarcane land. It is north of the original study site and abuts the H-1 Freeway (Figure 1). The site is fairly flat and has recently been plowed. At present the land is lying fallow and a dense crop of weed seedlings is beginning to emerge. The most prominent vegetation is scattered individuals of 'uhaloa (*Waltheria indica* L.) which are not more than thirty inches in height. At the northern edge of the study site where it abuts H-1 Freeway, there is a narrow band of land between the cane haul road and the freeway where there are a few 'opiuma trees (*Pithecellobium dulce* (Roxb.) Benth.) and koa haole shrubs which reach a height of fifteen to twenty feet. The understory in this area is either buffel grass or guinea grass. No outstanding vegetative features were found on this site.

### CHECKLIST OF ALL PLANT TAXA FOUND ON SITE B

| Scientific Name | Common Name | Abundance |
|---|---|---|
| **MONOCOTYLEDONES** | | |
| CYPERACEAE - Sedge Family | | |
| **Cyperus rotundus* L. | Nut grass | Common |
| POACEAE - Grass Family | | |
| **Cenchrus ciliaris* L. | Buffel grass | Locally abundant |
| **Chloris barbata* Swartz | Swollen fingergrass | Locally abundant |
| **Chloris divaricata* R. Br. | Star grass | Occasional |
| **Panicum maximum* Jacq. | Guinea grass | Common |
| **Rhynchelytrum repens* C.E.Hubb | Natal redtop | Common |
| **Saccharum officinarum* L. | Ko or sugar cane | Common |
| **DICOTYLEDONES** | | |
| ACANTHACEAE - Acanthus Family | | |
| **Asystasia gangetica* (L.) T. Anders | Chinese violet | Occasional |
| AMARANTHACEAE - Amaranth Family | | |
| **Amaranthus spinosus* L. | Spiny amaranth | Common |
| **Amaranthus viridis* L. | Slender amaranth | Occasional |

| Scientific Name | Common Name | Abundance |
|---|---|---|
| ANACARDIACEAE - Mango Family | | |
| **Schinus terebinthifolius* Raddi | Christmas berry | Uncommon |
| ASTERACEAE - Sunflower Family | | |
| **Bidens pilosa* L. | Spanish needle | Common |
| **Calyptocarpus vialis* Less. | | Occasional |
| **Conyza canadensis* Cronq. | Canadian fleabane | Occasional |
| **Lactuca scariola* L. | Wild lettuce | Occasional |
| **Pluchea indica* (L.) Less. | Indian pluchea | Occasional |
| **Pluchea symphytifolia* (L.) Cass. | Sourbush | Occasional |
| **Tridax procumbens* L. | Coat buttons | Locally abundant |
| **Verbesina encelioides* Cav. | Golden crown-beard | Occasional |
| CHENOPODIACEAE - Goosefoot Family | | |
| **Atriplex semibaccata* R. Br. | Australian saltbush | Occasional |
| CONVOLVULACEAE - Morningglory Family | | |
| **Ipomoea cairica* (L.) Sweet | Koali 'ai | Common |
| **Ipomoea obscura* (L.) Ker-Gawl | | Occasional |
| **Ipomoea triloba* L. | Little Bell | Occasional |
| **Merremia aegyptia* Urban | Hairy merremia | Common |
| CUCURBITACEAE - Cucumber Family | | |
| **Coccinia grandis* (L.) Voight | Ivory gourd | Common |
| **Momordica charantia* Crantz | Balsam apple | Common |
| EUPHORBIACEAE - Spurge Family | | |
| **Chamaesyce glomerifera* L. Wheeler | Graceful spurge | Locally abundant |
| **Ricinus communis* L. | Castor bean | Locally abundant |
| FABACEAE - Bean Family | | |
| **Crotalaria incana* L. | Fuzzy rattle-pod | Common |
| **Desmanthus virgatus* Willd. | Virgate mimosa | Occasional |
| **Leucaena leucocephala* Lam deWit | Koa-haole | Common |
| **Pithecellobium dulce* Benth. | Madras thorn | Occasional |
| **Prosopis pallida* HBK | Kiawe, algaroba | Occasional |
| MALVACEAE - Hibiscus Family | | |
| **Malvastrum coromandelianum* Garcke | False marrow | Occasional |
| **Sida fallax* Walp. | 'Ilima | Occasional |
| **Sida rhombifolia* L. | Cuba jute | Occasional |

| Scientific Name | Common Name | Abundance |
|---|---|---|
| NYCTAGINACEAE - Four o'clock Family | | |
| **Boerhavia coccinea* Mill. | | Common |
| PASSIFLORACEAE - Passion Flower Family | | |
| **Passiflora foetida* L. | Love-in-a-mist | Occasional |
| STERCULIACEAE - Stink tree Family | | |
| **Waltheria indica* L. | Hi'aloa, uha-loa | Occasional |
| ZYGOPHYLLACEAE - Tribulus Family | | |
| **Tribulus terrestria* L. | Puncture vine | Common |

## FAUNA OF SITE B

The Fauna survey of Site B was carried out just after the first fall rains when most of the vegetation was still in the seedling stage. In addition, Site B had recently been plowed which had destroyed the mature, seed bearing weed crop upon which the many species of seed eating birds depend. The small water storage reservoir that had occupied the north-eastern corner of this site has been filled and the flume water has been discontinued so there is no longer and open water source on this site. As a result very few birds now utilize the area.

Family Columbidae: Pigeons and Doves

*Geopelia striata* (Zebra Dove)

This ground dwelling, seed eating dove was the most abundant bird found on this site. Individuals were common along the cane haul roads especially where small tufts of old vegetation persisted.

Family Passeridae: Old World Sparrows

*Passer domesticus* (House sparrow or feathered mice)

The House sparrow, a familiar commensal species is usually found in large numbers on Ewa Plains sites. On this particular site only a single pair of these

streaky brown and gray birds were seen. They were seen near the power lines at the eastern boundry foraging in the weedy scrub.

Family Charadriiformes: Plovers and Dotterels

*Pluvialis dominica* (Lesser golden plover)

A single lesser golden plover in non-breeding plumage i.e. mottled buff below and darker brown mottled with gold and buff above, appears to inhabit the central part of the study site. No other plovers were seen.

The tracks of a single, small pig (*Sus scrofa*) were seen in the central part of the site. The imprint of the small, rounded, cloven hoofs were clearly visible for fifty feet or more. No pig was seen and there is no explanation of how these tracks appear in this area.

See Bibliography in the original report.

# I

## Air Quality Impact Report, East Kapolei Project, October 4, 1994; Air Quality Impact Report, East Kapolei Project, December 18, 1995.

J.W. Morrow

# AIR QUALITY IMPACT REPORT

## EAST KAPOLEI PROJECT

4 October 1994

PREPARED FOR:

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and

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PREPARED BY:

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## 1. INTRODUCTION

Schuler Homes, Inc. is proposing to construct a primarily residential project on an approximately 1,000-acre parcel in the Ewa District of the island of Oahu (Figure 1). The property was formerly used for sugar cane cultivation (Figure 2).

The intent is to develop the project in two phases to be completed in 2005 and 2011, respectively. The proposed land uses are summarized in Table 1.

**TABLE 1**

**PROPOSED LAND USES**
**(Acres)**

| LAND USE | PHASE 1 | PHASE 2 | TOTAL |
|---|---|---|---|
| Residential | 458 | 490 | 948 |
| Commercial | 10 | 10 | 20 |
| School | 12 | 0 | 12 |
| Parks | 10 | 10 | 20 |
| Circulation | 10 | 12 | 22 |
| TOTAL | 500 | 522 | 1,022 |

The purpose of this report is to assess the impact of the proposed development on air quality on a local and regional scale. 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 quality is its inherent attraction for mobile sources, i.e., motor vehicles. 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 the years 2005 and 2011 with and without the project.

A project such as this also requires electrical power and solid waste disposal, both of which involve combustion and emissions into the air at offsite locations. These have been addressed in the report.

FIGURE 1

PROJECT LOCATION

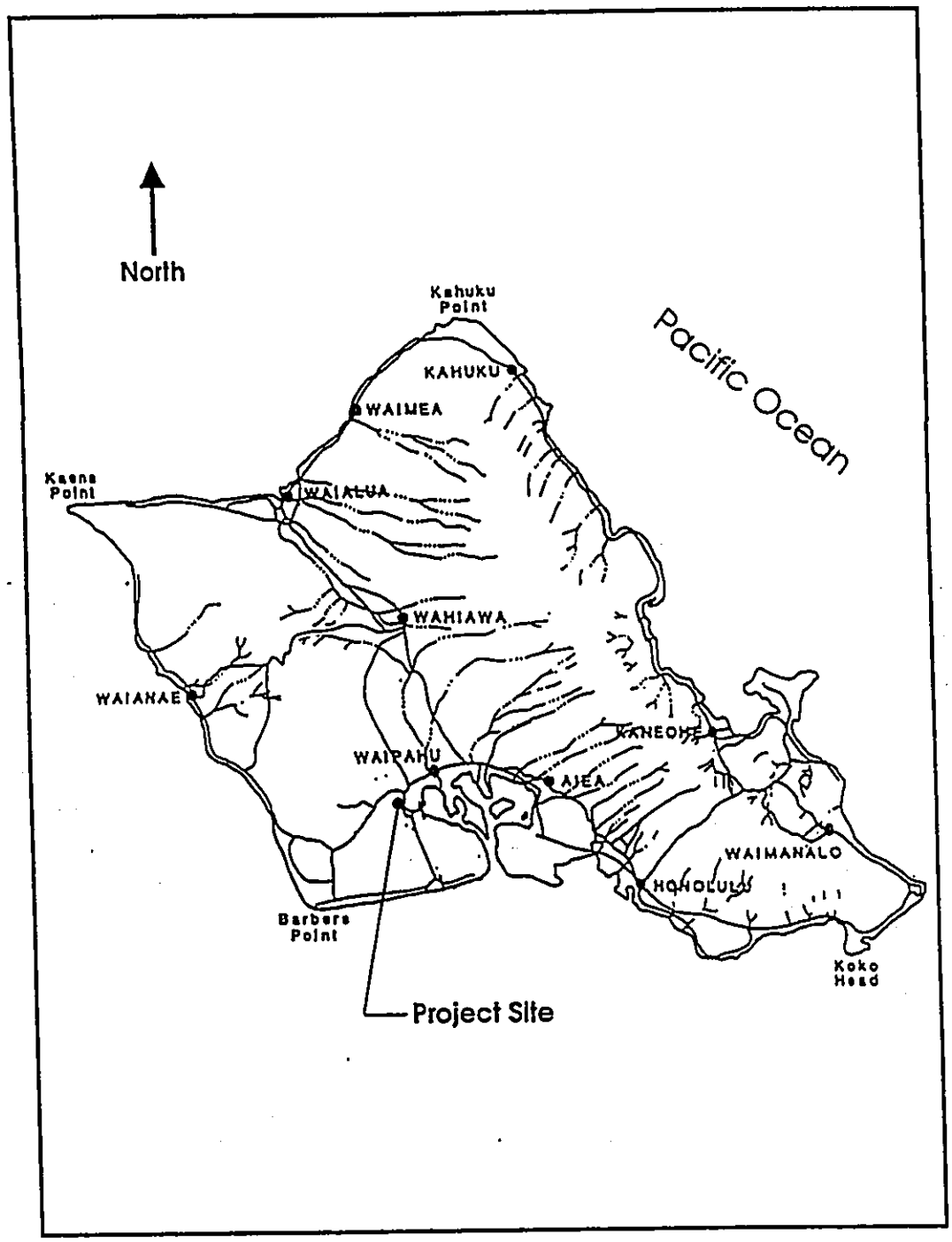
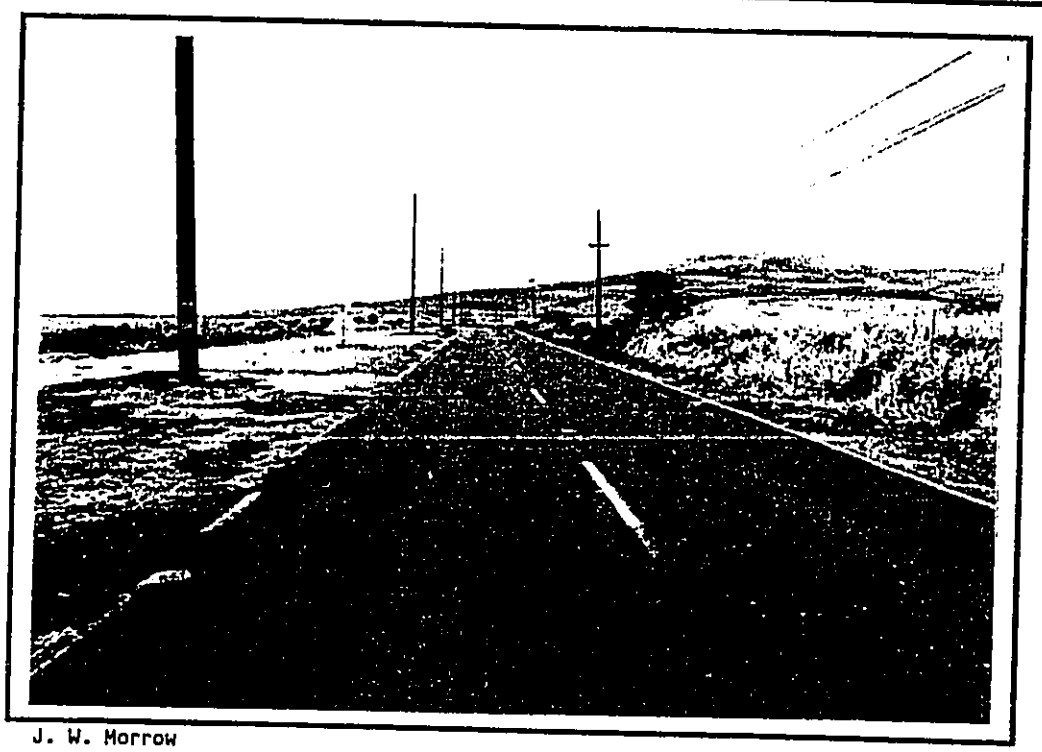


FIGURE 2

EXISTING SITE CONDITIONS
SEPTEMBER 1994

Cane Fields
(facing south)



Farrington Highway
Bordering Property
(facing southwest)

J. W. Morrow

Finally, during construction of the various buildings and facilities air pollutant emissions will be generated onsite and offsite due to vehicular movement, grading, concrete and asphalt batching, and general dust-generating construction activities. These impacts have also been addressed.

## 2. AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 2 [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 (CO, $NO_2$, and $O_3$) 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 November 1993, the Governor signed amendments to Chapter 59, Ambient Air Quality Standards [3], adopting the federal standard for particulate matter equal to or less than 10 microns in diameter ($PM_{10}$). Since measurement data in Hawaii indicate that $PM_{10}$ comprises about 50% of total suspended particulate matter (TSP), the adoption of that federal standard with a numerical value equal to the original state TSP standard of 150 $\mu g/m^3$ represents a substantial relaxation of the standard (approximately doubling it).

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 [5].

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 [1]. The last review resulted in the relaxation of the oxidant standard from 160 to 235 micrograms/cubic meter ($ug/m^3$) [6]. The carbon monoxide (CO), particulate matter, sulfur dioxide ($SO_2$), and nitrogen dioxide ($NO_2$) standards have been reviewed, but no new standards were proposed.

TABLE 2

SUMMARY OF STATE OF HAWAII AND FEDERAL AMBIENT AIR QUALITY STANDARDS

| POLLUTANT | SAMPLING PERIOD | NAAQS PRIMARY | NAAQS SECONDARY | STATE STANDARDS |
|---|---|---|---|---|
| $PM_{10}$ | Annual | 50 | 50 | 50 |
| | 24-hr | 150 | 150 | 150 |
| $SO_2$ | Annual | 80 | --- | 80 |
| | 24-hr | 365 | --- | 365 |
| | 3-hr | --- | 1,300 | 1,300 |
| $NO_2$ | Annual | 100 | --- | 70 |
| CO | 8-hr | 10 | --- | 5 |
| | 1-hr | 40 | --- | 10 |
| $O_3$ | 1-hr | 235 | --- | 100 |
| $H_2S$ | 1-hr | --- | --- | 35 |
| Pb | Calendar Quarter | 1.5 | --- | 1.5 |

KEY:

TSP - total suspended particulate matter
$PM_{10}$ - particulate matter < 10 microns
$SO_2$ - sulfur dioxide
$NO_2$ - nitrogen dioxide
CO - carbon monoxide
$O_3$ - ozone
Pb - lead

All concentrations in micrograms per cubic meter ($\mu g/m^3$) except CO which is in milligrams per cubic meter ($mg/m^3$).

Finally, the State of Hawaii also has fugitive dust regulations for particulate matter (PM) emanating from construction activities [7]. There simply can be no visible emissions from fugitive dust sources.

## 3. EXISTING AIR QUALITY

3.1 General. The State Department of Health (DOH) maintains a limited network of air monitoring stations around the state to gather data on the following regulated pollutants:

- particulate matter ≤ 10 microns ($PM_{10}$)
- total suspended particulate matter (TSP)
- sulfur dioxide ($SO_2$)
- carbon monoxide (CO)
- ozone ($O_3$)

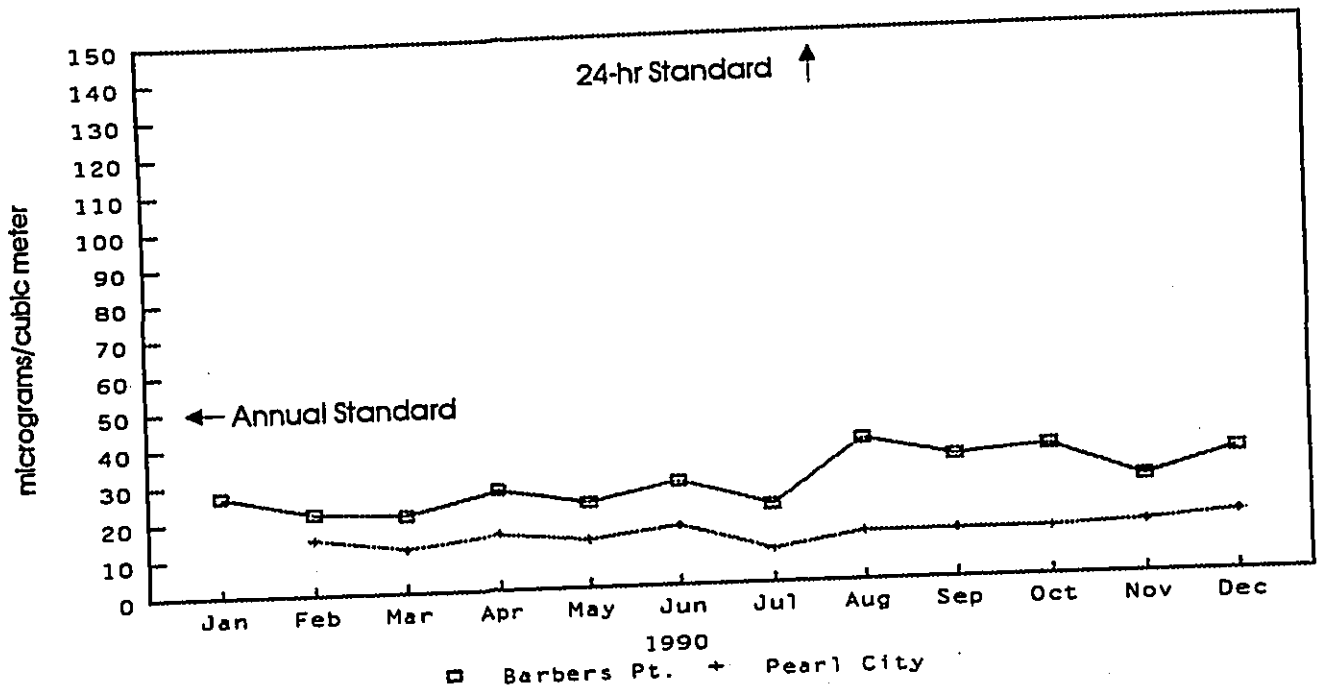
In the case of $PM_{10}$ and $SO_2$, measurements are made on a 24-hour basis to correspond with the averaging period specified in State and Federal standards. Samples are collected once every six days in accordance with U.S. Environmental Protection Agency (EPA) guidelines. Carbon monoxide and ozone, 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. There are no air monitoring sites in the immediate vicinity of the project site. The nearest stations are at Pearl City and Barbers Point where $PM_{10}$ is measured. A summary of the most recent published data from those sites are presented in Figure 3. Particulate matter levels are well below the 50 $\mu g/m^3$ annual and 150 $\mu g/m^3$ twenty-four hour standards.

The summary of monitoring results from the Department of Health building in downtown Honolulu presented in Table 3 also indicates compliance with standards. Air quality at the project area should be comparable or perhaps somewhat better given the site's more rural location.

FIGURE 3

MONTHLY $PM_{10}$ AVERAGES
PEARL CITY AND BARBERS POINT
MONITORING STATIONS
1990






J. W. Morrow

TABLE 3

AIR MONITORING DATA
DEPARTMENT OF HEALTH BUILDING[1]
1988 - 1990

| POLLUTANT | Concentration ($\mu g/m^3$) | | |
|---|---|---|---|
| | 1988 | 1989 | 1990 |
| Total suspended particulate matter (TSP) | 15 - 45<br>26 | 16 - 48<br>29 | 13 - 47<br>30 |
| Particulate matter < 10 microns ($PM_{10}$) | 9 - 25<br>17 | 10 - 33<br>16 | 8 - 36<br>15 |
| Sulfur dioxide ($SO_2$) | <5 - <5<br><5 | <5 - 8<br><5 | <5 - <5<br><5 |
| Carbon monoxide (CO) | 0.2 - 10.3<br>1.7 | 0.3 - 9.7<br>1.9 | 0.1 - 7.1<br>1.5 |
| Ozone ($O_3$) | 0 - 92<br>14 | 0 - 94<br>15 | 4 - 116<br>36 |
| Lead (Pb) | 0 - 0.1<br>0 | 0 - 0.1<br>0 | 0 - 0<br>0 |

Notes:
1. Values indicate range and annual mean.
2. CO values are $mg/m^3$.
3. $PM_{10}$ data are from the Liliha site.
4. $O_3$ data are from the Sand Island site.

## 4. CLIMATE AND METEOROLOGY

4.1 Temperature and Rainfall. Temperatures in the project area are expected to be similar to those found elsewhere in Hawaii. The nearest long-term weather station operated by the National Weather Service is located at the Honolulu International Airport. In an annual summary for that station, the National Climatic Center has summarized Honolulu's temperature regime as follows:

> Hawaii's equable temperatures are associated with the small seasonal variation in the amount of energy received from the sun and the tempering effect of the surrounding ocean. The range of temperatures averages only 7 degrees between the

warmest months (August and September) and the coolest months (January and February) and about 12 degrees between day and night. Daily maximums run from the high 70's in winter to the mid-80's in summer, and daily minimums from the mid-60's to the low 70's. However, the Honolulu Airport area has recorded as high as 93 degrees and as low as 53 [9].

Historical rainfall data from the Honolulu International Airport indicate an annual average of 23 inches. Based on this average and in accordance with Thornwaite's scheme for climatic classification, the area is considered semi-arid [10].

4.2 Surface Winds. Meteorological data records were reviewed from the nearby Honolulu International Airport and Hickam Air Force Base. The annual prevalence of northeast trade winds is clearly shown in Table 4. A closer examination of the data, however, indicates that low velocities (less than 10 mph) occur frequently and that the "normal" northeasterly trade winds tend to break down in the Fall giving way to more light, variable wind conditions through the Winter and on into early Spring. It is during these times that Honolulu generally experiences elevated pollutant levels. This seasonal difference in wind conditions can be easily contrasted by comparing August and January wind roses (Figures 4 and 5).

Of particular interest from an air pollution standpoint were the stability wind roses prepared for Hickam Air Force Base [11]. These data indicated that stable conditions, i.e., Pasquill-Gifford stability categories E and F [12], occur about 28% of the time on an annual basis and 36% of the time during the peak winter month (January). It is under such conditions that the greatest potential for air pollutant buildup from groundlevel sources, e.g., motor vehicles, exists.

## 5. SHORT-TERM IMPACTS

5.1 Onsite Impacts. The principal source of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along the existing roadways as well as on the project site itself. The additional construction vehicle traffic should not exceed street 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 onsite road construction. Construction vehicles movement on unpaved on-site roads will also generate particulate emissions. EPA studies on fugitive dust

TABLE 4

ANNUAL JOINT FREQUENCY DISTRIBUTION
OF WIND SPEED AND DIRECTION
HONOLULU INTERNATIONAL AIRPORT

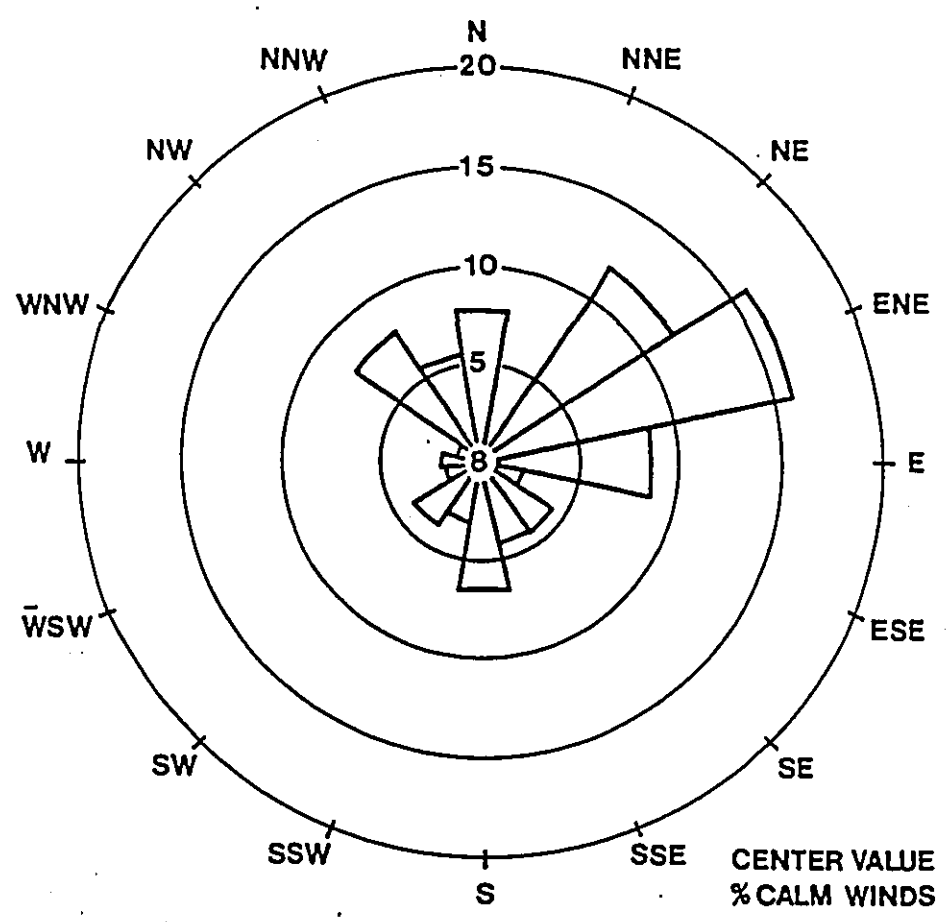
Wind Speed (kts)

| Dir | 0-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | Total |
|---|---|---|---|---|---|---|---|
| N | .0149 | .0261 | .0075 | .0020 | .0002 | .0000 | .0506 |
| NNE | .0114 | .0219 | .0106 | .0046 | .0005 | .0000 | .0490 |
| NE | .0114 | .0449 | .0829 | .0853 | .0204 | .0018 | .2466 |
| ENE | .0088 | .0637 | .1559 | .1209 | .0224 | .0014 | .3731 |
| E | .0039 | .0179 | .0329 | .0210 | .0023 | .0001 | .0782 |
| ESE | .0021 | .0056 | .0050 | .0015 | .0003 | .0001 | .0146 |
| SE | .0021 | .0059 | .0091 | .0049 | .0006 | .0002 | .0228 |
| SSE | .0023 | .0074 | .0123 | .0038 | .0008 | .0002 | .0268 |
| S | .0025 | .0104 | .0127 | .0033 | .0005 | .0003 | .0296 |
| SSW | .0011 | .0041 | .0053 | .0017 | .0003 | .0000 | .0125 |
| SW | .0007 | .0031 | .0058 | .0022 | .0003 | .0001 | .0122 |
| WSW | .0006 | .0017 | .0031 | .0022 | .0005 | .0001 | .0082 |
| W | .0019 | .0030 | .0021 | .0009 | .0002 | .0001 | .0082 |
| WNW | .0027 | .0051 | .0012 | .0003 | .0001 | .0000 | .0094 |
| NW | .0084 | .0153 | .0031 | .0008 | .0003 | .0000 | .0279 |
| NNW | .0087 | .0166 | .0041 | .0012 | .0002 | .0000 | .0308 |
| TOT | .0835 | .2527 | .3534 | .2567 | .0496 | .0043 | 1.0002 |

SOURCE: National Weather Service
Historical Records, 1940-67

FIGURE 4

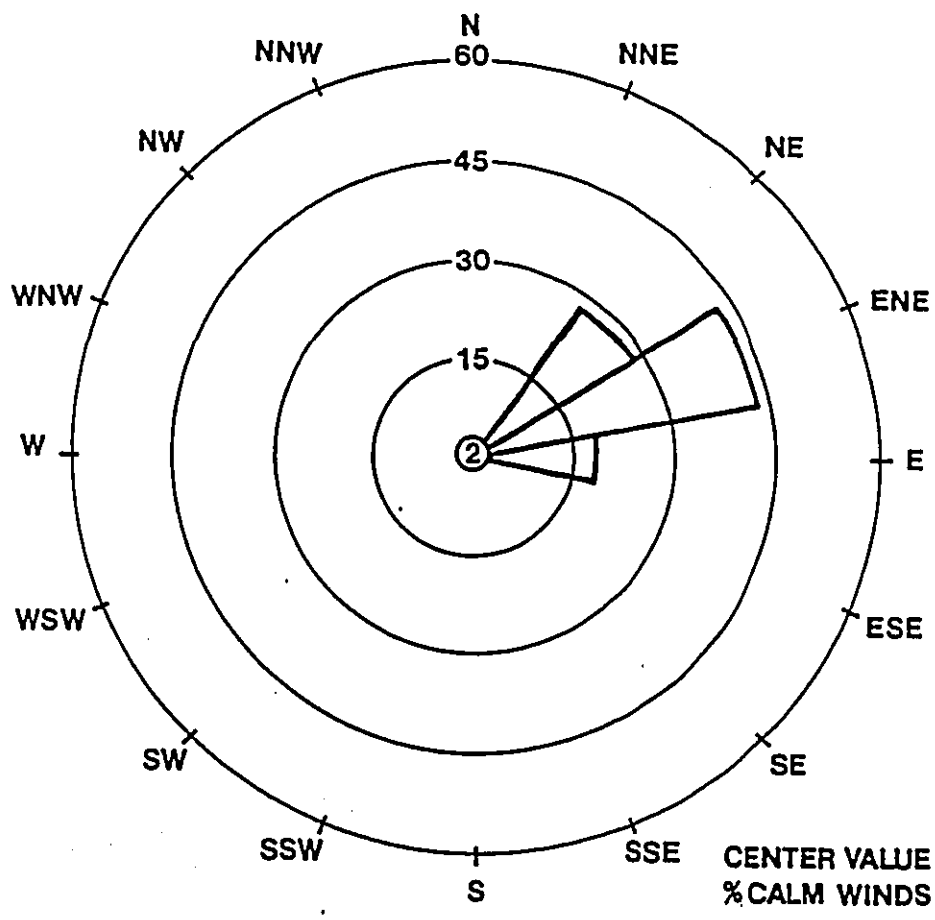
JANUARY WIND ROSE
HONOLULU INTERNATIONAL AIRPORT




SOURCE: National Weather Service
Historical Records, 1940-67

FIGURE 5

AUGUST WIND ROSE
HONOLULU INTERNATIONAL AIRPORT




SOURCE: National Weather Service
Historical Records, 1940-67

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 [10,13].

Onsite soils are high in clay content which suggests silt content of about 30% [14], the same as cited above. In conjunction with the semi-arid local climate (P/E Index 28.9), this suggests a potential for somewhat greater fugitive dust emissions than estimated by the EPA.

5.2 Offsite Impacts. In addition to the onsite impacts attributable to construction activity, there will also be offsite impacts due to the operation of concrete and asphalt batching plants needed for construction. Such plants routinely emit particulate matter and other gaseous pollutants. It is too early, however, to identify the specific facilities that will be providing these materials and thus the discussion of air quality impacts is necessarily generic. The batch plants which will be producing the concrete for foundations, curbing, etc. and the asphalt for roadways must be permitted by the Department of Health Clean Air Branch pursuant to state regulations [7]. In order to obtain these permits they must demonstrate their ability to continuously comply with both emission [7] and ambient air quality [3] standards. Under the recently promulgated federal Title V operating permit requirements [15], now incorporated in Hawaii's rules [7], air pollution sources must regularly attest to their compliance with all applicable requirements.

## 6. MOBILE SOURCE IMPACTS

6.1 Mobile Source Activity. The traffic assessment prepared for the proposed project served as the basis for this mobile source impact analysis [8]. Traffic projections for 2005 and 2011 with and without the project were provided for the major intersections serving the project area.

6.2 Emission Factors. Automotive emission factors for carbon monoxide (CO) were generated for calendar years 2005 and 2011 using the Mobile Source Emissions Model (MOBILE-5A) [16]. To localize the emission factors as much as possible, the September 1988 age distribution for registered vehicles in the City & County of Honolulu [17] was input in lieu of national statistics. That same age distribution was the basis for the distribution of vehicle miles travelled as well.

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)[18], and it comprises the largest fraction of automotive emissions.

Using the available traffic data, modeling was performed for the following intersections:

- Driveway "B" @ North-South Road
- Driveway "A" @ North-South Road
- North-South Road @ Farrington Highway
- Driveway "C" @ Farrington Highway

Because of the rural nature of the area, a stable atmosphere (Category "F") [19] was assumed for the morning and a neutral atmosphere (Category "D") for afternoon peak hours. A 1 meter per second (m/sec) wind speed was also assumed as worst case meteorological conditions.

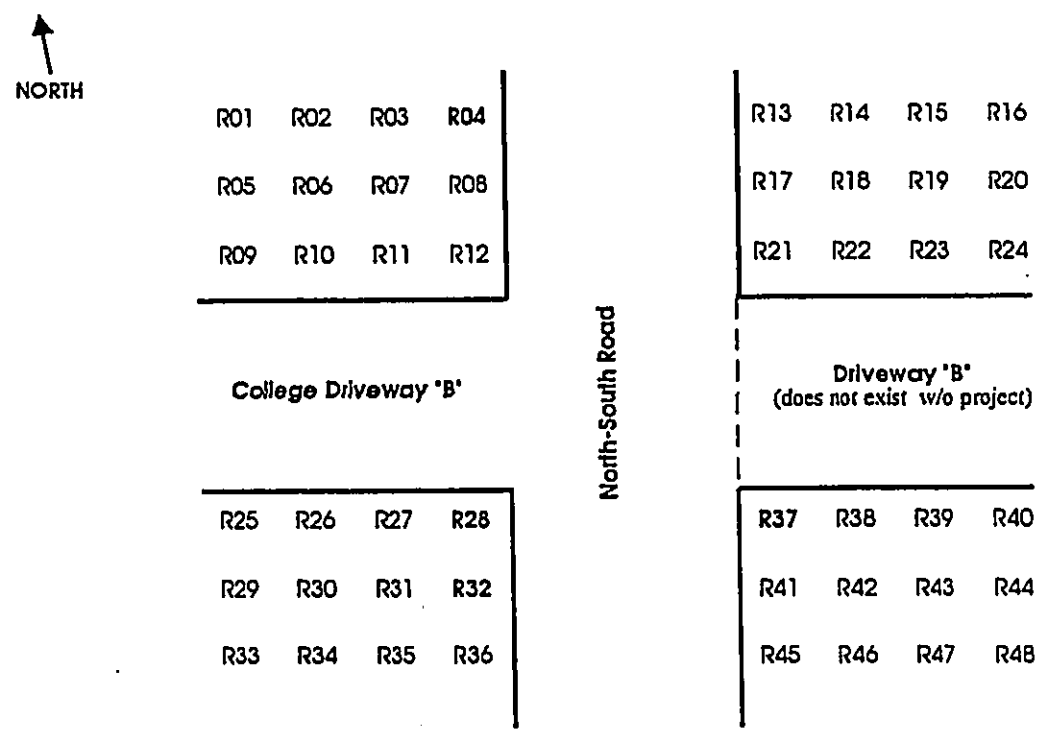
The EPA guideline model CAL3QHC [20,21] was employed to estimate near-intersection carbon monoxide concentrations. An array of 48 receptor sites at distances of 10 meters from the road edge were input to the model. Because the area is urbanizing with an increasing number of streets and traffic, a background CO concentration of 1.0 milligram per cubic meter ($mg/m^3$) was assumed. The model uses an iterative process to identify the wind direction producing the maximum CO concentration at each receptor location.

6.4 <u>Results: 1-Hour Concentrations</u>. The results of this modeling are presented in Figures 6 - 9. Each figure depicts the locations of the 48 receptor sites around the respective intersections. Maximum estimated concentrations in milligrams per cubic meter ($mg/m^3$) for each of the evaluated scenarios are also presented along with the particular receptor location at which they were predicted.

There appears to be some potential for exceedances of the state 1-hour CO standard in close proximity, i.e., within 10 meters, to the intersections along the future North-South Road during both a.m. and p.m. peak traffic hours. In fact, even without the project, exceedances are predicted during the a.m. peak hour at the intersection with Farrington Highway. No exceedances of the federal standard are predicted.

FIGURE 6

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Driveway "B" at North-South Road
Peak Traffic Hours
2005 - 2011



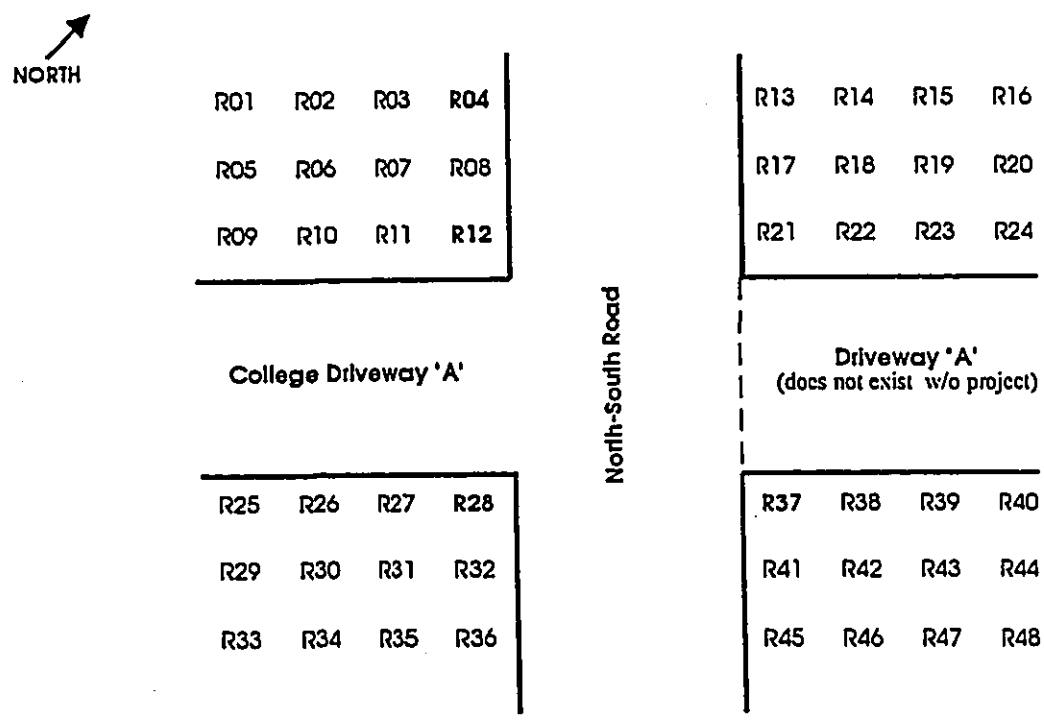

Receptor Spacing
= 10 meters

Estimated Maximum Concentrations
($mg/m^3$)

| | Without Project | | With Project | |
|---|---|---|---|---|
| Period | 2005 | 2011 | 2005 | 2011 |
| A.M. | 3.9<br>R37 | 4.1<br>R37 | 13.5<br>R32 | 16.0<br>R37 |
| P.M. | 3.0<br>R37 | 3.1<br>R28 | 6.4<br>R04 | 11.4<br>R37 |

FIGURE 7

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Driveway "A" at North-South Road
Peak Traffic Hours
2005 - 2011



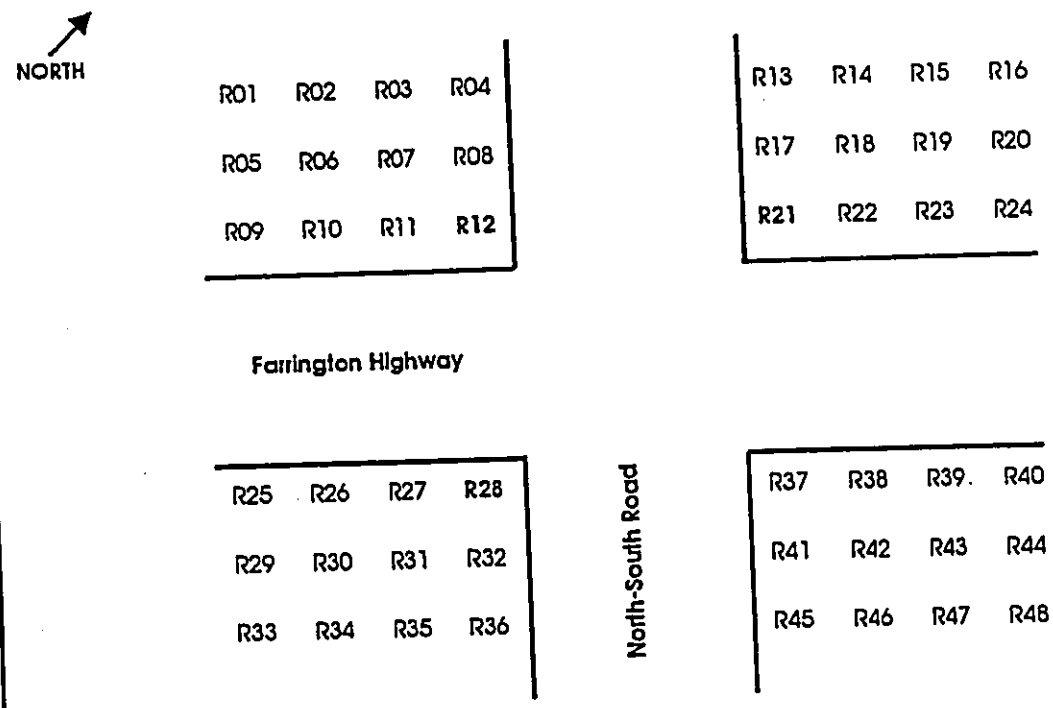

Receptor Spacing
= 10 meters

Estimated Maximum Concentrations
($mg/m^3$)

| Period | Without Project 2005 | Without Project 2011 | With Project 2005 | With Project 2011 |
|---|---|---|---|---|
| A.M. | 4.1<br>R37 | 4.3<br>R37 | 12.1<br>R28 | 13.8<br>R12 |
| P.M. | 3.1<br>R12 | 3.2<br>R37 | 6.5<br>R04 | 10.4<br>R37 |

FIGURE 8

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
North-South Road at Farrington Highway
Peak Traffic Hours
2005 - 2011



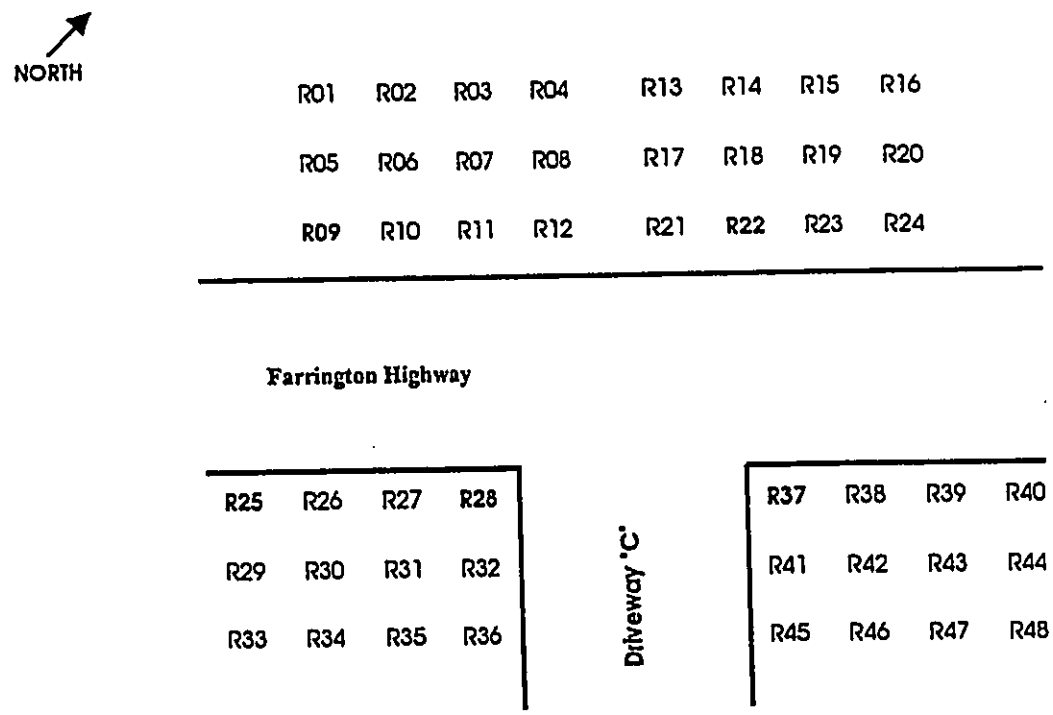

Receptor Spacing
= 10 meters

Estimated Maximum Concentrations
($mg/m^3$)

| Period | Without Project 2005 | Without Project 2011 | With Project 2005 | With Project 2011 |
|---|---|---|---|---|
| A.M. | 11.7<br>R12 | 12.4<br>R12 | 17.0<br>R28 | 16.4<br>R12 |
| P.M. | 6.7<br>R12 | 7.2<br>R21 | 10.5<br>R21 | 10.5<br>R12 |

FIGURE 9

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Driveway "C" @ Farrington Highway
Peak Traffic Hours
2005 - 2011




Receptor Spacing
= 10 meters

Estimated Maximum Concentrations
($mg/m^3$)

| | Without Project | | With Project | |
|---|---|---|---|---|
| Period | 2005 | 2011 | 2005 | 2011 |
| A.M. | 2.9<br>R09 | 3.2<br>R09 | 9.8<br>R37 | 9.2<br>R37 |
| P.M. | 1.7<br>R25 | 2.1<br>R25 | 5.5<br>R22 | 5.2<br>R28 |

The probability of these exceedances actually occurring, however, is low since the winds (speed and direction) and atmospheric stability conditions necessary to produce them generally occur at an overall frequency less than 1%.

6.5 Results: 8-Hour Concentrations. Estimates of 8-hour concentrations can be derived by applying a "persistence" factor of 0.6 to the 1-hour concentrations. This "persistence" factor has been recommended in an EPA publication on indirect source analysis [22] and has been further corroborated by analysis of carbon monoxide monitoring data in Honolulu which yielded the same 8-hour-to- 1-hour ratio [23]. Applying this factor to the maximum 1-hour estimates indicates compliance with the federal 8-hour standard but possible exceedance of the more stringent state standard in close proximity (< 10 meters) to the intersections studied.

Again, since the probability of the estimated maximum 1-hour concentrations is low, the 8-hour values derived from those concentrations would be expected to have an even lower probability given the longer averaging time and the changes in meteorological conditions which normally occur throughout the day.

## 7. OFFSITE IMPACTS

7.1 Electrical Generation. The estimated 59.6 and 55.9 million kilowatt hours (kwhrs) of annual electrical demand by Phases I and II of the project, respectively, will necessitate the generation of electricity by power plants. Currently, most of Oahu's electrical energy is generated by Hawaiian Electric Company's oil-fired plants at Kahe Point and Waiau. These units fire low sulfur (0.5%) fuel oil. The estimated emissions resulting from fuel burned to provide the power needed by the project are presented in Table 5.

7.2 Solid Waste Disposal. The refuse generated by the thousands of new residents eventually inhabiting the project area will require disposal. It is expected that most of this material will be reduced in volume by combustion prior to landfilling. Combustion will be accomplished at the existing resource recovery facility (HPOWER) located at the Campbell Industrial Park southwest of the project site. Estimates of annual emissions attributable to the burning of this waste are presented in Table 6.

TABLE 5

ESTIMATES OF ANNUAL EMISSIONS
DUE TO ELECTRICAL GENERATION

| Pollutant | Emissions (T/yr) | | | Percent of 1980 Inventory |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Total | |
| Sulfur oxides (SOx) | 163 | 153 | 316 | 0.6 |
| Nitrogen oxides (SOx) | 139 | 130 | 169 | 0.6 |
| Particulate matter (PM) | 16.2 | 15.2 | 31.4 | 0.2 |
| Carbon monoxide (CO) | 10.4 | 9.7 | 20.1 | 0.1 |
| Total organics (TOC) | 2.2 | 2.0 | 4.2 | <0.1 |

TABLE 6

ESTIMATES OF ANNUAL EMISSIONS
DUE TO SOLID WASTE COMBUSTION

| Pollutant | Emissions (T/yr) | | | Percent of 1980 Inventory |
|---|---|---|---|---|
| | Phase 1 | Phase 2 | Total | |
| Nitrogen oxides (NOx) | 30.3 | 34.5 | 64.8 | 0.16 |
| Carbon monoxide (CO) | 26.7 | 30.5 | 57.2 | <0.1 |
| Sulfur oxides (SOx) | 6.2 | 7.1 | 13.3 | <0.1 |
| Particulate matter (PM) | 2.5 | 2.9 | 5.4 | <0.1 |
| Total hydrocarbons (THC) | 1.6 | 1.8 | 3.4 | <0.1 |

## 8. DISCUSSION, CONCLUSIONS AND MITIGATION

8.1 Short-Term Impacts. Since as noted in Section 5, there is a 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. 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% [13]. The soonest possible landscaping of completed areas will also help.

8.2 Mobile Source Impacts. As noted in Section 6, possible exceedances of state carbon monoxide standards are predicted for 2005 and 2011 with the project. Factors which mitigate against this being a matter of serious concern for the proposed project are:

- the predicted exceedances were found only very close to the intersection (within 10 meters of the roadway) and at only particular receptor locations, not all close-in receptors; beyond that all standards are met.

- the probability of "worst case" conditions occurring and persisting for 1 to 8 hours is low.

8.3 Electrical Generation. The proposed project will increase electrical demand which in turn will cause more fuel to be burned and more pollutants to be emitted into Oahu's air. The estimated emissions represent relatively small increases (< 1%) over the latest available county emissions inventory. Until other nonpolluting means of generating electricity are developed or higher efficiency control technologies are applied, such increases in emissions are inevitable. Electrical demand, fuel consumption, and emissions can be reduced by energy conservations measures such as use of solar water heaters, heat pumps, proper design of buildings to reduce air conditioning needs, etc. For the present and future, the HECO facilities providing the power must demonstrate compliance with all applicable ambient air quality standards and control regulations in order to retain its operating permit.

8.4 Solid Waste Disposal. The proposed project will contribute additional solid waste which must be disposed of. Combustion of this waste to reduce its volume prior to landfilling will result in air emissions amounting to less than 0.5% of the most recent available Oahu emissions inventory. The combustion facility itself must at all times meet state and federal ambient air quality standards as well as emission limitations in its operating permit.

The proposed project can reduce solid waste generation by encouraging recycling of materials and composting of yard waste and other natural organic materials. Recycling and composting could be made an integral part of the project.

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# AIR QUALITY IMPACT REPORT

*EAST KAPOLEI PROJECT*

18 December 1995

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## 1. INTRODUCTION

Schuler Homes, Inc. is proposing to construct a primarily residential project on an approximately 794-acre parcel in the Ewa District of the island of Oahu (Figure 1). The property was formerly used for sugar cane cultivation (Figure 2).

The intent is to complete project development by the year 2010. Proposed land uses are summarized in Table 1.

**TABLE 1**

**PROPOSED LAND USES**

| Land Use | Area (acres) | Density (DU/ac) | Dwelling Units (DU) |
|---|---|---|---|
| Residential | 649 | 12/acre | 8,000 |
| Neighborhood Commercial | 16 | | |
| Schools | 25 | | |
| Parks | 32 | | |
| Circulation | 20 | | |

The purpose of this report is to assess the impact of the proposed development on air quality on a local and regional scale. 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 quality is its inherent attraction for mobile sources, i.e., motor vehicles. 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 the year 2010 with and without the project.

A project such as this also requires electrical power and solid waste disposal, both of which involve combustion and emissions into the air at offsite locations. These have been addressed in the report.

FIGURE 1

PROJECT LOCATION

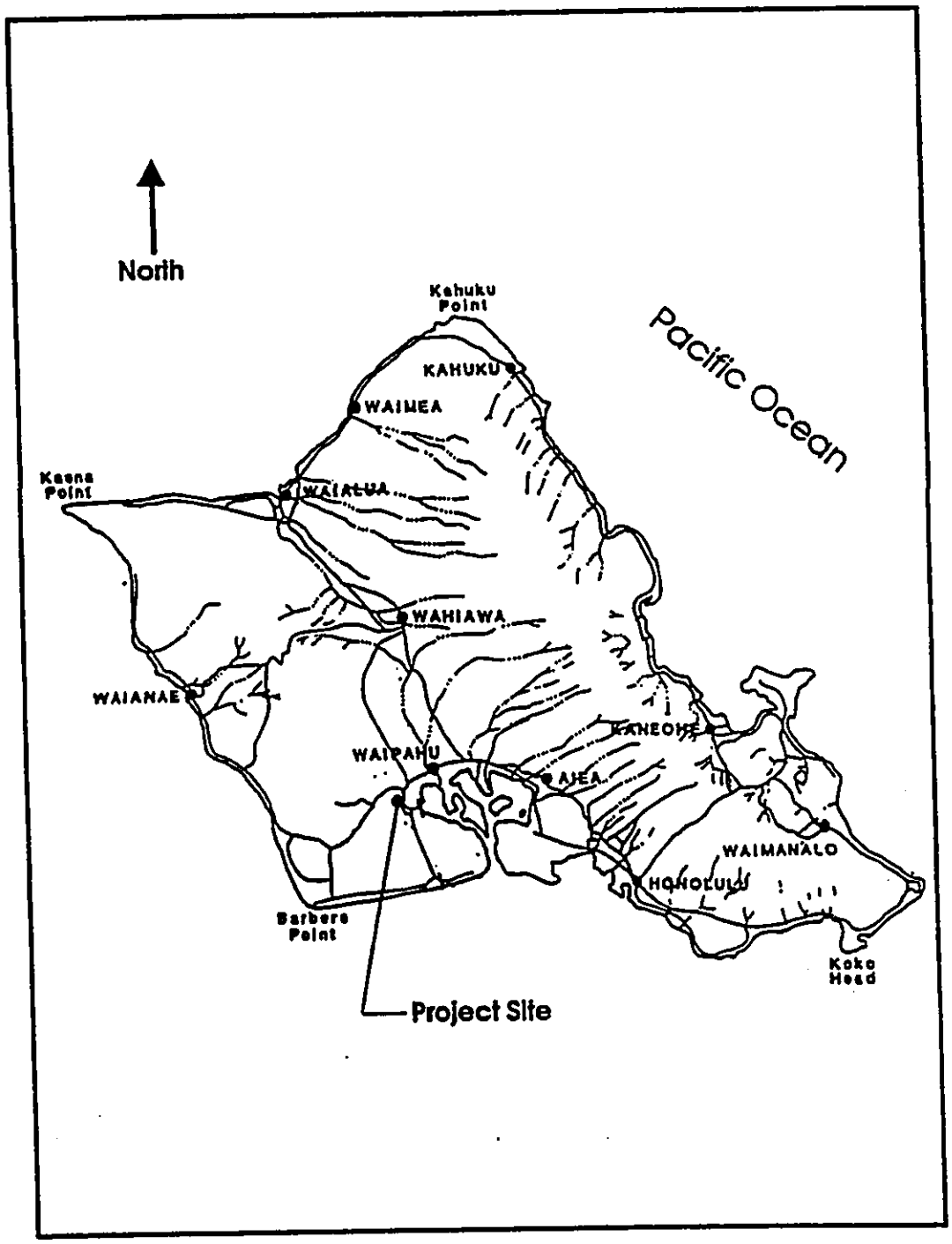
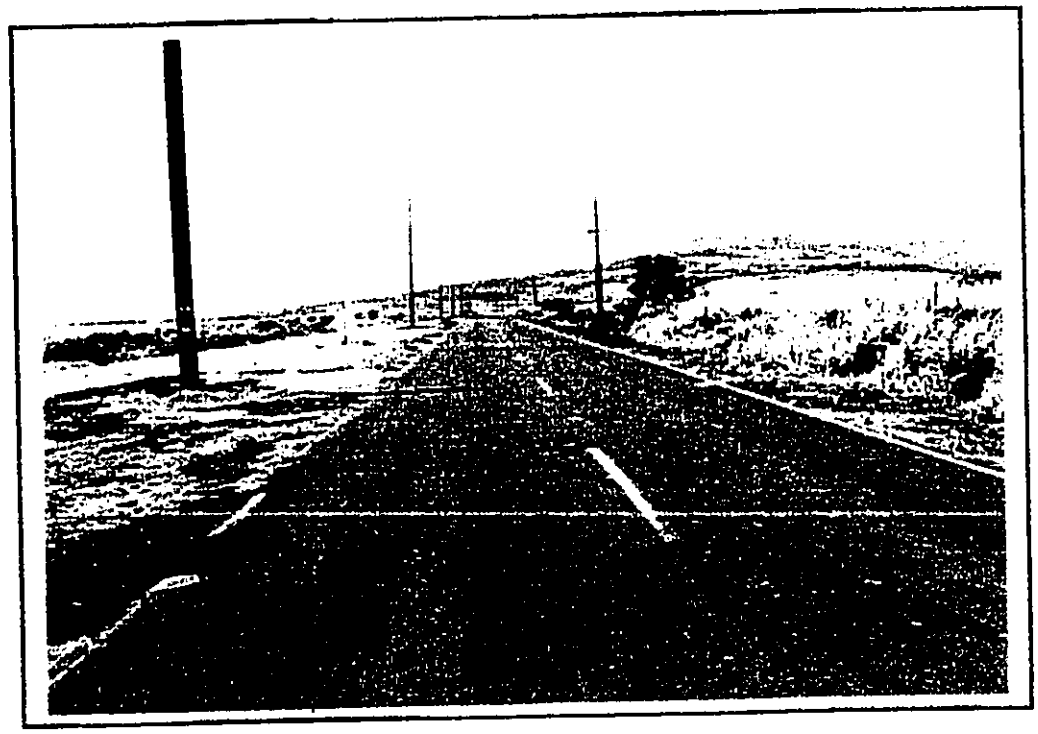


FIGURE 2

EXISTING SITE CONDITIONS
SEPTEMBER 1994

Cane Fields
(facing south)



Farrington Highway
Bordering Property
(facing southwest)

J. W. Morrow

Finally, during construction of the various buildings and facilities air pollutant emissions will be generated onsite and offsite due to vehicular movement, grading, concrete and asphalt batching, and general dust-generating construction activities. These impacts have also been addressed.

## 2. AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 2 [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 (CO, $NO_2$, and $O_3$) 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 November 1993, the Governor signed amendments to Chapter 59, Ambient Air Quality Standards [3], adopting the federal standard for particulate matter equal to or less than 10 microns in diameter ($PM_{10}$). Since measurement data in Hawaii indicate that $PM_{10}$ comprises about 50% of total suspended particulate matter (TSP), the adoption of that federal standard with a numerical value equal to the original state TSP standard of 150 $\mu g/m^3$ represents a substantial relaxation of the standard (approximately doubling it).

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 [5].

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 [1]. The last review resulted in the relaxation of the oxidant standard from 160 to 235 micrograms/cubic meter ($ug/m^3$) [6]. The carbon monoxide (CO), particulate matter, sulfur dioxide ($SO_2$), and nitrogen dioxide ($NO_2$) standards have been reviewed, but no new standards were proposed.

TABLE 2

SUMMARY OF STATE OF HAWAII AND FEDERAL AMBIENT AIR QUALITY STANDARDS

| POLLUTANT | SAMPLING PERIOD | NAAQS PRIMARY | NAAQS SECONDARY | STATE STANDARDS |
|---|---|---|---|---|
| $PM_{10}$ | Annual | 50 | 50 | 50 |
| | 24-hr | 150 | 150 | 150 |
| $SO_2$ | Annual | 80 | --- | 80 |
| | 24-hr | 365 | --- | 365 |
| | 3-hr | --- | 1,300 | 1,300 |
| $NO_2$ | Annual | 100 | --- | 70 |
| CO | 8-hr | 10 | --- | 5 |
| | 1-hr | 40 | --- | 10 |
| $O_3$ | 1-hr | 235 | --- | 100 |
| $H_2S$ | 1-hr | --- | --- | 35 |
| Pb | Calendar Quarter | 1.5 | --- | 1.5 |

KEY:
- TSP - total suspended particulate matter
- $PM_{10}$ - particulate matter < 10 microns
- $SO_2$ - sulfur dioxide
- $NO_2$ - nitrogen dioxide
- CO - carbon monoxide
- $O_3$ - ozone
- Pb - lead

All concentrations in micrograms per cubic meter ($\mu g/m^3$) except CO which is in milligrams per cubic meter ($mg/m^3$).

Finally, the State of Hawaii also has fugitive dust regulations for particulate matter (PM) emanating from construction activities [7]. There simply can be no visible emissions from fugitive dust sources.

## 3. EXISTING AIR QUALITY

3.1 General. The State Department of Health (DOH) maintains a limited network of air monitoring stations around the state to gather data on the following regulated pollutants:

- particulate matter ≤ 10 microns ($PM_{10}$)
- total suspended particulate matter (TSP)
- sulfur dioxide ($SO_2$)
- carbon monoxide (CO)
- ozone ($O_3$)

In the case of $PM_{10}$ and $SO_2$, 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. There are no air monitoring sites in the immediate vicinity of the project site. The nearest stations are at Pearl City and Barbers Point where $PM_{10}$ is measured. A summary of the most recent published data from those sites are presented in Figure 3. Particulate matter levels are well below the 50 $\mu g/m^3$ annual and 150 $\mu g/m^3$ twenty-four hour standards.

The summary of monitoring results from the Department of Health building in downtown Honolulu presented in Table 3 also indicates compliance with standards. Air quality at the project area should be comparable or perhaps somewhat better given the site's more rural location.

FIGURE 3

MONTHLY $PM_{10}$ AVERAGES
PEARL CITY AND BARBERS POINT
MONITORING STATIONS
1990

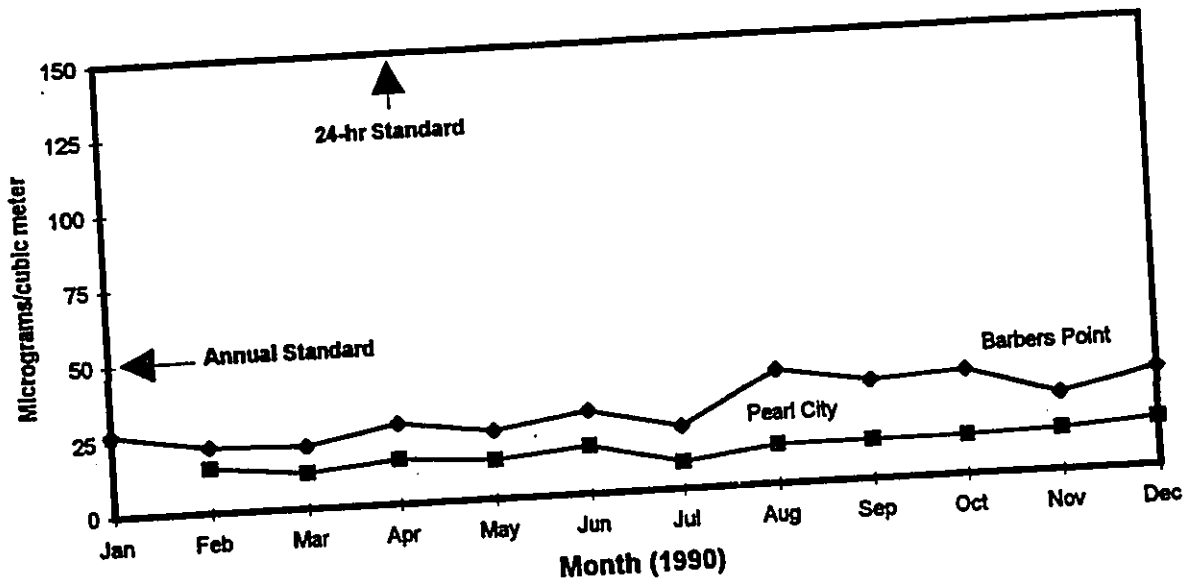


**TABLE 3**

**AIR MONITORING DATA**
**DEPARTMENT OF HEALTH BUILDING[1]**
**1988 - 1990**

| POLLUTANT | Concentration ($ug/m^3$) | | |
|---|---|---|---|
| | 1988 | 1989 | 1990 |
| Total Suspended Particulate Matter (TSP) | 15 - 45<br>26 | 6 - 48<br>29 | 13 - 47<br>30 |
| Particulate Matter < 10 microns ($PM_{10}$)[2] | 9 - 25<br>17 | 10 - 33<br>16 | 8 - 36<br>15 |
| Sulfur Dioxide ($SO_2$) | <5 - <5<br><5 | <5 - 8<br><5 | <5 - <5<br><5 |
| Carbon Monoxide[3] (CO) | 0.2 - 10.3<br>1.7 | 0.3 - 9.7<br>1.9 | 0.1 - 7.1<br>1.5 |
| Ozone ($O_3$)[4] | 0 - 92<br>14 | 0 - 94<br>15 | 4 - 116<br>36 |
| Lead (Pb) | 0 - 0.1<br>0 | 0 - 0.1<br>0 | 0 - 0<br>0 |

Notes:
1. Values indicate range and annual mean.
2. $PM_{10}$ data are from the Liliha site.
3. CO values are $mg/m^3$.
4. $O_3$ data are from the Sand Island site.

## 4. CLIMATE AND METEOROLOGY

4.1 Temperature and Rainfall. Temperatures in the project area are expected to be similar to those found elsewhere in Hawaii. The nearest long-term weather station operated by the National Weather Service is located at the Honolulu International Airport. In an annual summary for that station, the National Climatic Center has summarized Honolulu's temperature regime as follows:

> *Hawaii's equable temperatures are associated with the small seasonal variation in the amount of energy received from the sun and the tempering effect of the surrounding ocean. The range of temperatures averages only 7 degrees between the warmest months (August and September) and the coolest months (January and February) and about 12 degrees between day and night. Daily maximums run from the high 70's in winter to the mid-80's in summer, and daily minimums from the mid-60's to the low 70's. However, the Honolulu Airport area has recorded as high as 93 degrees and as low as 53 [9].*

Historical rainfall data from the Honolulu International Airport indicate an annual average of 23 inches. Based on this average and in accordance with Thornwaite's scheme for climatic classification, the area is considered semi-arid [10].

4.2 Surface Winds. Meteorological data records were reviewed from the nearby Honolulu International Airport and Hickam Air Force Base. The annual prevalence of northeast trade winds is clearly shown in Table 4. A closer examination of the data, however, indicates that low velocities (less than 10 mph) occur frequently and that the "normal" northeasterly trade winds tend to break down in the Fall giving way to more light, variable wind conditions through the Winter and on into early Spring. It is during these times that Honolulu generally experiences elevated pollutant levels. This seasonal difference in wind conditions can be easily contrasted by comparing August and January wind roses (Figures 4 and 5).

Of particular interest from an air pollution standpoint were the stability wind roses prepared for Hickam Air Force Base [11]. These data indicated that stable conditions, i.e., Pasquill-Gifford stability categories E and F [12], occur about 28% of the time on an annual basis and 36% of the time during the peak winter month (January). It is under such conditions that the greatest potential for air pollutant buildup from groundlevel sources, e.g., motor vehicles, exists.

## 5. SHORT-TERM IMPACTS

5.1 Onsite Impacts. The principal source of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along the existing roadways as well as on the project site itself. The additional construction vehicle traffic should not exceed street 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 onsite 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 [10,13].

Onsite soils are high in clay content which suggests silt content of about 30% [14], the same as cited above. In conjunction with the semi-arid local climate (P/E Index 28.9), this suggests a potential for somewhat greater fugitive dust emissions than estimated by the EPA.

5.2 Offsite Impacts. In addition to the onsite impacts attributable to construction activity, there will also be offsite impacts due to the operation of concrete and asphalt batching plants needed for construction. Such plants routinely emit particulate matter and other gaseous pollutants. It is too early, however, to identify the specific facilities that will be providing these materials and thus the discussion of air quality impacts is necessarily generic. The batch plants which will be producing the concrete for foundations, curbing, etc. and the asphalt for roadways must be permitted by the Department of Health Clean Air Branch pursuant to state regulations [7]. In order to obtain these permits they must demonstrate their ability to continuously comply with both emission [7] and ambient air quality [3] standards. Under the recently promulgated federal Title V operating permit requirements [15], now incorporated in Hawaii's rules [7], air pollution sources must regularly attest to their compliance with all applicable requirements.

TABLE 4

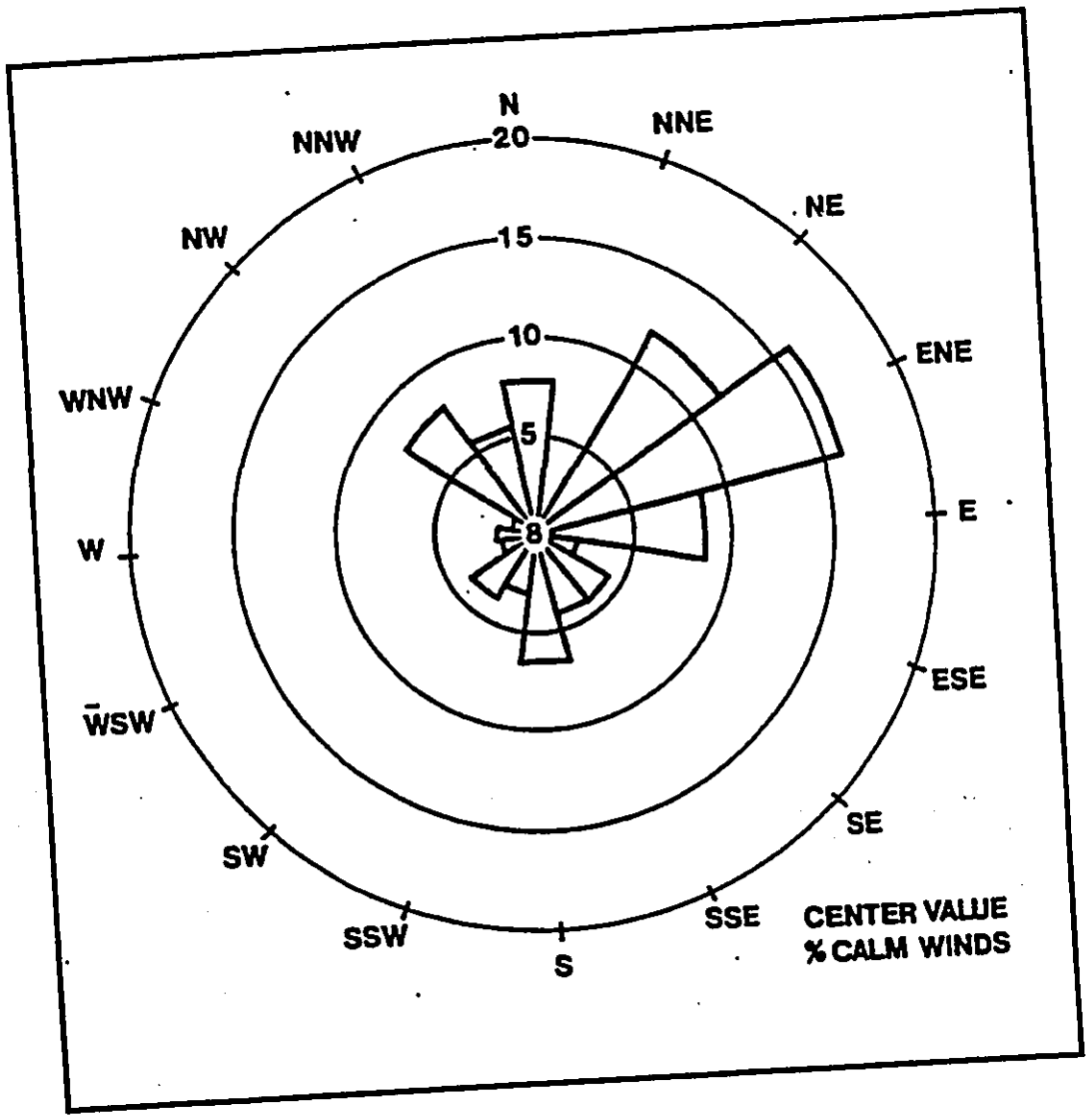
ANNUAL JOINT FREQUENCY DISTRIBUTION
OF WIND SPEED AND DIRECTION
HONOLULU INTERNATIONAL AIRPORT

| Direction | Wind Speed (kts) | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | 0-3 | 4-7 | 8-12 | 13-18 | 19-24 | >24 | |
| N | .0149 | .0261 | .0075 | .0020 | .0002 | .0000 | .0506 |
| NNE | .0114 | .0219 | .0106 | .0046 | .0005 | .0000 | .0490 |
| NE | .0114 | .0449 | .0829 | .0853 | .0204 | .0018 | .2466 |
| ENE | .0088 | .0637 | .1559 | .1209 | .0224 | .0014 | .3731 |
| E | .0039 | .0179 | .0329 | .0210 | .0023 | .0001 | .0782 |
| ESE | .0021 | .0056 | .0050 | .0015 | .0003 | .0001 | .0146 |
| SE | .0021 | .0059 | .0091 | .0049 | .0006 | .0002 | .0228 |
| SSE | .0023 | .0074 | .0123 | .0038 | .0008 | .0002 | .0268 |
| S | .0025 | .0104 | .0127 | .0033 | .0005 | .0003 | .0296 |
| SSW | .0011 | .0041 | .0053 | .0017 | .0003 | .0000 | .0125 |
| SW | .0007 | .0031 | .0058 | .0022 | .0003 | .0001 | .0122 |
| WSW | .0006 | .0017 | .0031 | .0022 | .0005 | .0001 | .0082 |
| W | .0019 | .0030 | .0021 | .0009 | .0002 | .0001 | .0082 |
| WNW | .0027 | .0051 | .0012 | .0003 | .0001 | .0000 | .0094 |
| NW | .0084 | .0153 | .0031 | .0008 | .0003 | .0000 | .0279 |
| NNW | .0087 | .0166 | .0041 | .0012 | .0002 | .0000 | .0308 |
| Total | .0835 | .2527 | .3534 | .2567 | .0496 | .0043 | 1.0002 |

SOURCE: National Weather Service
Historical Records, 1940-67

FIGURE 4

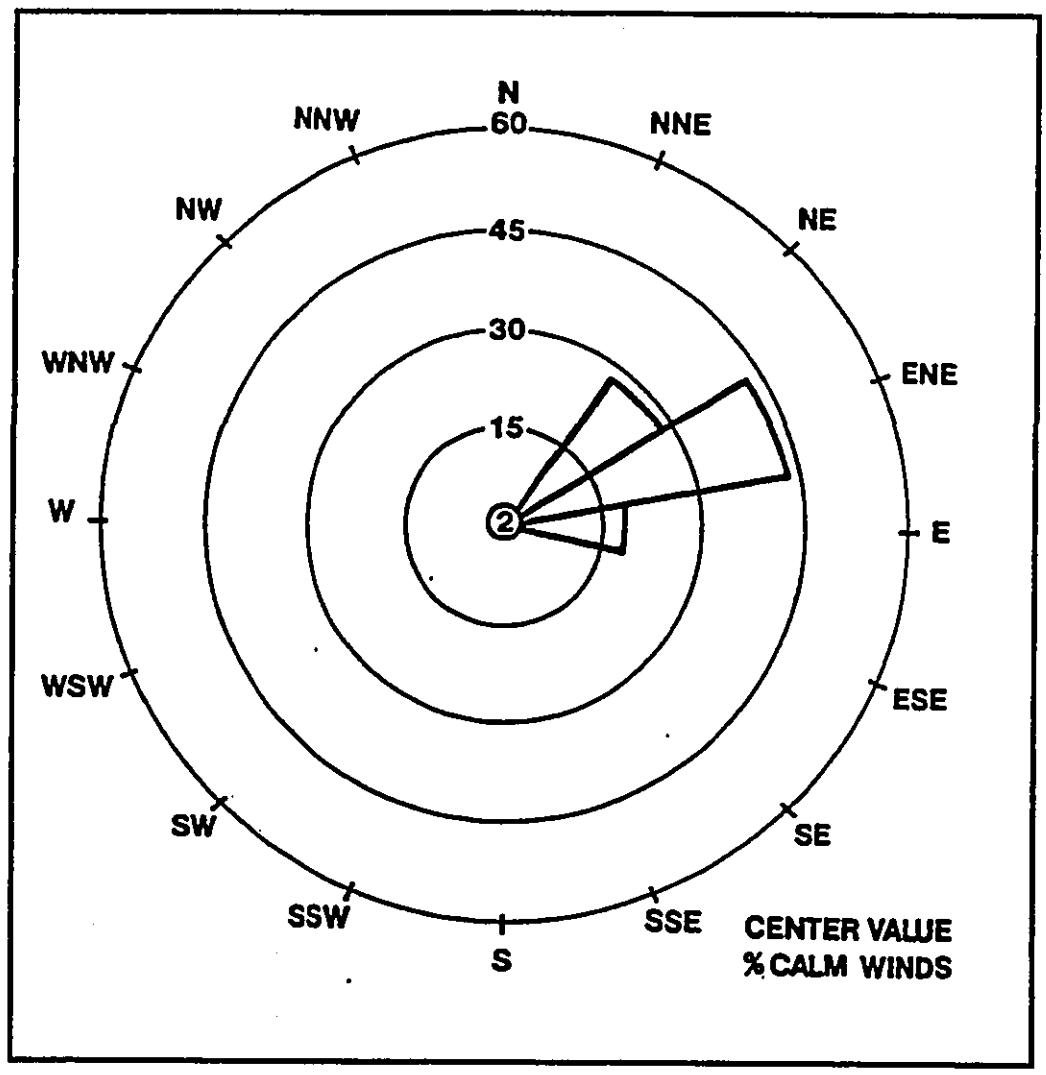
JANUARY WIND ROSE
HONOLULU INTERNATIONAL AIRPORT




SOURCE: National Weather Service
Historical Records, 1940-67

FIGURE 5

AUGUST WIND ROSE
HONOLULU INTERNATIONAL AIRPORT




SOURCE: National Weather Service
Historical Records, 1940-67

## 6. MOBILE SOURCE IMPACTS

6.1 Mobile Source Activity. The traffic assessment prepared for the proposed project served as the basis for this mobile source impact analysis [8]. Traffic projections for the year 2010 with and without the project were provided for the major intersections serving the project area.

6.2 Emission Factors. Automotive emission factors for carbon monoxide (CO) were generated for calendar year 2010 using the Mobile Source Emissions Model (MOBILE-5A) [16]. To localize the emission factors as much as possible, the March 1992 age distribution for registered vehicles in the City & County of Honolulu [17] was input in lieu of national statistics. That same age distribution was the basis for the distribution of vehicle miles traveled as well.

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)[18], and it comprises the largest fraction of automotive emissions.

Using the available traffic data, modeling was performed for the following intersections:

- Driveway "B" @ North-South Road
- Driveway "A" @ North-South Road
- North-South Road @ Farrington Highway
- Driveway "C" @ Farrington Highway

Because of the rural nature of the area, a stable atmosphere (Category "F") [19] was assumed for the morning and a neutral atmosphere (Category "D") for afternoon peak hours. A 1 meter per second (m/sec) wind speed was also assumed as worst case meteorological conditions.

The EPA guideline model CAL3QHC [20,21] was employed to estimate near-intersection carbon monoxide concentrations. An array of 48 receptor sites at distances of 10 meters from the road edge were input to the model. Because the area is urbanizing with an increasing number of streets and traffic, a background CO concentration of 1.0 milligram per cubic meter ($mg/m^3$) was assumed.

The model uses an iterative process to identify the wind direction producing the maximum CO concentration at each receptor location.

6.4 Results: 1-Hour Concentrations. The results of this modeling are presented in Figures 6 - 9. Each figure depicts the locations of the 48 receptor sites around the respective intersections. Maximum estimated concentrations in milligrams per cubic meter ($mg/m^3$) for each of the evaluated scenarios are also presented along with the particular receptor location at which they were predicted.

There appears to be some potential for exceedances of the state 1-hour CO standard in close proximity, i.e., within 10 meters, to the intersections along the future North-South Road during both a.m. and p.m. peak traffic hours. In fact, even without the project, exceedances are predicted during the a.m. peak hour at the intersection with Farrington Highway. No exceedances of the federal standard are predicted.

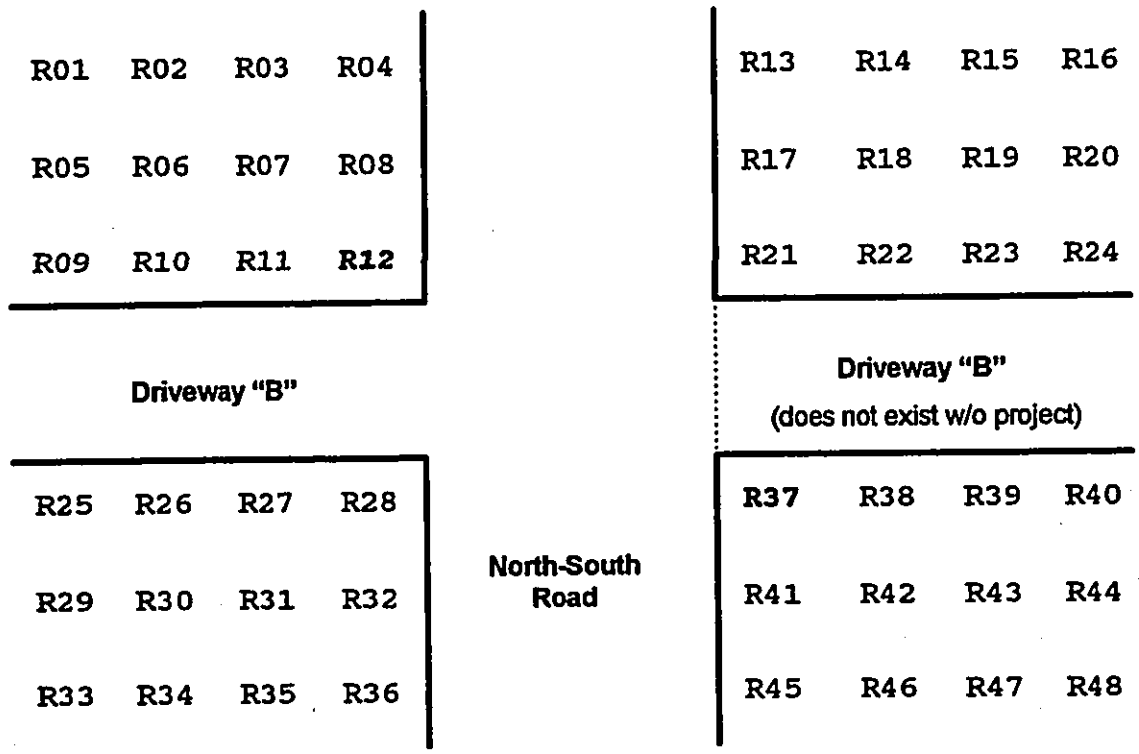
The probability of these exceedances actually occurring, however, is low since the winds (speed and direction) and atmospheric stability conditions necessary to produce them generally occur at an overall frequency less than 1%.

6.5 Results: 8-Hour Concentrations. Estimates of 8-hour concentrations can be derived by applying a "persistence" factor to the 1-hour concentrations. This "persistence" factor accounts for the fact that the worst case 1-hour meteorology and traffic volumes do not persist for 8 hours. EPA recommends calculation of a persistence factor based on actual 1-hour and 8-hour CO measurements. This was done for a recent Hawaii project [22] and yielded an average persistence factor of 0.5. Applying this factor to the maximum 1-hour estimates indicates compliance with the federal 8-hour standard but possible exceedance of the more stringent state standard in close proximity (< 10 meters) to the intersections studied.

Again, since the probability of the estimated maximum 1-hour concentrations is low, the 8-hour values derived from those concentrations would be expected to have an even lower probability given the longer averaging time and the changes in meteorological conditions which normally occur throughout the day.

FIGURE 6

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Driveway "B" at North-South Road
Peak Traffic Hours
2010



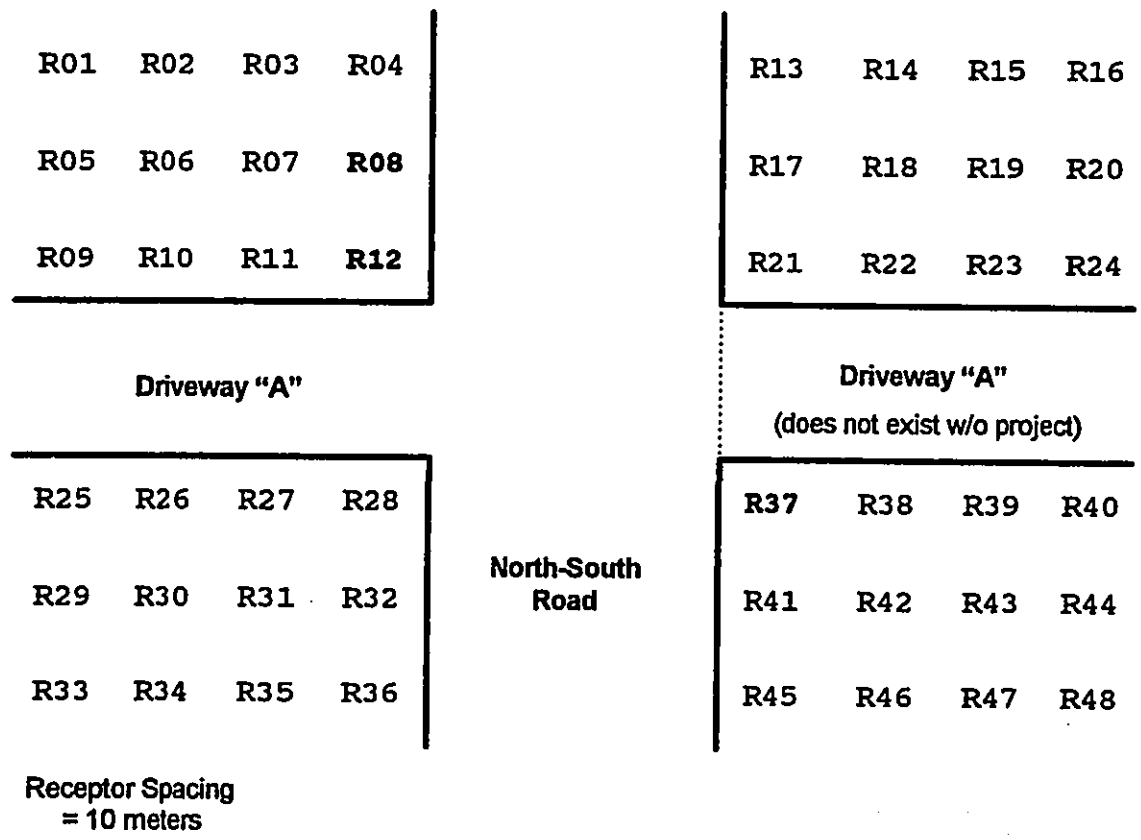

Receptor Spacing
= 10 meters

Estimated Maximum Concentrations
($mg/m^3$)

| Period | Without Project | With Project |
|---|---|---|
| A.M | 5.6 | 13.2 |
| | R12 | R37 |
| P.M | 3.5 | 9.5 |
| | R12 | R37 |

FIGURE 7

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Driveway "A" at North-South Road
Peak Traffic Hours
2010

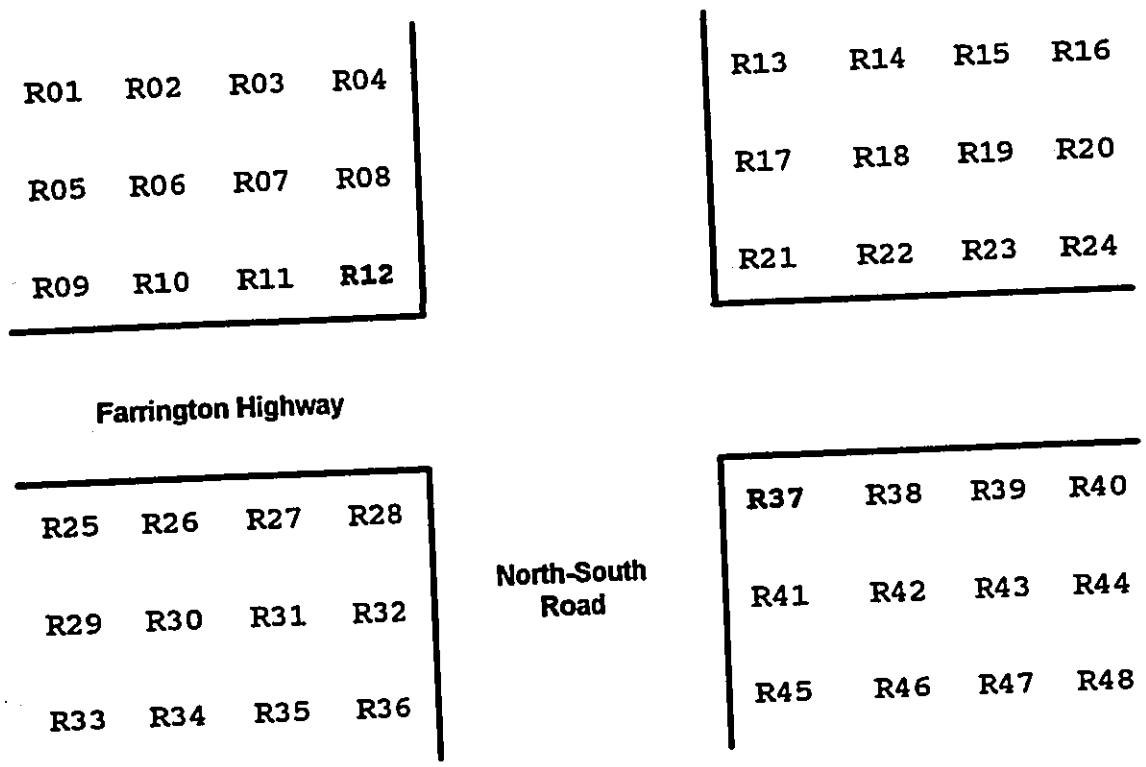



Estimated Maximum Concentrations
($mg/m^3$)

| Period | Without Project | With Project |
|---|---|---|
| A.M | 6.3 | 11.3 |
| | R08 | R37 |
| P.M | 3.8 | 8.5 |
| | R12 | R37 |

FIGURE 8

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
North-South Road at Farrington Highway
Peak Traffic Hours
2010



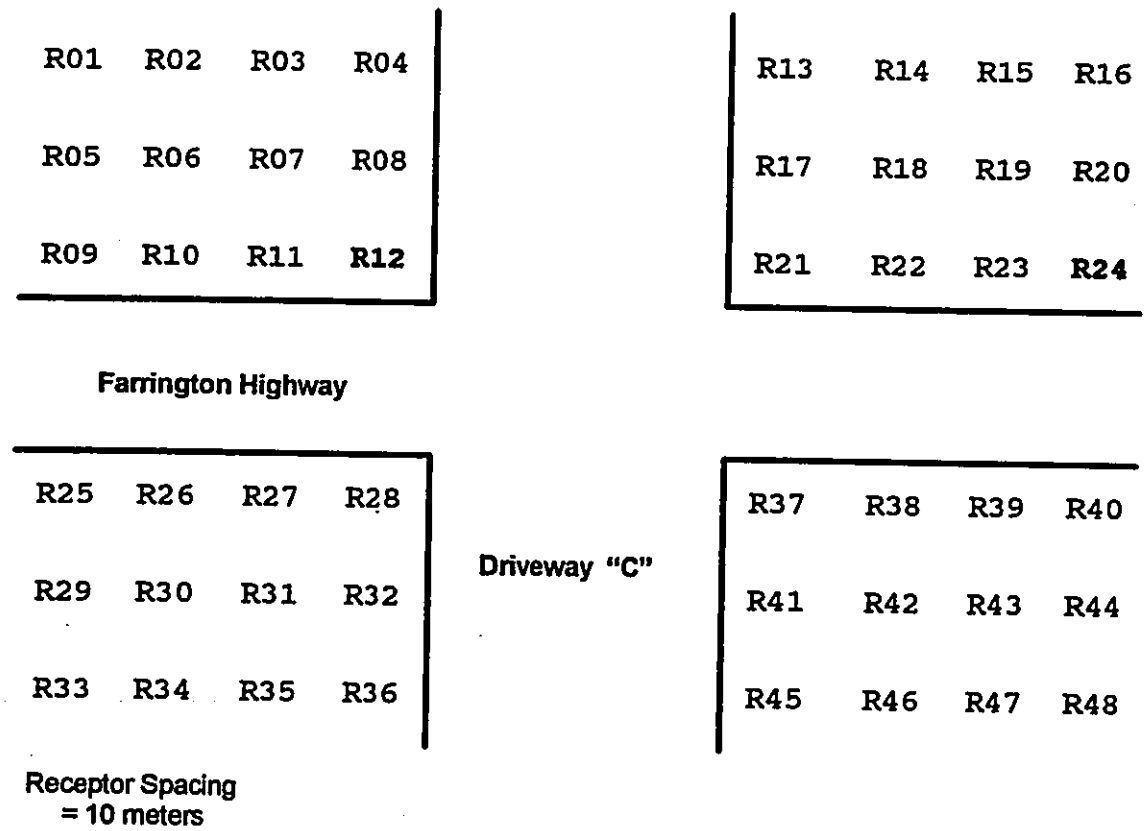

Receptor Spacing
= 10 meters

Estimated Maximum Concentrations
($mg/m^3$)

| Period | Without Project | With Project |
|---|---|---|
| A.M | 12.2<br>R12 | 16.1<br>R37 |
| P.M | 6.5<br>R12 | 11.4<br>R37 |

FIGURE 9

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Driveway "C" at Farrington Highway
Peak Traffic Hours
2010




Estimated Maximum Concentrations
($mg/m^3$)

| Period | With Project |
|---|---|
| A.M | 10.6<br>R12 |
| P.M | 7.6<br>R24 |

## 7. OFFSITE IMPACTS

7.1 Electrical Generation. The estimated 98.1 million kilowatt hours (kwhrs) of annual electrical demand by the project will necessitate the generation of electricity by power plants. Currently, most of Oahu's electrical energy is generated by Hawaiian Electric Company's oil-fired plants at Kahe Point and Waiau. These units fire low sulfur (0.5%) fuel oil. The estimated emissions resulting from fuel burned to provide the power needed by the project are presented in Table 5.

7.2 Solid Waste Disposal. The refuse generated by the thousands of new residents eventually inhabiting the project area will require disposal. It is expected that most of this material will be reduced in volume by combustion prior to landfilling. Combustion will be accomplished at the existing resource recovery facility (HPOWER) located at the Campbell Industrial Park southwest of the project site. Estimates of annual emissions attributable to the burning of this waste are presented in Table 6.

**TABLE 5**

**ESTIMATES OF ANNUAL EMISSIONS DUE TO ELECTRICAL GENERATION**

| Pollutant | Emissions (T/yr) | Percent of 1980 Inventory |
|---|---|---|
| | | |
| Sulfur oxides (SOx) | 268 | 0.6 |
| Nitrogen oxides (SOx) | 228 | 0.6 |
| Particulate matter (PM) | 27 | 0.2 |
| Carbon monoxide (CO) | 17 | <0.1 |
| Total organics (TOC) | 3.5 | <0.1 |

TABLE 6

ESTIMATES OF ANNUAL EMISSIONS
DUE TO SOLID WASTE COMBUSTION

| Pollutant | Emissions (T/yr) | Percent of 1980 Inventory |
|---|---|---|
| | | |
| Nitrogen oxides (NOx) | 48.5 | 0.12 |
| Carbon monoxide (CO) | 42.7 | 0.02 |
| Sulfur oxides (SOx) | 9.9 | 0.02 |
| Particulate matter (PM) | 4.1 | 0.03 |
| Total hydrocarbons (THC) | 2.5 | 0.01 |

## 8. DISCUSSION, CONCLUSIONS AND MITIGATION

8.1 Short-Term Impacts. Since as noted in Section 5, there is a 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. 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% [13]. The soonest possible landscaping of completed areas will also help.

8.2 Mobile Source Impacts. As noted in Section 6, possible exceedances of state carbon monoxide standards are predicted for 2010 with the project. Factors which mitigate against this being a matter of serious concern for the proposed project are:

- the predicted exceedances were found only very close to the intersection (within 10 meters of the roadway) and at only particular receptor locations, not all close-in receptors; beyond that all standards are met.

- the probability of "worst case" conditions occurring and persisting for 1 to 8 hours is low.

8.3 Electrical Generation. The proposed project will increase electrical demand which in turn will cause more fuel to be burned and more pollutants to be emitted into Oahu's air. The estimated emissions represent relatively small increases (< 1%) over the latest available county emissions inventory. Until other nonpolluting means of generating electricity are developed or higher efficiency control technologies are applied, such increases in emissions are inevitable. Electrical demand, fuel consumption, and emissions can be reduced by energy conservations measures such as use of solar water heaters, heat pumps, proper design of buildings to reduce air conditioning needs, etc. For the present and future, the HECO facilities providing the power must demonstrate compliance with all applicable ambient air quality standards and control regulations in order to retain its operating permit.

8.4 Solid Waste Disposal. The proposed project will contribute additional solid waste which must be disposed of. Combustion of this waste to reduce its volume prior to landfilling will result in air emissions amounting to less than 0.5% of the most recent available Oahu emissions inventory. The combustion facility itself must at all times meet state and federal ambient air quality standards as well as emission limitations in its operating permit. The proposed project can reduce solid waste generation by encouraging recycling of materials and composting of yard waste and other natural organic materials. Recycling and composting could be made an integral part of the project.

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# J

POTABLE WATER MASTER PLAN FOR THE EAST KAPOLEI AREA, OCTOBER 1994;

ADDENDUM REPORT FOR THE EAST KAPOLEI POTABLE WATER MASTER PLAN, DECEMBER 1995.

TOM NANCE WATER RESOURCE ENGINEERING

# Potable Water Master Plan for the East Kapolei Area

*Prepared for*

Gray Hong Bills & Associates, Inc.
119 Merchant Street - Suite 607
Honolulu, Hawaii 96813

*Prepared by*

Tom Nance Water Resource Engineering
680 Ala Moana Boulevard - Suite 406
Honolulu, Hawaii 96813

October 1994

THE ESTATE OF JAMES CAMPBELL

October 6, 1994

Mr. Michael G. Angotti
Director of Land Sales
Schuler Homes, Inc.
828 Fort Street Mall, 4th Floor
Honolulu, Hawaii 96813

Dear Mike:

Re: Schuler Ewa Water Master Plan

I am writing this letter to explain Campbell Estate's position regarding the identification of the Ewa Shaft (EP 15 and 16) as the water source for the proposed Schuler Homes project in Ewa. It is important that a copy of this letter be included with the submission of your Water Master Plan to the Land Use Commission and any other governmental agency involved with your project.

As we have discussed, the Estate intends to reserve all water rights with respect to the lands that Schuler intends to acquire from the Estate for this project. These rights include the ownership and operation of the Ewa Shaft which will be a water source for the Estate's activities including on-going agricultural operations upon expiration of the Oahu Sugar Company Ltd. Lease on June 30, 1995.

We have received correspondence from the Board of Water Supply indicating they are interested in owning the Ewa Shaft. Our response to them is "...that the loss of the Ewa Shaft or the water therefrom would cause significant and possible irreparable damage to the Estate. Furthermore, the Estate's loss of use of the Ewa Shaft through eminent domain or regulation, or both, would entitle the Estate to substantial compensation, not only for such loss, but also for loss of value to the Estate's surrounding lands."

To date, the Estate has received no proposal from the Board of Water Supply which addresses any terms and conditions which would mitigate the Estate's concerns.

We would prefer that you delete any references to the Ewa Shaft as a potential water source. Inasmuch as you desire to provide as much detail as possible in your entitlement applications, your cooperation by including this explanation with your Water Master Plan submissions will help the Estate continue to defend its rights.

1001 Kamokila Boulevard, Kapolei, Hawaii 96707 Phone (808) 674-6674 Facsimile (808) 674-3111

I am available to respond to any questions.

Very truly yours,

Donna B. Goth
Director, Hawaii Development

cc: Gray, Hong, Bills & Associates
David B. Bills

Estate of James Campbell
Jan Burns
George Hiu

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| 1 | Hydraulic Analysis of the 228-Foot Service Zone |
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## Introduction

This water master plan has been created for the East Kapolei area of Ewa shown on Figure 1. Projects and lands included in the master plan are:

- The East Kapolei Project of Schuler Homes, Inc. consisting of 10,000 residential units and school, park, and commercial sites on 1,022 acres;
- The University of Hawaii's West Oahu Campus on 500 acres;
- An 85-acre high school site;
- Residential development by the Department of Hawaiian Home Lands on 170 acres; and
- Mixed use development on 1,000 acres of Campbell Estate land, generally comprising the mauka and eastern portions of the master planned area.

The master plan establishes storage, transmission, and distribution requirements for all potable system facilities. All of these facilities would be new, stand-alone improvements and are analyzed as such in this Master Plan. However, the plan does not deal directly with sources of supply. A possible source is the shaft known as EP 15 & 16 (State Well No. 2202-21). Oahu Sugar Company's (OSCO) use of the shaft is scheduled to end in June 1995. Other possible sources would be located further east toward Waipahu. The Board of Water Supply will designate the source after allocations are set by the State Commission on Water Resource Management. Although EP 15 & 16 is shown as the source in graphic presentations in this Master Plan, this does not imply that Campbell Estate supports use of EP 15 & 16 for this purpose.

The caprock underlying the makai half to two-thirds of the master plan area is comprised of alluvium and poorly permeable marine calcareous deposits. In the mauka area, it is entirely alluvium. Attempts to develop brackish wells for irrigation supply have shown that the caprock formation here does not have sufficient permeability for successful well development. Based on this, all potential non-potable irrigation sources for the master plan area are offsite. They are: Waiahole Ditch; OSCO basalt aquifer wells in lower Honouliuli (EP 3 & 4, 5 & 6, and 7 & 8, State Nos. 2102-02, -04 to -22, 2202-03 to -14, and 2202-15 to 20, respectively); and polished effluent from the City's Honouliuli Wastewater Treatment Plant. None of these prospective sources are currently available. Issues of ownership, water use allocation, present use by OSCO through June 1995, and required infrastructure development will delay their possible use for a number of years. Accordingly, this master plan assumes that all water supply requirements will be provided by the potable system.

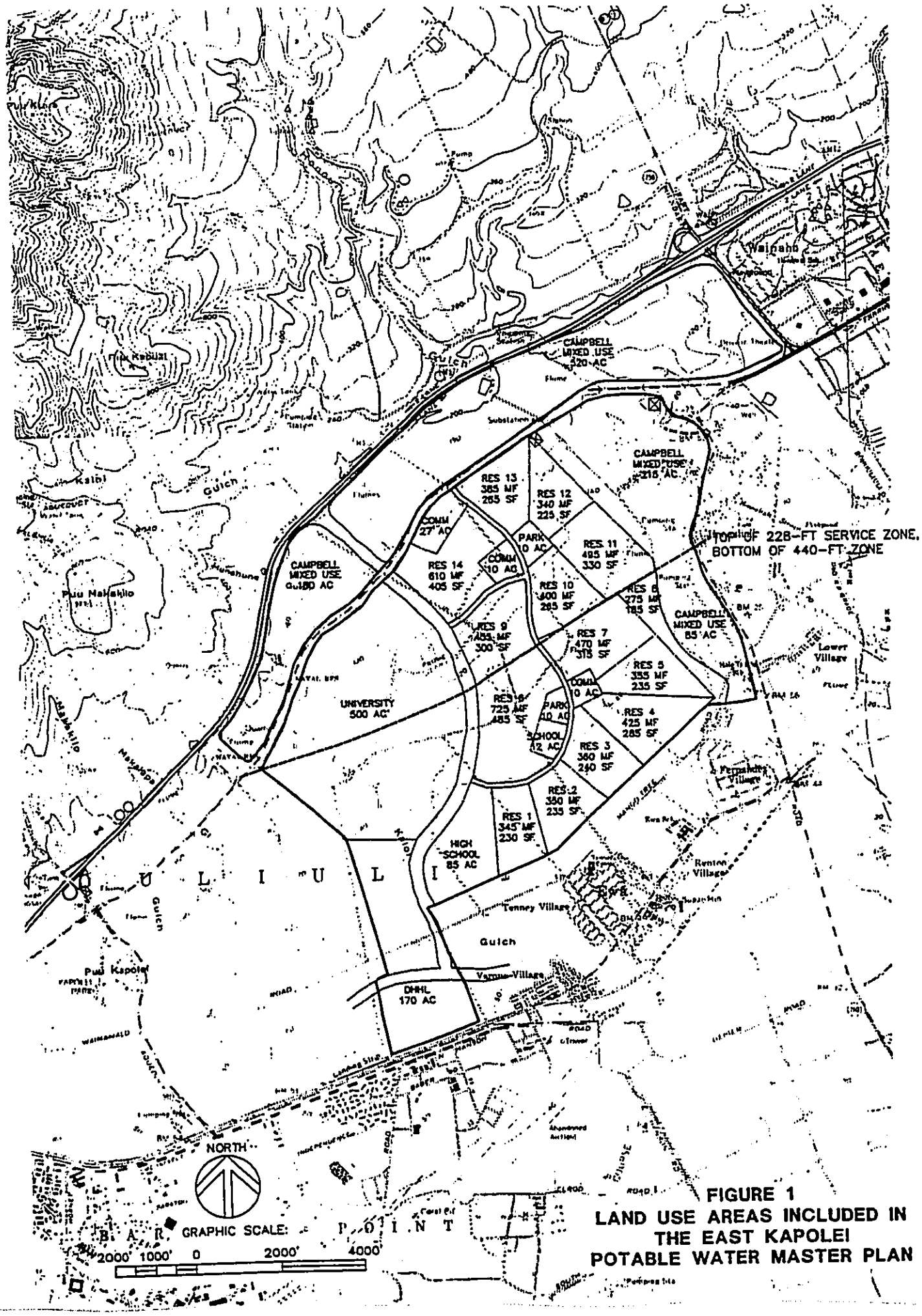


**FIGURE 1**
**LAND USE AREAS INCLUDED IN THE EAST KAPOLEI POTABLE WATER MASTER PLAN**

## Projected Potable Water Supply Requirements

The master plan area extends from elevations of 25 to 40 feet on its makai and east boundaries to just over 200 feet on the makai side of H-1 Freeway. These elevations span two service pressure zones which will be served from storage tanks with 228- and 440-foot tank spillway elevations. The boundary between the two service zones is shown on Figure 1. Ground elevations are typically 105 to 110 feet along the divide between the service areas.

Tables 1 and 2 provide parcel-by-parcel tabulations of the average, maximum day, and peak water demands within the 228- and 440-foot service zones, respectively. The total supply requirements are as follows:

| Service Zone | Average (MGD) | Max. Day (MGD) | Peak (MGD) |
|---|---|---|---|
| 228-Foot | 5.0000 | 7.5000 | 15.0000 |
| 440-Foot | 7.7360 | 11.6040 | 23.2080 |
| Total | 12.7360 | 19.1040 | 38.2080 |

## Layout of the Proposed Water System

Figure 2 is a layout of proposed water system improvements. For purposes of illustration, EP 15 & 16 is shown as the source of supply. Well pumping capacity of 28.656 MGD (19,900 GPM) would ultimately be required to provide the 19.104 MGD maximum day use in 16 hours for both service zones. The initial phase of development will consist of 500 acres of the Schuler project, all in the 228-foot service zone. Its maximum day supply requirement of 3.5287 MGD would require an initial well pumping capacity of 5.293 MGD (3,675 GPM).

Storage tanks for the 228-foot system would be located on a promontory on the makai side of H-1 Freeway. Figure 3 is a schematic layout of the initial 4 MG and subsequent 3.5 MG tanks that would be located there. Both tanks would have 20-foot working heights, 228-foot spillway elevations, and 208-foot finished floor elevations. Use of this site is predicated on utilizing berms and landscaping so the tank is visually acceptable to Campbell Estate.

Table 1

Water Demands for Projects in the 228-Foot Service Zone

| Development Parcel | | No. of Units | Area (Acres) | Unit Demand (GPD/Unit) | Water Demand Rates (MGD) | | | Location of Demand on Hydraulic Schematic (Node No. on Figure 4) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Average Day | Maximum Day | Peak | |
| Schuler | Res 1 - MF | 345 | | 400 | 0.1380 | 0.2070 | 0.4140 | 10 |
| | SF | 230 | | 500 | 0.1150 | 0.1725 | 0.3450 | 10 |
| | Res 2 - MF | 350 | | 400 | 0.1400 | 0.2100 | 0.4200 | 9 |
| | SF | 235 | | 500 | 0.1175 | 0.1762 | 0.3525 | 9 |
| | Res 3 - MF | 360 | | 400 | 0.1440 | 0.2160 | 0.4320 | 9 |
| | SF | 240 | | 500 | 0.1200 | 0.1800 | 0.3600 | 9 |
| | Res 4 - MF | 425 | | 400 | 0.1700 | 0.2550 | 0.5100 | 8 |
| | SF | 285 | | 500 | 0.1425 | 0.2138 | 0.4275 | 8 |
| | Res 5 - MF | 355 | | 400 | 0.1420 | 0.2130 | 0.4260 | 8 |
| | SF | 235 | | 500 | 0.1175 | 0.1762 | 0.3525 | 8 |
| | Res 6 - MF | 725 | | 400 | 0.2900 | 0.4350 | 0.8700 | 11 |
| | SF | 485 | | 500 | 0.2425 | 0.3638 | 0.7275 | 11 |
| | Res 7 - MF | 470 | | 400 | 0.1880 | 0.2820 | 0.5640 | 6 |
| | SF | 315 | | 500 | 0.1575 | 0.2362 | 0.4725 | 6 |
| | Res 8 - MF | 275 | | 400 | 0.1100 | 0.1650 | 0.3300 | 7 |
| | SF | 185 | | 500 | 0.0925 | 0.1388 | 0.2775 | 7 |
| | Commerical | | 10 | 4,000 | 0.0400 | 0.0600 | 0.1200 | 2 |
| | Park | | 10 | 4,000 | 0.0400 | 0.0600 | 0.1200 | 2 |
| | Elem. School | | 12 | 4,000 | 0.0480 | 0.0720 | 0.1440 | 2 |
| High School | | | 85 | 4,000 | 0.3400 | 0.5100 | 1.0200 | 4 |
| University (Lower Half) | | | 250 | 4,000 | 1.0000 | 1.5000 | 3.0000 | 4 |
| DHHL | | | 170 | 4,000 | 0.6800 | 1.0200 | 2.0400 | 5 |
| Campbell Mixed Use (Portion D) | | | 85 | 5,000 | 0.4250 | 0.6375 | 1.2750 | 7 |
| Totals | | 5,515 | 622 | -- | 5.0000 | 7.5000 | 15.0000 | -- |

Table 2

Water Demands for Projects in the 440-Foot Service Zone

| Development Parcel | | No. of Units | Area (Acres) | Unit Demand (GPD/Unit) | Water Demand Rates (MGD) | | | Location of Demand on Hydraulic Schematic (Node No. on Figure 4) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Average Day | Maximum Day | Peak | |
| Schuler | Res 9 - MF | 455 | | 400 | 0.1820 | 0.2730 | 0.5460 | 5 & 6 |
| | SF | 300 | | 500 | 0.1500 | 0.2250 | 0.4500 | 5 & 6 |
| | Res 10 - MF | 400 | | 400 | 0.1600 | 0.2400 | 0.4800 | 7 |
| | SF | 265 | | 500 | 0.1325 | 0.1988 | 0.3975 | 7 |
| | Res 11 - MF | 495 | | 400 | 0.1980 | 0.2970 | 0.5940 | 7 |
| | SF | 330 | | 500 | 0.1650 | 0.2475 | 0.4950 | 7 |
| | Res 12 - MF | 340 | | 400 | 0.1360 | 0.2040 | 0.4080 | 9 |
| | SF | 225 | | 500 | 0.1125 | 0.1688 | 0.3375 | 9 |
| | Res 13 - MF | 395 | | 400 | 0.1580 | 0.2370 | 0.4740 | 9 |
| | SF | 265 | | 500 | 0.1325 | 0.1987 | 0.3975 | 9 |
| | Res 14 - MF | 610 | | 400 | 0.2440 | 0.3660 | 0.7320 | 5 & 10 |
| | SF | 405 | | 500 | 0.2025 | 0.3037 | 0.6075 | 5 & 10 |
| | Park | | 10 | 4,000 | 0.0400 | 0.0600 | 0.1200 | 6 |
| | Commercial | | 10 | 4,000 | 0.0400 | 0.0600 | 0.1200 | 6 |
| University (Upper Half) | | | 250 | 4,000 | 1.0000 | 1.5000 | 3.0000 | 4 & 5 |
| Campbell Est. | Commercial | | 27 | 4,000 | 0.1080 | 0.1620 | 0.3240 | 2 |
| | Mixed Use | | 180 | 5,000 | 0.9000 | 1.3500 | 2.7000 | 4 |
| | Mixed Use | | 520 | 5,000 | 2.6000 | 3.9000 | 7.8000 | 2, 12, & 13 |
| | Mixed Use | | 215 | 5,000 | 1.0750 | 1.6125 | 3.2250 | 11 & 12 |
| Totals | | 4,485 | 1,212 | -- | 7.7360 | 11.6040 | 23.2080 | -- |

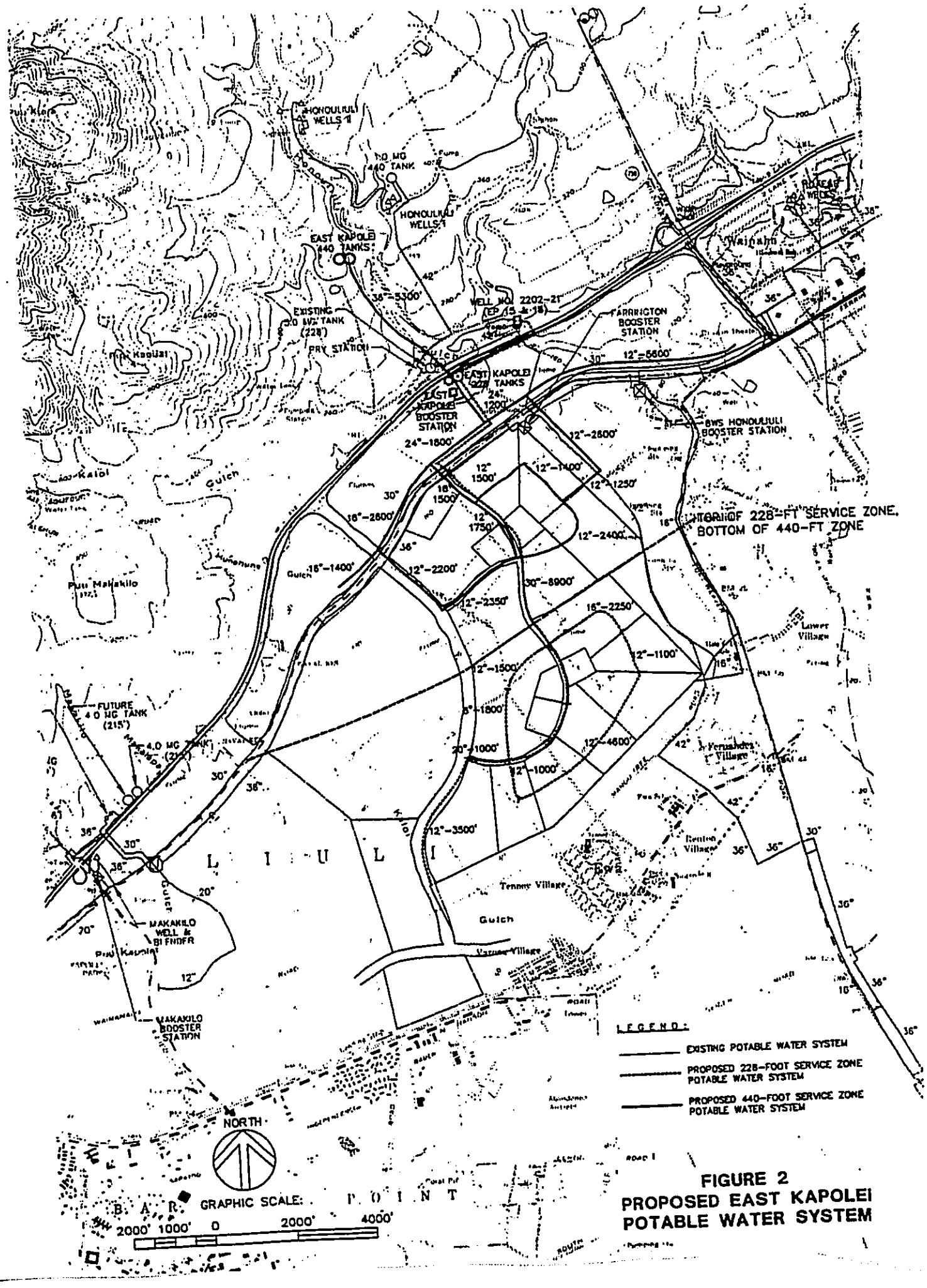


**FIGURE 2**
**PROPOSED EAST KAPOLEI POTABLE WATER SYSTEM**

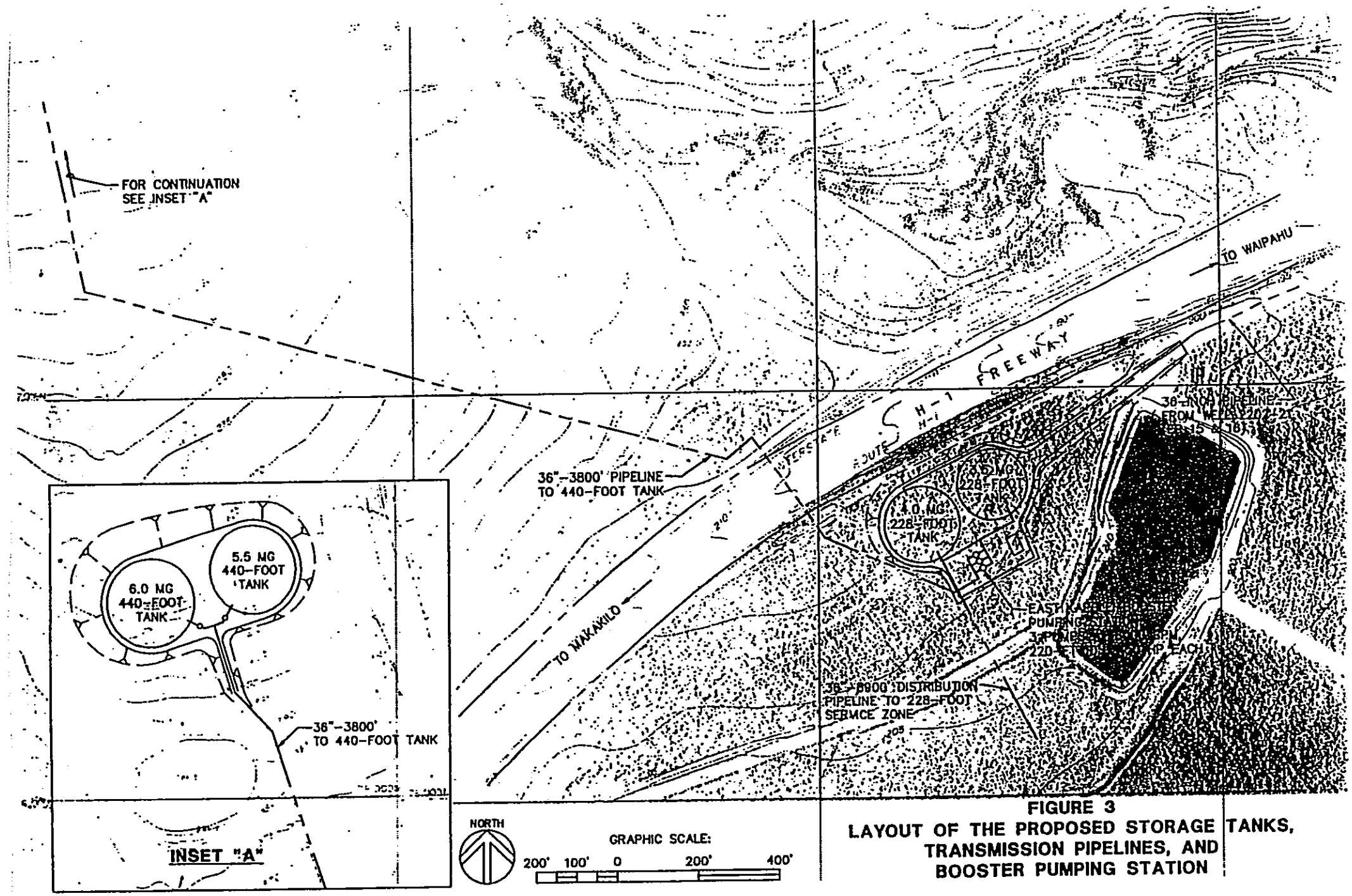


**FIGURE 3**
**LAYOUT OF THE PROPOSED STORAGE TANKS, TRANSMISSION PIPELINES, AND BOOSTER PUMPING STATION**

Storage for the 440-foot zone would be on the mauka side of the freeway (also shown on Figure 3). The 36-inch connecting transmission-distribution pipeline to the 440-foot tanks would be tunnelled through H-1 Freeway. The alternative to tunneling would be to route the pipeline underneath the Honouliuli Gulch bridge. The substantially greater length of this route would be more costly. Also, the remaining space through the Honouliuli Gulch opening is actually quite limited, particularly if EP 15 & 16 becomes the source of supply. The required ultimate storage capacity of 11.604 in the 440-foot zone would be provided by 6.0 and 5.5 MG tanks. A booster pumping station at the 228-tanks would lift water into the 440-foot tanks. Its ultimate capacity will have to be 17.406 MGD (12,087 GPM). This would be provided by three identical pumps with rated capacities of 6,000 GPM against 220-foot TDH and driven by 450 HP motors.

Except for the North-South Road and a major collector through the Schuler project, the roadway network through the master plan area has not yet been finalized. Portions of the layout of distribution pipelines shown on Figure 2 assume the existence of a road system which the pipelines would follow. When planning of these areas is further refined, the pipeline routes can be adjusted to match the actual roadway pattern.

## Hydraulic Analysis of the 228-Foot Service Zone Distribution Pipe Network

The schematic drawing on Figure 4 identifies pipe and node numbers used for the pipe network analyses of the 228-foot service zone. Table 1 identifies the nodes to which water demands of each of the development parcels were assigned. The analysis itself was done with the Kentucky Pipe Network computer program. Exhibit 1 is a printout of its results. All BWS criteria for allowable velocities and minimum pressures during peak and fire flow conditions are met with the pipe sizes chosen. The hydraulic analysis is based on a stand-alone system without interconnections to existing facilities. However, interconnection with the 42-inch, mauka-makai pipeline installed by EPWDC would ultimately be appropriate to provide operational flexibility and backup capacity.

## Hydraulic Analysis of the 440-Foot Service Zone Distribution Pipe Network

A schematic depiction of the distribution system for the 440-foot service zone is shown on Figure 5. Assignment of water demands to nodes in the network is indicated on the right-hand side of Table 2. Exhibit 2 is a printout of the computer analysis of the pipe network based on gravity delivery from the 440-foot tank. As with the 228-foot zone, all velocities and residual pressures meet BWS criteria for peak and fire flow conditions.

| PIPE NETWORK INFORMATION | | | | |
|---|---|---|---|---|
| PIPE NO. | UPSTR NODE | DNSTR NODE | PIPE DIAMETER (INCHES) | PIPE LENGTH (FEET) |
| 1 | 0 | 1 | 36 | 8900 |
| 2 | 1 | 2 | 24 | 1600 |
| 3 | 2 | 3 | 24 | 2150 |
| 4 | 3 | 4 | 20 | 1000 |
| 5 | 4 | 5 | 12 | 3500 |
| 6 | 1 | 6 | 16 | 1500 |
| 7 | 6 | 7 | 16 | 750 |
| 8 | 7 | 8 | 12 | 1100 |
| 9 | 8 | 9 | 12 | 2700 |
| 10 | 10 | 9 | 12 | 1900 |
| 11 | 3 | 10 | 12 | 1000 |
| 12 | 1 | 11 | 16 | 1500 |
| 13 | 11 | 3 | 12 | 1600 |

| NODE INFORMATION | | |
|---|---|---|
| NODE NO. | ELEV.* (FEET) | PEAK DRAFT (MGD) |
| 1 | 100 | 0.0000 |
| 2 | 84 | 0.3840 |
| 3 | 78 | 0.0000 |
| 4 | 80 | 4.0200 |
| 5 | 85 | 2.0400 |
| 6 | 90 | 1.0365 |
| 7 | 85 | 1.8825 |
| 8 | 75 | 1.7160 |
| 9 | 70 | 1.5845 |
| 10 | 70 | 0.7590 |
| 11 | 100 | 1.5975 |
| TOTAL | | 15.0000 |

* WHERE APPROXIMATE ELEVATION IS THE HIGHEST POINT OF THE PARCEL(S) TO BE SERVED FROM THE NODE.

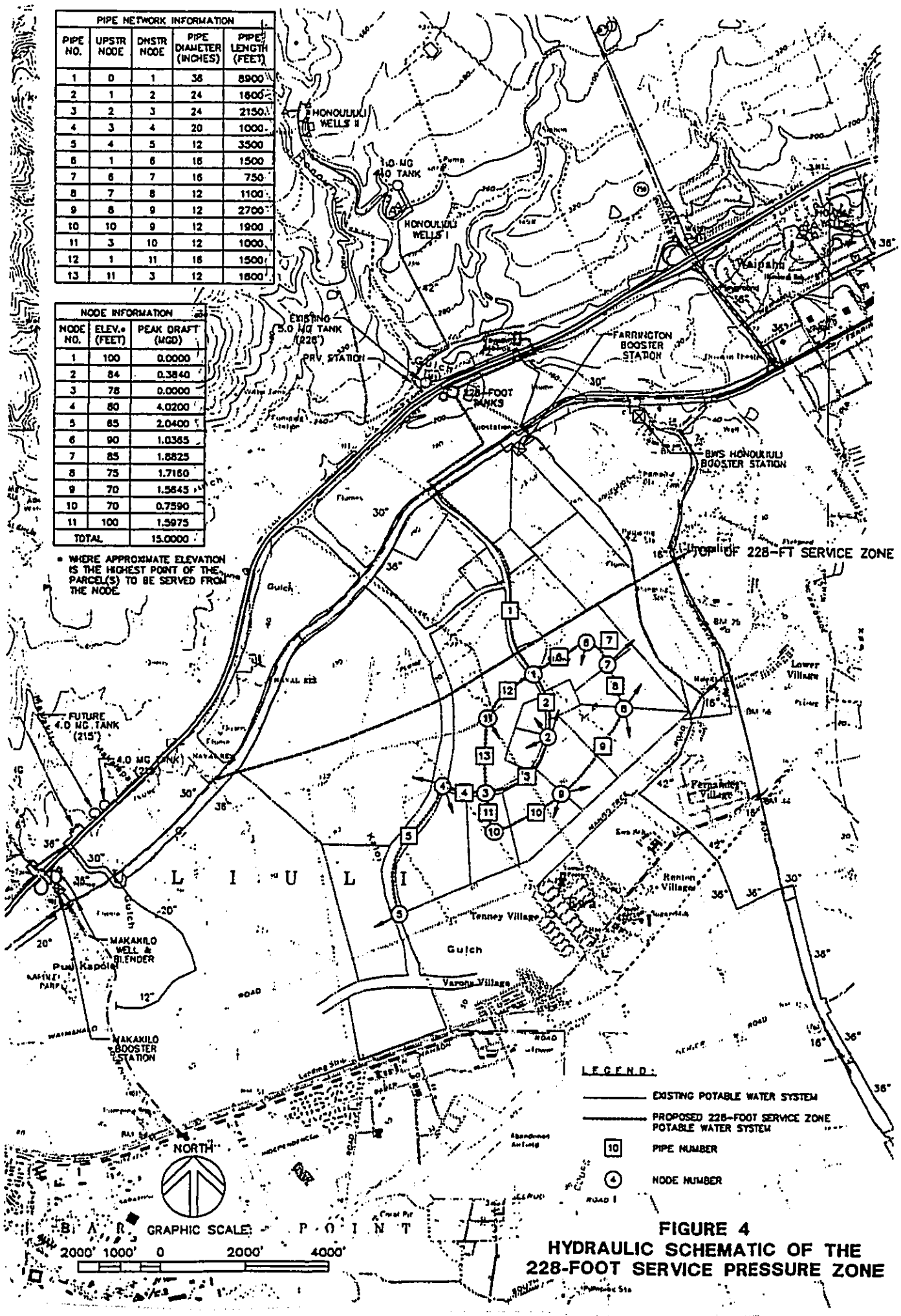


**FIGURE 4**
**HYDRAULIC SCHEMATIC OF THE 228-FOOT SERVICE PRESSURE ZONE**

| PIPE NETWORK INFORMATION | | | | |
|---|---|---|---|---|
| PIPE NO. | UPSTR NODE | DNSTR NODE | PIPE DIAMETER (INCHES) | PIPE LENGTH (FEET) |
| 1 | 0 | 1 | 36 | 5200 |
| 2 | 1 | 2 | 30 | 1800 |
| 3 | 2 | 3 | 20 | 2600 |
| 4 | 3 | 4 | 16 | 1400 |
| 5 | 3 | 5 | 12 | 2200 |
| 6 | 6 | 5 | 8 | 2350 |
| 7 | 6 | 7 | 8 | 1100 |
| 8 | 8 | 7 | 8 | 1300 |
| 9 | 9 | 8 | 12 | 1400 |
| 10 | 10 | 9 | 12 | 1500 |
| 11 | 10 | 6 | 12 | 1750 |
| 12 | 2 | 10 | 16 | 1500 |
| 13 | 11 | 8 | 8 | 1250 |
| 14 | 12 | 11 | 12 | 2600 |
| 15 | 1 | 12 | 24 | 1200 |
| 16 | 12 | 13 | 12 | 5600 |

| NODE INFORMATION | | |
|---|---|---|
| NODE NO. | ELEV.* (FEET) | PEAK DRAFT (MGD) |
| 1 | 175 | 0.0000 |
| 2 | 200 | 2.9240 |
| 3 | 157 | 0.0000 |
| 4 | 200 | 4.2000 |
| 5 | 135 | 2.6878 |
| 6 | 130 | 0.7360 |
| 7 | 125 | 1.9685 |
| 8 | 130 | 0.0000 |
| 9 | 155 | 1.6170 |
| 10 | 150 | 0.6698 |
| 11 | 140 | 1.6125 |
| 12 | 175 | 4.2125 |
| 13 | 160 | 2.6000 |
| TOTAL | | 23.2081 |

* WHERE APPROXIMATE ELEVATION IS THE HIGHEST POINT OF THE PARCEL(S) TO BE SERVED FROM THE NODE.

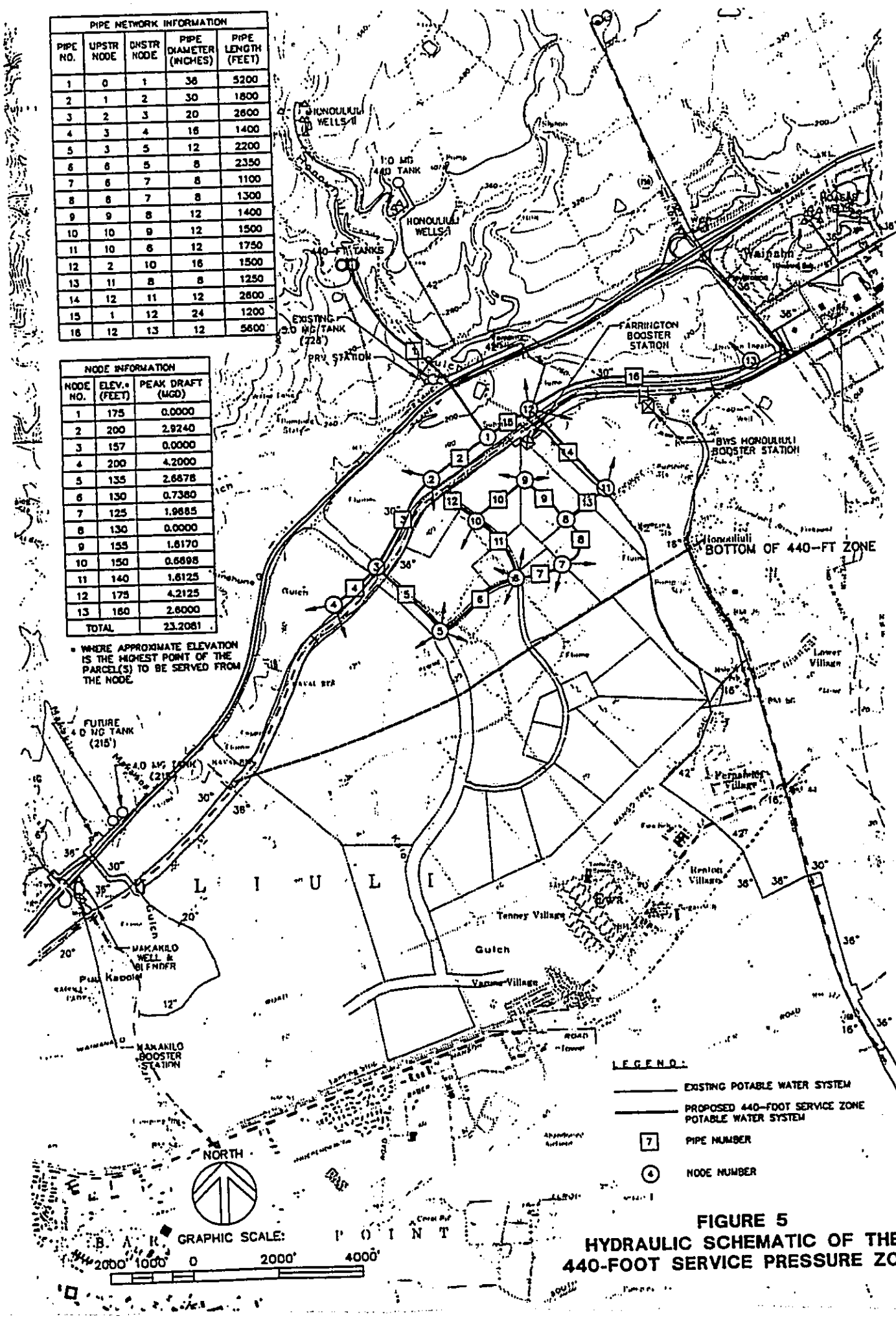


**FIGURE 5**
**HYDRAULIC SCHEMATIC OF THE 440-FOOT SERVICE PRESSURE ZONE**

Exhibit 3 is a hydraulic analysis of the 440-foot service zone with the booster pumps operating (two of the three proposed pumps on and producing approximately 10,000 GPM). To accommodate the booster pumps for this analysis, a node was added at the booster station (node No. 14), pipe No. 1 was divided into two pipe sections (Nos. 1 and 17), and another pipe was added to connect the booster pumps and the 228-foot tanks to the 440-foot system at node No. 14 (pipe No. 18). As might be expected, most pressures throughout the system are slightly higher when the booster pumps are on than during gravity delivery from the 440-foot tank.

**Exhibit 1**

**Hydraulic Analysis of the 228-Foot Service Zone**

*** UNIVERSITY OF KENTUCKY PIPE NETWORK ANALYSIS PROGRAM - 1985 VERSION ***
RESULTS TO OUTPUT FILE

INPUT DATA FILE NAME FOR THIS SIMULATION = EKLR.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = EKLR.OUT

NUMBER OF PIPES = 13
NUMBER OF JUNCTION NODES = 11
FLOW UNITS = MILLION GALLONS / DAY
PRESSURE UNITS = PSI

**** SUMMARY OF INPUT DATA ***

| PIPE NO. | NODE #1 | NODE #2 | LENGTH (FT.) | DIAM. (IN.) | HW-C VALUE | SUM-M FACT. | PUMP TYPE | FGN GRADE |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 8900.0 | 36.0 | 130.0 | 0.0 | 0.0 | 223.0 |
| 2 | 1 | 2 | 1600.0 | 24.0 | 130.0 | 0.0 | 0.0 | |
| 3 | 2 | 3 | 2150.0 | 24.0 | 130.0 | 0.0 | 0.0 | |
| 4 | 3 | 4 | 1000.0 | 20.0 | 120.0 | 0.0 | 0.0 | |
| 5 | 4 | 5 | 3500.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 6 | 1 | 6 | 1500.0 | 16.0 | 120.0 | 0.0 | 0.0 | |
| 7 | 6 | 7 | 750.0 | 16.0 | 120.0 | 0.0 | 0.0 | |
| 8 | 7 | 8 | 1100.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 9 | 8 | 9 | 2700.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 10 | 10 | 9 | 1900.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 11 | 3 | 10 | 1000.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 12 | 1 | 11 | 1500.0 | 16.0 | 120.0 | 0.0 | 0.0 | |
| 13 | 11 | 3 | 1800.0 | 12.0 | 110.0 | 0.0 | 0.0 | |

| JUNCT. NO. | DEMAND | ELEVATION |
|---|---|---|
| 1 | 0.0 | 100.0 |
| 2 | 0.4 | 95.0 |
| 3 | 0.0 | 78.0 |
| 4 | 4.0 | 110.0 |
| 5 | 2.0 | 80.0 |
| 6 | 1.0 | 105.0 |
| 7 | 1.9 | 100.0 |
| 8 | 1.7 | 90.0 |
| 9 | 1.6 | 85.0 |
| 10 | 0.8 | 75.0 |
| 11 | 1.6 | 115.0 |

Peak Flowrate

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 5 - ACCURACY ATTAINED = .0009

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 15.00 | 8.22 | 0.00 | 0.00 | 3.28 | 0.92 |
| 2 | 1 | 2 | 7.56 | 2.99 | 0.00 | 0.00 | 3.72 | 1.87 |
| 3 | 2 | 3 | 7.17 | 3.65 | 0.00 | 0.00 | 3.53 | 1.70 |
| 4 | 3 | 4 | 6.06 | 3.50 | 0.00 | 0.00 | 4.30 | 3.50 |
| 5 | 4 | 5 | 2.04 | 23.05 | 0.00 | 0.00 | 4.02 | 6.59 |
| 6 | 1 | 6 | 4.82 | 10.17 | 0.00 | 0.00 | 5.34 | 6.78 |
| 7 | 6 | 7 | 3.78 | 3.25 | 0.00 | 0.00 | 4.19 | 4.33 |
| 8 | 7 | 8 | 1.90 | 6.33 | 0.00 | 0.00 | 3.74 | 5.76 |
| 9 | 8 | 9 | 0.18 | 0.20 | 0.00 | 0.00 | 0.36 | 0.07 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10 | 10 | 9 | 1.38 | 6.10 | 0.00 | 0.00 | 2.73 | 3.21 |
| 11 | 3 | 10 | 2.14 | 7.21 | 0.00 | 0.00 | 4.22 | 7.21 |
| 12 | 1 | 11 | 2.63 | 3.31 | 0.00 | 0.00 | 2.91 | 2.20 |
| 13 | 11 | 3 | 1.03 | 3.33 | 0.00 | 0.00 | 2.03 | 1.85 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 100.0 | 0.0 | 49.7 | 214.8 |
| 2 | 95.0 | 0.4 | 50.6 | 211.8 |
| 3 | 78.0 | 0.0 | 56.4 | 208.1 |
| 4 | 110.0 | 4.0 | 41.0 | 204.6 |
| 5 | 80.0 | 2.0 | 44.0 | 181.6 |
| 6 | 105.0 | 1.0 | 43.2 | 204.6 |
| 7 | 100.0 | 1.9 | 43.9 | 201.4 |
| 8 | 90.0 | 1.7 | 45.5 | 195.0 |
| 9 | 85.0 | 1.6 | 47.6 | 194.8 |
| 10 | 75.0 | 0.8 | 54.6 | 200.9 |
| 11 | 115.0 | 1.6 | 41.8 | 211.5 |

THE NET SYSTEM DEMAND = 15
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 15.00 |

THE FOLLOWING CHANGES ARE MADE

JUNCT. NO. DEMAND
GLOBAL DEMAND FACTOR = .5
4 4.89

Max. Day Plus 2,000 GPM
Fire Flow at Node 4

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 3 - ACCURACY ATTAINED = 0

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 10.38 | 4.16 | 0.00 | 0.00 | 2.27 | 0.47 |
| 2 | 1 | 2 | 6.05 | 1.98 | 0.00 | 0.00 | 2.98 | 1.24 |
| 3 | 2 | 3 | 5.86 | 2.51 | 0.00 | 0.00 | 2.89 | 1.17 |
| 4 | 3 | 4 | 5.91 | 3.34 | 0.00 | 0.00 | 4.19 | 3.34 |
| 5 | 4 | 5 | 1.02 | 6.39 | 0.00 | 0.00 | 2.01 | 1.82 |
| 6 | 1 | 6 | 2.57 | 3.18 | 0.00 | 0.00 | 2.85 | 2.12 |
| 7 | 6 | 7 | 2.05 | 1.05 | 0.00 | 0.00 | 2.28 | 1.40 |
| 8 | 7 | 8 | 1.11 | 2.36 | 0.00 | 0.00 | 2.19 | 2.15 |
| 9 | 8 | 9 | 0.26 | 0.38 | 0.00 | 0.00 | 0.50 | 0.14 |
| 10 | 10 | 9 | 0.53 | 1.02 | 0.00 | 0.00 | 1.04 | 0.54 |
| 11 | 3 | 10 | 0.91 | 1.47 | 0.00 | 0.00 | 1.79 | 1.47 |
| 12 | 1 | 11 | 1.76 | 1.57 | 0.00 | 0.00 | 1.95 | 1.05 |
| 13 | 11 | 3 | 0.96 | 2.92 | 0.00 | 0.00 | 1.89 | 1.62 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 100.0 | 0.0 | 51.5 | 218.8 |
| 2 | 95.0 | 0.2 | 52.8 | 216.9 |
| 3 | 78.0 | 0.0 | 59.1 | 214.4 |
| 4 | 110.0 | 4.9 | 43.8 | 211.0 |
| 5 | 80.0 | 1.0 | 54.0 | 204.6 |
| 6 | 105.0 | 0.5 | 48.0 | 215.7 |
| 7 | 100.0 | 0.9 | 49.7 | 214.6 |

| | | | | |
|---|---|---|---|---|
| 8 | 90.0 | 0.9 | 53.0 | 212.2 |
| 9 | 85.0 | 0.8 | 55.0 | 211.9 |
| 10 | 75.0 | 0.4 | 59.8 | 212.9 |
| 11 | 115.0 | 0.8 | 44.3 | 217.3 |

THE NET SYSTEM DEMAND = 10.38
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 10.38 |

THE FOLLOWING CHANGES ARE MADE

Max. Day Plus 2,000 GPM
Fire Flow at Node 6

JUNCT. NO. DEMAND
GLOBAL DEMAND FACTOR = .5

| | |
|---|---|
| 6 | 3.39825 |
| 4 | 2.01 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 4 - ACCURACY ATTAINED = .0016

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 10.38 | 4.16 | 0.00 | 0.00 | 2.27 | 0.47 |
| 2 | 1 | 2 | 4.17 | 0.99 | 0.00 | 0.00 | 2.05 | 0.62 |
| 3 | 2 | 3 | 3.97 | 1.22 | 0.00 | 0.00 | 1.96 | 0.57 |
| 4 | 3 | 4 | 3.03 | 0.97 | 0.00 | 0.00 | 2.15 | 0.97 |
| 5 | 4 | 5 | 1.02 | 6.39 | 0.00 | 0.00 | 2.01 | 1.82 |
| 6 | 1 | 6 | 4.82 | 10.20 | 0.00 | 0.00 | 5.35 | 6.80 |
| 7 | 6 | 7 | 1.43 | 0.53 | 0.00 | 0.00 | 1.58 | 0.71 |
| 8 | 7 | 8 | 0.48 | 0.51 | 0.00 | 0.00 | 0.95 | 0.46 |
| 9 | 8 | 9 | -0.37 | 0.77 | 0.00 | 0.00 | 0.74 | 0.28 |
| 10 | 10 | 9 | 1.16 | 4.37 | 0.00 | 0.00 | 2.28 | 2.30 |
| 11 | 3 | 10 | 1.54 | 3.89 | 0.00 | 0.00 | 3.02 | 3.89 |
| 12 | 1 | 11 | 1.39 | 1.02 | 0.00 | 0.00 | 1.54 | 0.68 |
| 13 | 11 | 3 | 0.59 | 1.20 | 0.00 | 0.00 | 1.16 | 0.66 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 100.0 | 0.0 | 51.5 | 218.8 |
| 2 | 95.0 | 0.2 | 53.2 | 217.9 |
| 3 | 78.0 | 0.0 | 60.1 | 216.6 |
| 4 | 110.0 | 2.0 | 45.8 | 215.7 |
| 5 | 80.0 | 1.0 | 56.0 | 209.3 |
| 6 | 105.0 | 3.4 | 44.9 | 208.6 |
| 7 | 100.0 | 0.9 | 46.8 | 208.1 |
| 8 | 90.0 | 0.9 | 51.0 | 207.6 |
| 9 | 85.0 | 0.8 | 53.5 | 208.4 |
| 10 | 75.0 | 0.4 | 59.7 | 212.7 |
| 11 | 115.0 | 0.8 | 44.6 | 217.8 |

THE NET SYSTEM DEMAND = 10.38
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 10.38 |

THE FOLLOWING CHANGES ARE MADE

Max. Day Plus 2,000 GPM
Fire Flow at Node 11

JUNCT. NO. DEMAND
GLOBAL DEMAND FACTOR = .5

| | |
|---|---|
| 11 | 3.67875 |
| 4 | 2.01 |
| 6 | .51825 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 4 - ACCURACY ATTAINED = .0001

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 10.38 | 4.16 | 0.00 | 0.00 | 2.27 | 0.47 |
| 2 | 1 | 2 | 4.86 | 1.32 | 0.00 | 0.00 | 2.39 | 0.82 |
| 3 | 2 | 3 | 4.67 | 1.65 | 0.00 | 0.00 | 2.30 | 0.77 |
| 4 | 3 | 4 | 3.03 | 0.97 | 0.00 | 0.00 | 2.15 | 0.97 |
| 5 | 4 | 5 | 1.02 | 6.39 | 0.00 | 0.00 | 2.01 | 1.82 |
| 6 | 1 | 6 | 2.48 | 2.97 | 0.00 | 0.00 | 2.75 | 1.98 |
| 7 | 6 | 7 | 1.96 | 0.96 | 0.00 | 0.00 | 2.17 | 1.28 |
| 8 | 7 | 8 | 1.02 | 2.01 | 0.00 | 0.00 | 2.01 | 1.82 |
| 9 | 8 | 9 | 0.16 | 0.16 | 0.00 | 0.00 | 0.32 | 0.06 |
| 10 | 10 | 9 | 0.62 | 1.38 | 0.00 | 0.00 | 1.22 | 0.73 |
| 11 | 3 | 10 | 1.00 | 1.76 | 0.00 | 0.00 | 1.97 | 1.76 |
| 12 | 1 | 11 | 3.04 | 4.34 | 0.00 | 0.00 | 3.37 | 2.89 |
| 13 | 11 | 3 | -0.64 | 1.37 | 0.00 | 0.00 | 1.26 | 0.76 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 100.0 | 0.0 | 51.5 | 218.8 |
| 2 | 95.0 | 0.2 | 53.1 | 217.5 |
| 3 | 78.0 | 0.0 | 59.7 | 215.9 |
| 4 | 110.0 | 2.0 | 45.5 | 214.9 |
| 5 | 80.0 | 1.0 | 55.7 | 208.5 |
| 6 | 105.0 | 0.5 | 48.0 | 215.9 |
| 7 | 100.0 | 0.9 | 49.8 | 214.9 |
| 8 | 90.0 | 0.9 | 53.3 | 212.9 |
| 9 | 85.0 | 0.8 | 55.4 | 212.7 |
| 10 | 75.0 | 0.4 | 60.3 | 214.1 |
| 11 | 115.0 | 3.7 | 43.1 | 214.5 |

THE NET SYSTEM DEMAND = 10.38
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 10.38 |

Max. Day Plus 2,000 GPM
Fire Flow at Node 5

THE FOLLOWING CHANGES ARE MADE

JUNCT. NO. DEMAND
GLOBAL DEMAND FACTOR = .5

| | |
|---|---|
| 5 | 3.9 |
| 4 | 2.01 |
| 6 | .51825 |
| 11 | .79875 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 4 - ACCURACY ATTAINED = 0

| PIPE | NODE | NODE | FLOW | HEAD | MINOR | PUMP | LINE | HL |
|---|---|---|---|---|---|---|---|---|

| NO. | #1 | #2 | RATE | LOSS | LOSS | HEAD | VELOCITY | 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 10.38 | 4.16 | 0.00 | 0.00 | 2.27 | 0.47 |
| 2 | 1 | 2 | 6.05 | 1.98 | 0.00 | 0.00 | 2.98 | 1.24 |
| 3 | 2 | 3 | 5.86 | 2.51 | 0.00 | 0.00 | 2.89 | 1.17 |
| 4 | 3 | 4 | 5.91 | 3.34 | 0.00 | 0.00 | 4.19 | 3.34 |
| 5 | 4 | 5 | 3.90 | 76.55 | 0.00 | 0.00 | 7.68 | 21.87 |
| 6 | 1 | 6 | 2.57 | 3.18 | 0.00 | 0.00 | 2.85 | 2.12 |
| 7 | 6 | 7 | 2.05 | 1.05 | 0.00 | 0.00 | 2.28 | 1.40 |
| 8 | 7 | 8 | 1.11 | 2.36 | 0.00 | 0.00 | 2.19 | 2.15 |
| 9 | 8 | 9 | 0.26 | 0.38 | 0.00 | 0.00 | 0.50 | 0.14 |
| 10 | 10 | 9 | 0.53 | 1.02 | 0.00 | 0.00 | 1.04 | 0.54 |
| 11 | 3 | 10 | 0.91 | 1.47 | 0.00 | 0.00 | 1.79 | 1.47 |
| 12 | 1 | 11 | 1.76 | 1.57 | 0.00 | 0.00 | 1.95 | 1.05 |
| 13 | 11 | 3 | 0.96 | 2.92 | 0.00 | 0.00 | 1.89 | 1.62 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 100.0 | 0.0 | 51.5 | 218.8 |
| 2 | 95.0 | 0.2 | 52.8 | 216.9 |
| 3 | 78.0 | 0.0 | 59.1 | 214.4 |
| 4 | 110.0 | 2.0 | 43.8 | 211.0 |
| 5 | 80.0 | 3.9 | 23.6 | 134.5 |
| 6 | 105.0 | 0.5 | 48.0 | 215.7 |
| 7 | 100.0 | 0.9 | 49.7 | 214.6 |
| 8 | 90.0 | 0.9 | 53.0 | 212.2 |
| 9 | 85.0 | 0.8 | 55.0 | 211.9 |
| 10 | 75.0 | 0.4 | 59.8 | 212.9 |
| 11 | 115.0 | 0.8 | 44.3 | 217.3 |

THE NET SYSTEM DEMAND = 10.38
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 10.38 |

******* END OF THIS SIMULATION *******

**Exhibit 2**

**Hydraulic Analysis of the 440-Foot Service Zone**

*** UNIVERSITY OF KENTUCKY PIPE NETWORK ANALYSIS PROGRAM - 1985 VERSION ***
RESULTS TO OUTPUT FILE

INPUT DATA FILE NAME FOR THIS SIMULATION = EKUR.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = EKUR.OUT

NUMBER OF PIPES = 16
NUMBER OF JUNCTION NODES = 13
FLOW UNITS = MILLION GALLONS / DAY
PRESSURE UNITS = PSI

**** SUMMARY OF INPUT DATA ***

| PIPE NO. | NODE #1 | NODE #2 | LENGTH (FT.) | DIAM. (IN.) | HW-C VALUE | SUM-M FACT. | PUMP TYPE | FGN GRADE |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 5300.0 | 36.0 | 130.0 | 0.0 | 0.0 | 435.0 |
| 2 | 1 | 2 | 1800.0 | 30.0 | 130.0 | 0.0 | 0.0 | |
| 3 | 2 | 3 | 2600.0 | 20.0 | 120.0 | 0.0 | 0.0 | |
| 4 | 3 | 4 | 1400.0 | 16.0 | 120.0 | 0.0 | 0.0 | |
| 5 | 3 | 5 | 2200.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 6 | 6 | 5 | 2350.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 7 | 6 | 7 | 1100.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 8 | 8 | 7 | 1300.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 9 | 9 | 8 | 1400.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 10 | 10 | 9 | 1500.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 11 | 10 | 6 | 1750.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 12 | 2 | 10 | 1500.0 | 16.0 | 120.0 | 0.0 | 0.0 | |
| 13 | 11 | 8 | 1250.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 14 | 12 | 11 | 2600.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 15 | 1 | 12 | 1200.0 | 24.0 | 130.0 | 0.0 | 0.0 | |
| 16 | 12 | 13 | 5600.0 | 12.0 | 110.0 | 0.0 | 0.0 | |

| JUNCT. NO. | DEMAND | ELEVATION |
|---|---|---|
| 1 | 0.0 | 175.0 |
| 2 | 2.9 | 200.0 |
| 3 | 0.0 | 157.0 |
| 4 | 4.2 | 200.0 |
| 5 | 2.7 | 155.0 |
| 6 | 0.7 | 135.0 |
| 7 | 2.0 | 135.0 |
| 8 | 0.0 | 130.0 |
| 9 | 1.6 | 175.0 |
| 10 | 0.7 | 155.0 |
| 11 | 1.6 | 175.0 |
| 12 | 4.2 | 200.0 |
| 13 | 2.6 | 165.0 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

Peak Flowrate

NO. OF TRIALS = 3 - ACCURACY ATTAINED = .0002

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 23.21 | 10.98 | 0.00 | 0.00 | 5.08 | 2.07 |
| 2 | 1 | 2 | 14.25 | 3.67 | 0.00 | 0.00 | 4.49 | 2.04 |
| 3 | 2 | 3 | 6.48 | 10.30 | 0.00 | 0.00 | 4.60 | 3.96 |
| 4 | 3 | 4 | 4.20 | 7.36 | 0.00 | 0.00 | 4.65 | 5.26 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5 | 3 | 5 | 2.28 | 17.83 | 0.00 | 0.00 | 4.49 | 8.10 |
| 6 | 6 | 5 | 0.39 | 5.11 | 0.00 | 0.00 | 1.71 | 2.17 |
| 7 | 6 | 7 | 1.03 | 14.74 | 0.00 | 0.00 | 4.57 | 13.40 |
| 8 | 8 | 7 | 0.94 | 14.56 | 0.00 | 0.00 | 4.15 | 11.20 |
| 9 | 9 | 8 | 0.40 | 3.26 | 0.00 | 0.00 | 1.78 | 2.33 |
| 10 | 10 | 9 | 2.02 | 9.68 | 0.00 | 0.00 | 3.97 | 6.45 |
| 11 | 10 | 6 | 2.15 | 12.76 | 0.00 | 0.00 | 4.24 | 7.29 |
| 12 | 2 | 10 | 4.84 | 10.27 | 0.00 | 0.00 | 5.37 | 6.85 |
| 13 | 11 | 8 | 0.54 | 4.97 | 0.00 | 0.00 | 2.37 | 3.98 |
| 14 | 12 | 11 | 2.15 | 18.83 | 0.00 | 0.00 | 4.23 | 7.24 |
| 15 | 1 | 12 | 8.96 | 3.07 | 0.00 | 0.00 | 4.41 | 2.56 |
| 16 | 12 | 13 | 2.60 | 57.80 | 0.00 | 0.00 | 5.12 | 10.32 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 107.9 | 424.0 |
| 2 | 200.0 | 2.9 | 95.5 | 420.3 |
| 3 | 157.0 | 0.0 | 109.7 | 410.0 |
| 4 | 200.0 | 4.2 | 87.8 | 402.7 |
| 5 | 155.0 | 2.7 | 102.8 | 392.2 |
| 6 | 135.0 | 0.7 | 113.7 | 397.3 |
| 7 | 135.0 | 2.0 | 107.3 | 382.6 |
| 8 | 130.0 | 0.0 | 115.8 | 397.1 |
| 9 | 175.0 | 1.6 | 97.7 | 400.4 |
| 10 | 155.0 | 0.7 | 110.5 | 410.1 |
| 11 | 175.0 | 1.6 | 98.4 | 402.1 |
| 12 | 200.0 | 4.2 | 95.7 | 420.9 |
| 13 | 165.0 | 2.6 | 85.9 | 363.1 |

THE NET SYSTEM DEMAND = 23.208
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 23.21 |

THE FOLLOWING CHANGES ARE MADE

Max. Day Plus 2,000 GPM
Fire Flow at Node 4

JUNCT. NO. DEMAND
GLOBAL DEMAND FACTOR = .5
4 4.98
**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 3 - ACCURACY ATTAINED = .0023

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 14.48 | 4.59 | 0.00 | 0.00 | 3.17 | 0.87 |
| 2 | 1 | 2 | 9.95 | 1.89 | 0.00 | 0.00 | 3.14 | 1.05 |
| 3 | 2 | 3 | 5.94 | 8.77 | 0.00 | 0.00 | 4.21 | 3.37 |
| 4 | 3 | 4 | 4.98 | 10.10 | 0.00 | 0.00 | 5.52 | 7.21 |
| 5 | 3 | 5 | 0.96 | 3.60 | 0.00 | 0.00 | 1.89 | 1.64 |
| 6 | 6 | 5 | 0.37 | 4.78 | 0.00 | 0.00 | 1.65 | 2.03 |
| 7 | 6 | 7 | 0.48 | 3.57 | 0.00 | 0.00 | 2.13 | 3.25 |
| 8 | 8 | 7 | 0.50 | 4.62 | 0.00 | 0.00 | 2.23 | 3.56 |
| 9 | 9 | 8 | 0.19 | 0.79 | 0.00 | 0.00 | 0.83 | 0.56 |
| 10 | 10 | 9 | 0.99 | 2.61 | 0.00 | 0.00 | 1.96 | 1.74 |
| 11 | 10 | 6 | 1.22 | 4.46 | 0.00 | 0.00 | 2.41 | 2.55 |
| 12 | 2 | 10 | 2.55 | 3.13 | 0.00 | 0.00 | 2.83 | 2.09 |
| 13 | 11 | 8 | 0.32 | 1.89 | 0.00 | 0.00 | 1.41 | 1.51 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 14 | 12 | 11 | 1.12 | 5.67 | 0.00 | 0.00 | 2.21 | 2.18 |
| 15 | 1 | 12 | 4.53 | 0.87 | 0.00 | 0.00 | 2.23 | 0.72 |
| 16 | 12 | 13 | 1.30 | 16.01 | 0.00 | 0.00 | 2.56 | 2.86 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 110.7 | 430.4 |
| 2 | 200.0 | 1.5 | 99.0 | 428.5 |
| 3 | 157.0 | 0.0 | 113.9 | 419.8 |
| 4 | 200.0 | 5.0 | 90.9 | 409.7 |
| 5 | 155.0 | 1.3 | 113.2 | 416.2 |
| 6 | 135.0 | 0.4 | 123.9 | 420.9 |
| 7 | 135.0 | 1.0 | 122.4 | 417.4 |
| 8 | 130.0 | 0.0 | 126.5 | 422.0 |
| 9 | 175.0 | 0.8 | 107.4 | 422.8 |
| 10 | 155.0 | 0.3 | 117.2 | 425.4 |
| 11 | 175.0 | 0.8 | 107.8 | 423.9 |
| 12 | 200.0 | 2.1 | 99.5 | 429.5 |
| 13 | 165.0 | 1.3 | 107.7 | 413.5 |

THE NET SYSTEM DEMAND = 14.484
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 14.48 |

THE FOLLOWING CHANGES ARE MADE

Max. Day Plus 2,000 GPM
Fire Flow at Node 2

| JUNCT. NO. | DEMAND |
|---|---|
| GLOBAL DEMAND FACTOR = | .5 |
| 2 | 4.342 |
| 4 | 2.1 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 3 - ACCURACY ATTAINED = .0001

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 14.48 | 4.59 | 0.00 | 0.00 | 3.17 | 0.87 |
| 2 | 1 | 2 | 9.98 | 1.90 | 0.00 | 0.00 | 3.14 | 1.05 |
| 3 | 2 | 3 | 3.24 | 2.85 | 0.00 | 0.00 | 2.30 | 1.10 |
| 4 | 3 | 4 | 2.10 | 2.04 | 0.00 | 0.00 | 2.33 | 1.46 |
| 5 | 3 | 5 | 1.14 | 4.91 | 0.00 | 0.00 | 2.24 | 2.23 |
| 6 | 6 | 5 | 0.20 | 1.46 | 0.00 | 0.00 | 0.87 | 0.62 |
| 7 | 6 | 7 | 0.51 | 3.97 | 0.00 | 0.00 | 2.25 | 3.61 |
| 8 | 8 | 7 | 0.48 | 4.16 | 0.00 | 0.00 | 2.11 | 3.20 |
| 9 | 9 | 8 | 0.18 | 0.74 | 0.00 | 0.00 | 0.80 | 0.53 |
| 10 | 10 | 9 | 0.99 | 2.58 | 0.00 | 0.00 | 1.95 | 1.72 |
| 11 | 10 | 6 | 1.07 | 3.51 | 0.00 | 0.00 | 2.11 | 2.00 |
| 12 | 2 | 10 | 2.40 | 2.79 | 0.00 | 0.00 | 2.65 | 1.86 |
| 13 | 11 | 8 | 0.30 | 1.66 | 0.00 | 0.00 | 1.31 | 1.33 |
| 14 | 12 | 11 | 1.10 | 5.48 | 0.00 | 0.00 | 2.17 | 2.11 |
| 15 | 1 | 12 | 4.51 | 0.86 | 0.00 | 0.00 | 2.22 | 0.72 |
| 16 | 12 | 13 | 1.30 | 16.01 | 0.00 | 0.00 | 2.56 | 2.86 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 110.7 | 430.4 |
| 2 | 200.0 | 4.3 | 99.0 | 428.5 |

| | | | | |
|---|---|---|---|---|
| 3 | 157.0 | 0.0 | 116.4 | 425.7 |
| 4 | 200.0 | 2.1 | 96.9 | 423.6 |
| 5 | 155.0 | 1.3 | 115.2 | 420.8 |
| 6 | 135.0 | 0.4 | 124.5 | 422.2 |
| 7 | 135.0 | 1.0 | 122.7 | 418.2 |
| 8 | 130.0 | 0.0 | 126.7 | 422.4 |
| 9 | 175.0 | 0.8 | 107.5 | 423.1 |
| 10 | 155.0 | 0.3 | 117.3 | 425.7 |
| 11 | 175.0 | 0.8 | 107.9 | 424.1 |
| 12 | 200.0 | 2.1 | 99.5 | 429.6 |
| 13 | 165.0 | 1.3 | 107.7 | 413.5 |

THE NET SYSTEM DEMAND = 14.484
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 14.48 |

THE FOLLOWING CHANGES ARE MADE

Max. Day Plus 2,000 GPM
Fire Flow at Node 12

| JUNCT. NO. | DEMAND |
|---|---|
| GLOBAL DEMAND | FACTOR = .5 |
| 12 | 4.98625 |
| 4 | 2.1 |
| 2 | 1.462 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 2 - ACCURACY ATTAINED = .0019

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 14.48 | 4.59 | 0.00 | 0.00 | 3.17 | 0.87 |
| 2 | 1 | 2 | 7.17 | 1.03 | 0.00 | 0.00 | 2.26 | 0.57 |
| 3 | 2 | 3 | 3.25 | 2.86 | 0.00 | 0.00 | 2.30 | 1.10 |
| 4 | 3 | 4 | 2.10 | 2.04 | 0.00 | 0.00 | 2.33 | 1.46 |
| 5 | 3 | 5 | 1.15 | 4.98 | 0.00 | 0.00 | 2.26 | 2.26 |
| 6 | 6 | 5 | 0.19 | 1.34 | 0.00 | 0.00 | 0.83 | 0.57 |
| 7 | 6 | 7 | 0.53 | 4.27 | 0.00 | 0.00 | 2.34 | 3.88 |
| 8 | 8 | 7 | 0.46 | 3.84 | 0.00 | 0.00 | 2.02 | 2.95 |
| 9 | 9 | 8 | 0.23 | 1.17 | 0.00 | 0.00 | 1.02 | 0.84 |
| 10 | 10 | 9 | 1.04 | 2.83 | 0.00 | 0.00 | 2.05 | 1.89 |
| 11 | 10 | 6 | 1.08 | 3.58 | 0.00 | 0.00 | 2.14 | 2.04 |
| 12 | 2 | 10 | 2.46 | 2.93 | 0.00 | 0.00 | 2.72 | 1.95 |
| 13 | 11 | 8 | 0.23 | 1.00 | 0.00 | 0.00 | 1.00 | 0.80 |
| 14 | 12 | 11 | 1.03 | 4.84 | 0.00 | 0.00 | 2.03 | 1.86 |
| 15 | 1 | 12 | 7.32 | 2.11 | 0.00 | 0.00 | 3.60 | 1.76 |
| 16 | 12 | 13 | 1.30 | 16.01 | 0.00 | 0.00 | 2.56 | 2.86 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 110.7 | 430.4 |
| 2 | 200.0 | 1.5 | 99.4 | 429.4 |
| 3 | 157.0 | 0.0 | 116.8 | 426.5 |
| 4 | 200.0 | 2.1 | 97.3 | 424.5 |
| 5 | 155.0 | 1.3 | 115.5 | 421.5 |
| 6 | 135.0 | 0.4 | 124.7 | 422.9 |
| 7 | 135.0 | 1.0 | 122.9 | 418.6 |
| 8 | 130.0 | 0.0 | 126.7 | 422.5 |
| 9 | 175.0 | 0.8 | 107.7 | 423.6 |

| | | | | |
|---|---|---|---|---|
| 10 | 155.0 | 0.3 | 117.6 | 426.5 |
| 11 | 175.0 | 0.8 | 107.7 | 423.5 |
| 12 | 200.0 | 5.0 | 98.9 | 428.3 |
| 13 | 165.0 | 1.3 | 107.2 | 412.3 |

THE NET SYSTEM DEMAND = 14.484
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 14.48 |

THE FOLLOWING CHANGES ARE MADE

Max. Day Plus 2,000 GPM
Fire Flow at Node 13

| JUNCT. NO. | DEMAND |
|---|---|
| GLOBAL DEMAND FACTOR = | .5 |
| 13 | 4.18 |
| 4 | 2.1 |
| 2 | 1.462 |
| 12 | 2.10625 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 1 - ACCURACY ATTAINED = 0

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 14.48 | 4.59 | 0.00 | 0.00 | 3.17 | 0.87 |
| 2 | 1 | 2 | 7.17 | 1.03 | 0.00 | 0.00 | 2.26 | 0.57 |
| 3 | 2 | 3 | 3.25 | 2.86 | 0.00 | 0.00 | 2.30 | 1.10 |
| 4 | 3 | 4 | 2.10 | 2.04 | 0.00 | 0.00 | 2.33 | 1.46 |
| 5 | 3 | 5 | 1.15 | 4.98 | 0.00 | 0.00 | 2.26 | 2.26 |
| 6 | 6 | 5 | 0.19 | 1.34 | 0.00 | 0.00 | 0.83 | 0.57 |
| 7 | 6 | 7 | 0.53 | 4.27 | 0.00 | 0.00 | 2.34 | 3.88 |
| 8 | 8 | 7 | 0.46 | 3.84 | 0.00 | 0.00 | 2.02 | 2.95 |
| 9 | 9 | 8 | 0.23 | 1.17 | 0.00 | 0.00 | 1.02 | 0.84 |
| 10 | 10 | 9 | 1.04 | 2.83 | 0.00 | 0.00 | 2.05 | 1.89 |
| 11 | 10 | 6 | 1.08 | 3.58 | 0.00 | 0.00 | 2.14 | 2.04 |
| 12 | 2 | 10 | 2.46 | 2.93 | 0.00 | 0.00 | 2.72 | 1.95 |
| 13 | 11 | 8 | 0.23 | 1.00 | 0.00 | 0.00 | 1.00 | 0.80 |
| 14 | 12 | 11 | 1.03 | 4.84 | 0.00 | 0.00 | 2.03 | 1.86 |
| 15 | 1 | 12 | 7.32 | 2.11 | 0.00 | 0.00 | 3.60 | 1.76 |
| 16 | 12 | 13 | 4.18 | 139.25 | 0.00 | 0.00 | 8.23 | 24.87 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 110.7 | 430.4 |
| 2 | 200.0 | 1.5 | 99.4 | 429.4 |
| 3 | 157.0 | 0.0 | 116.8 | 426.5 |
| 4 | 200.0 | 2.1 | 97.3 | 424.5 |
| 5 | 155.0 | 1.3 | 115.5 | 421.5 |
| 6 | 135.0 | 0.4 | 124.7 | 422.9 |
| 7 | 135.0 | 1.0 | 122.9 | 418.6 |
| 8 | 130.0 | 0.0 | 126.7 | 422.5 |
| 9 | 175.0 | 0.8 | 107.7 | 423.6 |
| 10 | 155.0 | 0.3 | 117.6 | 426.5 |
| 11 | 175.0 | 0.8 | 107.7 | 423.5 |
| 12 | 200.0 | 2.1 | 98.9 | 428.3 |
| 13 | 165.0 | 4.2 | 53.8 | 289.0 |

THE NET SYSTEM DEMAND = 14.484

```
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)
PIPE NO.          FLOW
    1             14.48


******* END OF THIS SIMULATION *******
```

**Exhibit 3**

**Hydraulic Analysis of the 440-Foot Service Zone With Two 6,000 GPM Pumps On**

*** UNIVERSITY OF KENTUCKY PIPE NETWORK ANALYSIS PROGRAM - 1985 VERSION ***
RESULTS TO OUTPUT FILE

INPUT DATA FILE NAME FOR THIS SIMULATION = EKUPR.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = EKUPR.OUT

NUMBER OF PIPES = 18
NUMBER OF JUNCTION NODES = 14
FLOW UNITS = MILLION GALLONS / DAY
PRESSURE UNITS = PSI

**** SUMMARY OF INPUT DATA ***

| PIPE NO. | NODE #1 | NODE #2 | LENGTH (FT.) | DIAM. (IN.) | HW-C VALUE | SUM-M FACT. | PUMP TYPE | FGN GRADE |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 3800.0 | 36.0 | 130.0 | 0.0 | 0.0 | 435.0 |
| 2 | 1 | 2 | 1800.0 | 30.0 | 130.0 | 0.0 | 0.0 | |
| 3 | 2 | 3 | 2600.0 | 20.0 | 120.0 | 0.0 | 0.0 | |
| 4 | 3 | 4 | 1400.0 | 16.0 | 120.0 | 0.0 | 0.0 | |
| 5 | 3 | 5 | 2200.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 6 | 6 | 5 | 2350.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 7 | 6 | 7 | 1100.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 8 | 8 | 7 | 1300.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 9 | 9 | 8 | 1400.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 10 | 10 | 9 | 1500.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 11 | 10 | 6 | 1750.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 12 | 2 | 10 | 1500.0 | 16.0 | 120.0 | 0.0 | 0.0 | |
| 13 | 11 | 8 | 1250.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 14 | 12 | 11 | 2600.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 15 | 1 | 12 | 1200.0 | 24.0 | 130.0 | 0.0 | 0.0 | |
| 16 | 12 | 13 | 5600.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 17 | 14 | 1 | 1500.0 | 36.0 | 130.0 | 0.0 | 0.0 | |
| 18 | 0 | 14 | 100.0 | 30.0 | 130.0 | 0.0 | 1.0 | 223.0 |

*** DATA FOR PUMPS FOR THIS SYSTEM ***

PUMP TYPE # 1 IS DESCRIBED BY THE FOLLOWING DATA:

| HEAD | DISCHARGE |
|---|---|
| 250 | 0 |
| 220 | 17.28 |
| 200 | 24.56 |

| JUNCT. NO. | DEMAND | ELEVATION |
|---|---|---|
| 1 | 0.0 | 175.0 |
| 2 | 2.9 | 200.0 |
| 3 | 0.0 | 157.0 |
| 4 | 4.2 | 200.0 |
| 5 | 2.7 | 155.0 |
| 6 | 0.7 | 135.0 |
| 7 | 2.0 | 135.0 |
| 8 | 0.0 | 130.0 |
| 9 | 1.6 | 175.0 |
| 10 | 0.7 | 155.0 |
| 11 | 1.6 | 175.0 |
| 12 | 4.2 | 200.0 |
| 13 | 2.6 | 165.0 |
| 14 | 0.0 | 208.0 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

Peak Flowrate

NO. OF TRIALS = 3 - ACCURACY ATTAINED = .0011

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 3.74 | 0.27 | 0.00 | 0.00 | 0.82 | 0.07 |
| 2 | 1 | 2 | 14.25 | 3.67 | 0.00 | 0.00 | 4.49 | 2.04 |
| 3 | 2 | 3 | 6.48 | 10.30 | 0.00 | 0.00 | 4.60 | 3.96 |
| 4 | 3 | 4 | 4.20 | 7.36 | 0.00 | 0.00 | 4.65 | 5.26 |
| 5 | 3 | 5 | 2.28 | 17.83 | 0.00 | 0.00 | 4.49 | 8.10 |
| 6 | 6 | 5 | 0.39 | 5.11 | 0.00 | 0.00 | 1.71 | 2.17 |
| 7 | 6 | 7 | 1.03 | 14.74 | 0.00 | 0.00 | 4.57 | 13.40 |
| 8 | 8 | 7 | 0.94 | 14.56 | 0.00 | 0.00 | 4.15 | 11.20 |
| 9 | 9 | 8 | 0.40 | 3.26 | 0.00 | 0.00 | 1.78 | 2.33 |
| 10 | 10 | 9 | 2.02 | 9.68 | 0.00 | 0.00 | 3.97 | 6.45 |
| 11 | 10 | 6 | 2.15 | 12.76 | 0.00 | 0.00 | 4.24 | 7.29 |
| 12 | 2 | 10 | 4.84 | 10.27 | 0.00 | 0.00 | 5.37 | 6.85 |
| 13 | 11 | 8 | 0.54 | 4.97 | 0.00 | 0.00 | 2.37 | 3.98 |
| 14 | 12 | 11 | 2.15 | 18.83 | 0.00 | 0.00 | 4.23 | 7.24 |
| 15 | 1 | 12 | 8.96 | 3.07 | 0.00 | 0.00 | 4.41 | 2.56 |
| 16 | 12 | 13 | 2.60 | 57.80 | 0.00 | 0.00 | 5.12 | 10.32 |
| 17 | 14 | 1 | 19.46 | 2.24 | 0.00 | 0.00 | 4.26 | 1.50 |
| 18 | 0 | 14 | 19.46 | 0.36 | 0.00 | 214.34 | 6.13 | 3.63 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 112.5 | 434.7 |
| 2 | 200.0 | 2.9 | 100.1 | 431.1 |
| 3 | 157.0 | 0.0 | 114.3 | 420.8 |
| 4 | 200.0 | 4.2 | 92.5 | 413.4 |
| 5 | 155.0 | 2.7 | 107.4 | 402.9 |
| 6 | 135.0 | 0.7 | 118.3 | 408.0 |
| 7 | 135.0 | 2.0 | 111.9 | 393.3 |
| 8 | 130.0 | 0.0 | 120.4 | 407.8 |
| 9 | 175.0 | 1.6 | 102.3 | 411.1 |
| 10 | 155.0 | 0.7 | 115.2 | 420.8 |
| 11 | 175.0 | 1.6 | 103.1 | 412.8 |
| 12 | 200.0 | 4.2 | 100.4 | 431.7 |
| 13 | 165.0 | 2.6 | 90.5 | 373.9 |
| 14 | 208.0 | 0.0 | 99.2 | 437.0 |

THE NET SYSTEM DEMAND = 23.208

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 3.74 |
| 18 | 19.46 |

SUMMARY OF PUMP OPERATION

| PIPE NO. | PUMP TYPE | PUMP FLOW | PUMP HEAD | USEFUL POWER | EFFIC-IENCY | TOTAL KWH |
|---|---|---|---|---|---|---|
| 18 | 1 | 19.46 | 214.34 | 732.26 | 0.80 | 682.83 |

THE FOLLOWING CHANGES ARE MADE

JUNCT. NO. DEMAND

Max. Day Plus 2,000 GPM
Fire Flow at Node 4

GLOBAL DEMAND FACTOR = .5
4 4.98
**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 3 - ACCURACY ATTAINED = .0012

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | -4.74 | 0.42 | 0.00 | 0.00 | 1.04 | 0.11 |
| 2 | 1 | 2 | 9.95 | 1.89 | 0.00 | 0.00 | 3.14 | 1.05 |
| 3 | 2 | 3 | 5.94 | 8.77 | 0.00 | 0.00 | 4.21 | 3.37 |
| 4 | 3 | 4 | 4.98 | 10.10 | 0.00 | 0.00 | 5.52 | 7.21 |
| 5 | 3 | 5 | 0.96 | 3.60 | 0.00 | 0.00 | 1.89 | 1.64 |
| 6 | 6 | 5 | 0.37 | 4.78 | 0.00 | 0.00 | 1.65 | 2.03 |
| 7 | 6 | 7 | 0.48 | 3.57 | 0.00 | 0.00 | 2.13 | 3.25 |
| 8 | 8 | 7 | 0.50 | 4.62 | 0.00 | 0.00 | 2.23 | 3.56 |
| 9 | 9 | 8 | 0.19 | 0.79 | 0.00 | 0.00 | 0.83 | 0.56 |
| 10 | 10 | 9 | 0.99 | 2.61 | 0.00 | 0.00 | 1.96 | 1.74 |
| 11 | 10 | 6 | 1.22 | 4.46 | 0.00 | 0.00 | 2.41 | 2.55 |
| 12 | 2 | 10 | 2.55 | 3.13 | 0.00 | 0.00 | 2.83 | 2.09 |
| 13 | 11 | 8 | 0.32 | 1.89 | 0.00 | 0.00 | 1.41 | 1.51 |
| 14 | 12 | 11 | 1.12 | 5.67 | 0.00 | 0.00 | 2.21 | 2.18 |
| 15 | 1 | 12 | 4.53 | 0.87 | 0.00 | 0.00 | 2.23 | 0.72 |
| 16 | 12 | 13 | 1.30 | 16.01 | 0.00 | 0.00 | 2.56 | 2.86 |
| 17 | 14 | 1 | 19.23 | 2.19 | 0.00 | 0.00 | 4.21 | 1.46 |
| 18 | 0 | 14 | 19.23 | 0.36 | 0.00 | 214.97 | 6.06 | 3.55 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 112.8 | 435.4 |
| 2 | 200.0 | 1.5 | 101.2 | 433.5 |
| 3 | 157.0 | 0.0 | 116.0 | 424.8 |
| 4 | 200.0 | 5.0 | 93.0 | 414.7 |
| 5 | 155.0 | 1.3 | 115.3 | 421.2 |
| 6 | 135.0 | 0.4 | 126.1 | 425.9 |
| 7 | 135.0 | 1.0 | 124.5 | 422.4 |
| 8 | 130.0 | 0.0 | 128.7 | 427.0 |
| 9 | 175.0 | 0.8 | 109.5 | 427.8 |
| 10 | 155.0 | 0.3 | 119.3 | 430.4 |
| 11 | 175.0 | 0.8 | 110.0 | 428.9 |
| 12 | 200.0 | 2.1 | 101.6 | 434.5 |
| 13 | 165.0 | 1.3 | 109.9 | 418.5 |
| 14 | 208.0 | 0.0 | 99.5 | 437.6 |

THE NET SYSTEM DEMAND = 14.484
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | -4.74 |
| 18 | 19.23 |

SUMMARY OF PUMP OPERATION

| PIPE NO. | PUMP TYPE | PUMP FLOW | PUMP HEAD | USEFUL POWER | EFFIC-IENCY | TOTAL KWH |
|---|---|---|---|---|---|---|
| 18 | 1 | 19.23 | 214.97 | 725.50 | 0.80 | 676.53 |

THE FOLLOWING CHANGES ARE MADE

Max. Day Plus 2,000 GPM
Fire Flow at Node 2

JUNCT. NO. DEMAND
GLOBAL DEMAND FACTOR = .5

| | |
|---|---|
| 2 | 4.342 |
| 4 | 2.1 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 2 - ACCURACY ATTAINED = .0033

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | -4.74 | 0.42 | 0.00 | 0.00 | 1.04 | 0.11 |
| 2 | 1 | 2 | 9.98 | 1.90 | 0.00 | 0.00 | 3.14 | 1.05 |
| 3 | 2 | 3 | 3.24 | 2.85 | 0.00 | 0.00 | 2.30 | 1.10 |
| 4 | 3 | 4 | 2.10 | 2.04 | 0.00 | 0.00 | 2.33 | 1.46 |
| 5 | 3 | 5 | 1.14 | 4.91 | 0.00 | 0.00 | 2.24 | 2.23 |
| 6 | 6 | 5 | 0.20 | 1.47 | 0.00 | 0.00 | 0.87 | 0.63 |
| 7 | 6 | 7 | 0.51 | 3.97 | 0.00 | 0.00 | 2.25 | 3.61 |
| 8 | 8 | 7 | 0.48 | 4.16 | 0.00 | 0.00 | 2.11 | 3.20 |
| 9 | 9 | 8 | 0.18 | 0.74 | 0.00 | 0.00 | 0.80 | 0.53 |
| 10 | 10 | 9 | 0.99 | 2.58 | 0.00 | 0.00 | 1.95 | 1.72 |
| 11 | 10 | 6 | 1.07 | 3.51 | 0.00 | 0.00 | 2.11 | 2.01 |
| 12 | 2 | 10 | 2.40 | 2.79 | 0.00 | 0.00 | 2.66 | 1.86 |
| 13 | 11 | 8 | 0.30 | 1.67 | 0.00 | 0.00 | 1.31 | 1.33 |
| 14 | 12 | 11 | 1.10 | 5.48 | 0.00 | 0.00 | 2.17 | 2.11 |
| 15 | 1 | 12 | 4.51 | 0.86 | 0.00 | 0.00 | 2.22 | 0.72 |
| 16 | 12 | 13 | 1.30 | 16.01 | 0.00 | 0.00 | 2.56 | 2.86 |
| 17 | 14 | 1 | 19.23 | 2.19 | 0.00 | 0.00 | 4.21 | 1.46 |
| 18 | 0 | 14 | 19.23 | 0.36 | 0.00 | 214.97 | 6.06 | 3.55 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 112.8 | 435.4 |
| 2 | 200.0 | 4.3 | 101.2 | 433.5 |
| 3 | 157.0 | 0.0 | 118.6 | 430.7 |
| 4 | 200.0 | 2.1 | 99.1 | 428.6 |
| 5 | 155.0 | 1.3 | 117.3 | 425.8 |
| 6 | 135.0 | 0.4 | 126.6 | 427.2 |
| 7 | 135.0 | 1.0 | 124.9 | 423.3 |
| 8 | 130.0 | 0.0 | 128.9 | 427.4 |
| 9 | 175.0 | 0.8 | 109.7 | 428.1 |
| 10 | 155.0 | 0.3 | 119.5 | 430.7 |
| 11 | 175.0 | 0.8 | 110.1 | 429.1 |
| 12 | 200.0 | 2.1 | 101.6 | 434.6 |
| 13 | 165.0 | 1.3 | 109.9 | 418.5 |
| 14 | 208.0 | 0.0 | 99.5 | 437.6 |

THE NET SYSTEM DEMAND = 14.484
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | -4.74 |
| 18 | 19.23 |

SUMMARY OF PUMP OPERATION

| PIPE NO. | PUMP TYPE | PUMP FLOW | PUMP HEAD | USEFUL POWER | EFFIC-IENCY | TOTAL KWH |
|---|---|---|---|---|---|---|
| 18 | 1 | 19.23 | 214.97 | 725.50 | 0.80 | 676.53 |

Max. Day Plus 2,000 GPM
Fire Flow at Node 12

THE FOLLOWING CHANGES ARE MADE

JUNCT. NO. DEMAND
GLOBAL DEMAND FACTOR = .5
12 4.98625
4 2.1
2 1.462
**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 2 - ACCURACY ATTAINED = .001

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | -4.74 | 0.42 | 0.00 | 0.00 | 1.04 | 0.11 |
| 2 | 1 | 2 | 7.17 | 1.03 | 0.00 | 0.00 | 2.26 | 0.57 |
| 3 | 2 | 3 | 3.25 | 2.86 | 0.00 | 0.00 | 2.30 | 1.10 |
| 4 | 3 | 4 | 2.10 | 2.04 | 0.00 | 0.00 | 2.33 | 1.46 |
| 5 | 3 | 5 | 1.15 | 4.98 | 0.00 | 0.00 | 2.26 | 2.26 |
| 6 | 6 | 5 | 0.19 | 1.34 | 0.00 | 0.00 | 0.83 | 0.57 |
| 7 | 6 | 7 | 0.53 | 4.27 | 0.00 | 0.00 | 2.34 | 3.88 |
| 8 | 8 | 7 | 0.46 | 3.84 | 0.00 | 0.00 | 2.02 | 2.95 |
| 9 | 9 | 8 | 0.23 | 1.17 | 0.00 | 0.00 | 1.02 | 0.84 |
| 10 | 10 | 9 | 1.04 | 2.83 | 0.00 | 0.00 | 2.05 | 1.89 |
| 11 | 10 | 6 | 1.08 | 3.58 | 0.00 | 0.00 | 2.14 | 2.04 |
| 12 | 2 | 10 | 2.46 | 2.93 | 0.00 | 0.00 | 2.72 | 1.95 |
| 13 | 11 | 8 | 0.23 | 1.00 | 0.00 | 0.00 | 1.00 | 0.80 |
| 14 | 12 | 11 | 1.03 | 4.84 | 0.00 | 0.00 | 2.03 | 1.86 |
| 15 | 1 | 12 | 7.32 | 2.11 | 0.00 | 0.00 | 3.60 | 1.76 |
| 16 | 12 | 13 | 1.30 | 16.01 | 0.00 | 0.00 | 2.56 | 2.86 |
| 17 | 14 | 1 | 19.23 | 2.19 | 0.00 | 0.00 | 4.21 | 1.46 |
| 18 | 0 | 14 | 19.23 | 0.36 | 0.00 | 214.97 | 6.06 | 3.55 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 112.8 | 435.4 |
| 2 | 200.0 | 1.5 | 101.6 | 434.4 |
| 3 | 157.0 | 0.0 | 119.0 | 431.5 |
| 4 | 200.0 | 2.1 | 99.4 | 429.5 |
| 5 | 155.0 | 1.3 | 117.7 | 426.5 |
| 6 | 135.0 | 0.4 | 126.9 | 427.9 |
| 7 | 135.0 | 1.0 | 125.1 | 423.6 |
| 8 | 130.0 | 0.0 | 128.9 | 427.5 |
| 9 | 175.0 | 0.8 | 109.9 | 428.6 |
| 10 | 155.0 | 0.3 | 119.8 | 431.5 |
| 11 | 175.0 | 0.8 | 109.8 | 428.5 |
| 12 | 200.0 | 5.0 | 101.1 | 433.3 |
| 13 | 165.0 | 1.3 | 109.3 | 417.3 |
| 14 | 208.0 | 0.0 | 99.5 | 437.6 |

THE NET SYSTEM DEMAND = 14.484
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | -4.74 |
| 18 | 19.23 |

SUMMARY OF PUMP OPERATION

| PIPE NO. | PUMP TYPE | PUMP FLOW | PUMP HEAD | USEFUL POWER | EFFIC-IENCY | TOTAL KWH |
|---|---|---|---|---|---|---|
| 18 | 1 | 19.23 | 214.97 | 725.50 | 0.80 | 676.53 |

Max. Day Plus 2,000 GPM
Fire Flow at Node 13

THE FOLLOWING CHANGES ARE MADE

| JUNCT. NO. | DEMAND |
|---|---|
| GLOBAL DEMAND FACTOR = | .5 |
| 13 | 4.18 |
| 4 | 2.1 |
| 2 | 1.462 |
| 12 | 2.10625 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 1 - ACCURACY ATTAINED = 0

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | -4.74 | 0.42 | 0.00 | 0.00 | 1.04 | 0.11 |
| 2 | 1 | 2 | 7.17 | 1.03 | 0.00 | 0.00 | 2.26 | 0.57 |
| 3 | 2 | 3 | 3.25 | 2.86 | 0.00 | 0.00 | 2.30 | 1.10 |
| 4 | 3 | 4 | 2.10 | 2.04 | 0.00 | 0.00 | 2.33 | 1.46 |
| 5 | 3 | 5 | 1.15 | 4.98 | 0.00 | 0.00 | 2.26 | 2.26 |
| 6 | 6 | 5 | 0.19 | 1.34 | 0.00 | 0.00 | 0.83 | 0.57 |
| 7 | 6 | 7 | 0.53 | 4.27 | 0.00 | 0.00 | 2.34 | 3.88 |
| 8 | 8 | 7 | 0.46 | 3.84 | 0.00 | 0.00 | 2.02 | 2.95 |
| 9 | 9 | 8 | 0.23 | 1.17 | 0.00 | 0.00 | 1.02 | 0.84 |
| 10 | 10 | 9 | 1.04 | 2.83 | 0.00 | 0.00 | 2.05 | 1.89 |
| 11 | 10 | 6 | 1.08 | 3.58 | 0.00 | 0.00 | 2.14 | 2.04 |
| 12 | 2 | 10 | 2.46 | 2.93 | 0.00 | 0.00 | 2.72 | 1.95 |
| 13 | 11 | 8 | 0.23 | 1.00 | 0.00 | 0.00 | 1.00 | 0.80 |
| 14 | 12 | 11 | 1.03 | 4.84 | 0.00 | 0.00 | 2.03 | 1.86 |
| 15 | 1 | 12 | 7.32 | 2.11 | 0.00 | 0.00 | 3.60 | 1.76 |
| 16 | 12 | 13 | 4.18 | 139.25 | 0.00 | 0.00 | 8.23 | 24.87 |
| 17 | 14 | 1 | 19.23 | 2.19 | 0.00 | 0.00 | 4.21 | 1.46 |
| 18 | 0 | 14 | 19.23 | 0.36 | 0.00 | 214.97 | 6.06 | 3.55 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 175.0 | 0.0 | 112.8 | 435.4 |
| 2 | 200.0 | 1.5 | 101.6 | 434.4 |
| 3 | 157.0 | 0.0 | 119.0 | 431.5 |
| 4 | 200.0 | 2.1 | 99.4 | 429.5 |
| 5 | 155.0 | 1.3 | 117.7 | 426.5 |
| 6 | 135.0 | 0.4 | 126.9 | 427.9 |
| 7 | 135.0 | 1.0 | 125.1 | 423.6 |
| 8 | 130.0 | 0.0 | 128.9 | 427.5 |
| 9 | 175.0 | 0.8 | 109.9 | 428.6 |
| 10 | 155.0 | 0.3 | 119.8 | 431.5 |
| 11 | 175.0 | 0.8 | 109.8 | 428.5 |
| 12 | 200.0 | 2.1 | 101.1 | 433.3 |
| 13 | 165.0 | 4.2 | 55.9 | 294.0 |
| 14 | 208.0 | 0.0 | 99.5 | 437.6 |

THE NET SYSTEM DEMAND = 14.484
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | -4.74 |
| 18 | 19.23 |

SUMMARY OF PUMP OPERATION

| PIPE NO. | PUMP TYPE | PUMP FLOW | PUMP HEAD | USEFUL POWER | EFFIC-IENCY | TOTAL KWH |
|---|---|---|---|---|---|---|
| 18 | 1 | 19.23 | 214.97 | 725.50 | 0.80 | 676.53 |

******* END OF THIS SIMULATION *******

# Addendum Report

# For the

# East Kapolei Potable Water Master Plan

*Prepared for*

Schuler Homes, Inc.
828 Fort Street Mall - 4th Floor
Honolulu, Hawaii 96813

*Prepared by*

Tom Nance Water Resource Engineering
680 Ala Moana Boulevard - Suite 406
Honolulu, Hawaii 96813

December 1995

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EXHIBIT 1: *Hydraulic Analysis of the 440-Foot Service Zone*

EXHIBIT 2: Hydraulic Analysis of the 228-Foot Service Zone


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## Introduction

The original potable water master plan for the East Kapolei area was prepared in October 1994 and subsequently revised in November 1994. Since that time, the Kapolei project site and land use plan of Schuler Homes, Inc. have been modified. This addendum report has been prepared to identify the potable water system components that would be required to serve Schuler's new land use plan. The comparison of the unit counts of the original and revised land use plans below shows a reduction in the total number of residential units:

| | Original Land Use Plan | New Land Use Plan |
|---|---|---|
| Residential Units | 10,000 | 8,000 |
| Park (Acres) | 20 | 32 |
| Schools (Acres) | 12 | 25* |
| Commercial (Acres) | 20 | 16 |

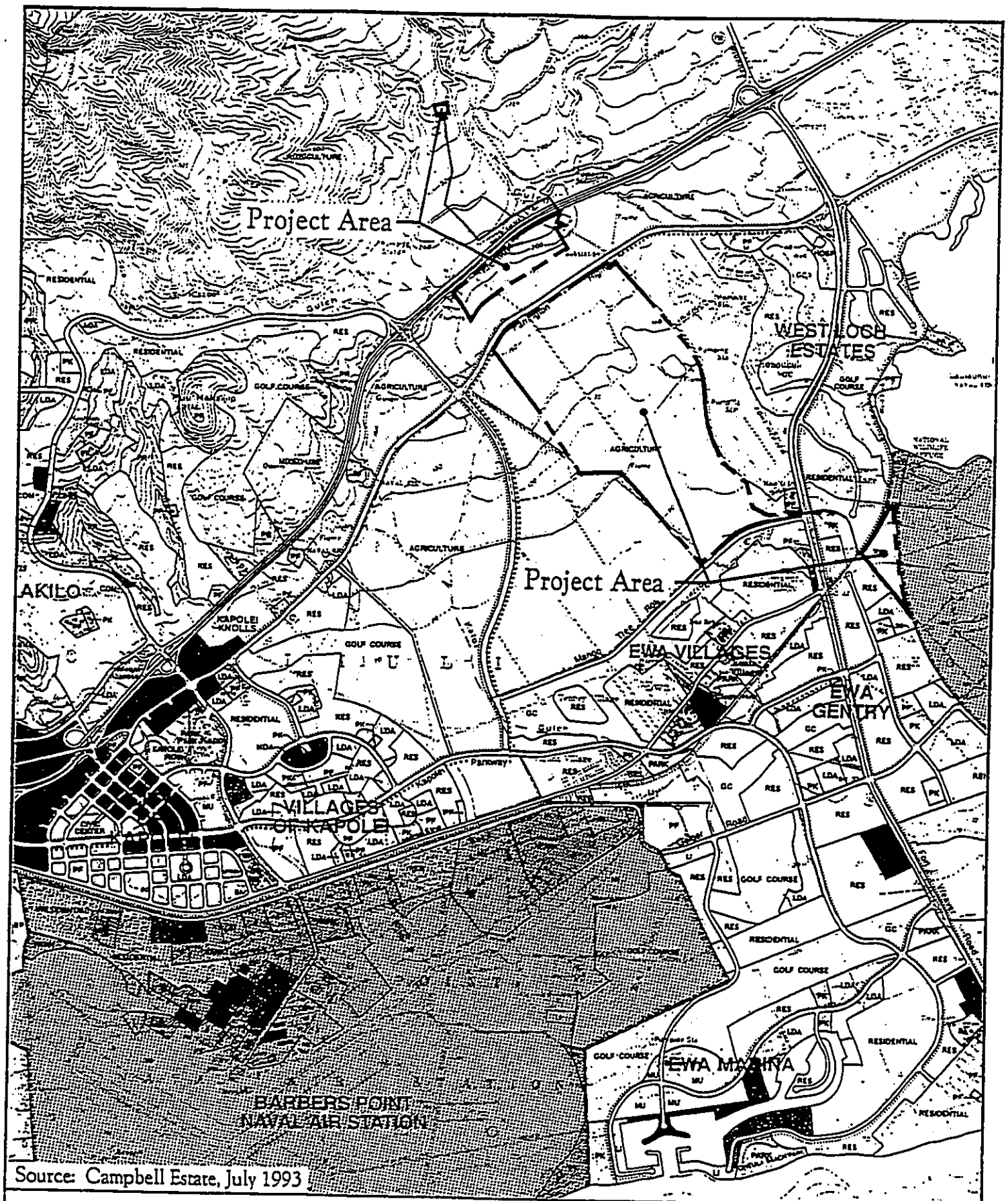
* *Half of an 18-acre Intermediate School Site is in Schuler's East Kapolei project site.*

There is one other significant difference with this addendum report in comparison with the original potable water master plan. The addendum report addresses the water system requirements to serve the Schuler project exclusively. The original master plan also covered areas outside of the Schuler project, including the proposed University campus, a high school site, 170 acres for residential development by the Department of Hawaiian Home Lands, and 1,100 acres of mixed use development on Campbell Estate lands. None of these areas is included in this addendum report.

As with the original water master plan, this addendum report establishes the storage, transmission, and distribution requirements for all potable water system facilities. All of these would be new, stand-alone improvements and are analyzed as such in this report. The report does not deal with sources of supply for the Schuler project. It is assumed that the Board of Water Supply (BWS) will designate the source of supply for the project after the State Water Commission has reviewed and adjusted the Oahu Sugar Company groundwater allocations now held by Campbell Estate and Amfac. No wells or transmission pipeline from the wells to the Schuler potable water system are considered in this report.

## Project Site and Land Use Plan

Figures 1 and 2, which were prepared by the planning firm of Helber Hastert & Fee, depict the extent of the project site and its proposed land uses. Figure 2 includes a summary of land uses on the 742-acre site. The 649 acres of residential development will include a mix of single family and multi-family. For the purposes of this report, it is assumed that the 75 percent of the 8,000 residential



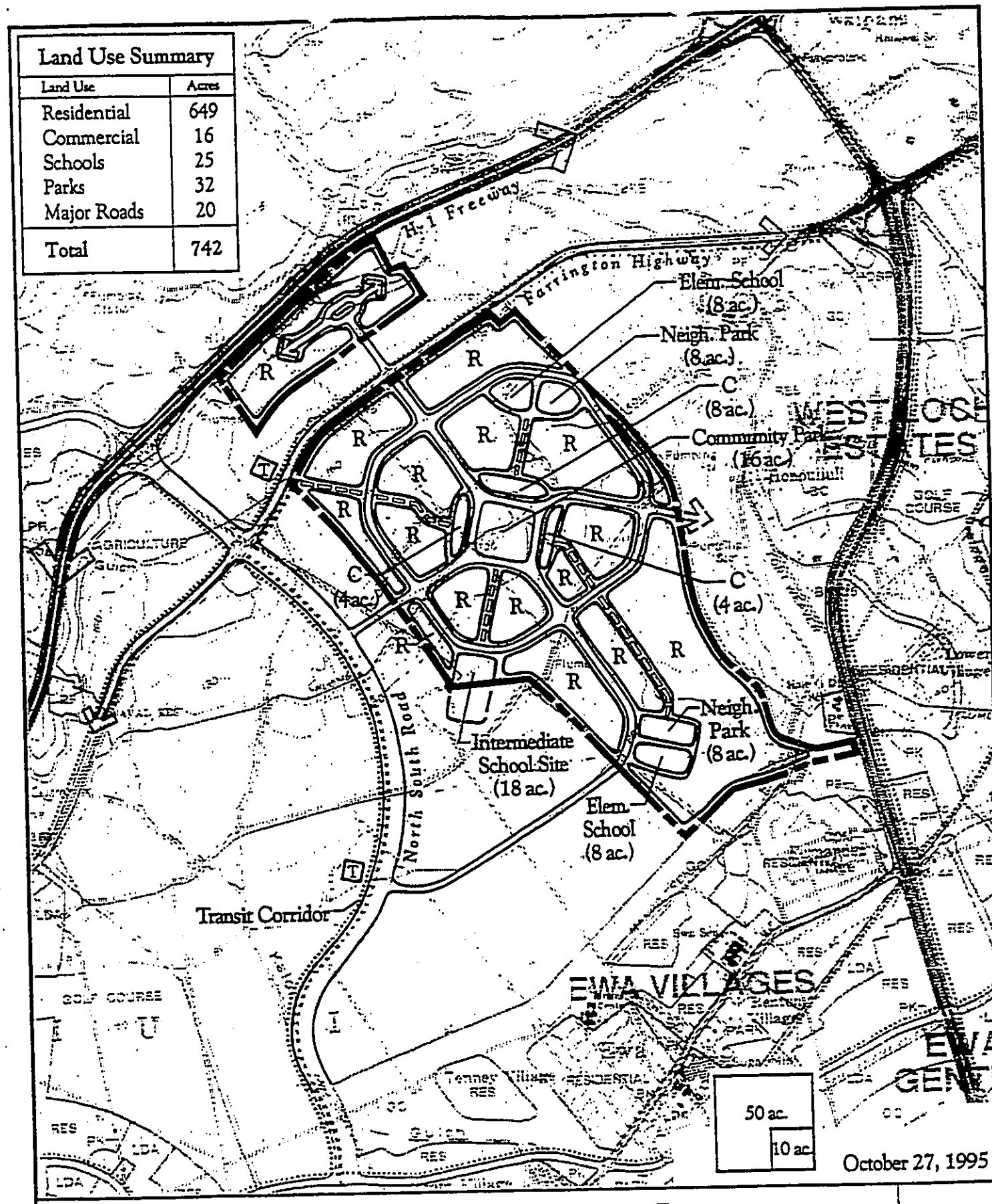

Source: Campbell Estate, July 1993

**Location of the Schuler Homes Projects in East Kapolei, Ewa, Oahu**

FEET 0 2000 4000

Helber Hastert & Fee, Planners

Figure 1




| Land Use Summary | |
|---|---|
| Land Use | Acres |
| Residential | 649 |
| Commercial | 16 |
| Schools | 25 |
| Parks | 32 |
| Major Roads | 20 |
| Total | 742 |

Preliminary Concept Plan

# EAST KAPOLEI PROJECT

Schuler Homes, Inc.

FEET 0 1000 2000

Helber Hastert & Fee, Planners

Figure 2

units will be multi-family (i.e. 6,000 units) and the balance (2,000 units) will be single family. This single family/multi-family mix is expected to be distributed in residential parcels throughout the project site.

### Delineation of Service Pressure Zones

Division of the project site into areas served by the 440-foot and 228-foot service pressure zones is illustrated on Figure 3. The division occurs at approximately 110-foot elevation. The storage tank for the 440-foot zone would be on the mauka side of H-1 Freeway at the location shown on Figure 1. The tank for the 228-foot service zone would be within the project site on the makai side of the freeway. About two-thirds of the project site is in the upper, 440-foot service zone.

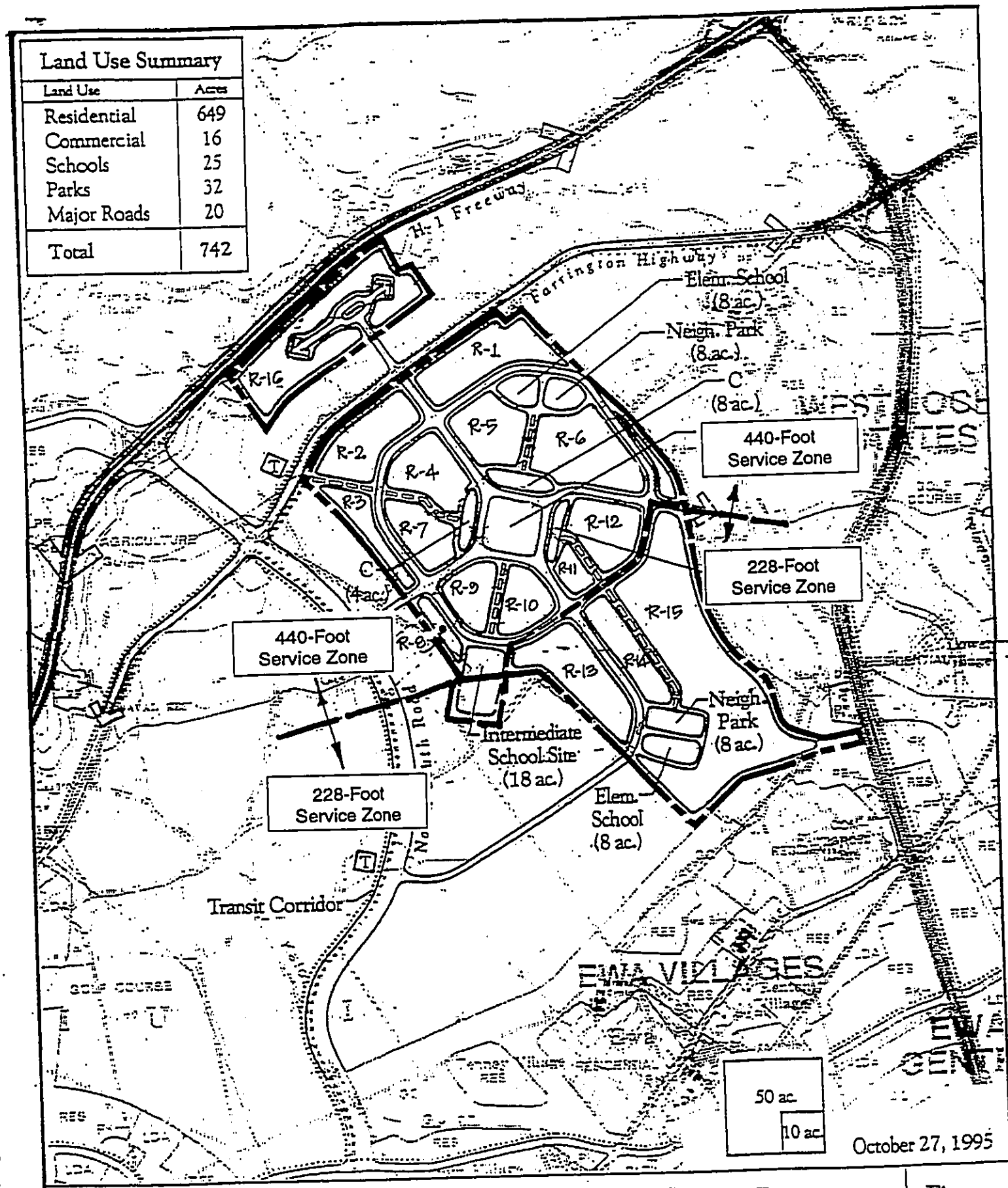
### Projected Water Supply Requirements

Tables 1 and 2 provide tabulations of the average, maximum day, and peak hour water supply requirements for the 440- and 228-foot zones. For each of the residential parcels, the 75/25 mix of multi-/single-family residential units translates to an average of 425 GPD per residential unit (based on 400 GPD for multi-family and 500 GPD for single family). With this mix, total supply requirements are as follows:

| Service Zone | Average (MGD) | Maximum Day (MGD) | Peak (MGD) |
|---|---|---|---|
| 228-Foot | 1.3370 | 2.0053 | 4.0107 |
| 440-Foot | 2.3911 | 3.5867 | 7.1734 |
| Totals | 3.7281 | 5.5920 | 11.1841 |

### Layout of the Proposed Potable Water System

Figures 4 and 5 schematically depict the required tanks and pipelines for the 440- and 228-foot service zones, respectively. The 440-foot system features a tank (or tanks) on the mauka side of H-1 Freeway and a distribution main which would run beneath the freeway into the project site. Alternatively, this main could be routed to cross beneath the Honouliuli Gulch Bridge. Such a route would add approximately 3,200 feet of extra pipeline, but it would not require a larger diameter pipe. Required storage for this zone is 3.6 million gallons. It could be constructed in one or two increments. If the well supply (to be designated by BWS) feeds into the 228-foot service zone, a booster station which draws water from the 228-foot tank to deliver it into the 440-foot zone would be necessary. Figure 3 of the original master plan report illustrates a potential layout for such a booster station. To provide maximum day supply in 16 hours, the booster station would ultimately require a pumping capacity of 3,740 GPM plus a standby pump.




Delineation of the 440- and 228-Foot Service Pressure Zones For the East Kapolei Project

Figure 3

**Table 1**

**Water Supply Requirements For Projects In the 440-Foot Service Zone**

| Development Parcel | No. of Units | Area (Acres) | Unit Demand (GPD/Unit) | Water Demand (MGD) | | | Location of Demand on the Hydraulic Schematic (Figure 4) |
|---|---|---|---|---|---|---|---|
| | | | | Average Day | Maximum Day | Peak | |
| Residential - 1 | 550 | 45 | 425 | .2338 | .3506 | .7013 | 15 |
| - 2 | 475 | 39 | 425 | .2019 | .3028 | .6056 | 3 |
| - 3 | 225 | 18 | 425 | .0956 | .1434 | .2869 | 4 |
| - 4 | 420 | 34 | 425 | .1785 | .2678 | .5355 | 3 |
| - 5 | 415 | 34 | 425 | .1764 | .2646 | .5291 | 2, 14, & 15 |
| - 6 | 710 | 58 | 425 | .3018 | .4526 | .9053 | 12, 13, & 14 |
| - 7 | 305 | 25 | 425 | .1296 | .1944 | .3889 | 4 |
| - 8 | 80 | 6 | 425 | .0340 | .0510 | .1020 | 6 |
| - 9 | 270 | 22 | 425 | .1148 | .1721 | .3443 | 6 & 8 |
| - 10 | 270 | 22 | 425 | .1148 | .1721 | .3443 | 10 |
| - 11 | 110 | 9 | 425 | .0468 | .0701 | .1403 | 10 |
| - 12 | 410 | 33 | 425 | .1743 | .2614 | .5228 | 12 |
| - 16 | 765 | 62 | 425 | .3251 | .4877 | .9754 | 1 |
| Elementary School | | 8 | 4,000 | .0320 | .0480 | .0960 | 14 |
| Intermediate School | | 18 | 4,000 | .0720 | .1080 | .2160 | 7 |
| Neighborhood Park | | 8 | 4,000 | .0320 | .0480 | .0960 | 14 |
| Commercial | | 16 | 4,000 | .0640 | .0960 | .1920 | 8, 9, 10, & 11 |
| Community Park | | 16 | 4,000 | .0640 | .0960 | .1920 | 8, 9, 10, & 11 |
| Totals | 5,005 | 473 | -- | 2.3911 | 3.5867 | 7.1734 | -- |

**Table 2**

**Water Supply Requirements For Projects in the 228-Foot Service Zone**

| Development Parcel | No. of Units | Area (Acres) | Unit Demand (GPD/Unit) | Water Demand (MGD) | | | Location of Demand on the Hydraulic Schematic (Figure 5) |
|---|---|---|---|---|---|---|---|
| | | | | Average Day | Maximum Day | Peak | |
| Residential - 13 | 590 | 48 | 425 | .2508 | .3761 | .7523 | 4 |
| - 14 | 330 | 27 | 425 | .1403 | .2104 | .4208 | 3 |
| - 15 | 2,075 | 168 | 425 | .8819 | 1.3228 | 2.6456 | 2, 6, & 7 |
| Neighborhood Park | | 8 | 4,000 | .0320 | .0480 | .0960 | 5 |
| Elementary School | | 8 | 4,000 | .0320 | .0480 | .0960 | 5 |
| Totals | 2,995 | 259 | -- | 1.3370 | 2.0053 | 4.0107 | -- |

| Node Information | | |
|---|---|---|
| Node No. | Elevation ( Feet ) | Peak Draft ( MGD ) |
| 1 | 210 | 0.9754 |
| 2 | 175 | 0.1764 |
| 3 | 170 | 1.1411 |
| 4 | 160 | 0.6758 |
| 5 | 140 | 0.0000 |
| 6 | 125 | 0.2741 |
| 7 | 110 | 0.2160 |
| 8 | 135 | 0.2441 |
| 9 | 145 | 0.1200 |
| 10 | 125 | 0.5326 |
| 11 | 140 | 0.1440 |
| 12 | 130 | 0.8246 |
| 13 | 140 | 0.3018 |
| 14 | 160 | 0.6702 |
| 15 | 175 | 0.8777 |

| Pipe Network Data | | | | |
|---|---|---|---|---|
| Pipe No. | Upstream Node | Downstream Node | Pipe Diam. ( Inches ) | Pipe Length ( Feet ) |
| 1 | 0 | 1 | 20 | 4,600 |
| 2 | 2 | 3 | 12 | 800 |
| 3 | 3 | 4 | 8 | 1,650 |
| 4 | 4 | 5 | 8 | 750 |
| 5 | 5 | 6 | 8 | 600 |
| 6 | 6 | 7 | 8 | 750 |
| 7 | 8 | 5 | 8 | 950 |
| 8 | 9 | 8 | 8 | 925 |
| 9 | 8 | 10 | 8 | 925 |
| 10 | 11 | 10 | 8 | 925 |
| 11 | 11 | 12 | 12 | 1,000 |
| 12 | 13 | 12 | 8 | 2,400 |
| 13 | 14 | 13 | 8 | 1,000 |
| 14 | 15 | 14 | 8 | 900 |
| 15 | 2 | 15 | 12 | 975 |
| 16 | 2 | 9 | 12 | 1,400 |
| 17 | 9 | 11 | 8 | 925 |
| 18 | 1 | 2 | 20 | 2,150 |

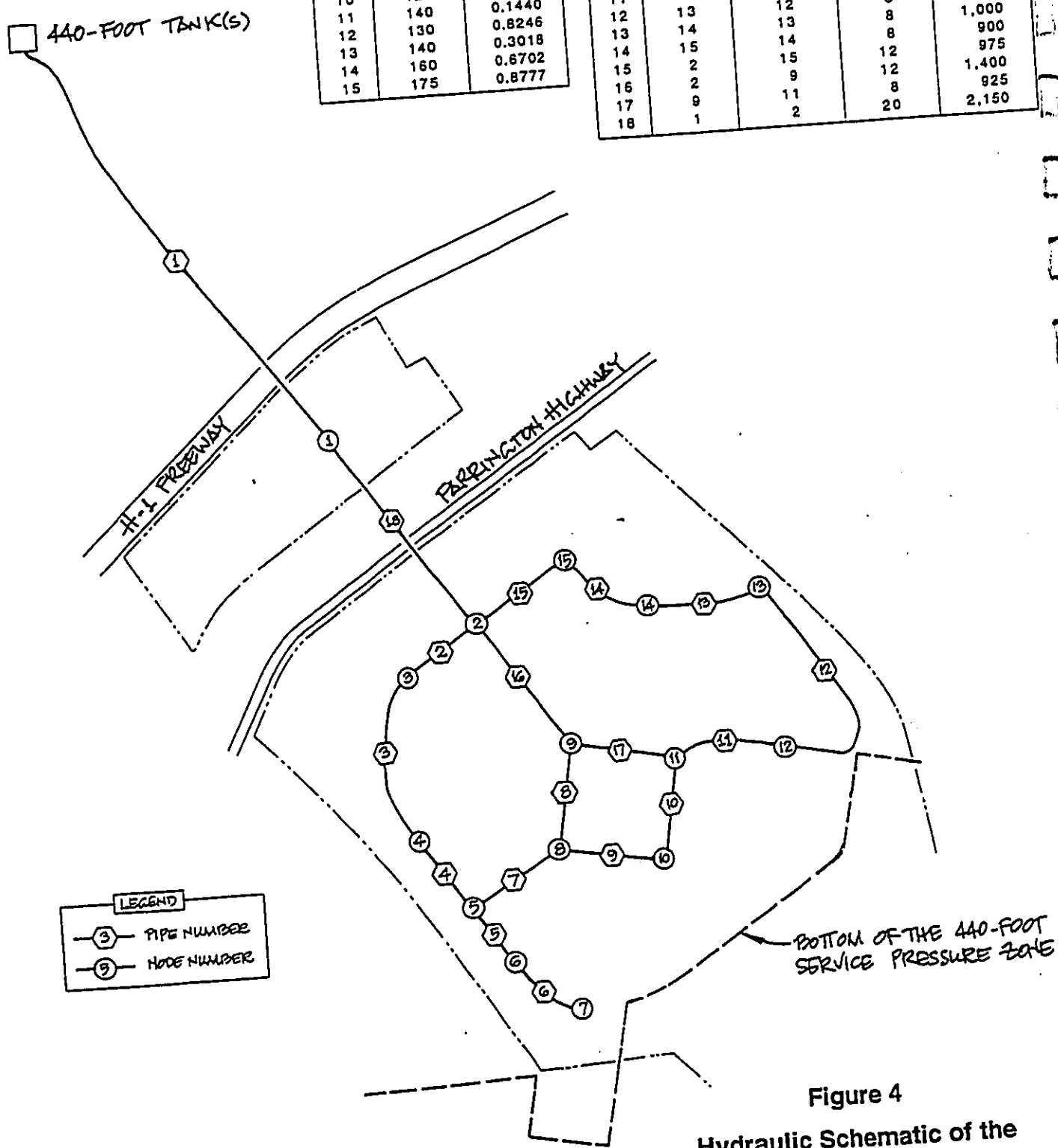



**Figure 4**

**Hydraulic Schematic of the 440-Foot Service Pressure Zone**

| Node Information | | |
|---|---|---|
| Node No. | Elevation ( Feet ) | Peak Draft ( MGD ) |
| 1 | 100 | 0.0000 |
| 2 | 110 | 0.8819 |
| 3 | 95 | 0.4208 |
| 4 | 102 | 0.7523 |
| 5 | 77 | 0.1920 |
| 6 | 80 | 0.8819 |
| 7 | 95 | 0.8819 |

| Pipe Network Data | | | | |
|---|---|---|---|---|
| Pipe No. | Upstream Node | Downstream Node | Pipe Diam. ( Inches ) | Pipe Length ( Feet ) |
| 1 | 0 | 1 | 20 | 8,350 |
| 2 | 1 | 2 | 16 | 650 |
| 3 | 2 | 3 | 12 | 1,200 |
| 4 | 3 | 4 | 12 | 350 |
| 5 | 4 | 5 | 8 | 1,700 |
| 6 | 5 | 6 | 8 | 900 |
| 7 | 7 | 6 | 8 | 950 |
| 8 | 2 | 7 | 12 | 950 |

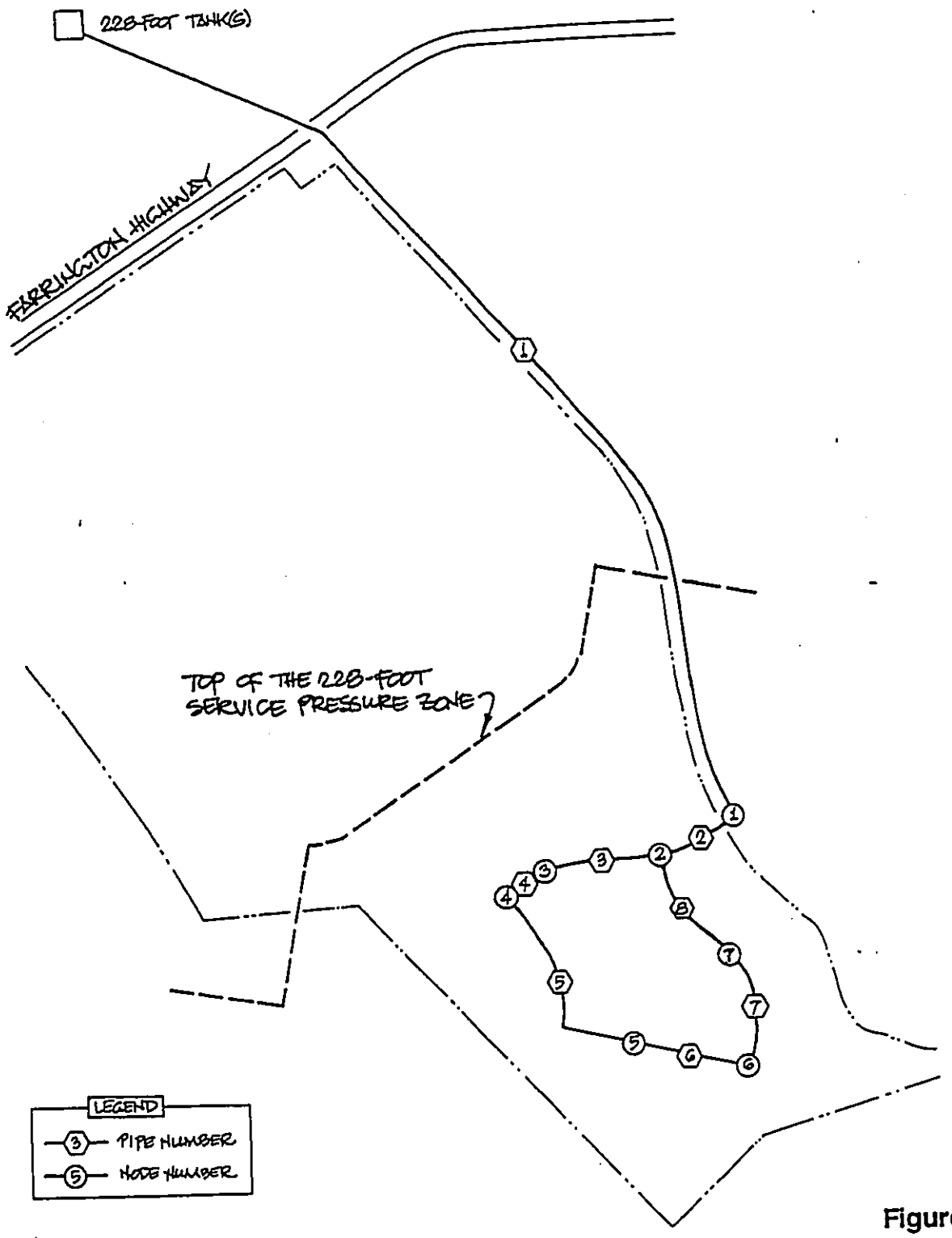



**Figure 5**

**Hydraulic Schematic of the 228-Foot Service Pressure Zone**

The 228-foot service zone requires a storage capacity of 2.0 million gallons. The tank (or tanks) would be located on the promontory on the makai side of the freeway. The primary distribution main for the 228-foot service zone shown on Figure 5 follows the "Pipeline Road" alignment along the eastern boundary of the Schuler site.

## Hydraulic Analysis of the 440-Foot Service Zone

Exhibit 1 is a printout of the Hardy-Cross analysis (using the Kentucky Pipe Network program) of the distribution network of the 440-foot zone. All BWS criteria for maximum velocities and minimum pressures during peak and fire flow conditions are met with the pipe sizes shown on Figure 4. Elevations of the nodes used in the analysis are the highest points within the parcel(s) to be served from the particular node, not the elevation of the node itself. The analysis in Exhibit 1 is for gravity delivery from the 440-foot tank, assuming that the tank is 3/4-full. Gravity delivery is the critical operating condition. The original master plan also included a computer run with the booster station operating which demonstrated that residual pressures are slightly higher than for delivery entirely by gravity.

## Hydraulic Analysis of the 228-Foot Service Zone

Exhibit 2 is the Kentucky Pipe Network printout of the hydraulic analysis for the 228-foot service zone. All BWS criteria for maximum velocities and minimum pressures during peak and fire flow conditions are met with the pipe sizes shown on Figure 5. Node elevations for this analysis also reflect the highest delivery point from the particular node. All delivery is by gravity from the 228-foot tank, assuming that it is 3/4 full.

**Exhibit 1**

**Hydraulic Analysis of the 440-Foot Service Zone**

*** UNIVERSITY OF KENTUCKY PIPE NETWORK ANALYSIS PROGRAM - 1985 VERSION ***
RESULTS TO OUTPUT FILE

INPUT DATA FILE NAME FOR THIS SIMULATION = SCH440.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = SCH440.OUT

NUMBER OF PIPES = 18
NUMBER OF JUNCTION NODES = 15
FLOW UNITS = MILLION GALLONS / DAY
PRESSURE UNITS = PSI

**** SUMMARY OF INPUT DATA ***

| PIPE NO. | NODE #1 | NODE #2 | LENGTH (FT.) | DIAM. (IN.) | HW-C VALUE | SUM-M FACT. | PUMP TYPE | FGN GRADE |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 4600.0 | 20.0 | 120.0 | 0.0 | 0.0 | 435.0 |
| 2 | 2 | 3 | 800.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 3 | 3 | 4 | 1650.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 4 | 4 | 5 | 750.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 5 | 5 | 6 | 600.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 6 | 6 | 7 | 750.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 7 | 8 | 5 | 950.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 8 | 9 | 8 | 925.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 9 | 8 | 10 | 925.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 10 | 11 | 10 | 925.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 11 | 11 | 12 | 1000.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 12 | 13 | 12 | 2400.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 13 | 14 | 13 | 1000.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 14 | 15 | 14 | 900.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 15 | 2 | 15 | 975.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 16 | 2 | 9 | 1400.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 17 | 9 | 11 | 925.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 18 | 1 | 2 | 2150.0 | 20.0 | 120.0 | 0.0 | 0.0 | |

| JUNCT. NO. | DEMAND | ELEVATION |
|---|---|---|
| 1 | 1.0 | 210.0 |
| 2 | 0.2 | 175.0 |
| 3 | 1.1 | 170.0 |
| 4 | 0.7 | 160.0 |
| 5 | 0.0 | 140.0 |
| 6 | 0.3 | 125.0 |
| 7 | 0.2 | 110.0 |
| 8 | 0.2 | 135.0 |
| 9 | 0.1 | 145.0 |
| 10 | 0.5 | 125.0 |
| 11 | 0.1 | 140.0 |
| 12 | 0.8 | 130.0 |
| 13 | 0.3 | 140.0 |
| 14 | 0.7 | 160.0 |
| 15 | 0.9 | 175.0 |

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

PEAK FLOWRATES

NO. OF TRIALS = 5 - ACCURACY ATTAINED = 0

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 7.17 | 22.00 | 0.00 | 0.00 | 5.09 | 4.78 |
| 2 | 2 | 3 | 1.98 | 4.99 | 0.00 | 0.00 | 3.90 | 6.24 |
| 3 | 3 | 4 | 0.84 | 15.15 | 0.00 | 0.00 | 3.72 | 9.18 |
| 4 | 4 | 5 | 0.16 | 0.34 | 0.00 | 0.00 | 0.73 | 0.45 |
| 5 | 5 | 6 | 0.49 | 2.03 | 0.00 | 0.00 | 2.17 | 3.38 |
| 6 | 6 | 7 | 0.22 | 0.56 | 0.00 | 0.00 | 0.96 | 0.74 |
| 7 | 8 | 5 | 0.33 | 1.51 | 0.00 | 0.00 | 1.44 | 1.59 |
| 8 | 9 | 8 | 0.92 | 9.99 | 0.00 | 0.00 | 4.07 | 10.81 |
| 9 | 8 | 10 | 0.35 | 1.66 | 0.00 | 0.00 | 1.54 | 1.79 |
| 10 | 11 | 10 | 0.18 | 0.51 | 0.00 | 0.00 | 0.82 | 0.55 |
| 11 | 11 | 12 | 0.64 | 5.62 | 0.00 | 0.00 | 2.86 | 5.62 |
| 12 | 13 | 12 | 0.18 | 1.27 | 0.00 | 0.00 | 0.80 | 0.53 |
| 13 | 14 | 13 | 0.48 | 3.28 | 0.00 | 0.00 | 2.14 | 3.28 |
| 14 | 15 | 14 | 1.15 | 14.82 | 0.00 | 0.00 | 5.11 | 16.47 |
| 15 | 2 | 15 | 2.03 | 6.36 | 0.00 | 0.00 | 4.00 | 6.53 |
| 16 | 2 | 9 | 2.01 | 8.98 | 0.00 | 0.00 | 3.96 | 6.41 |
| 17 | 9 | 11 | 0.97 | 11.14 | 0.00 | 0.00 | 4.31 | 12.04 |
| 18 | 1 | 2 | 6.20 | 7.84 | 0.00 | 0.00 | 4.40 | 3.65 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 210.0 | 1.0 | 88.0 | 413.0 |
| 2 | 175.0 | 0.2 | 99.7 | 405.2 |
| 3 | 170.0 | 1.1 | 99.7 | 400.2 |
| 4 | 160.0 | 0.7 | 97.5 | 385.0 |
| 5 | 140.0 | 0.0 | 106.0 | 384.7 |
| 6 | 125.0 | 0.3 | 111.6 | 382.6 |
| 7 | 110.0 | 0.2 | 117.9 | 382.1 |
| 8 | 135.0 | 0.2 | 108.8 | 386.2 |
| 9 | 145.0 | 0.1 | 108.8 | 396.2 |
| 10 | 125.0 | 0.5 | 112.5 | 384.5 |
| 11 | 140.0 | 0.1 | 106.2 | 385.0 |
| 12 | 130.0 | 0.8 | 108.1 | 379.4 |
| 13 | 140.0 | 0.3 | 104.3 | 380.7 |
| 14 | 160.0 | 0.7 | 97.1 | 384.0 |
| 15 | 175.0 | 0.9 | 97.0 | 398.8 |

THE NET SYSTEM DEMAND = 7.1738
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 7.17 |

THE FOLLOWING CHANGES ARE MADE

| JUNCT. NO. | DEMAND |
|---|---|
| GLOBAL DEMAND FACTOR = | .5 |
| 13 | 3.0309 |

2000 GPM FIRE FLOWRATE AT NODE 13

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 5 - ACCURACY ATTAINED = .0002

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 6.47 | 18.15 | 0.00 | 0.00 | 4.59 | 3.95 |
| 2 | 2 | 3 | 1.29 | 2.25 | 0.00 | 0.00 | 2.54 | 2.81 |
| 3 | 3 | 4 | 0.72 | 11.28 | 0.00 | 0.00 | 3.18 | 6.83 |
| 4 | 4 | 5 | 0.38 | 1.57 | 0.00 | 0.00 | 1.68 | 2.10 |
| 5 | 5 | 6 | 0.25 | 0.56 | 0.00 | 0.00 | 1.09 | 0.94 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6 | 6 | 7 | 0.11 | 0.15 | 0.00 | 0.00 | 0.48 | 0.21 |
| 7 | 8 | 5 | -0.13 | 0.29 | 0.00 | 0.00 | 0.59 | 0.30 |
| 8 | 9 | 8 | 0.73 | 6.58 | 0.00 | 0.00 | 3.25 | 7.12 |
| 9 | 8 | 10 | 0.74 | 6.78 | 0.00 | 0.00 | 3.30 | 7.33 |
| 10 | 11 | 10 | -0.48 | 2.98 | 0.00 | 0.00 | 2.12 | 3.23 |
| 11 | 11 | 12 | 1.60 | 30.35 | 0.00 | 0.00 | 7.10 | 30.35 |
| 12 | 13 | 12 | -1.19 | 41.99 | 0.00 | 0.00 | 5.28 | 17.50 |
| 13 | 14 | 13 | 1.84 | 39.21 | 0.00 | 0.00 | 8.16 | 39.21 |
| 14 | 15 | 14 | 2.18 | 48.11 | 0.00 | 0.00 | 9.64 | 53.45 |
| 15 | 2 | 15 | 2.61 | 10.17 | 0.00 | 0.00 | 5.15 | 10.43 |
| 16 | 2 | 9 | 1.99 | 8.80 | 0.00 | 0.00 | 3.92 | 6.29 |
| 17 | 9 | 11 | 1.20 | 16.35 | 0.00 | 0.00 | 5.30 | 17.67 |
| 18 | 1 | 2 | 5.98 | 7.34 | 0.00 | 0.00 | 4.24 | 3.41 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 210.0 | 0.5 | 89.6 | 416.8 |
| 2 | 175.0 | 0.1 | 101.6 | 409.5 |
| 3 | 170.0 | 0.6 | 102.8 | 407.3 |
| 4 | 160.0 | 0.3 | 102.3 | 396.0 |
| 5 | 140.0 | 0.0 | 110.2 | 394.4 |
| 6 | 125.0 | 0.1 | 116.5 | 393.8 |
| 7 | 110.0 | 0.1 | 122.9 | 393.7 |
| 8 | 135.0 | 0.1 | 112.3 | 394.1 |
| 9 | 145.0 | 0.1 | 110.8 | 400.7 |
| 10 | 125.0 | 0.3 | 113.7 | 387.3 |
| 11 | 140.0 | 0.1 | 105.9 | 384.4 |
| 12 | 130.0 | 0.4 | 97.1 | 354.0 |
| 13 | 140.0 | 3.0 | 74.5 | 312.0 |
| 14 | 160.0 | 0.3 | 82.9 | 351.2 |
| 15 | 175.0 | 0.4 | 97.2 | 399.3 |

THE NET SYSTEM DEMAND = 6.4669
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 6.47 |

THE FOLLOWING CHANGES ARE MADE

| JUNCT. NO. | DEMAND |
|---|---|
| GLOBAL DEMAND | FACTOR = .5 |
| 9 | 2.94 |
| 13 | .1509 |

2000 GPM FIRE FLOWRATE AT NODE 9

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 6 - ACCURACY ATTAINED = 0

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 6.47 | 18.15 | 0.00 | 0.00 | 4.59 | 3.95 |
| 2 | 2 | 3 | 1.40 | 2.63 | 0.00 | 0.00 | 2.76 | 3.29 |
| 3 | 3 | 4 | 0.83 | 14.83 | 0.00 | 0.00 | 3.68 | 8.99 |
| 4 | 4 | 5 | 0.49 | 2.56 | 0.00 | 0.00 | 2.19 | 3.42 |
| 5 | 5 | 6 | 0.25 | 0.56 | 0.00 | 0.00 | 1.09 | 0.94 |
| 6 | 6 | 7 | 0.11 | 0.15 | 0.00 | 0.00 | 0.48 | 0.21 |
| 7 | 8 | 5 | -0.25 | 0.91 | 0.00 | 0.00 | 1.10 | 0.96 |
| 8 | 9 | 8 | 0.06 | 0.06 | 0.00 | 0.00 | 0.26 | 0.07 |
| 9 | 8 | 10 | 0.18 | 0.51 | 0.00 | 0.00 | 0.82 | 0.55 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10 | 11 | 10 | 0.08 | 0.11 | 0.00 | 0.00 | 0.36 | 0.12 |
| 11 | 11 | 12 | 0.02 | 0.01 | 0.00 | 0.00 | 0.08 | 0.01 |
| 12 | 13 | 12 | 0.39 | 5.40 | 0.00 | 0.00 | 1.74 | 2.25 |
| 13 | 14 | 13 | 0.54 | 4.10 | 0.00 | 0.00 | 2.41 | 4.10 |
| 14 | 15 | 14 | 0.88 | 8.98 | 0.00 | 0.00 | 3.90 | 9.98 |
| 15 | 2 | 15 | 1.32 | 2.86 | 0.00 | 0.00 | 2.60 | 2.93 |
| 16 | 2 | 9 | 3.17 | 20.88 | 0.00 | 0.00 | 6.25 | 14.91 |
| 17 | 9 | 11 | 0.17 | 0.46 | 0.00 | 0.00 | 0.77 | 0.49 |
| 18 | 1 | 2 | 5.98 | 7.34 | 0.00 | 0.00 | 4.24 | 3.41 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 210.0 | 0.5 | 89.6 | 416.8 |
| 2 | 175.0 | 0.1 | 101.6 | 409.5 |
| 3 | 170.0 | 0.6 | 102.6 | 406.9 |
| 4 | 160.0 | 0.3 | 100.6 | 392.0 |
| 5 | 140.0 | 0.0 | 108.1 | 389.5 |
| 6 | 125.0 | 0.1 | 114.4 | 388.9 |
| 7 | 110.0 | 0.1 | 120.8 | 388.8 |
| 8 | 135.0 | 0.1 | 109.9 | 388.6 |
| 9 | 145.0 | 2.9 | 105.6 | 388.6 |
| 10 | 125.0 | 0.3 | 114.0 | 388.1 |
| 11 | 140.0 | 0.1 | 107.5 | 388.2 |
| 12 | 130.0 | 0.4 | 111.9 | 388.2 |
| 13 | 140.0 | 0.2 | 109.9 | 393.6 |
| 14 | 160.0 | 0.3 | 103.0 | 397.7 |
| 15 | 175.0 | 0.4 | 100.4 | 406.6 |

THE NET SYSTEM DEMAND = 6.466901
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 6.47 |

THE FOLLOWING CHANGES ARE MADE

JUNCT. NO. DEMAND
GLOBAL DEMAND FACTOR = .5
7 2.988
9 .06

2000 GPM FIRE FLOWRATE AT NODE 7

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 3 - ACCURACY ATTAINED = .001

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 6.47 | 18.15 | 0.00 | 0.00 | 4.59 | 3.95 |
| 2 | 2 | 3 | 2.19 | 5.99 | 0.00 | 0.00 | 4.31 | 7.49 |
| 3 | 3 | 4 | 1.62 | 50.84 | 0.00 | 0.00 | 7.16 | 30.81 |
| 4 | 4 | 5 | 1.28 | 14.97 | 0.00 | 0.00 | 5.66 | 19.96 |
| 5 | 5 | 6 | 3.13 | 62.72 | 0.00 | 0.00 | 13.85 | 104.53 |
| 6 | 6 | 7 | 2.99 | 72.15 | 0.00 | 0.00 | 13.24 | 96.20 |
| 7 | 8 | 5 | 1.85 | 37.50 | 0.00 | 0.00 | 8.19 | 39.47 |
| 8 | 9 | 8 | 1.41 | 22.08 | 0.00 | 0.00 | 6.24 | 23.87 |
| 9 | 8 | 10 | -0.56 | 4.02 | 0.00 | 0.00 | 2.49 | 4.35 |
| 10 | 11 | 10 | 0.83 | 8.26 | 0.00 | 0.00 | 3.67 | 8.93 |
| 11 | 11 | 12 | 0.01 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 |
| 12 | 13 | 12 | 0.40 | 5.68 | 0.00 | 0.00 | 1.79 | 2.37 |
| 13 | 14 | 13 | 0.55 | 4.26 | 0.00 | 0.00 | 2.46 | 4.26 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 14 | 15 | 14 | 0.89 | 9.19 | 0.00 | 0.00 | 3.94 | 10.21 |
| 15 | 2 | 15 | 1.33 | 2.90 | 0.00 | 0.00 | 2.62 | 2.98 |
| 16 | 2 | 9 | 2.38 | 12.23 | 0.00 | 0.00 | 4.68 | 8.73 |
| 17 | 9 | 11 | 0.91 | 9.80 | 0.00 | 0.00 | 4.02 | 10.59 |
| 18 | 1 | 2 | 5.98 | 7.34 | 0.00 | 0.00 | 4.24 | 3.41 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 210.0 | 0.5 | 89.6 | 416.8 |
| 2 | 175.0 | 0.1 | 101.6 | 409.5 |
| 3 | 170.0 | 0.6 | 101.2 | 403.5 |
| 4 | 160.0 | 0.3 | 83.5 | 352.7 |
| 5 | 140.0 | 0.0 | 85.7 | 337.7 |
| 6 | 125.0 | 0.1 | 65.0 | 275.0 |
| 7 | 110.0 | 3.0 | 40.2 | 202.8 |
| 8 | 135.0 | 0.1 | 104.1 | 375.2 |
| 9 | 145.0 | 0.1 | 109.3 | 397.3 |
| 10 | 125.0 | 0.3 | 110.2 | 379.2 |
| 11 | 140.0 | 0.1 | 107.2 | 387.5 |
| 12 | 130.0 | 0.4 | 111.6 | 387.5 |
| 13 | 140.0 | 0.2 | 109.7 | 393.2 |
| 14 | 160.0 | 0.3 | 102.9 | 397.4 |
| 15 | 175.0 | 0.4 | 100.4 | 406.6 |

THE NET SYSTEM DEMAND = 6.466901
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 6.47 |

******* END OF THIS SIMULATION *******

**Exhibit 2**

**Hydraulic Analysis of the 228-Foot Service Zone**

*** UNIVERSITY OF KENTUCKY PIPE NETWORK ANALYSIS PROGRAM - 1985 VERSION ***
RESULTS TO OUTPUT FILE

INPUT DATA FILE NAME FOR THIS SIMULATION = SCH228.DAT
OUTPUT DATA FILE NAME FOR THIS SIMULATION = SCH228.OUT

NUMBER OF PIPES = 8
NUMBER OF JUNCTION NODES = 7
FLOW UNITS = MILLION GALLONS / DAY
PRESSURE UNITS = PSI

**** SUMMARY OF INPUT DATA ***

| PIPE NO. | NODE #1 | NODE #2 | LENGTH (FT.) | DIAM. (IN.) | HW-C VALUE | SUM-M FACT. | PUMP TYPE | FGN GRADE |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 8350.0 | 20.0 | 120.0 | 0.0 | 0.0 | 223.0 |
| 2 | 1 | 2 | 650.0 | 16.0 | 120.0 | 0.0 | 0.0 | |
| 3 | 2 | 3 | 1200.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 4 | 3 | 4 | 350.0 | 12.0 | 110.0 | 0.0 | 0.0 | |
| 5 | 4 | 5 | 1700.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 6 | 5 | 6 | 900.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 7 | 7 | 6 | 950.0 | 8.0 | 110.0 | 0.0 | 0.0 | |
| 8 | 2 | 7 | 950.0 | 12.0 | 110.0 | 0.0 | 0.0 | |

| JUNCT. NO. | DEMAND | ELEVATION |
|---|---|---|
| 1 | 0.0 | 100.0 |
| 2 | 0.9 | 110.0 |
| 3 | 0.4 | 95.0 |
| 4 | 0.8 | 102.0 |
| 5 | 0.2 | 77.0 |
| 6 | 0.9 | 80.0 |
| 7 | 0.9 | 95.0 |

PEAK FLOWRATE

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 3 - ACCURACY ATTAINED = .0027

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 4.01 | 13.60 | 0.00 | 0.00 | 2.84 | 1.63 |
| 2 | 1 | 2 | 4.01 | 3.14 | 0.00 | 0.00 | 4.44 | 4.83 |
| 3 | 2 | 3 | 1.56 | 4.81 | 0.00 | 0.00 | 3.07 | 4.01 |
| 4 | 3 | 4 | 1.14 | 0.78 | 0.00 | 0.00 | 2.24 | 2.24 |
| 5 | 4 | 5 | 0.39 | 3.71 | 0.00 | 0.00 | 1.71 | 2.18 |
| 6 | 5 | 6 | 0.19 | 0.55 | 0.00 | 0.00 | 0.86 | 0.61 |
| 7 | 7 | 6 | 0.69 | 6.01 | 0.00 | 0.00 | 3.05 | 6.32 |
| 8 | 2 | 7 | 1.57 | 3.85 | 0.00 | 0.00 | 3.09 | 4.05 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 100.0 | 0.0 | 47.4 | 209.4 |
| 2 | 110.0 | 0.9 | 41.7 | 206.3 |
| 3 | 95.0 | 0.4 | 46.1 | 201.4 |
| 4 | 102.0 | 0.8 | 42.8 | 200.7 |
| 5 | 77.0 | 0.2 | 52.0 | 197.0 |
| 6 | 80.0 | 0.9 | 50.4 | 196.4 |
| 7 | 95.0 | 0.9 | 46.5 | 202.4 |

THE NET SYSTEM DEMAND = 4.0108
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 4.01 |

THE FOLLOWING CHANGES ARE MADE

2000 GPM FIRE FLOWRATE AT NODE 5

| JUNCT. NO. | DEMAND |
|---|---|
| 5 | 2.976 |

GLOBAL DEMAND FACTOR = .5

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 2 - ACCURACY ATTAINED = .0001

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 4.89 | 19.60 | 0.00 | 0.00 | 3.46 | 2.35 |
| 2 | 1 | 2 | 4.89 | 4.52 | 0.00 | 0.00 | 5.41 | 6.96 |
| 3 | 2 | 3 | 2.20 | 9.09 | 0.00 | 0.00 | 4.33 | 7.58 |
| 4 | 3 | 4 | 1.99 | 2.20 | 0.00 | 0.00 | 3.92 | 6.29 |
| 5 | 4 | 5 | 1.61 | 52.25 | 0.00 | 0.00 | 7.15 | 30.74 |
| 6 | 5 | 6 | -1.36 | 20.21 | 0.00 | 0.00 | 6.04 | 22.46 |
| 7 | 7 | 6 | 1.80 | 35.87 | 0.00 | 0.00 | 7.99 | 37.75 |
| 8 | 2 | 7 | 2.24 | 7.47 | 0.00 | 0.00 | 4.42 | 7.86 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 100.0 | 0.0 | 44.8 | 203.4 |
| 2 | 110.0 | 0.4 | 38.5 | 198.9 |
| 3 | 95.0 | 0.2 | 41.1 | 189.8 |
| 4 | 102.0 | 0.4 | 37.1 | 187.6 |
| 5 | 77.0 | 3.0 | 25.3 | 135.3 |
| 6 | 80.0 | 0.4 | 32.7 | 155.5 |
| 7 | 95.0 | 0.4 | 41.8 | 191.4 |

THE NET SYSTEM DEMAND = 4.8854
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 4.89 |

THE FOLLOWING CHANGES ARE MADE

1500 GPM FIRE FLOWRATE AT NODE 3

| JUNCT. NO. | DEMAND |
|---|---|
| 5 | .096 |
| 3 | 2.3704 |

GLOBAL DEMAND FACTOR = .5

**** THE RESULTS FOR THIS SIMULATION FOLLOW ****

NO. OF TRIALS = 4 - ACCURACY ATTAINED = .0012

| PIPE NO. | NODE #1 | NODE #2 | FLOW RATE | HEAD LOSS | MINOR LOSS | PUMP HEAD | LINE VELOCITY | HL 1000 |
|---|---|---|---|---|---|---|---|---|
| 1 | 0 | 1 | 4.17 | 14.59 | 0.00 | 0.00 | 2.95 | 1.75 |
| 2 | 1 | 2 | 4.17 | 3.37 | 0.00 | 0.00 | 4.62 | 5.18 |
| 3 | 2 | 3 | 2.53 | 11.82 | 0.00 | 0.00 | 4.99 | 9.85 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4 | 3 | 4 | 0.16 | 0.02 | 0.00 | 0.00 | 0.32 | 0.06 |
| 5 | 4 | 5 | -0.21 | 1.21 | 0.00 | 0.00 | 0.94 | 0.71 |
| 6 | 5 | 6 | -0.31 | 1.28 | 0.00 | 0.00 | 1.36 | 1.43 |
| 7 | 7 | 6 | 0.75 | 7.04 | 0.00 | 0.00 | 3.32 | 7.41 |
| 8 | 2 | 7 | 1.19 | 2.30 | 0.00 | 0.00 | 2.34 | 2.43 |

| JUNCTION NO. | ELEVATION (FT.) | DEMAND | PRESSURE (PSI) | HYDRAULIC GRADE |
|---|---|---|---|---|
| 1 | 100.0 | 0.0 | 47.0 | 208.4 |
| 2 | 110.0 | 0.4 | 41.2 | 205.0 |
| 3 | 95.0 | 2.4 | 42.6 | 193.2 |
| 4 | 102.0 | 0.4 | 39.5 | 193.2 |
| 5 | 77.0 | 0.1 | 50.9 | 194.4 |
| 6 | 80.0 | 0.4 | 50.1 | 195.7 |
| 7 | 95.0 | 0.4 | 46.7 | 202.7 |

THE NET SYSTEM DEMAND = 4.1654
SUMMARY OF INFLOWS(+) AND OUTFLOWS(-)

| PIPE NO. | FLOW |
|---|---|
| 1 | 4.17 |

******* END OF THIS SIMULATION *******

# K

## Traffic Impact Assessment Report for East Kapolei Project, October 1994;
## Updated Traffic Impact Assessment Report for East Kapolei Project, December 11, 1995

Pacific Planning and Engineering, Inc.

# TRAFFIC IMPACT ASSESSMENT REPORT

# FOR

# EAST KAPOLEI PROJECT

17 October 1994

Honolulu, Oahu, Hawaii

Prepared for:

Schuler Homes, Inc. and Hawaiian Trust Co., Ltd.

Prepared By:

Pacific Planning & Engineering, Inc.
1221 Kapiolani Boulevard, Suite 6D
Honolulu, Hawaii 96814

## FOREWORD

The traffic forecasts shown within this report's figures and tables are the direct result of Pacific Planning & Engineering, Inc.'s proprietary analytical tools. For report editing and review purposes, the forecast values have been rounded to the nearest five vehicles from our mathematical results, although we do not imply this level of accuracy can exist in any forecast method. The rounded values, however, reasonably quantify the forecasted traffic volumes for the purposes of this study.

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# EXECUTIVE SUMMARY

Pacific Planning & Engineering, Inc. (PPE) was engaged to undertake a study to identify and assess future traffic impacts caused by the proposed East Kapolei Project.

This report describes the methodology and guidelines used to address the above concerns and presents the findings and recommendations from the study.

## Project Description

Schuler Homes, Inc. and Hawaiian Trust Co., Ltd. are proposing to construct the East Kapolei Project in Honolulu, Oahu, Hawaii.

The project is divided into two phases. The first phase includes development of 500 acres by year 2005, and the second phase 522 acres by year 2011. The project is located west of Fort Weaver Road in Ewa, south of existing Farrington Highway, and just east of the proposed North-South Road. The area is currently agricultural, with no existing traffic. The table below summarizes the proposed land uses by phase.

Vehicular access to the Project will be provided by three intersections. The first intersection will be located on Farrington Highway when a major spine road is constructed. Two other intersections will be connected to the proposed North-South Road at points serving the proposed University site forming four-legged intersections. Direct connection to Fort Weaver Road was discouraged by the State Highways Division due to the traffic conditions on that roadway.

Table 1. Land Use Summary (Acres)

| Land Use | Phase 1 | Phase 2 | Total |
|---|---|---|---|
| Residential | 458 | 490 | 948 |
| Commercial | 10 | 10 | 20 |
| School | 12 | 0 | 12 |
| Parks | 10 | 10 | 20 |
| Circulation | 10 | 12 | 22 |
| Total | 500 | 522 | 1,022 |

## Study Methodology

This Report identifies and describes the probable impact of the traffic generated by the proposed development in the year 2005 and 2011 when the project is expected to be completed in two phases. The analysis primarily focuses on the following intersections:

- Farrington Highway and Project Spine Road
- Proposed North-South Road at Secondary Project Road
- Proposed North-South Road at Project Spine Road
- Ramps at H-1 Interchange with Proposed North-South Road

Traffic was forecasted for the years 2005 and 2011 at the study intersections and ramps by:

- adjusting trips for current development absorption rates as calculated based on the City Planning Department preliminary population estimates[1] for areas within the Ewa region,
- updating land uses and roadway plans for 2005 and 2010 prepared for

[1] Draft values for possible adoption in the OMPO planning process. The process is undergoing updating of models and plans. This study and results are intended solely for assessing the traffic impact on relevant roadways by the East Kapolei Project. Forecast values are not intended as a substitute for the formal OMPO planning results.

the Ewa Region Highway Master Plan,

- preparing aggregated zonal trip tables for the years 2005 and 2011 for the morning and afternoon peak hours,
- estimating traffic assignments to study roadways and balancing volumes for capacity restraints,
- forecast traffic generated by the proposed commercial project, University, High School and housing development of the Department of Hawaiian Home Lands,
- estimating traffic generated by the project and assigning traffic to the study roadways, and
- adding the traffic forecasts for the project and other developments.

The Report describes the impacts on each study roadway segment by the *level-of-service* (LOS) and *capacity levels* for years 2005 and 2011 traffic conditions "without project" and years 2005 and 2011 traffic conditions "with" Project.

## Conclusions & Recommendations

The results of the traffic operations analysis indicate that the proposed East Kapolei Project will significantly change the traffic flow quality at the study intersections when the project is completed in two phases. Major road improvements have already been identified in the Ewa Region Highway Master Plan and adopted by the Oahu Metropolitan Planning Organization (OMPO). These improvements are assumed as part of the roadway network in 2005 and 2011 in the assessment of the traffic impacts.

For the year 2005 (Phase 1), in order to minimize the impact of the project and provide for smoother traffic operating conditions, we recommend the following:

- Two left-turn lanes northbound exiting the project driveway onto Farrington Highway.
- Two left-turn lanes westbound at the intersection of Farrington Highway and the North-South Road.
- Addition of an extra through lane from about 1000' west of the intersection of Farrington Highway and the North-South Road to Project Driveway C, east of the intersection.
- A project connection to the North-South Road would relieve traffic at other intersections. If a connection is made, the two-left-turn lanes at the intersections of Farrington Highway with the North-South Road and Project Driveway C may not be required to handle makai-bound traffic volumes. However, makai-bound traffic would shift to the North-South Road connection and thus this intersection would require two left turn lanes exiting the project.

For the year 2011 (Phase 2), mitigative measures to the study intersections would be more involved because of the level of traffic volumes during the peak hours.

The possibility of a grade separation at the intersection of Farrington Highway and the North-South Road would increase capacity through the area. However, alternate methods of transportation actions should be investigated. A comprehensive plan that includes both Transportation System Management and Transportation Demand Management concepts should be developed for the area which would include the Project. The future traffic levels have regional sources that are undergoing current development. Integrated transit services, roadway plans and construction schedules, computer controlled traffic lights, remote parking areas, shuttle services, paratransit, bicycle and pedestrian ways, and some form of exclusive way transit should be considered in a comprehensive plan. Beyond transportation actions, the need for integrated land use planning

for all the major parcels will aid in reducing the need for vehicle trips.

From a planning perspective, OMPO's current efforts to update its Long Range Plan will institute new population and traffic forecast values for the Ewa Region. The results reported herein pertain specifically to the East Kapolei Project in addition to current preliminary population estimates. This assessment approach is conservative in that the impact is greater than would be expected, as population exceeds what is set forth in preliminary figures. The OMPO's new region-wide forecasts will likely result in less impacts and roadway needs than indicated herein due to smaller values of population. A major roadway needs study is needed to update the previous study for the Ewa Region.

An example of a potentially major change that should be included in the update study is the final version of the BPNAS Reuse Plan. This and other major land use proposals in the Ewa Region should be evaluated for traffic impact on a region-wide basis, and their mitigating actions included in the afore-mentioned comprehensive transportation plan. Thus, 2011 (Phase 2) impacts should be re-evaluated when those forecasts are available, and a plan be developed that not only addresses highway projects but land use planning (to obviate the need for vehicle trips) transit, and other modes and services as well.

## PROJECT DESCRIPTION

Schuler Homes, Inc. and Hawaiian Trust Co., Ltd. are proposing to construct the East Kapolei Project in Ewa, Oahu. Figure 1 shows the project location and roadway network in the vicinity.

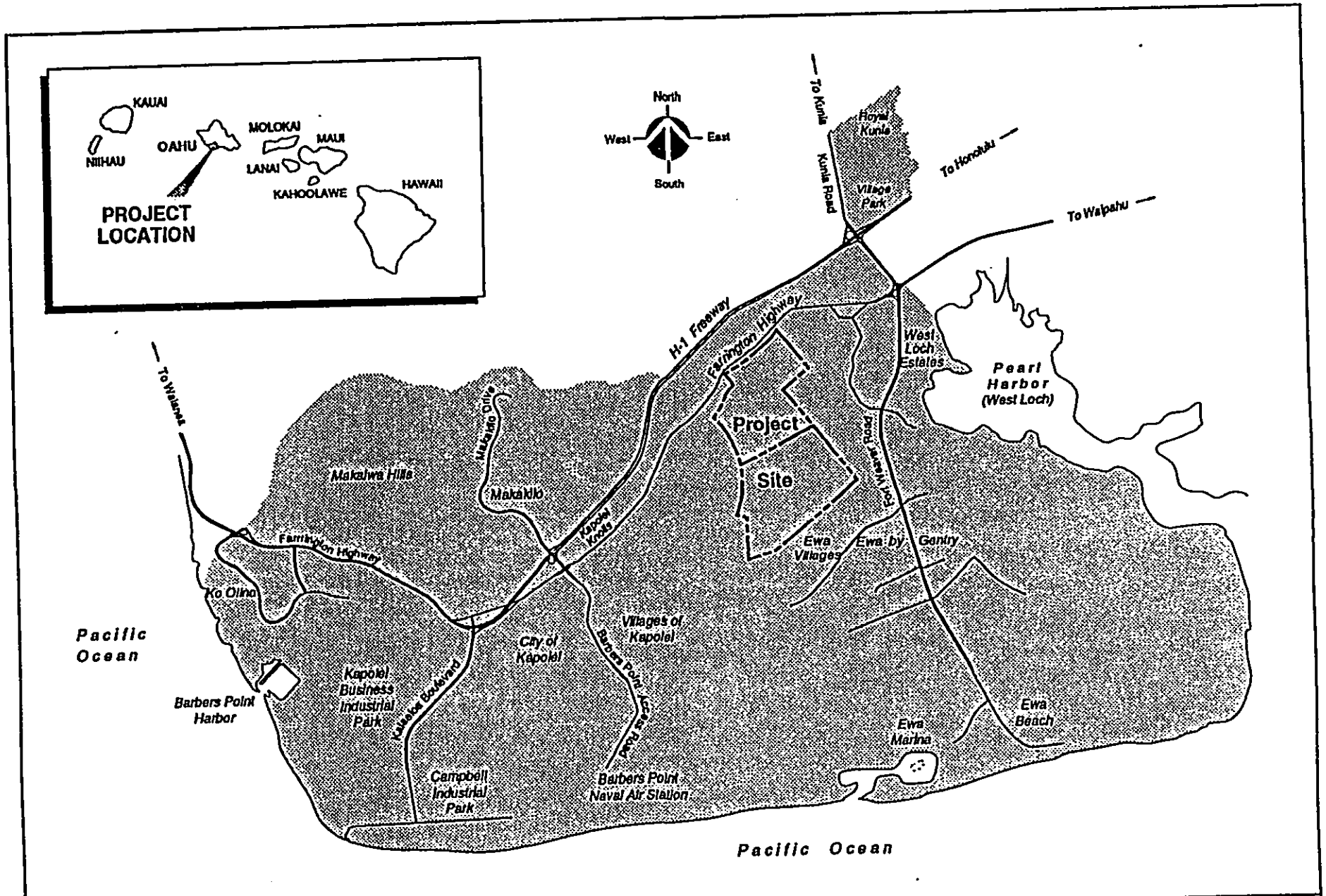
### Project Land Uses

The project is divided into two phases. The first phase includes development of 500 acres by year 2005, and the second phase 522 acres by year 2011. The project is located west of Fort Weaver Road in Ewa, south of existing Farrington Highway, and just east of the proposed North-South Road. The area is currently agricultural, with no existing traffic. Table 2 below summarizes the proposed land uses by phase. Figure 2 shows the Project Site Plan.

**Table 2. Land Use Summary (Acres)**

| Land Use | Phase 1 | Phase 2 | Total |
|---|---|---|---|
| Residential | 458 | 490 | 948 |
| Commercial | 10 | 10 | 20 |
| School | 12 | 0 | 12 |
| Parks | 10 | 10 | 20 |
| Circulation | 10 | 12 | 22 |
| Total | 500 | 522 | 1,022 |

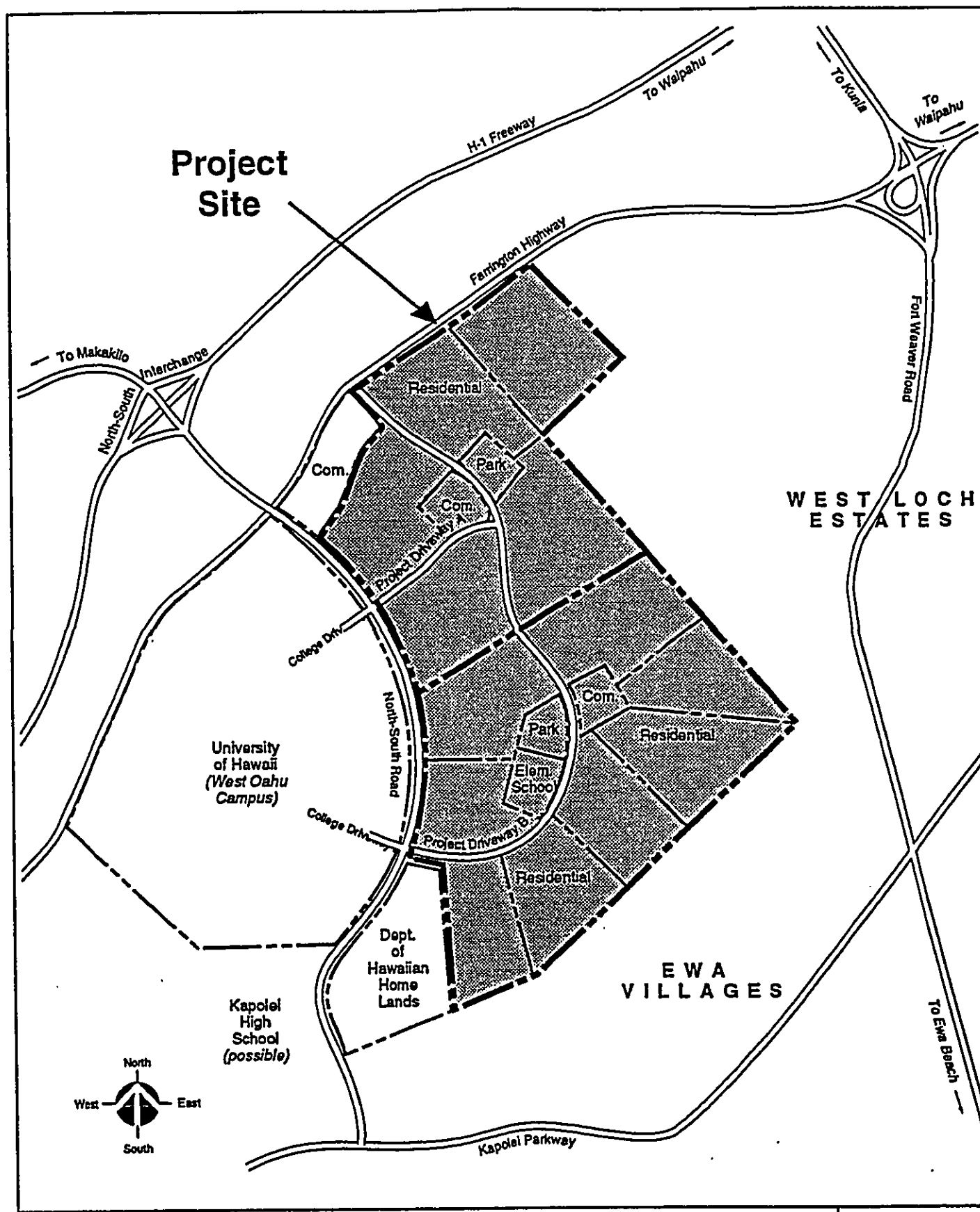
Vehicular access to the Project will be provided by three intersections. The first intersection will be located on Farrington Highway when a major spine road is constructed. The other two intersections will be connected to the proposed North-South Road at points serving the proposed University site forming four-legged intersections.




PACIFIC PLANNING & ENGINEERING, INC

**Project Location Map**

**Figure 1**

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**Project Site Plan**

**Figure 2**

# EXISTING CONDITIONS

## Land Uses

The existing land is in agriculture. There are no vehicle trips generated in the project site.

## Roadway Facilities

The site is currently served by Farrington Highway, a two-lane highway connecting Waipahu and Kapolei. Just north of Farrington Highway, H-1 freeway serves major east-west traffic demand.

## Traffic Conditions

Existing conditions are not relevant for estimating the potential traffic impact of the proposed project since the Ewa region itself is planned for major growth in population and infrastructure. These changes by Years 2005 and 2011 will form the bases of the analysis for the "without project" scenario.

## FUTURE CONDITIONS

The future conditions were based on the current schedule of proposed developments in the Ewa Region. Research of planned developments and improvements to transportation facilities was conducted to estimate future traffic conditions at the study road segments. Adjustments were made to previously calculated trip tables for the Ewa Region highway study to update the vehicle trips during the morning and afternoon peak hours in the years 2005 and 2011.

Year 2011 trips were derived by interpolation of most current Planning Department estimates for year 2010 and 2020. These population forecasts are preliminary and are used to reflect the current planning approach to include recent historical trends in absorption rates. While these estimates are used in this study, the forecasts are intended solely for deriving traffic impacts for the East Kapolei project and are not meant to be used for other regional forecast analysis.

### Land Uses

In deriving the 2005 trip table, the Ewa region land uses (i.e. housing and employment) for the projects included in the Ewa Region highway study were based on the individual developer projections of land uses and completion schedules and adjusted for the planning department estimates. Estimates of *existing* land uses were based on available data. These land uses were updated for this traffic study.

The Planning Department land use forecasts and HALI 2005 traffic forecasts include construction employment and work trips. To maintain consistency with these forecasts, construction jobs are added to employment

estimates of the Ewa developers for the Master Plan area.

The land use data for existing areas, such as Barbers Point Naval Air Station (BPNAS), Honokai Hale, Nanakai Gardens, Ewa Beach and Iroquois Point, were based on various sources, including planning department estimates, tax maps and other research. However, the land use information obtained for these areas, especially the military bases, was difficult to confirm and could not be as detailed as the developer land use projections. Current plans for the reuse of BPNAS are still in development and no special adjustment was made to existing forecasts.

Projects which are handled separately are:

- commercial development of about 27 acres,
- University of Hawaii, located directly across of the Project and on the west side of the proposed North-South Road,
- Kapolei High School[2] (originally sited at Kapolei Villages), and
- Department of Hawaiian Home Lands (DHHL) project.

The commercial development was not included in the Ewa Region highway study. Traffic from this development is assumed to occur by 2005. The University is currently in initial planning stages and traffic forecasts are very preliminary in nature. The high school might not be located in the immediate area, since DOE is also in its early stages of reviewing the project. Similarly, the DHHL project is still in its earliest stages of planning. It is unclear as to when and how much of the above project's will actually be developed. However, for the purposes of this impact study, they are all included as being developed and operating.

[2] While the State Department of Education has not made an official decision to site the high school in this specific area, current proposals include this location. For analysis purposes, the high school is included to ensure a conservative estimate of traffic volumes on the study roadways.

## Roadway Facilities

The road network for the years 2005 and 2011 in the immediate area are shown in Figure 3 and 4, respectively. The major road changes planned in the Project area will include the following.

### North-South Road

The four-lane North-South Road provides an alternative route to/from the H-1 Freeway for the projects along the Fort Weaver Road corridor. With its link to Farrington Highway and Kapolei Parkway, the North-South Road would also serve to connect Ewa Beach and new residential projects in this vicinity with the employment in the Kapolei area.

### North-South Interchange

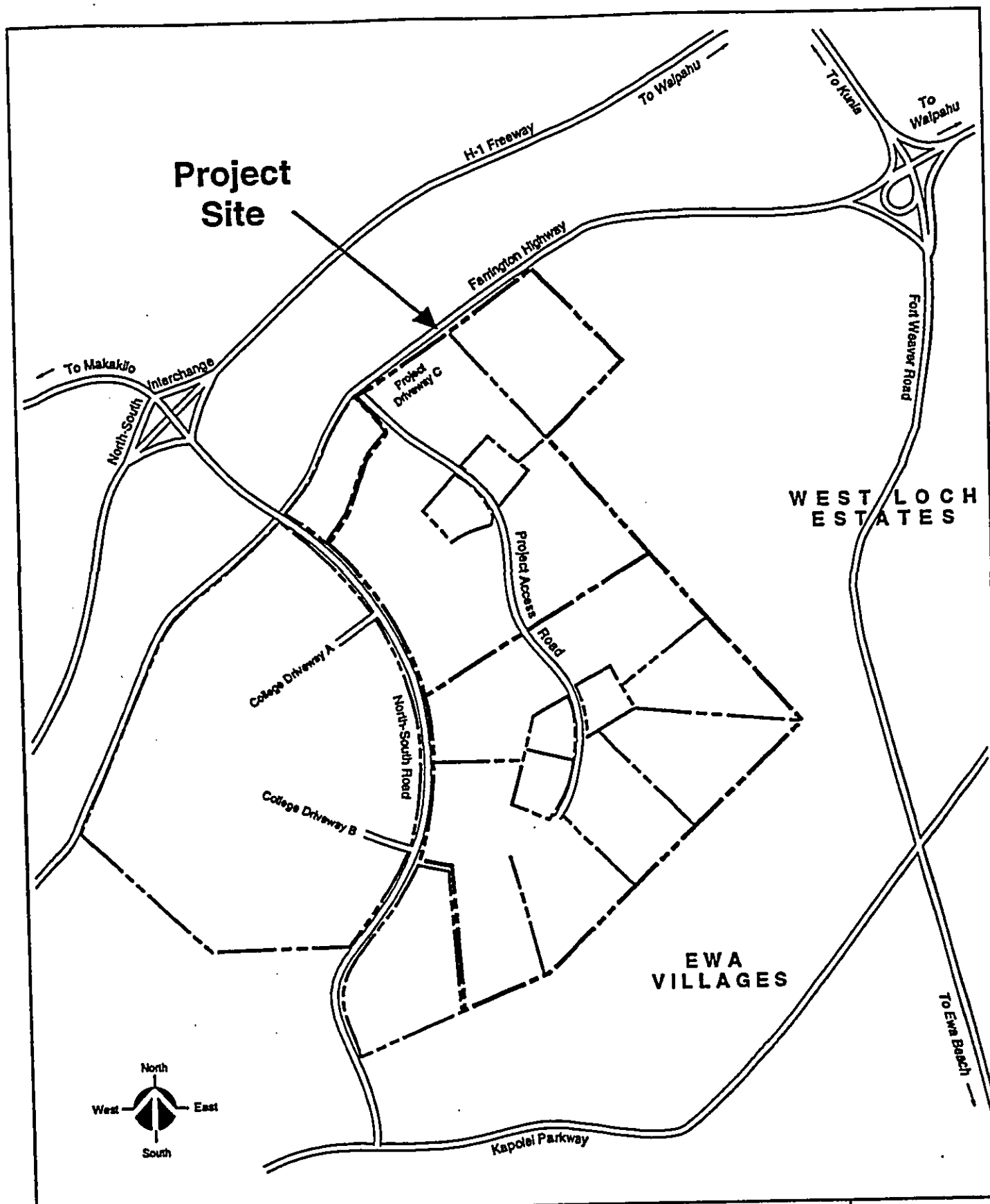
Along with the North-South Road, the new North-South Interchange with H-1 freeway will improve access to several areas within the Ewa region. The North-South Road will provide an alternative route to the Fort Weaver Road corridor and the H-1 Freeway. The North-South Interchange will also serve as a secondary access to the Makakilo development, the Villages of Kapolei, and the City of Kapolei.

### Farrington Highway

Farrington Highway, between Barbers Point Access Road and the access to Kapolei Knolls and the Villages of Kapolei, would be widened to provide two travel lanes in each direction with a median turning lane. The widening would increase the capacity of this roadway to accommodate the new developments in this area.

Kapolei Parkway

The proposed four- and six-lane Kapolei Parkway provides a new east-west link in the Ewa region between Kalaeloa Boulevard and the North-South Road; this roadway provides additional capacity for vehicles travelling between the residential areas in the east and the employment areas in the west. The provision of Kapolei Parkway will divert traffic that would otherwise need to travel on Farrington Highway or the H-1 Freeway. While this roadway is not a study segment, it is described here since it will be a new facility that will carry a significant amount of regional traffic.

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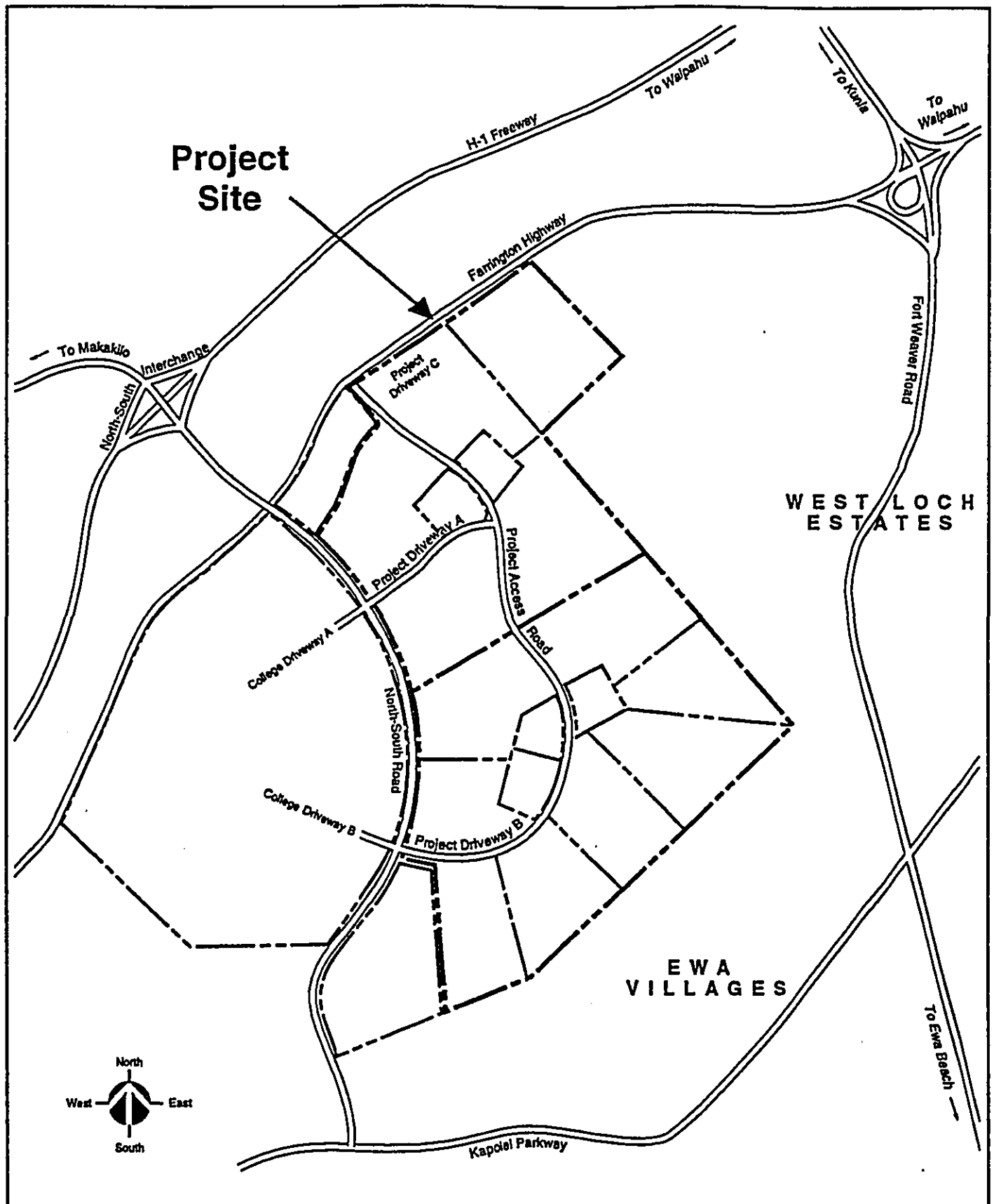
**2005 Roadway Network**

**Figure 3**

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**2011 Roadway Network**

**Figure 4**

## PROJECTED TRAFFIC CONDITIONS

Future traffic was forecasted for the "without project" and "with project" conditions. Traffic forecasts were developed for the years 2005 and 2011 when the project is expected to be completed in two phases. As can be seen, the roads and therefore, the traffic volume distribution throughout the area will bear little relationship to existing patterns.

### Future Traffic Without Project

This component of the future traffic might be considered as the ambient traffic volumes. Future traffic is estimated by identifying all other land uses and forecasting traffic from those land uses.

In total, traffic was forecasted for the years 2005 and 2011 at the study intersections and ramps by:

- updating land uses and roadway plans for 2005 and 2010 prepared for the Ewa Region Highway Master Plan,
- adjusting trips forecasted by the Ewa Region Highway study for current development absorption rates as calculated based on the City Planning Department preliminary population estimates[3] for areas within the Ewa region,
- preparing aggregated zonal trip tables for the years 2005 and 2011 for the morning and afternoon peak hours,
- estimating traffic assignments to study roadways and balancing volumes for capacity restraints,

[3] Draft values for possible adoption in the OMPO planning process. The process is undergoing updating of models and plans. This study and results are intended solely for assessing the traffic impact on relevant roadways by the East Kapolei Project. Forecast values are not intended as a substitute for the formal OMPO planning results.

- forecast traffic generated by the commercial development, proposed University, High School and housing development the Department of Hawaiian Home Lands,
- estimating traffic generated by the project and assigning traffic to the study roadways, and
- adding the traffic forecasts for the project and other developments.

These values are used to calculate the impacts on each study roadway segment by determining the *level-of-service* (LOS) and *capacity levels* for years 2005 and 2011 traffic conditions without project, and years 2005 and 2011 traffic conditions with the Project.

Traffic forecasts are needed in the analysis to determine the LOS for each road segment of interest by specific time periods. The forecasts for the study roadways are shown in the following figures.

Traffic From Other Developments

In addition to the trips from the major project developments in the Ewa and Kunia areas, three major parcel developments adjacent to the East Kapolei Project will occur in the study time frame. For analysis purposes only, these are :

- commercial development of about 27 acres,
- University of Hawaii, located directly across from the Project and on the west side of the proposed North-South Road,
- Kapolei High School[4] (originally sited at Kapolei Villages), and
- Department of Hawaiian Home Lands (DHHL) project.

[4] While the State Department of Education has not made an official decision to site the high school in this specific area, current proposals include this location. For analysis purposes, the high school is included to ensure a conservative estimate of traffic volumes on the study roadways.

The Ewa Region highway study did not include the commercial development and DHHL development. The high school was included in Kapolei Villages. In this analysis, all of the high school traffic and DHHL development are assumed to be directly accessing the study roadways. Trips were deleted from the trip table and manually added on to the roadways for more direct analysis of its effect.

The three-step procedure of trip generation, trip distribution, and traffic assignment was used to estimate peak hour traffic for 2005 and 2011 for these four major parcel uses.

The trip generation step estimates the number of trips which would be generated by the proposed project. The number of trips generated by the projects was estimated based upon trip generation rates, which were obtained from the manual on Trip Generation, by the Institute of Transportation Engineers. Table 3 shows the estimated number of trips generated by the three projects when they are completed.

**Table 3. Trip Generation For Other Adjacent Projects**

| Land Use | Morning | | Afternoon | |
|---|---|---|---|---|
| | Enter | Exit | Enter | Exit |
| University | 437 | 96 | 189 | 462 |
| High School | 470 | 253 | 28 | 47 |
| DHHL Project | 125 | 445 | 479 | 260 |
| Commercial | 149 | 88 | 494 | 494 |

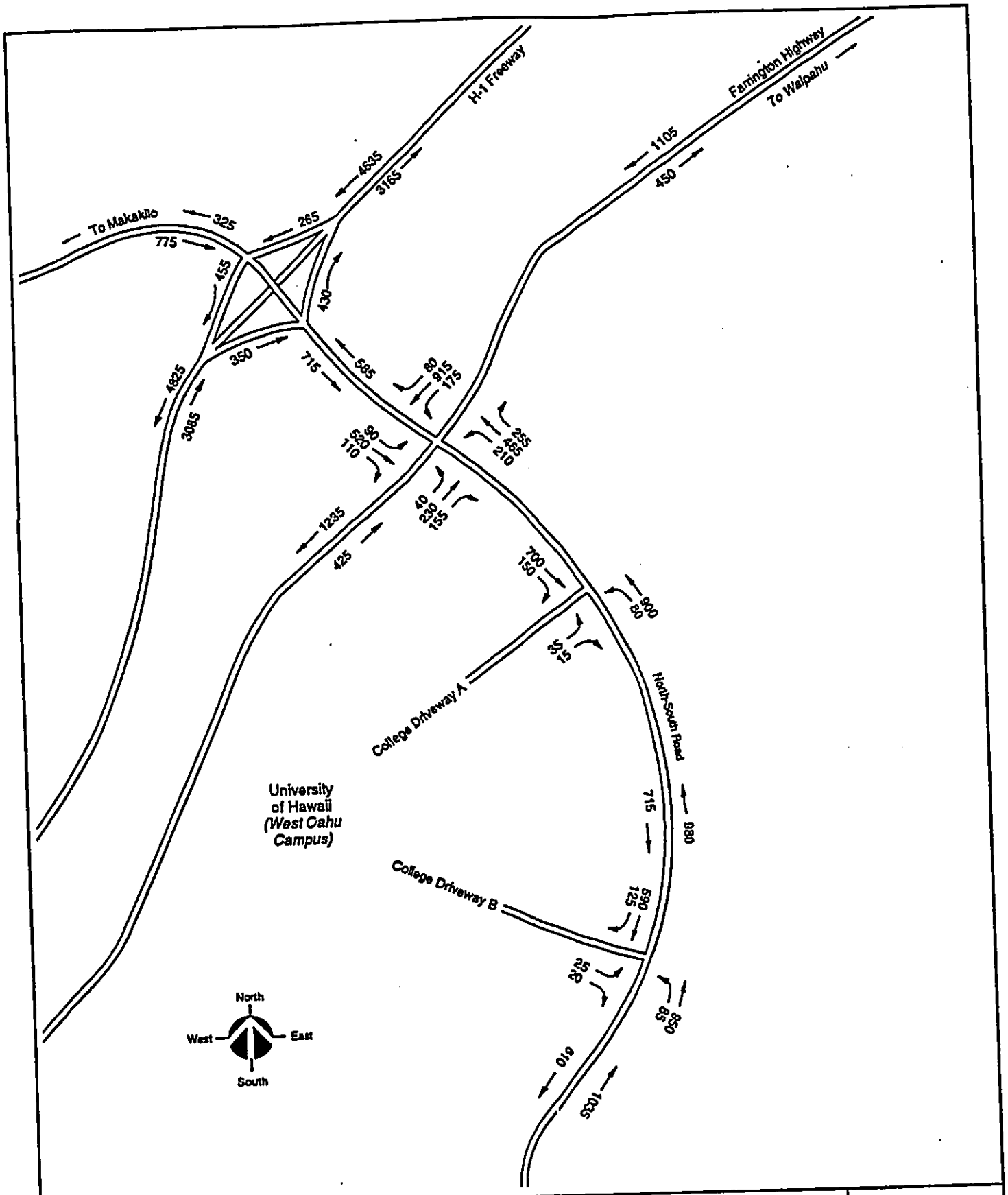
The trip distribution step assigns trips to their expected origins and destinations. Trip distribution for the project was estimated based on development of the Ewa Region as the Second City of Oahu.

The traffic assignment step assign trips to a specific route on the roadway network that will take the driver from origin to destination.

Traffic was assigned based on the estimated shortest path or travel time from origins to destinations.

For Phase I of the Project, Figure 5 displays the forecasts for the morning peak hour in 2005 without the Project. Figure 6 displays the forecasts for the afternoon peak hour in 2005 without the Project.

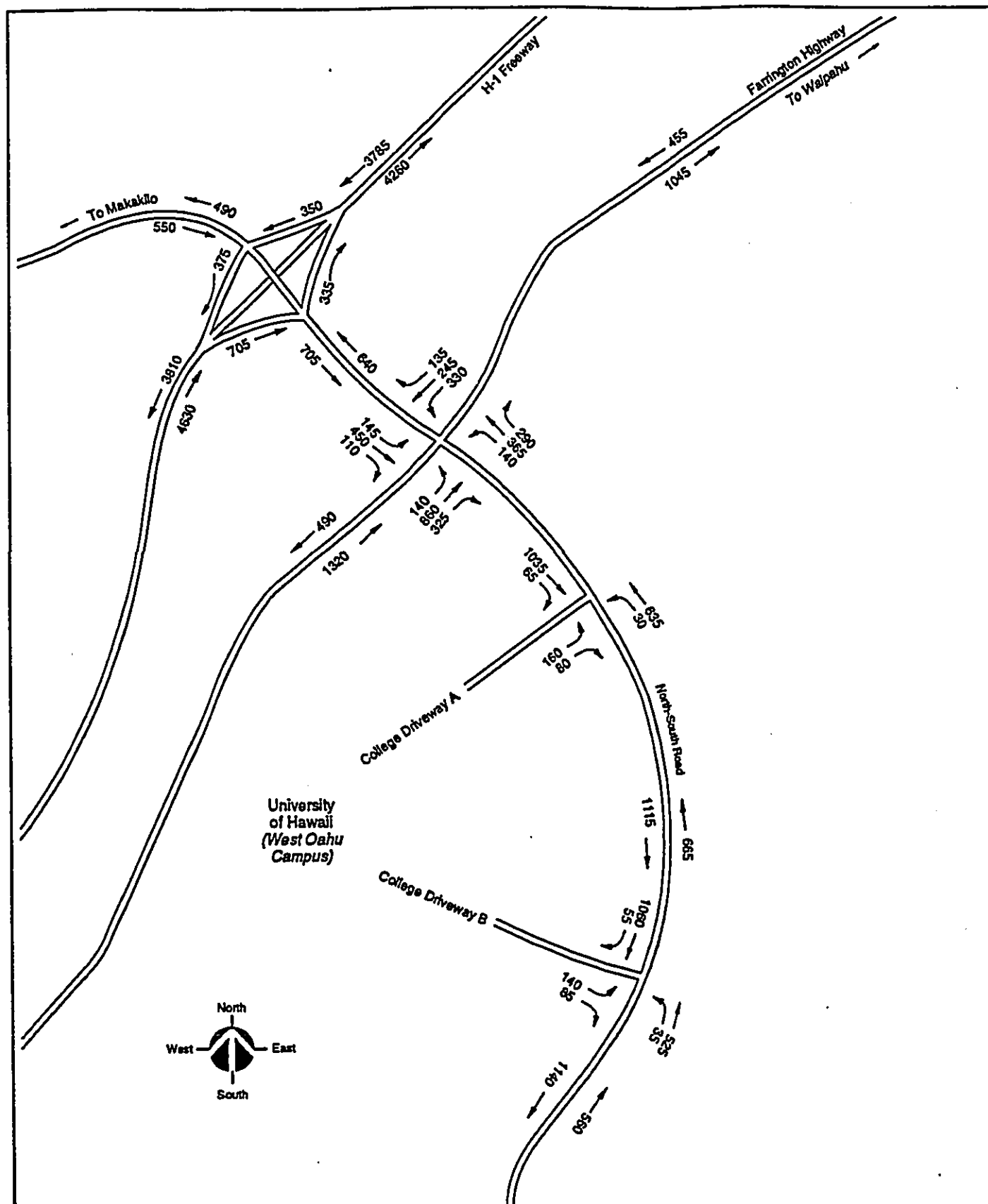
For Phase II of the Project, Figure 7 displays the forecasts for the morning peak hour in 2011 without the Project. Figure 8 displays the forecasts for the afternoon peak hour in 2011 without the Project.




PACIFIC PLANNING & ENGINEERING, INC

**2005 Morning Peak Hour Forecast Traffic Without Project**

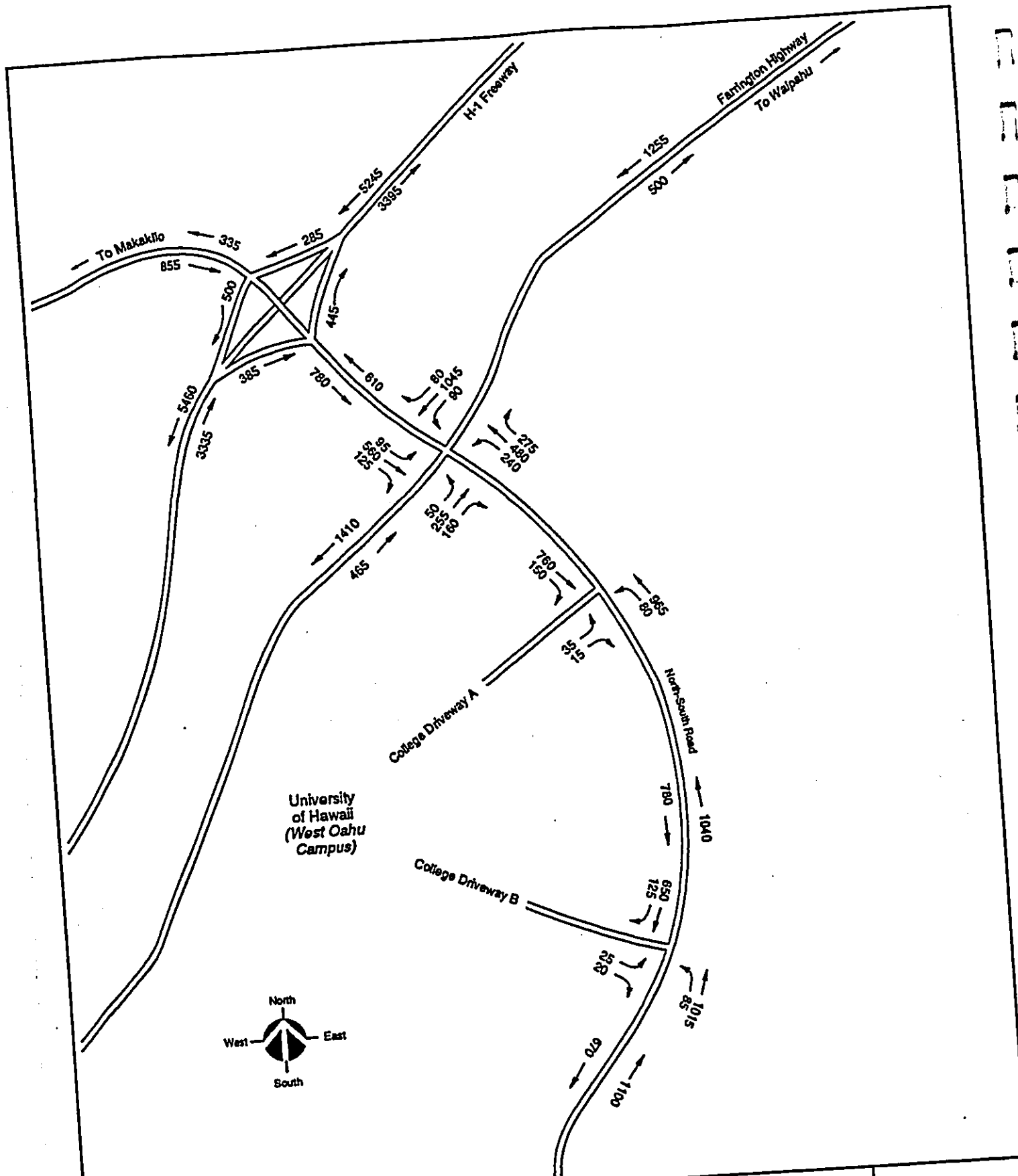
**Figure 5**




PACIFIC PLANNING & ENGINEERING, INC

**2005 Afternoon Peak Hour Forecast Traffic Without Project**

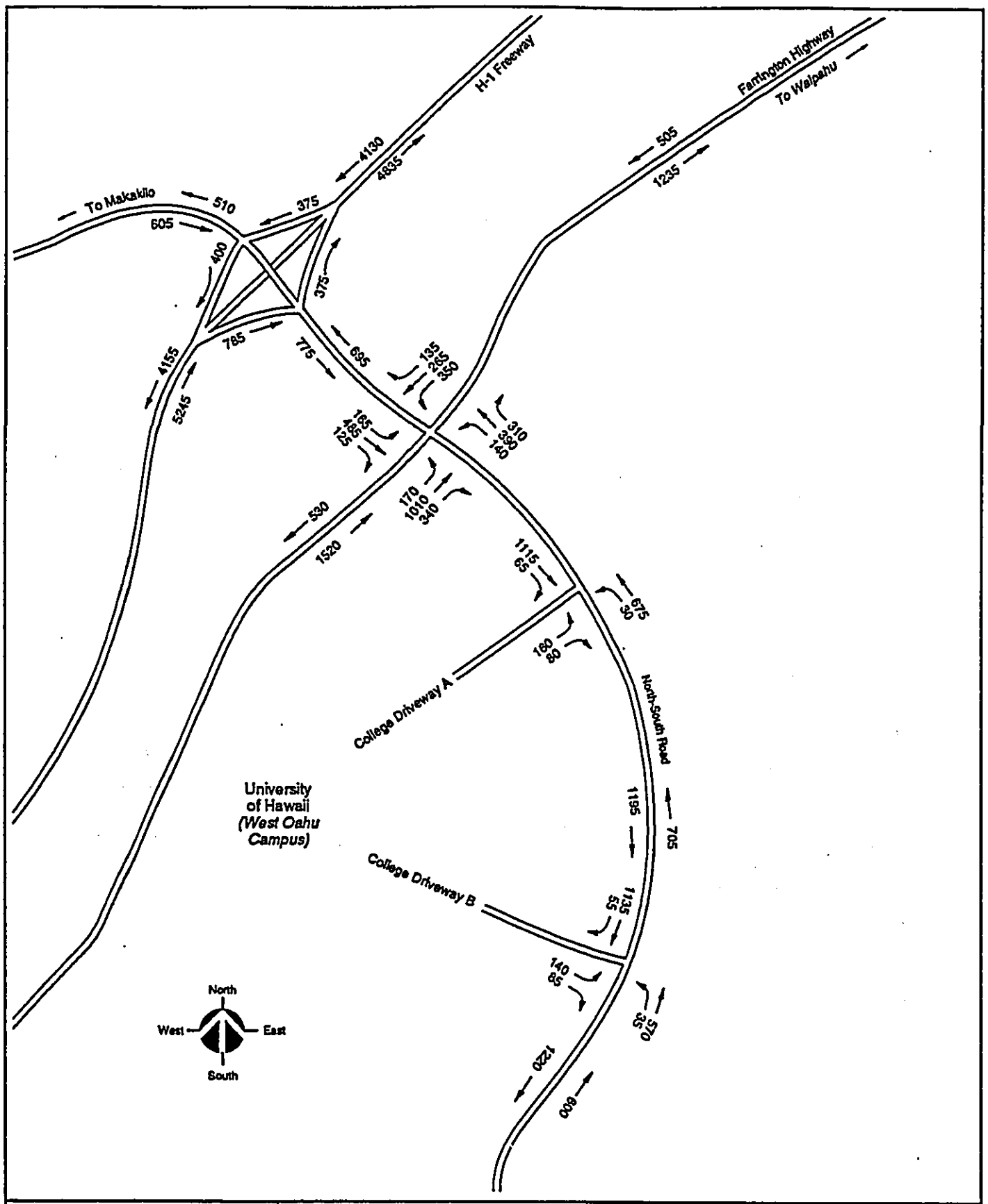
**Figure 6**




PACIFIC PLANNING & ENGINEERING, INC

**2011 Morning Peak Hour Forecast Traffic Without Project**

**Figure 7**




PACIFIC PLANNING & ENGINEERING, INC

**2011 Afternoon Peak Hour Forecast Traffic Without Project**

**Figure 8**

## Future Traffic With Project

Future traffic with the East Kapolei Project included in the land uses is calculated by adding the without project traffic to the traffic generated by the proposed Project. The method of determining the number of vehicle trips assigned to the roadways is described in the following sections.

As in the calculation of vehicle trips from other developments, the Project trip generation step estimates the number of trips generated by the proposed project. This estimate is based on rates obtained from the manual on Trip Generation, by the Institute of Transportation Engineers. Table 4 shows the estimated number of trips generated by the Project for years 2005 and 2011.

**Table 4. 2005 - Trip Generation For East Kapolei Project**

| PHASE 1 (2005) | | | | |
|---|---|---|---|---|
| Land Use | Morning | | Afternoon | |
| | Enter | Exit | Enter | Exit |
| Single Family Homes | 347 | 935 | 1076 | 632 |
| Multi-Family Homes | 181 | 956 | 959 | 472 |
| Elementary School | 110 | 74 | 8 | 8 |
| Commercial | 184 | 79 | 437 | 437 |

| PHASE 2 (2011) | | | | |
|---|---|---|---|---|
| Land Use | Morning | | Afternoon | |
| | Enter | Exit | Enter | Exit |
| Single Family Homes | 755 | 2035 | 2342 | 1375 |
| Multi-Family Homes | 394 | 2081 | 2087 | 1027 |
| Elementary School | 220 | 148 | 16 | 16 |
| Commercial | 268 | 158 | 874 | 874 |

For Phase I (2005) of the Project, Figures 9 and 10 displays the "with Project" forecasts for the morning and afternoon peak hour, respectively.

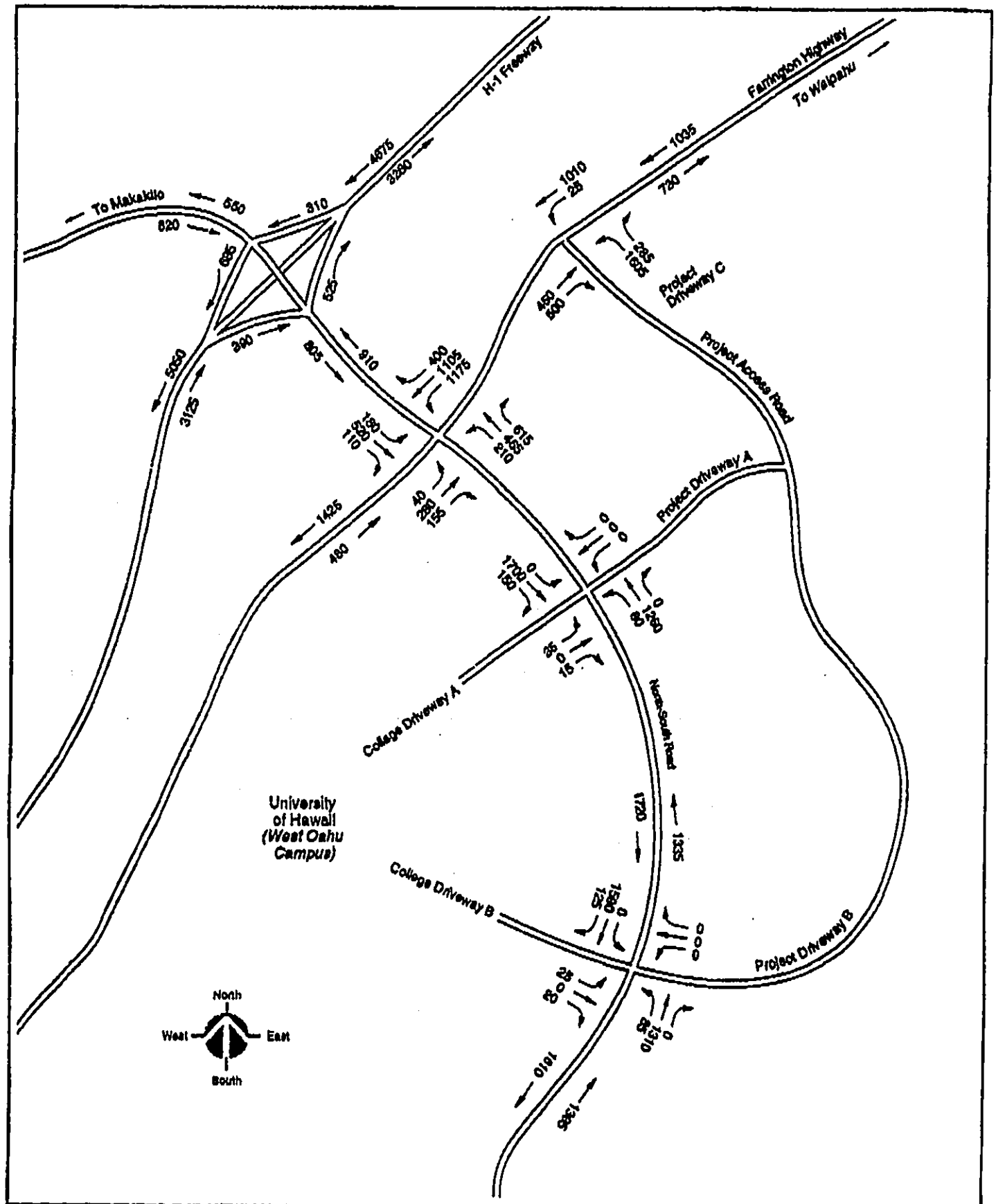
For Phase II (2011) of the Project, Figures 11 and 12 displays the "with Project" forecasts for the morning and afternoon peak hour, respectively.

The trip distribution step assigns trips to their expected origins and destinations. Trip distribution for the project was estimated based on development of the Ewa Region as the Second City of Oahu. The trips were generally distributed as shown in Table 5.

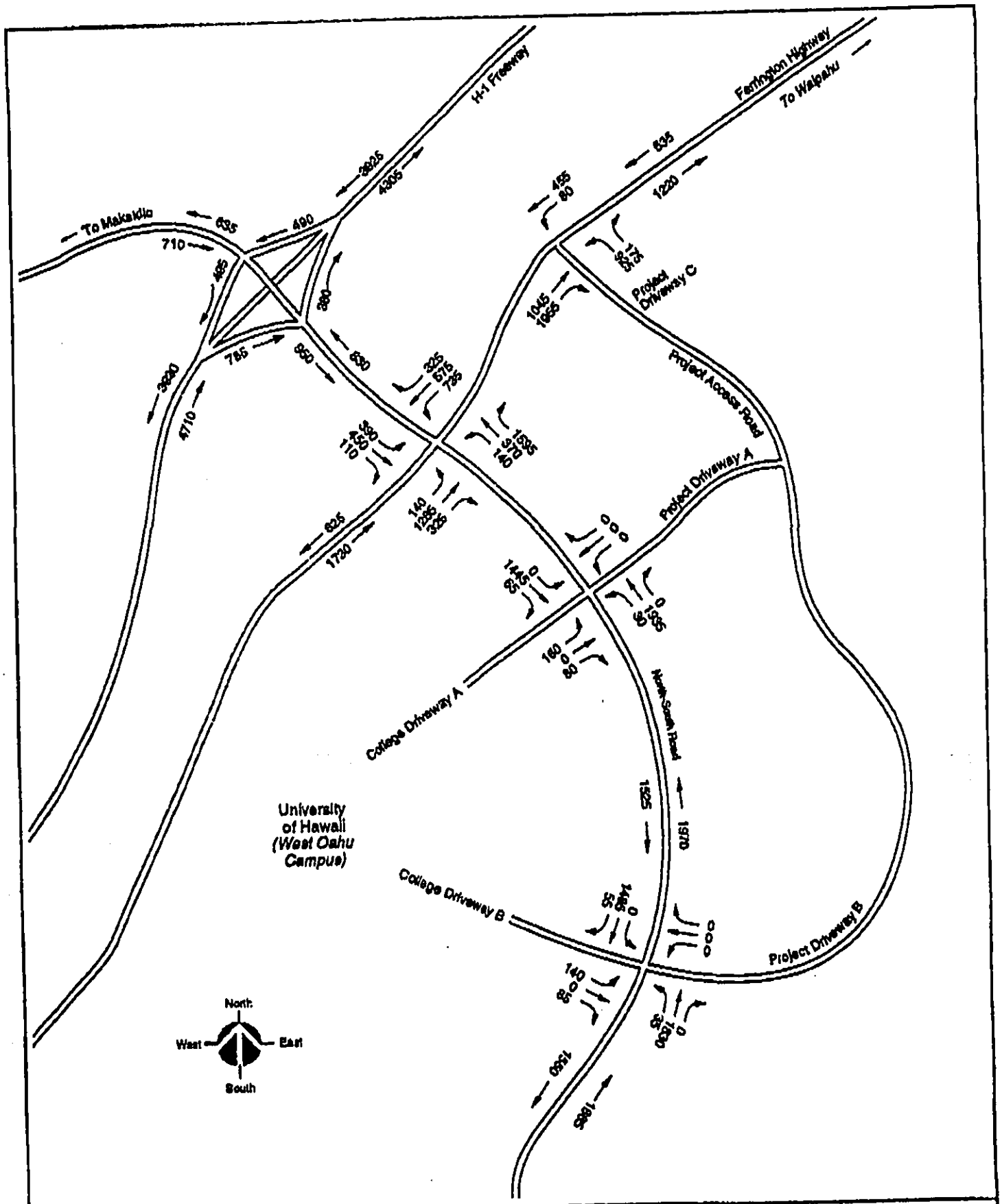
**Table 5. Project Trip Distribution**

| | Morning | | Afternoon | |
|---|---|---|---|---|
| | Enter | Exit | Enter | Exit |
| West of Project | 57 | 72 | 72 | 63 |
| South of Project | 30 | 15 | 18 | 25 |
| East of Project | 11 | 13 | 9 | 10 |
| North of Project | 2 | 0 | 1 | 2 |
| Total | 100% | 100% | 100% | 100% |

The traffic assignment step assigns trips to a specific route on the roadway network that will take the driver from origin to destination. Traffic was assigned based on the estimated shortest path or travel time from origins to destinations.



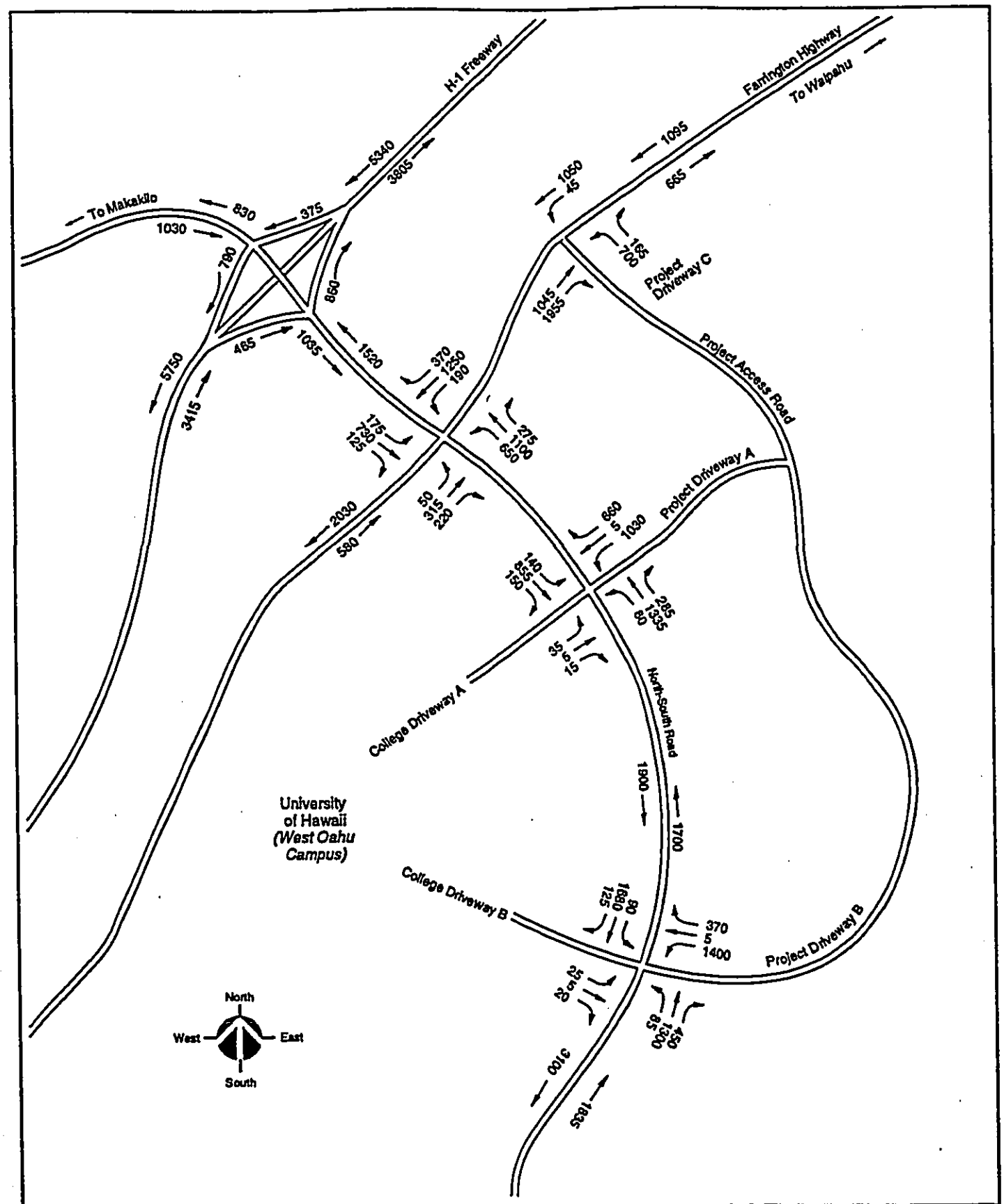

| PACIFIC PLANNING ENGINEERING, INC | 2005 Morning Peak Hour Forecast Traffic With Project | Figure 9 |
|---|---|---|




PACIFIC PLANNING & ENGINEERING, INC

**2005 Afternoon Peak Hour Forecast Traffic With Project**

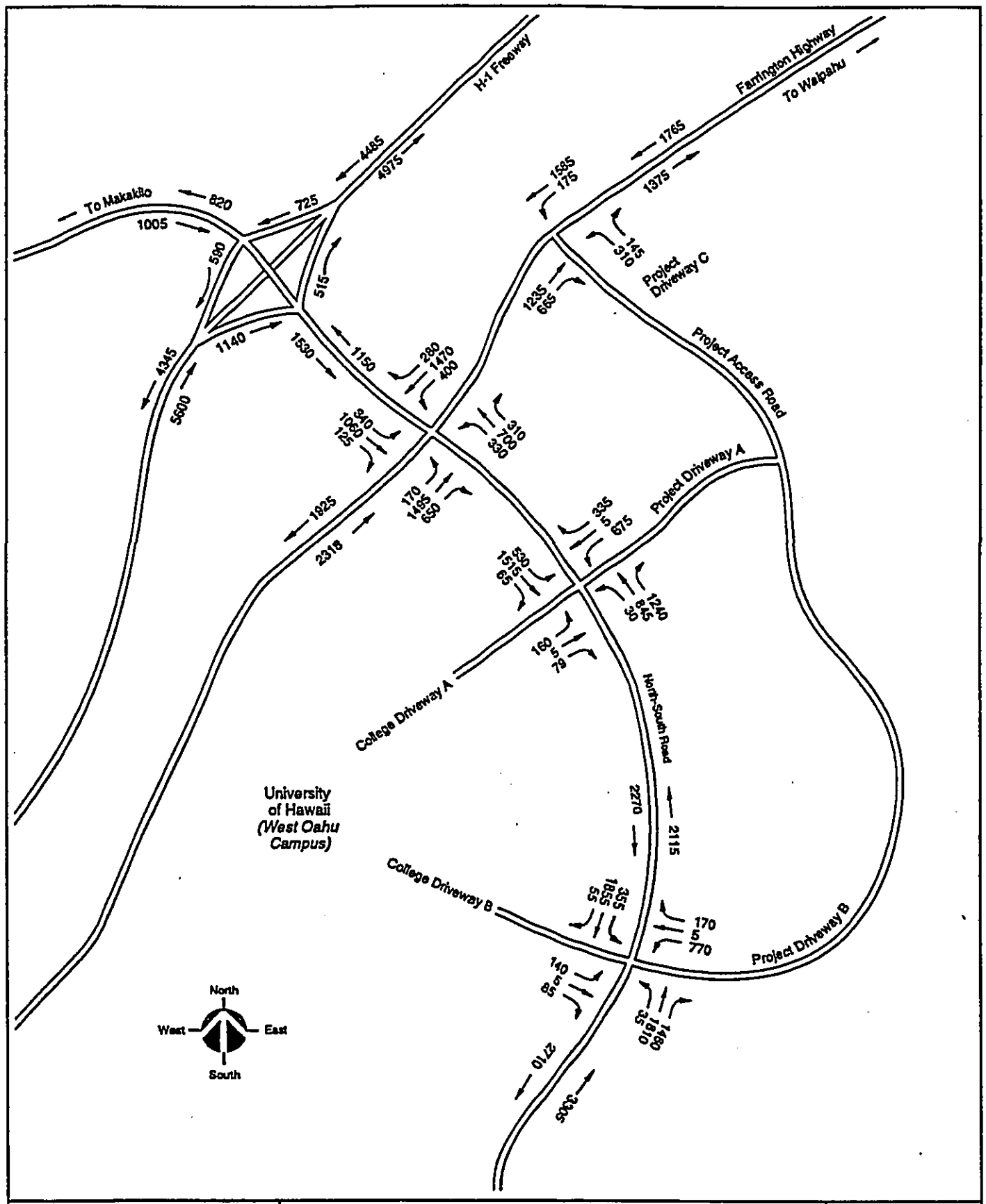
**Figure 10**




PACIFIC PLANNING & ENGINEERING, INC

**2011 Morning Peak Hour Forecast Traffic With Project**

**Figure 11**




PACIFIC PLANNING & ENGINEERING, INC

**2011 Afternoon Peak Hour Forecast Traffic With Project**

**Figure 12**

# TRAFFIC IMPACT ANALYSIS

Analyses were conducted on the study roadway facilities to determine the relative impact of the proposed project on the local roadway system and to determine improvements to mitigate the impact of the project, if necessary.

## Project Impact Analysis

Analyses were conducted on the study roadway facilities to determine the relative impact of the proposed project on the roadway system. The analyses were conducted for the existing, years 2005 and 2011 forecasts "without project" and forecasts "with project" traffic conditions for the morning and afternoon peak hours.

The roadway facilities were analyzed based on the existing roadway geometrics and planned improvements. All known approved planned transportation improvements to the study facilities by the year 2005 and 2011 have been included. The major roadway additions are widening Farrington Highway to four lanes, completion of the future North-South Road, a new H-1 interchange with the future North-South Road, and addition of a lane to H-1 freeway. These major projects were identified in previous analyses conducted for the Ewa Region highway study. As noted, the current Planning Department forecasts call for lower densities than used in the aforementioned study. Thus, it is possible that not all of the above projects are needed for 2005 or 2011. A major regional study is needed to update the roadway needs for the Ewa Region.

## Analysis Methods

The study roadway facilities were analyzed using methods contained in the Highway Capacity Manual (HCM). Appendix A describes in more detail the various methods of analysis used in the study.

For the study intersections, Planning Analysis was used to estimate the impact of the Project. Planning analysis is a broad evaluation of the capacity of an intersection without considering the details of signalization. It provides a basic assessment of whether or not capacity is likely to be exceeded for a given set of demand volumes and geometrics. The analysis determines whether an intersection is under, near, or over capacity.

The new H-1 interchange with the future North-South Road was analyzed using Ramp analyses methods. This method provides a Level-of-Service (LOS) which measures traffic operational conditions ranging from LOS A, good operating conditions, to LOS F, poor operating conditions.

Multilane Highway Analysis was performed on Farrington Highway east of the project site. Like Ramp analysis, a Level-of-Service (LOS) is determined.

The analyses results pertain to the following roadways:

- Farrington Highway - four lanes by year 2005.
- H-1 Freeway - eight lanes by year 2005.
- North-South Road - four lanes by year 2005

Tables 6, 7, 8, 9 and 10 summarize the results of the analysis for the "without project" and "with" project scenarios for the years 2005 and 2011.

## Table 6. Planning Analysis

| 2005 - MORNING PEAK HOUR | Without Project | | With Project | |
|---|---|---|---|---|
| Intersection | Capacity Level | Critical Volume | Capacity Level | Critical Volume |
| Farrington Highway / North-South Rd. | Under | 971 | Over | 1789 |
| North-South Rd. / Project Driveway A | Under | 483 | Under | 963 |
| North-South Rd. / Project Driveway B | Under | 503 | Under | 906 |
| North-South Rd. / Project Driveway C | n/a | n/a | Over | 2112 |

| 2005 - AFTERNOON PEAK HOUR | Without Project | | With Project | |
|---|---|---|---|---|
| Intersection | Capacity Level | Critical Volume | Capacity Level | Critical Volume |
| Farrington Highway / North-South Rd. | Under | 1120 | Over | 1942 |
| North-South Rd. / Project Driveway A | Under | 713 | Under | 917 |
| North-South Rd. / Project Driveway B | Under | 703 | Under | 1054 |
| North-South Rd. / Project Driveway C | n/a | n/a | Over | 1530 |

| 2011 - MORNING PEAK HOUR | Without Project | | With Project | |
|---|---|---|---|---|
| Intersection | Capacity Level | Critical Volume | Capacity Level | Critical Volume |
| Farrington Highway / North-South Rd. | Under | 1092 | Over | 1692 |
| North-South Rd. / Project Driveway A | Under | 515 | Over | 1850 |
| North-South Rd. / Project Driveway B | Under | 535 | Over | 2340 |
| North-South Rd. / Project Driveway C | n/a | n/a | Near | 1224 |

| 2011 - AFTERNOON PEAK HOUR | Without Project | | With Project | |
|---|---|---|---|---|
| Intersection | Capacity Level | Critical Volume | Capacity Level | Critical Volume |
| Farrington Highway / North-South Rd. | Near | 1238 | Over | 2010 |
| North-South Rd. / Project Driveway A | Under | 751 | Over | 1705 |
| North-South Rd. / Project Driveway B | Under | 741 | Over | 2110 |
| North-South Rd. / Project Driveway C | n/a | n/a | Under | 1106 |

**Table 7. Level of Service - 2005 Morning Peak Hour**

| H-1/North-South Road Interchange | | | |
|---|---|---|---|
| | Study Segment | LOS without Project | LOS with Project |
| Eastbound | Off Ramp - Diverge Area | B | B |
| | Freeway Lanes Adjacent | B | B |
| | On Ramp - Merge Area | B | C |
| | Freeway Lanes Adjacent | B | B |
| Westbound | Off Ramp - Diverge Area | B | C |
| | Freeway Lanes Adjacent | C | C |
| | On Ramp - Merge Area | C | D |
| | Freeway Lanes Adjacent | C | C |
| **Farrington Highway East of Project Driveway** | | | |
| | Eastbound lanes | A | A |
| | Westbound lanes | B | B |

**Table 8. Level of Service - 2005 Afternoon Peak Hour**

| H-1/North-South Road Interchange | | | |
|---|---|---|---|
| | Study Segment | LOS without Project | LOS with Project |
| Eastbound | Off Ramp - Diverge Area | C | C |
| | Freeway Lanes Adjacent | C | C |
| | On Ramp - Merge Area | B | B |
| | Freeway Lanes Adjacent | C | C |
| Westbound | Off Ramp - Diverge Area | B | B |
| | Freeway Lanes Adjacent | C | C |
| | On Ramp - Merge Area | B | C |
| | Freeway Lanes Adjacent | B | B |
| **Farrington Highway East of Project Driveway** | | | |
| | Eastbound lanes | B | B |
| | Westbound lanes | A | A |

**Table 9. Level of Service - 2011 Morning Peak Hour**

| | Study Segment | LOS without Project | LOS with Project |
|---|---|---|---|
| **H-1/North-South Road Interchange** | | | |
| Eastbound | Off Ramp - Diverge Area | B | B |
| | Freeway Lanes Adjacent | B | C |
| | Freeway Lanes Adjacent | B | C |
| | Freeway Lanes Adjacent | B | B |
| Westbound | Off Ramp - Diverge Area | C | C |
| | Freeway Lanes Adjacent | D | D |
| | On Ramp - Merge Area | C | D |
| | Freeway Lanes Adjacent | C | C |
| **Farrington Highway East of Project Driveway** | | | |
| | Eastbound lanes | A | A |
| | Westbound lanes | B | B |

**Table 10. Level of Service - 2011 Afternoon Peak Hour**

| | Study Segment | LOS without Project | LOS with Project |
|---|---|---|---|
| **H-1/North-South Road Interchange** | | | |
| Eastbound | Off Ramp - Diverge Area | D | D |
| | Freeway Lanes Adjacent | C | C |
| | On Ramp - Merge Area | C | C |
| | Freeway Lanes Adjacent | C | C |
| Westbound | Off Ramp - Diverge Area | B | C |
| | Freeway Lanes Adjacent | C | C |
| | On Ramp - Merge Area | B | C |
| | Freeway Lanes Adjacent | C | C |
| **Farrington Highway East of Project Driveway** | | | |
| | Eastbound lanes | B | B |
| | Westbound lanes | A | C |

## Analysis Results

The following is a summary based on the analysis results:

*2005 Without Project*

- The intersections of Farrington Highway with the North-South Road and North-South Road with College Driveways A and B all operate under capacity for the morning and afternoon peak hours.
- The planned H-1/North-South Road Interchange operates at LOS C or better during the peak hours.
- Farrington Highway east of the project operates at LOS B or better during the peak hours.

*2011 Without Project*

- The intersections of the North-South Road with College Driveways A and B continue to operate under capacity for the morning and afternoon peak hours. However, the intersection of Farrington Highway with the North-South Road worsens to near capacity conditions in the afternoon peak hour.
- The planned H-1/North-South Road Interchange operates at LOS D or better during the peak hours.
- Farrington Highway east of the project operates at LOS B or better during the peak hours.

*2005 With Project*

- The intersections of Farrington Highway with the North-South Road and Project Driveway C would be over capacity during the peak hours. The intersections of the North-South Road with Project Driveways A and B are both under capacity.
- The planned H-1/North-South Road Interchange operates at LOS D or

better during the peak hours.

- Farrington Highway east of the project operates at LOS B or better during the peak hours.

*2011 With Project*

- The intersections of Farrington Highway with the North-South Road and North-South Road with Project Driveways A and B would be over capacity for the morning and afternoon peak hours. The intersection of Farrington Highway with Project Driveway C would operate at near capacity conditions in the morning peak hour and under capacity during the afternoon peak hour.
- The planned H-1/North-South Road Interchange operates at LOS D or better during the peak hours.
- Farrington Highway east of the project operates at LOS C or better during the peak hours.

## MITIGATION MEASURES

The intersection analyses indicate that the future traffic volumes at the study intersections will exceed planned capacity if improvements are not made. Sufficient right-of-way should be set aside to provide for future widening as development and traffic warrants. Traffic signals should be planned. Exact implementation dates depend on when traffic volumes meet established signal warrants.

### Year 2005 (Phase 1)

For this scenario year, the intersections of Farrington Highway with the North-South Road and Project Driveway would need the following lanes in order to operate under or near capacity during the peak hours.

- Two left-turn lanes northbound exiting the project driveway onto Farrington Highway.
- Two left-turn lanes westbound at the intersection of Farrington Highway and the North-South Road.
- Addition of an extra through lane from about 1000' west of the intersection of Farrington Highway and the North-South Road to Project Driveway C, east of the intersection.

A road connection from the project to the planned North-South Road would mitigate traffic problems at other intersections by using all available capacity. This would relieve traffic entering and exiting the project driveway onto Farrington Highway as well as at the intersection of Farrington Highway with the North-South Road. If a connection is made, the two-left-turn lanes at the intersections of Farrington Highway with the North-South Road and Project Driveway C may not be required to handle

makai-bound traffic volumes. However, makai-bound traffic would shift to the North-South Road connection and thus this intersection would require two left turn lanes exiting the project.

## Year 2011 (Phase 2)

For Phase 2, mitigative measures to the study intersections would be more involved because of the level of traffic volumes during the peak hours.

The possibility of a grade separation at the intersection of Farrington Highway and the North-South Road would increase capacity through the area. However, alternate methods of transportation should be investigated such as;

- Usage of carpools and bus service. City bus services would reduce the number of vehicles.
- Shuttle services to and from the development to areas such as Kapolei City given the relatively close proximity.
- Encouragement of other types of travel if possible (bicycles, walking, etc.) to nearby trip generators such as the college.
- Parking management strategies at major employment sites discourage use of private vehicles for commuting and encourage it for recreation, retail and service type purposes.

These type of measures would reduce the project traffic to a level that might allow for smoother traffic flow through the study intersections.

## CONCLUSIONS AND RECOMMENDATIONS

The results of the traffic operations analysis indicate that the proposed East Kapolei Project will significantly change the traffic flow quality at the study intersections when the project is completed in two phases. Major road improvements have already been identified in the Ewa Region Highway Master Plan and adopted by the Oahu Metropolitan Planning Organization (OMPO). These improvements are assumed as part of the roadway network in 2005 and 2011 in the assessment of the traffic impacts.

For the year 2005 (Phase 1), in order to minimize the impact of the project and provide for smoother traffic operating conditions, we recommend the following:

- Two left-turn lanes northbound exiting the project driveway onto Farrington Highway.
- Two left-turn lanes westbound at the intersection of Farrington Highway and the North-South Road.
- Addition of an extra through lane from about 1000' west of the intersection of Farrington Highway and the North-South Road to Project Driveway C, east of the intersection.
- A project connection to the North-South Road would relieve traffic at other intersections. If a connection is made, the two-left-turn lanes at the intersections of Farrington Highway with the North-South Road and Project Driveway C may not be required to handle makai-bound traffic volumes. However, makai-bound traffic would shift to the North-South Road connection and thus this intersection would require two left turn lanes exiting the project.

For the year 2011 (Phase 2), mitigative measures to the study intersections would be more involved because of the level of traffic volumes during the peak hours.

The possibility of a grade separation at the intersection of Farrington Highway and the North-South Road would increase capacity through the area. However, alternate methods of transportation actions should be investigated. A comprehensive plan that includes both Transportation System Management and Transportation Demand Management concepts should be developed for the area which would include the Project. The future traffic levels have regional sources that are undergoing current development. Integrated transit services, roadway plans and construction schedules, computer controlled traffic lights, remote parking areas, shuttle services, paratransit, bicycle and pedestrian ways, and some form of exclusive way transit should be considered in a comprehensive plan. Beyond transportation actions, the need for integrated land use planning for all the major parcels will aid in reducing the need for vehicle trips.

From a planning perspective, OMPO's current efforts to update its Long Range Plan will institute new population and traffic forecast values for the Ewa Region. The results reported herein pertain specifically to the East Kapolei Project in addition to current preliminary population estimates. This assessment approach is conservative in that the impact is greater than would be expected, as population exceeds what is set forth in preliminary figures. The OMPO's new region-wide forecasts will likely result in less impacts and roadway needs than indicated herein due to smaller values of population. A major roadway needs study is needed to update the previous study for the Ewa Region.

An example of a potentially major change that should be included in the update study is the final version of the BPNAS Reuse Plan. This and other major land use proposals in the Ewa Region should be evaluated for traffic impact on a region-wide basis, and their mitigating actions included in the afore-mentioned comprehensive transportation plan. Thus, 2011 (Phase 2) impacts should be re-evaluated when those forecasts are available, and a plan be developed that not only addresses highway projects but land use planning (to obviate the need for vehicle trips) transit, and other modes and services as well.

# APPENDIX A

## DEFINITIONS
## FOR

## PLANNING ANALYSIS
## MULTILANE HIGHWAY ANALYSIS
## ON-RAMP AND OFF-RAMP ANALYSIS

## DEFINITION OF PLANNING ANALYSIS
## FOR
## SIGNALIZED INTERSECTIONS

Planning analysis of intersections is a broad evaluation of the capacity of an intersection without considering the details of signalization. It provides a basic assessment of whether or not capacity is likely to be exceeded for a given set of demand volumes and geometrics. At this level, only capacity is addressed because the detailed information needed to estimate delay is not available.

Planning Analysis measures a signalized intersection's capacity level using the sum of its critical movements. The total critical volume for the intersection is the sum of the critical volumes for the north-south and east-west streets. The critical volume for the intersection is compared to the criteria in the table below The analysis determines whether an intersection is under, near, or over capacity.

| Critical Volume (vehicles per hour) | Relationship to Probable Capacity |
|---|---|
| 0 to 1,200 | Under Capacity |
| 1,200 to 1,400 | Near Capacity |
| ≥ 1,400 | Over Capacity |

REFERENCE: Highway Capacity Manual (Special Report 209, 1985)

## DEFINITION OF LEVEL-OF-SERVICE
## FOR
## MULTI-LANE HIGHWAYS

Level of service for multi-lane highways is defined in terms of *density*.

Level-of- service A describes completely free-flow conditions. Maximum density is 12 passenger cars per mile per lane (pcpmpl) and the ability to maneuver within the traffic stream is high.

Level-of-service B is also indicative of free flow. The maximum density is 20 pcpmpl. Minor disruptions to flow are still easily absorbed at this level.

Level-of-service C represents a range in which the influence of traffic density on operations becomes marked. The ability to maneuver within the traffic stream, and to select an operating speed, is now clearly affected by the presence of other vehicles. The maximum density is 30 pcpmpl.

Level-of-service D borders on unstable flow. Speeds and ability to maneuver are severely restricted because of traffic congestion. The maximum density is 42 pcpmpl.

Level-of-service E represents operations at or near capacity and is quite unstable. The maximum density is 67 pcpmpl. This is the minimum spacing at which uniform flow can be maintained, and effectively defined a traffic stream with no usable gaps.

Level-of-service F represents forced or breakdown flow. It occurs at a point where vehicles arrive either at a rate greater than that at which they are discharged or at a point on a planned facility where forecasted demand exceeds the computed capacity. Densities are higher than 67 pcpmpl. Queues form behind the breakdowns and are highly unstable.

REFERENCE: Highway Capacity Manual (Special Report 209, 1985)

## DEFINITION OF LEVEL-OF-SERVICE
## FOR
## ON-RAMPS and OFF-RAMPS

Level of service for signalized intersections is defined in terms of *flow rates.*

Level-of service A: Represents unrestricted operation. Merging and diverging vehicles have little effect on other freeway flows.

Level-of-service B: Merging vehicles have to adjust their speed slightly to fill lane 1 gaps; diverging vehicles still do not experience any significant turbulence. Flow may be described generally as smooth and stable.

Level-of-service C: Both lane 1 and on-ramp vehicles must adjust their speed to accomplish smooth merging, and under heavy on-ramp flows, minor ramp queuing may occur. Some slowing may also occur in diverge areas. Overall speed and density of freeway vehicles are not expected to be seriously deteriorated.

Level-of-service D: Smooth merging becomes difficult to achieve. Both lane 1 and on-ramp vehicles must frequently adjust their speed to avoid conflicts in the merge area. Slowing in the vicinity of diverge areas is also significant. At heavily used on-ramps, ramp queues may become a disruptive factor.

Level-of-service E: Represents capacity operation. On-ramp queues may be significant. Diverge movements are significantly slowed, and some queuing may occur in the diverge area. All vehicles are affected by turbulence on freeway.

Level-of-service F: All merging is on a stop-and-go basis, and ramp queues and lane 1 breakdowns are extensive. Much turbulence is created as vehicles attempt to change lanes to avoid merge and diverge areas. Considerable delay is encountered in the vicinity of the ramp terminal, and conditions may vary widely, from minute to minute, as unstable conditions create "waves" of alternatively good and forced flow.

REFERENCE: Highway Capacity Manual (Special Report 209, 1985)

# UPDATED TRAFFIC IMPACT ASSESSMENT REPORT

# FOR

# EAST KAPOLEI PROJECT

**December 11, 1995**

**Honolulu, Oahu, Hawaii**

**Prepared for:**

**Schuler Homes, Inc.**

**Prepared By:**

**Pacific Planning & Engineering, Inc.**
**1221 Kapiolani Boulevard, Suite 6D**
**Honolulu, Hawaii 96814**

# FOREWORD

The traffic forecasts shown within this report's figures and tables are the direct result of Pacific Planning & Engineering, Inc.'s proprietary analytical tools. For report editing and review purposes, some of the forecast values have been rounded to the nearest five vehicles from our mathematical results, although we do not imply this level of accuracy can exist in any forecast method. The rounded values, however, reasonably quantify the forecasted traffic volumes for the purposes of this study.

This report is an update to our previous report titled "Traffic Impact Assessment Report For East Kapolei Project" dated 17 October 1994. It includes the current master plan for the project which has been downsized in terms of residential units. Major land use proposals are still in the earliest planning stages such as the University, and agency assumptions of their locations are updated wherever possible.

In those report sections where no new information is provided or reading would not be interrupted, the reader is referred to the previous Report titled "Traffic Impact Assessment Report For East Kapolei Project" dated 17 October 1994.

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## APPENDICES


Appendix A. Definitions of Level of Service

# EXECUTIVE SUMMARY

Pacific Planning & Engineering, Inc. (PPE) was engaged to undertake a study to update its previous report titled "Traffic Impact Assessment Report For East Kapolei Project" dated 17 October 1994. This report updates the previous findings of future traffic impacts caused by the current plan for the East Kapolei Project. The current Plan contains less residential units with a corresponding decrease of project traffic compared to the previous master plan.

This report describes the methodology and guidelines used to evaluate the traffic impacts and presents the findings and recommendations from the study.

## Project Description

Schuler Homes, Inc. is proposing to construct the East Kapolei Project in Honolulu, Oahu, Hawaii.

The project plan contains uses for residential, park, commercial, school, and roadways. The project is located west of Fort Weaver Road in Ewa, south of existing Farrington Highway, and east of the proposed North-South Road. Part of the project is also located just north of Farrington Highway. The project site was recently agricultural, with no existing traffic. The table below summarizes the proposed land uses.

Vehicular access to the Project will be provided by three intersections. The first intersection will be located on Farrington Highway when a major spine road is constructed. Two other intersections will be connected to the proposed North-South Road at points serving the proposed University site forming four-legged intersections. If the University is not located there, the intersections

Table ES-1. Land Use Summary

| Land Use | Acres |
|---|---|
| Residential | 649 |
| Commercial | 16 |
| Schools | 25 |
| Parks | 32 |
| Major Roads | 20 |
| Total | 742 |

would be T-intersections with higher levels of service since there would be no conflicting movements into and out of the University roadway.

## Study Methodology

This Report identifies and describes the probable impact of the traffic generated by the proposed development in the year 2010 when the project is expected to be completed. The analysis primarily focuses on the following intersections:

- Farrington Highway and Project Spine Road
- Proposed North-South Road at Secondary Project Road
- Proposed North-South Road at Project Spine Road
- Ramps at H-1 Interchange with Proposed North-South Road

Traffic was forecasted for the year 2010 at the study intersections and ramps by:

- adjusting trips for current development absorption rates as calculated based on the City Planning Department population estimates for areas within the Ewa region,
- updating land uses and roadway plans for the year 2010 prepared for the Ewa Region Highway Master Plan,
- preparing aggregated zonal trip tables for the year 2010 for the morning and afternoon peak hours,
- estimating traffic assignments to study roadways and balancing volumes for capacity restraints,
- forecast traffic generated by a proposed commercial project, and University,
- estimating traffic generated by the project and assigning traffic to the study roadways, and
- adding the traffic forecasts for the project and other developments.

The Report describes the impacts on each study roadway segment by the level-of-service (LOS) and capacity levels for year 2010 traffic conditions "without" and "with" Project.

## Conclusions & Recommendations

The previous plan for the East Kapolei Project reported in "Traffic Impact Assessment Report For East Kapolei Project" had assumed significantly more residential units and consequently more traffic than proposed currently. However, the previous conclusions and recommendations are still valid for this report update.

The results of the traffic analysis indicate that the proposed East Kapolei Project will significantly change the traffic flow quality at the study intersections when the project is completed. Major road improvements have been identified in the Ewa Region Highway Master Plan and adopted by the Oahu Metropolitan Planning Organization (OMPO). These improvements are assumed as part of the roadway network by 2010 in the assessment of the traffic impacts.

In order to minimize the impact of the project and provide for smoother traffic operating conditions, we recommend the following by the year 2010:

- Two left-turn lanes westbound at the intersection of Farrington Highway and the North-South Road.
- Addition of an extra through lane from about 1000' west of the intersection of Farrington Highway and the North-South Road to Project Road "C", east of the intersection.
- Two left-turn lanes entering and exiting Project Roads "A" and "B"

Sufficient right-of-way should be set aside to provide for future widening as development and traffic warrants. Traffic signals should be planned. Exact implementation dates depend on when traffic volumes meet established signal warrants.

Alternate methods of transportation actions should be investigated. A comprehensive plan that includes both Transportation System Management and Transportation Demand Management concepts should be developed for the area which would include the Project. Future traffic levels have regional sources that are undergoing current development. Integrated transit services, roadway plans and construction schedules, computer controlled traffic lights, remote parking areas, shuttle services, paratransit, bicycle and pedestrian ways, and some form of exclusive way transit should be considered in a comprehensive plan. Beyond transportation actions, the need for integrated land use planning for all the major parcels will aid in reducing the need for vehicle trips. The inclusion of convenience retail, minor commercial, schools, and parks within the East Kapolei Project will eliminate the need of travel on external roads for those trip purposes.

From a planning perspective, the City and State are making efforts to update the Long Range Plan with new population and traffic forecast values for the Ewa Region. The results reported herein pertain specifically to the East Kapolei Project in addition to current preliminary population estimates. This assessment approach is conservative in that the impact is greater than would be expected, as population exceeds what is set forth in preliminary figures. The new region-wide forecasts will likely result in less impacts and roadway needs than indicated herein due to smaller values of population.

An example of a potentially major change that should be included in the update study is the final version of the BPNAS Reuse Plan. This and other major land use proposals in the Ewa Region should be evaluated for traffic impact on a region-wide basis, and their mitigating actions included in the afore-mentioned comprehensive transportation plan. Thus, 2010 impacts should be re-evaluated when those forecasts are available, and a plan be developed that not only addresses highway projects but land use planning, transit, and other modes and services as well.

## PROJECT DESCRIPTION

Schuler Homes, Inc. is proposing to construct the East Kapolei Project in Ewa, Oahu. Figure 1 shows the project location and roadway network in the vicinity.

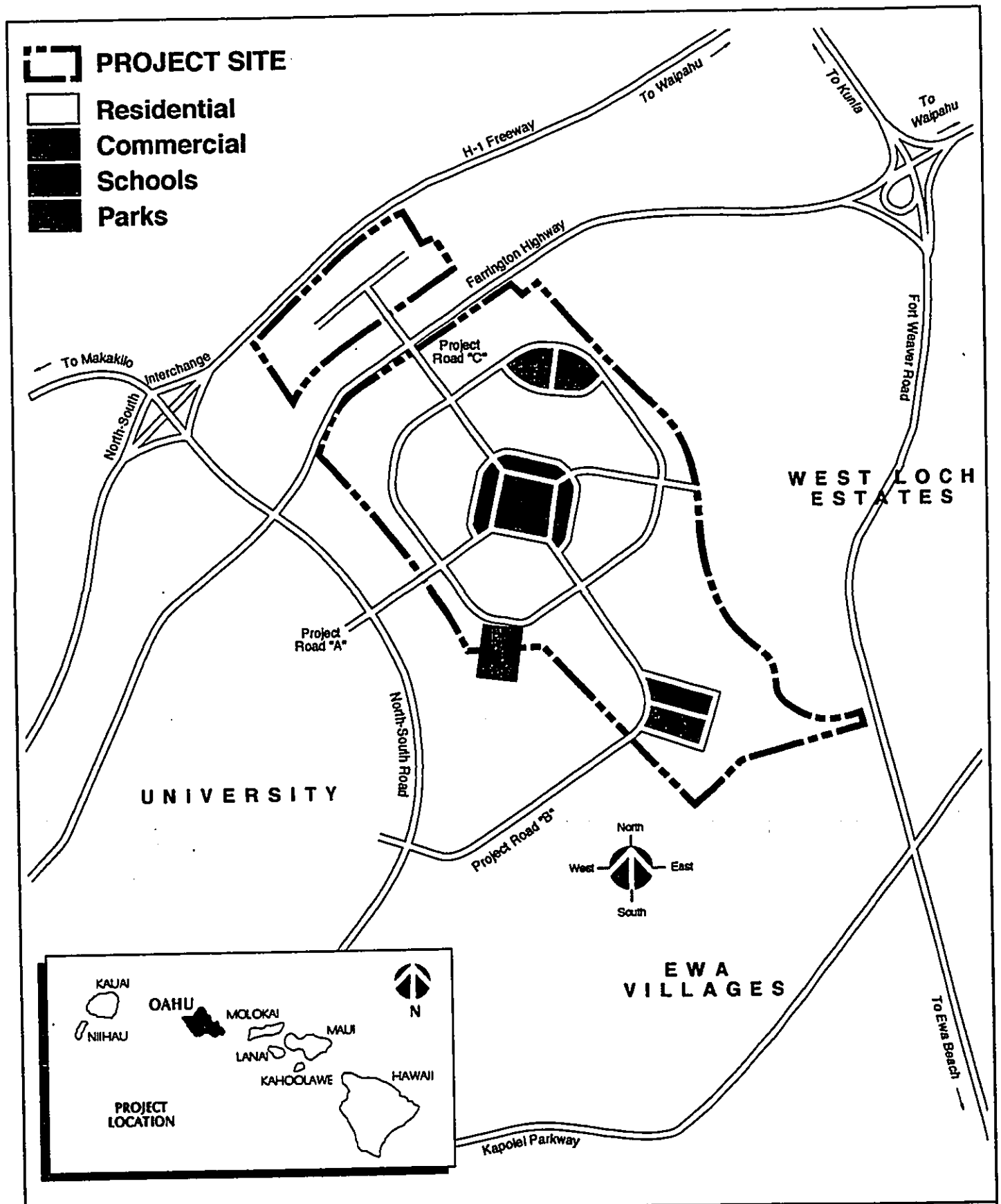
### Project Land Uses

The project includes development of 742 acres by year 2010. The project is located west of Fort Weaver Road in Ewa, south of existing Farrington Highway, and just east of the proposed North-South Road. Part of the project is also located just north of Farrington Highway The area is currently agricultural, with no existing traffic. Table 2 below summarizes the proposed land uses. Figure 1 shows the Project Site Plan.

Vehicular access to the Project will be provided by three intersections. The first intersection will be located on Farrington Highway when a major spine road is constructed. The other two intersections will be connected to the proposed North-South Road at points serving the proposed University site forming four-legged intersections. If the University is not located there, the intersections would be T-intersections with higher levels of service since there would be no conflicting movements into and out of the University roadway.

Table 2. Land Use Summary

| Land Use | Acres |
|---|---|
| Residential | 649 |
| Commercial | 16 |
| Schools | 25 |
| Parks | 32 |
| Major Roads | 20 |
| **Total** | **742** |




PACIFIC PLANNING & ENGINEERING, INC

**Project Site Plan**

**Figure 1**

# EXISTING CONDITIONS

## Land Uses

The existing land is in agriculture. There are no vehicle trips generated in the project site.

## Roadway Facilities

The site is currently served by Farrington Highway, a two-lane highway connecting Waipahu and Kapolei. Just north of Farrington Highway, H-1 freeway serves major east-west traffic volumes.

## Traffic Conditions

Existing conditions are not relevant for estimating the potential traffic impact of the proposed project since the Ewa region itself is planned for major growth in population and infrastructure. These changes by year 2010 will form the bases of the analysis for the "without project" scenario.

## FUTURE CONDITIONS

Future 2010 conditions were based on the current schedule of proposed developments in the Ewa Region. Research of planned developments and improvements to transportation facilities was conducted to estimate future traffic conditions at the study road segments. Adjustments were made to previously calculated trip tables for the Ewa Region highway study to update the vehicle trips during the morning and afternoon peak hours in the year 2010.

A comparison of the current Department of Planning population estimates to the values used in the previous Report indicates that residential uses would increase in Kapolei City but decrease in outlying areas, with the total population in the Ewa Region unchanged. Adjustments to the vehicle trips were made to reflect this new distribution of population within the Region. Adjustments were made to increase the external trips to Kapolei City as a conservative step to address the observation that the traffic forecasts for the Ewa Master Plan should reflect a lower retention of trips within the Region. These adjusted trips affect H-1 traffic volumes.

### Land Uses

The reader is referred to the previous Report titled "Traffic Impact Assessment Report For East Kapolei Project" dated 17 October 1994.

### Roadway Facilities

The road network for the year 2010 in the immediate area are shown in Figure 1. The major road changes planned in the Project area will include the following.

North-South Road

The four-lane North-South Road provides an alternative route to/from the H-1 Freeway for the projects along the Fort Weaver Road corridor. With its link to Farrington Highway and Kapolei Parkway, the North-South Road would also serve to connect Ewa Beach and new residential projects in this vicinity with the employment in the Kapolei area.

North-South Interchange

Along with the North-South Road, the new North-South Interchange with H-1 freeway will improve access to several areas within the Ewa region. The North-South Road will provide an alternative route to the Fort Weaver Road corridor and the H-1 Freeway. The North-South Interchange will also serve as a secondary access to the Makakilo development, the Villages of Kapolei, and the City of Kapolei.

Farrington Highway

Farrington Highway, between Barbers Point Access Road and the access to Kapolei Knolls and the Villages of Kapolei, would be widened to provide two travel lanes in each direction with a median turning lane. The widening would increase the capacity of this roadway to accommodate the new developments in this area.

## PROJECTED TRAFFIC CONDITIONS

Future traffic was forecasted for the "without project" and "with project" conditions. Traffic forecasts were developed for the year 2010 when the project is expected to be completed.

### Future Traffic Without Project

This component of the forecast are future ambient traffic volumes. Future traffic is estimated by identifying all other land uses and forecasting traffic from those land uses.

In total, traffic was forecasted for the year 2010 at the study intersections and ramps by:

- updating land uses and roadway plans for 2010 prepared for the Ewa Region Highway Master Plan,
- adjusting trips forecasted by the Ewa Region Highway study for current development absorption rates as calculated based on the City Planning Department preliminary population estimates for areas within the Ewa region,
- preparing aggregated zonal trip tables for the year 2010 for the morning and afternoon peak hours,
- estimating traffic assignments to study roadways and balancing volumes for capacity restraints,
- forecast traffic generated by the commercial development, proposed University,
- estimating traffic generated by the project and assigning traffic to the study roadways, and
- adding the traffic forecasts for the project and other developments.

These forecast values are used to calculate the impacts on each study roadway segment by determining the level-of-service (LOS) and capacity levels for year 2010 traffic conditions without project and year 2010 traffic conditions with the Project.

Traffic forecasts are needed in the analysis to determine the LOS for each road segment of interest by specific time periods. The forecasts for the study roadways are shown in the following figures.

Traffic From Other Developments

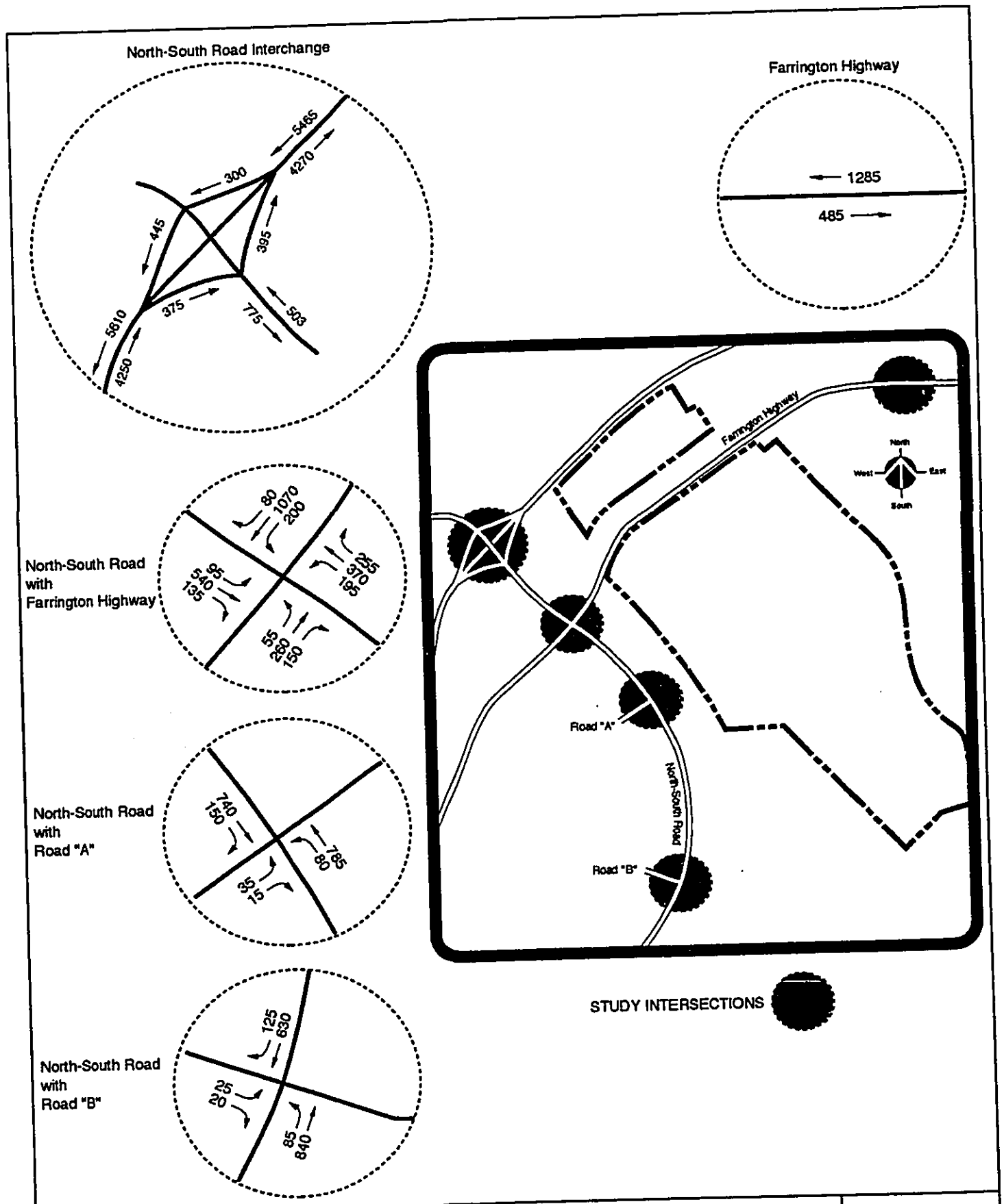
The reader is referred to the previous Report titled "Traffic Impact Assessment Report For East Kapolei Project" dated 17 October 1994.

Figures 2 and 3 show the year 2010 "without project" traffic forecasts for the weekday morning and afternoon peak hours, respectively.

## Future Traffic With Project

Future traffic with the East Kapolei Project included in the land uses is calculated by adding the without project traffic to the traffic generated by the proposed Project. The method of determining the number of vehicle trips assigned to the roadways is described in the following sections.

As in the calculation of vehicle trips from other developments, the Project trip generation step estimates the number of trips generated by the proposed project. This estimate is based on rates obtained from the manual on Trip Generation, by the Institute of Transportation Engineers. Table 4 shows the estimated number of trips generated by the Project for year 2010.

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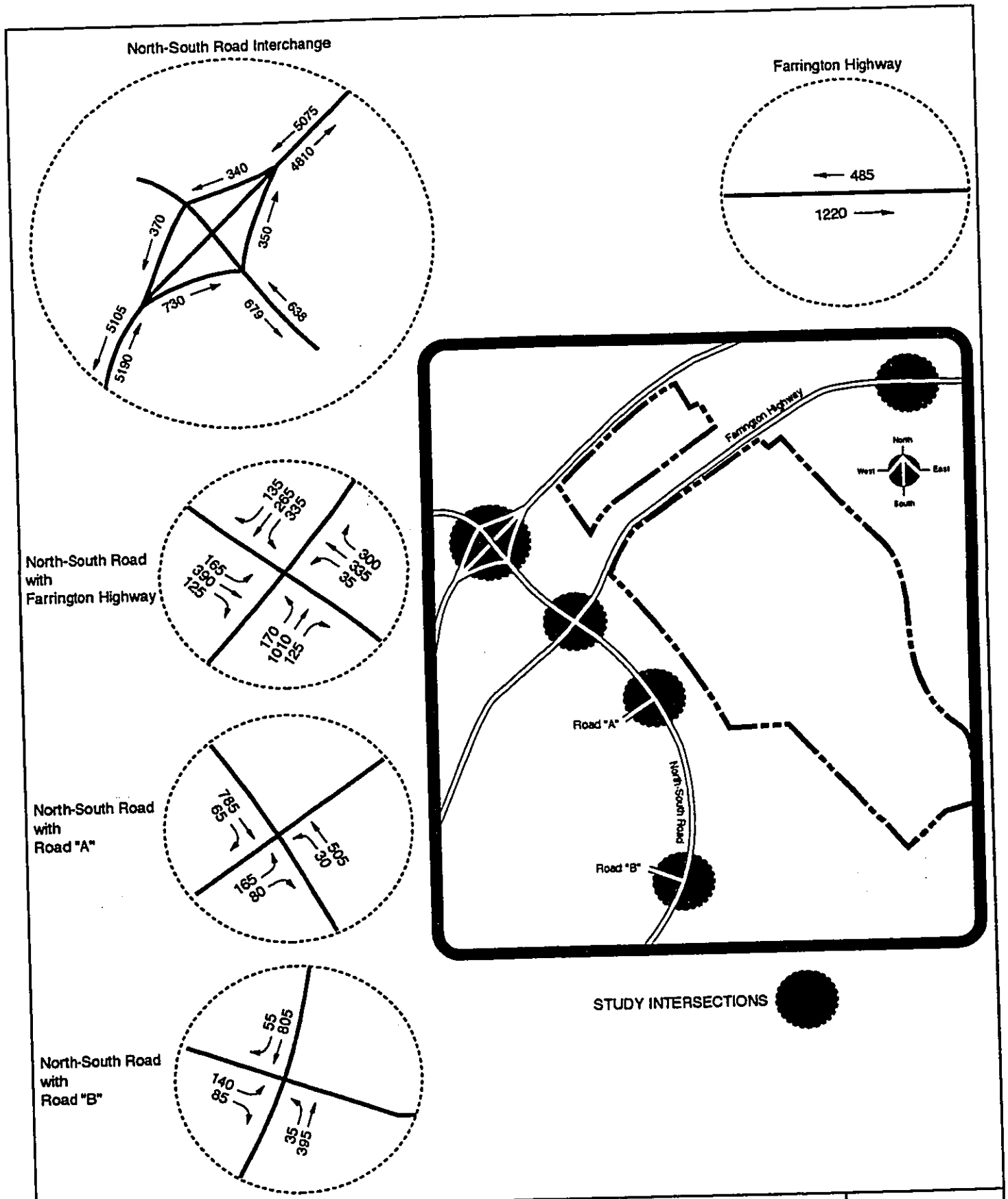
**2010 Weekay Morning Peak Hour Traffic Volumes Without Project**

**Figure 2**

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**2010 Weekay Afternoon Peak Hour Traffic Volumes Without Project**

**Figure 3**

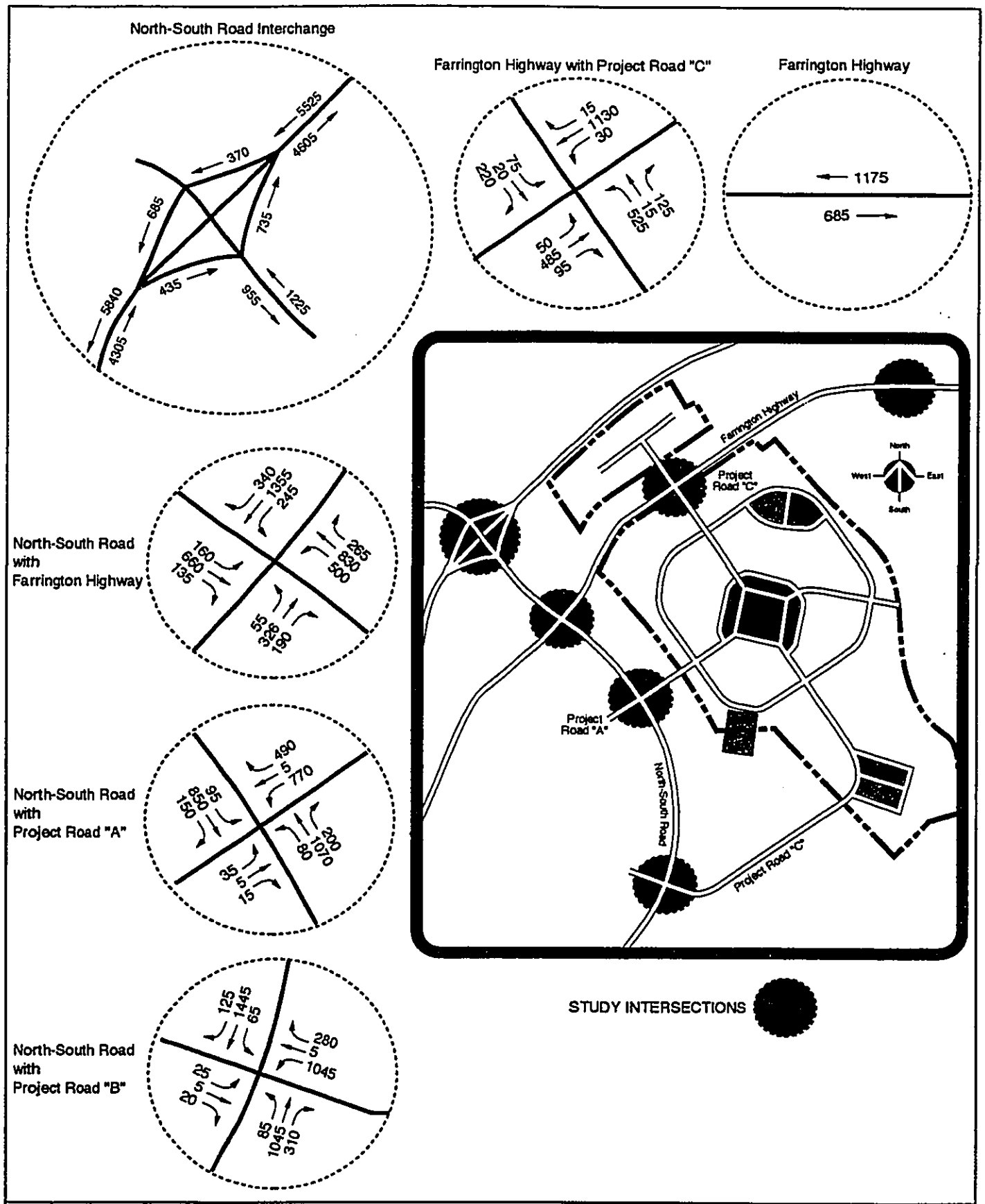
| Table 4. Trip Generation for East Kapolei Project | | | | | |
|---|---|---|---|---|---|
| | | Morning Peak Hour | | Afternoon Peak Hour | |
| Land Use | Parameter | Enter | Exit | Enter | Exit |
| Single Family Homes | 2,400 du | 480 | 1320 | 1512 | 888 |
| Multi Family Homes | 5,600 du | 392 | 2072 | 2128 | 1064 |
| Schools | 3 schools | 336 | 216 | 24 | 24 |
| Commercial Centers | 16 acres | 136 | 80 | 430 | 430 |

Figures 4 and 5 displays the "with Project" forecasts for the weekday morning and afternoon peak hours, respectively.

The trip distribution step assigns trips to their expected origins and destinations. Trip distribution for the project was estimated based on development of the Ewa Region as the Second City of Oahu. The trips were generally distributed as shown in Table 5.

| Table 5. Project Trip Distribution | | | | |
|---|---|---|---|---|
| | Morning Peak Hour | | Afternoon Peak Hour | |
| Land Use | Enter | Exit | Enter | Exit |
| West of Project | 57 | 72 | 72 | 63 |
| South of Project | 30 | 15 | 18 | 25 |
| East of Project | 11 | 13 | 9 | 10 |
| North of Project | 2 | 0 | 1 | 2 |
| Total | 100% | 100% | 100% | 100% |

The traffic assignment step assigns trips to a specific route on the roadway network that will take the driver from origin to destination. Traffic was assigned based on the estimated shortest path or travel time from origins to destinations.

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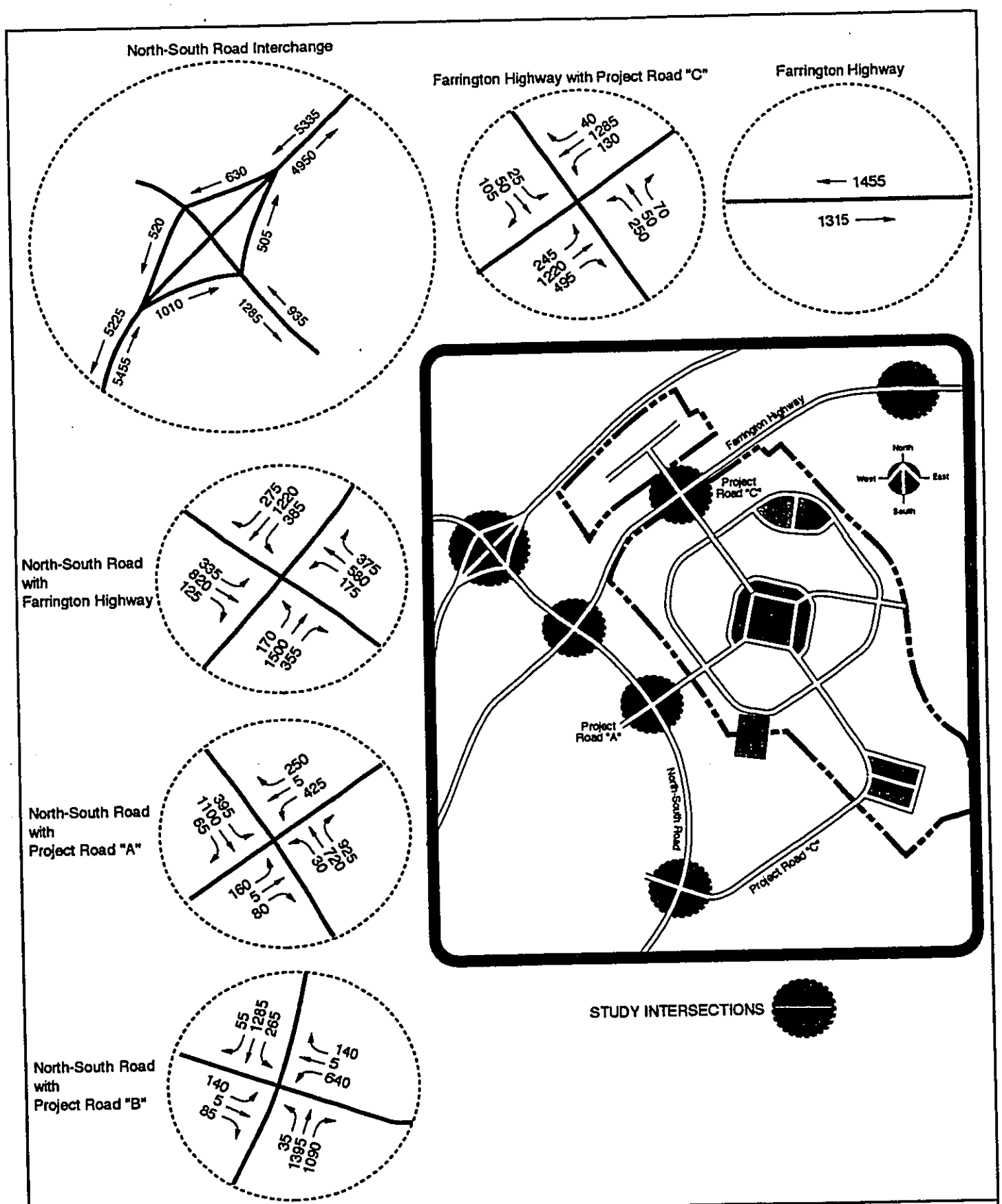
**2010 Weekay Morning Peak Hour Traffic Volumes With Project**

**Figure 4**

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**2010 Weekay Afternoon Peak Hour Traffic Volumes With Project**

**Figure 5**

## TRAFFIC IMPACT ANALYSIS

Analyses were conducted for the study roadway facilities to determine the relative impact of the proposed project on the local roadway system and to determine improvements to mitigate the impact of the project, if necessary.

### Project Impact Analysis

Analyses were conducted on the study roadway facilities to determine the relative impact of the proposed project on the roadway system. The analyses were conducted for the study year 2010 "with project" traffic conditions for the morning and afternoon peak hours.

The roadway facilities were analyzed based on the existing roadway geometrics and planned improvements. All known approved planned transportation improvements to the study facilities by the year 2010 have been included. The major roadway additions are widening Farrington Highway to four lanes, completion of the future North-South Road, a new H-1 interchange with the future North-South Road, and addition of a lane to H-1 freeway. These major projects were identified in previous analyses conducted for the Ewa Region highway study. As noted, the current Planning Department forecasts call for lower densities than used in the aforementioned study. Thus, it is possible that not all of the above projects are needed by 2010. A major regional study is needed to update the roadway needs for the Ewa Region.

### Analysis Methods

The study roadway facilities were analyzed using methods outlined in the Highway Capacity Manual (HCM), Special Report 209, 1994. Appendix A describes in more detail the various methods of analysis used in the study. (The

reader should note that certain significant changes released in early 1995 have been made to the HCM. These changes are incorporated in our analysis).

For the study intersections, HCM's Planning Analysis was used to estimate the impact of the Project. This planning method compares traffic volumes of the intersection to the capacity. The analysis determines whether an intersection is under, near, at, or over capacity.

The proposed H-1 interchange with the future North-South Road was analyzed using ramp analyses methods. This method provides a Level-of-Service (LOS) which measures traffic operational conditions ranging from LOS A, good operating conditions, to LOS F, poor operating conditions.

Multilane Rural and Suburban Highway Analysis was performed on Farrington Highway east of the project site. A Level-of-Service (LOS) is determined.

The analyses results assume the following roadways:

- Farrington Highway - four lanes by year 2010.
- H-1 Freeway - six lanes by year 2010.
- North-South Road - four lanes by year 2010.

In addition, the following improvement measures shown below were assumed for the "with" project analyses.

- Two left-turn lanes westbound at the intersection of Farrington Highway and the North-South Road.
- Addition of an extra through lane from about 1000' west of the intersection of Farrington Highway and the North-South Road to Project Road "C", east of the intersection.
- Two left-turn lanes entering and exiting project roads "A" and "B".

## Analysis Results

The following is a summary based on the analysis results:

- Without the project, the intersections of Farrington Highway with the North-South Road and North-South Road with Roads "A" and "B" would be under capacity for the morning and afternoon peak hours.

- With the project, the intersection of Farrington Highway with the North-South Road would operate at capacity for both peak hours.

  The intersection of the North-South with Project Road "A" would operate under capacity during the morning peak hour and near capacity during the afternoon peak hour.

  The intersection of the North-South Road with Project Road "B" would operate near capacity during both peak hours.

  The intersection of the North-South Road with Project Road "C" would operate under capacity during both peak hours.

- The planned H-1/North-South Road Interchange operates at LOS D or better during the peak hours without or with the project.

- Farrington Highway east of the project operates at LOS A during the peak hours without or with the project.

Tables 6, 7, and 8 summarize the results of the analysis for the "with" project scenarios for the year 2010.

| Table 6 - Planning Analysis | | |
|---|---|---|
| | Critical v/c Ratio $X_{cm}$ (Capacity Level) | |
| **Morning Peak Hour** | **Without Project** | **With Project** |
| Farrington Highway / North-South Road | 0.69 (under) | 0.98 (at) |
| North-South Road / Project Road A | 0.31 (under) | 0.71 (under) |
| North-South Road / Project Road B | 0.28 (under) | 0.86 (near) |
| North-South Road / Project Road C | n/a | 0.70 (under) |
| | | |
| | Critical v/c Ratio $X_{cm}$ (Capacity Level) | |
| **Afternoon Peak Hour** | **Without Project** | **With Project** |
| Farrington Highway / North-South Road | 0.61 (under) | 0.90 (near) |
| North-South Road / Project Road A | 0.36 (under) | 0.87 (near) |
| North-South Road / Project Road B | 0.32 (under) | 0.88 (near) |
| North-South Road / Project Road C | n/a | 0.76 (under) |

| Table 7 - Ramp-Freeway Terminal Analysis | | | |
|---|---|---|---|
| | | LOS (Max Density-pc/mi/ln) | |
| **Morning Peak Hour** | | **Without Project** | **With Project** |
| Eastbound | Off Ramp - Diverge Area | C (22) | C (23) |
| | On Ramp - Merge Area | C (22) | C (25) |
| Westbound | On Ramp - Diverge Area | D (28) | D (29) |
| | Off Ramp - Merge Area | D (31) | D (33) |
| | | | |
| | | LOS (Max Density-pc/mi/ln) | |
| **Afternoon Peak Hour** | | **Without Project** | **With Project** |
| Eastbound | Off Ramp - Diverge Area | C (28) | D (29) |
| | On Ramp - Merge Area | C (25) | C (25) |
| Westbound | On Ramp - Diverge Area | C (25) | C (28) |
| | Off Ramp - Merge Area | C (25) | C (27) |

| Table 8 - Multilane Highway Analysis | | | |
|---|---|---|---|
| | | LOS | |
| Morning Peak Hour | | Without Project | With Project |
| Farrington Highway East of Project Road C | Eastbound | A | A |
| | Westbound | A | A |
| | | LOS | |
| Afternoon Peak Hour | | Without Project | With Project |
| Farrington Highway East of Project Road C | Eastbound | A | A |
| | Westbound | A | A |

## CONCLUSIONS AND RECOMMENDATIONS

The previous plan for the East Kapolei Project reported in "Traffic Impact Assessment Report For East Kapolei Project" had assumed significantly more residential units and consequently more traffic than proposed currently. However, the previous conclusions and recommendations are still valid for this report update.

The results of the traffic analysis indicate that the proposed East Kapolei Project will significantly change the traffic flow quality at the study intersections when the project is completed. Major road improvements have been identified in the Ewa Region Highway Master Plan and adopted by the Oahu Metropolitan Planning Organization (OMPO). These improvements are assumed as part of the roadway network by 2010 in the assessment of the traffic impacts.

In order to minimize the impact of the project and provide for smoother traffic operating conditions, we recommend the following by the year 2010:

- Two left-turn lanes westbound at the intersection of Farrington Highway and the North-South Road.
- Addition of an extra through lane from about 1000' west of the intersection of Farrington Highway and the North-South Road to Project Road "C", east of the intersection.
- Two left-turn lanes entering and exiting Project Roads "A" and "B"

Sufficient right-of-way should be set aside to provide for future widening as development and traffic warrants. Traffic signals should be planned. Exact implementation dates depend on when traffic volumes meet established signal warrants.

Alternate methods of transportation actions should be investigated. A comprehensive plan that includes both Transportation System Management and

Transportation Demand Management concepts should be developed for the area which would include the Project. Future traffic levels have regional sources that are undergoing current development. Integrated transit services, roadway plans and construction schedules, computer controlled traffic lights, remote parking areas, shuttle services, paratransit, bicycle and pedestrian ways, and some form of exclusive way transit should be considered in a comprehensive plan. Beyond transportation actions, the need for integrated land use planning for all the major parcels will aid in reducing the need for vehicle trips. The inclusion of convenience retail, minor commercial, schools, and parks within the East Kapolei Project will eliminate the need of travel on external roads for those trip purposes.

From a planning perspective, the City and State are making efforts to update the Long Range Plan with new population and traffic forecast values for the Ewa Region. The results reported herein pertain specifically to the East Kapolei Project in addition to current preliminary population estimates. This assessment approach is conservative in that the impact is greater than would be expected, as population exceeds what is set forth in preliminary figures. The new region-wide forecasts will likely result in less impacts and roadway needs than indicated herein due to smaller values of population.

An example of a potentially major change that should be included in the update study is the final version of the BPNAS Reuse Plan. This and other major land use proposals in the Ewa Region should be evaluated for traffic impact on a region-wide basis, and their mitigating actions included in the afore-mentioned comprehensive transportation plan. Thus, 2010 impacts should be re-evaluated when those forecasts are available, and a plan be developed that not only addresses highway projects but land use planning, transit, and other modes and services as well.

# L

## THE EAST KAPOLEI AND VICINITY WASTEWATER COLLECTION SYSTEM MASTER PLAN, REVISED FEBRUARY 15, 1996

GRAY, HONG, BILLS & ASSOCIATES

# THE EAST KAPOLEI & VICINITY

# WASTEWATER COLLECTION SYSTEM MASTER PLAN

# EAST KAPOLEI PROJECT

# HONOULIULI, EWA, OAHU, HAWAII

Prepared By

GRAY, HONG, BILLS & ASSOCIATES, INC.
119 Merchant Street, Suite 607
Honolulu, Hawaii 96813

Revised February 15, 1996

2479-1

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## EXHIBITS


EXHIBIT 1 -- East Kapolei Sewer Tributary Areas

EXHIBIT 2 -- Total Average Daily Flow Calculations

EXHIBIT 3 -- Tributary Area Flow Projections

EXHIBIT 4 -- Proposed Regional Interceptor Sewer System

EXHIBIT 5 -- Projected Wastewater Flows from Various Developments Revised to Add East Kapolei Development

EXHIBIT 6 -- Interceptor Capacities

EXHIBIT 7 -- Campbell Estate Disclaimer


## LIST OF APPENDICES


APPENDIX 1 -- Preliminary Oversizing of East Kapolei Project Sewer Lines for Campbell Estate Property

APPENDIX 2 -- Proposed 42" Sewer Alignment within HECO 138 KV Easement

APPENDIX 3 -- Preliminary Sizing of Sewer Lines for East Kapolei Project Alone

## SECTION 1. BACKGROUND INFORMATION

Schuler Homes, Inc. will be developing approximately 742 acres of land in Ewa known as the East Kapolei project. The East Kapolei project is bound by the H-1 freeway to the north, North-South Road to the west, Ewa Villages to the south and Fort Weaver Road to the east. The project will consist of 8,000 single-family and multi-family units.

We are in the process of preparing preliminary planning documents for the East Kapolei project to support a Land Use Commission petition, Development Plan redesignation and ultimately a Change of Zone request. To that end, Schuler Homes, Inc. is requesting preliminary comments regarding various infrastructure requirements. To assist the Department of Wastewater Management, Schuler Homes, Inc. has assumed the lead in providing master planning for utility services to the project area which makes assumptions for its unsewered neighbors. This preliminary wastewater master plan covers all the agricultural lands remaining in Ewa and bounded by the H-1 Freeway to the north, Ewa Villages to the south, the Villages of Kapolei to the west and West Loch Estates to the east. The total acreage involved in this master plan is approximately 2,809 acres. Of all the projects proposed in this area, it is only known that the development of Schuler's acreage will be proceeding uniformly beginning in 1998 with completion in 2010, approximately 13 years later (approximately 600 units per year).

## SECTION 2. DESIGN FLOWS

Exhibit 1 shows the master plan area. Exhibit 2 shows sewer projections for all of the individual parcels within the master planning boundaries. Exhibit 3 tabulates the average daily flow for each subarea within the tributary area including maximum flow, design average flow and peak design flow. This master plan assumes that the main interceptor trunk sewer which would deliver wastewater to the Honouliuli Treatment Plant would conceptually exist as shown on Exhibit 4.

Based on the data generated in Exhibit 3, the design peak flow for the master plan area would be approximately 19.9 mgd. This wastewater would need to be transported from the mauka limits of Ewa Villages along North-South Road in a southerly direction to a corridor approximately parallel with the existing Makakilo interceptor (30" sewer). At this intersection, the East Kapolei interceptor sewer would have the following possibilities:

1. Install its own parallel interceptor and travel east to the Honouliuli Treatment Plant. The required sewer interceptor size would be 42-inch based on the flow calculations contained in Exhibit 6.

2. Combine with the Kapolei interceptor (future). The total flow which would exist in this segment of trunk sewer is based on a combination of the master plan service area and the Villages of Kapolei trunk sewer calculations as shown on Exhibit 5. The required interceptor size would be 60-inches based on the design peak flow of 52.2 mgd as shown on the calculations contained in Exhibit 6.

Appendix 1 includes preliminary line oversizing for the East Kapolei project accounting for Estate of James Campbell property. Appendix 2 includes information on the alignment of the proposed 42" sewer line within the easement for the 138 KV Heco line. Appendix 3 includes preliminary line sizing of the sewer lines for the East Kapolei Project alone.

## SECTION 3. HONOULIULI TREATMENT PLANT CAPACITY

The proposed East Kapolei project will ultimately generate an average daily flow of 1.98 million gallons of wastewater flow over a 13-year period. The total average daily flow from the planning area will be 8.0 mgd. The time frame to generate the average daily flow of 8.0 mgd is unknown at the current time. Assuming orderly development it will be necessary to determine whether Honouliuli expansion can accommodate the East Kapolei sewage generation projections.

## SECTION 4. TEMPORARY COLLECTOR & SERVICE

We anticipate that 2 or 3 of the 50-acre blocks could be constructed before the North-South Road corridor is in place with the 42-inch East Kapolei trunk sewer connecting to Honouliuli Wastewater Treatment Plant. To meet project scheduling, it is anticipated that the 42-inch interceptor will be available for connection in 1999. However, since Schuler Homes, Inc. anticipates sales beginning in late 1998, a temporary connection to the City & County system is proposed as shown on Exhibit 1. The proposed connection to the City & County system is at the terminus of the 30-inch system adjacent to the elderly housing project on Fort Weaver Road.

The proposed interim flow has been calculated based on the following:

1. Development = 1000 units
   a. 750 multi-family
   b. 250 single-family
2. Development area = 100 acres
3. Equivalent population = 3,100 people
4. Average daily flow (80 gal.) = 0.25 mgd
5. Maximum flow factor (Factor = $5/P^{0.2}$) = 3.99
6. Maximum flow = 1.0 mgd

7. Dry weather infiltration (5 gcd) = 0.016 mgd

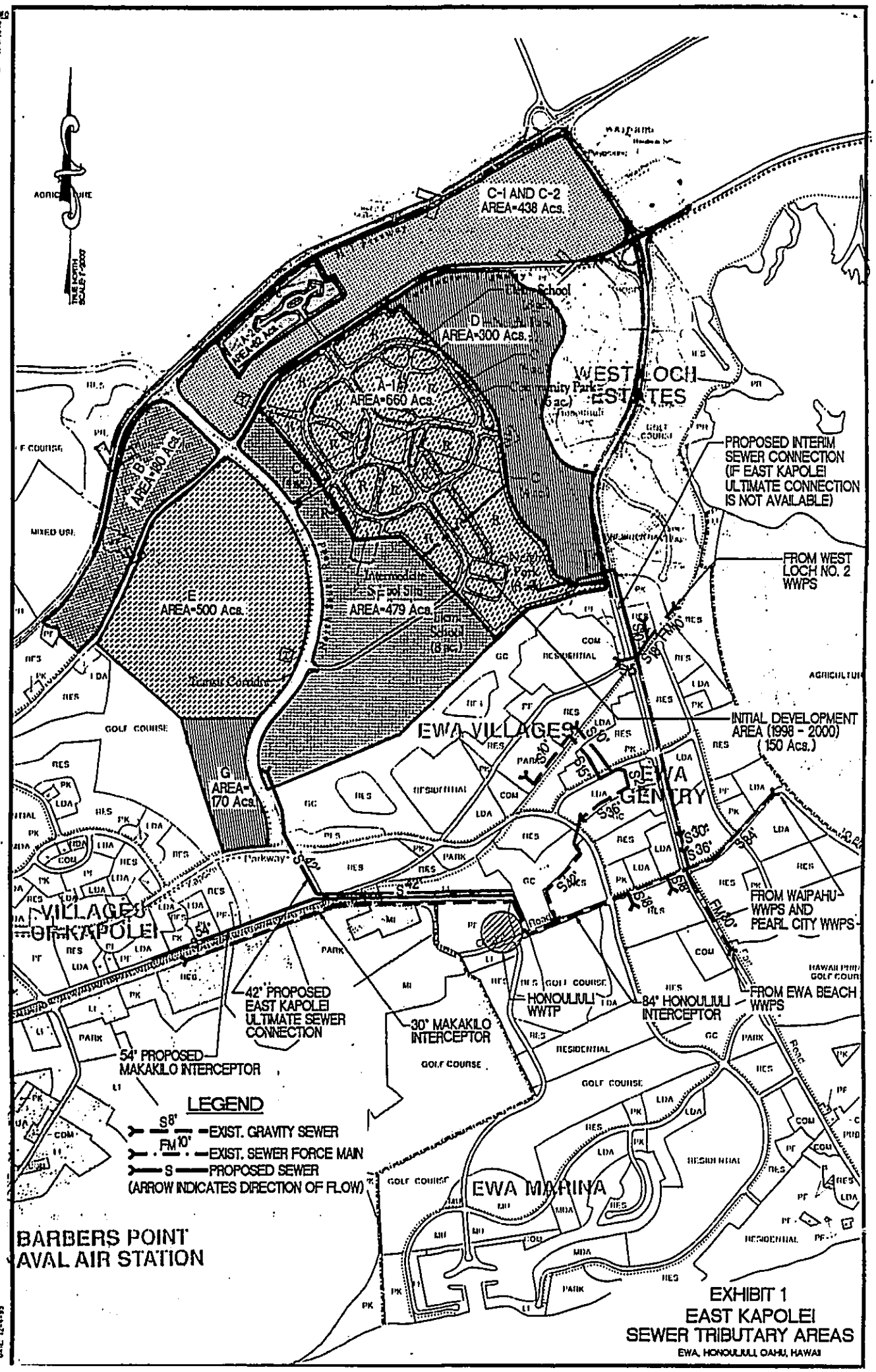
8. Design average flow = 0.25 + 0.016 = 0.266 mgd

9. Design maximum flow = 1.0 + 0.016 = 1.016 mgd

10. Wet weather infiltration (1250 gad) = 0.188 mgd

11. Design peak flow = 1.016 + 0.188 = 1.204 mgd say 1.2 mgd

The Department of Wastewater Management will need to confirm that capacity is available with the existing sewer lines within Fort Weaver Road. A determination as to whether this temporary improvement could be permanent is also an unresolved issue.


C-1 AND C-2
AREA=438 Acs.
D
AREA=300 Acs.
A-1
AREA=660 Acs.
A-2
AREA=92 Acs.
B
AREA=80 Acs.
E
AREA=500 Acs.
F
AREA=479 Acs.
G
AREA=
170 Acs.
WEST LOCH
ESTATES
EWA VILLAGES
EWA
GENTRY
VILLAGES
OF KAPOLEI
EWA MARINA
BARBERS POINT
NAVAL AIR STATION
PROPOSED INTERIM
SEWER CONNECTION
(IF EAST KAPOLEI
ULTIMATE CONNECTION
IS NOT AVAILABLE)
FROM WEST
LOCH NO. 2
WWPS
INITIAL DEVELOPMENT
AREA (1998 - 2000)
(150 Acs.)
FROM WAIPAHU
WWPS AND
PEARL CITY WWPS
FROM EWA BEACH
WWPS
84" HONOULIULI
INTERCEPTOR
HONOULIULI
WWTP
30" MAKAKILO
INTERCEPTOR
42" PROPOSED
EAST KAPOLEI
ULTIMATE SEWER
CONNECTION
54" PROPOSED
MAKAKILO INTERCEPTOR
LEGEND
S8" EXIST. GRAVITY SEWER
FM10" EXIST. SEWER FORCE MAIN
S PROPOSED SEWER
(ARROW INDICATES DIRECTION OF FLOW)
EXHIBIT 1
EAST KAPOLEI
SEWER TRIBUTARY AREAS
EWA, HONOLULU, OAHU, HAWAII

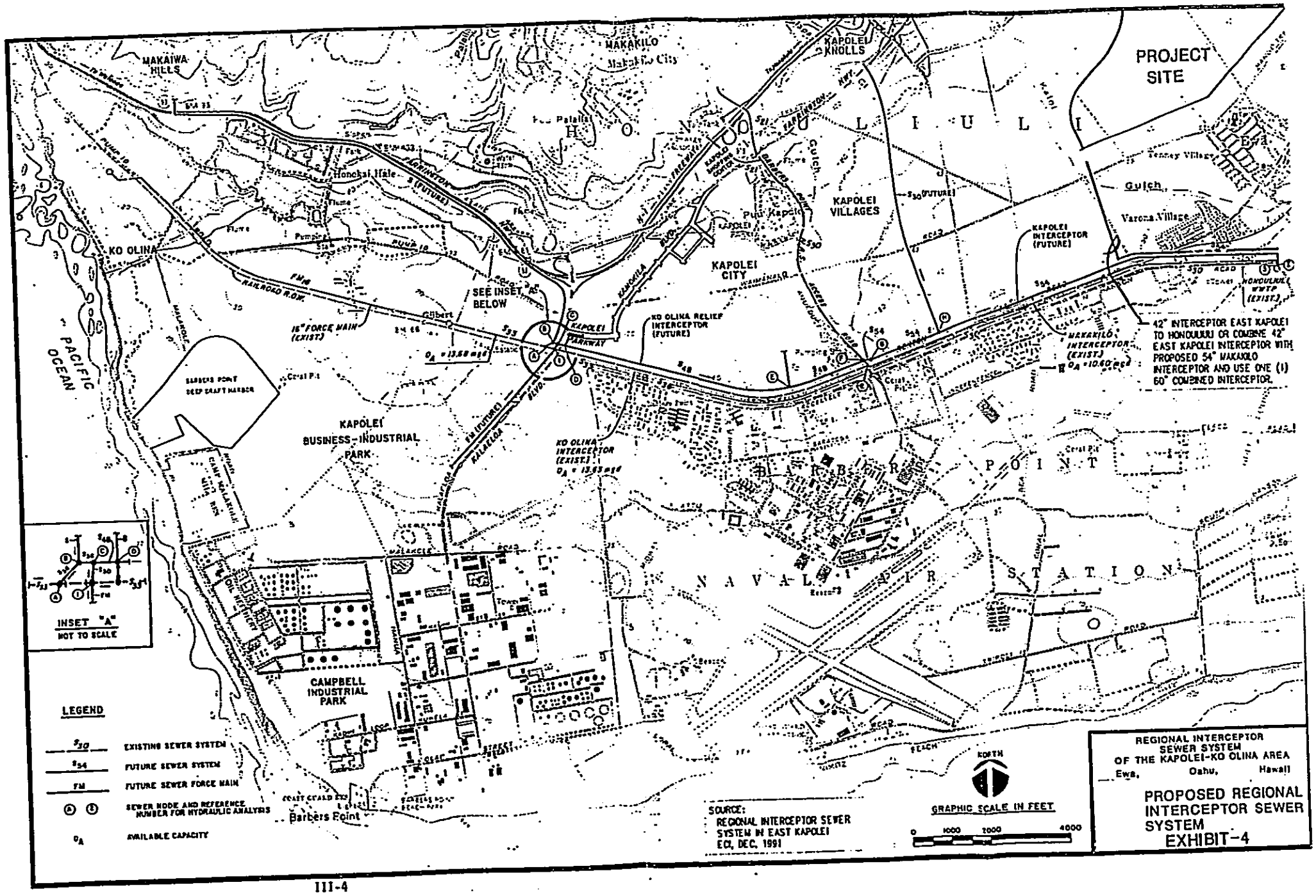
| .Owner | Zone | Tributary Area (Acres) | Units Capita | Equivalent Population | Average Flow Calculations | Total Flow (mgd) |
|---|---|---|---|---|---|---|
| East Kapolei | A-1 | 660 | 1,780 Single-family<br>5,340 Multi-family | 22,072 | 1,780 x 4 x 80 gpcd = 0.570 mgd<br>5,340 x 2.8 x 80 gpcd = 1.196 mgd | 1.766 |
| | A-2 | 82 | 220 Single-family<br>660 Multi-family | 2,728 | 220 x 4 x 80 gpcd = 0.070 mgd<br>660 x 2.8 x 80 gpcd = 0.148 mgd | 0.218 |
| | Subtotal | 742 | 2,000 Single-family<br>6,000 Multi-family | 24,800 | Subtotal | 1.984 |
| Campbell Estate | B | 180 | 47 capita per acre [1] | 8,460 | 180 x 47 x 80 gpcd = 0.676 mgd | 0.676 |
| Campbell Estate | C-1 | 172 | 41 capita per acre [1] | 7,052 | 172 x 41 x 80 gpcd = 0.564 mgd | 0.564 |
| | C-2 | 266 | 45 capita per acre [1] | 11,970 | 266 x 45 x 80 gpcd = 0.958 mgd | 0.958 |
| | Subtotal | 438 | | 19,022 | Subtotal | 1.522 |
| Campbell Estate | D | 300 | 48 capita per acre [1] | 14,400 | 300 x 48 x 80 gpcd = 1.152 mgd | 1.152 |
| University of Hawaii, West Oahu Campus | E | 500 | 20,000 capita | 6,250[2] | 6,250 x 25 gpcd = 0.5 mgd | 0.500 |
| Campbell Estate<br>State of Hawaii[3] | F | 46 (Campbell)[3]<br>433 (State)[3]<br>479 (Total) | 48 capita per acre [1] | 22,992 | 479 x 48 x 80 gpcd = 1.839 mgd | 1.839 |
| DHHL | G | 170 | 6 units/acre | 4,080 | 170 x 6 x 4 x 80 gpcd = 0.327 mgd | 0.327 |
| | | 2,809 | | 113,754 | Total Average Daily Flow | 8.000 |

[1] Based on information provided by Engineering Concepts, Inc.
[2] Based on 20,000 @ 25 gpcd = 6,250 @ 80 gpcd
[3] Revised January 16, 1996

Exhibit 2 -- Total Average Daily Flow Calculations

| Sewer Location | | Tributary Area (Acres) | | Tributary Equivalent Population | | | | | | Wastewater Flow Computation | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Residential | | Other | | Total | | | | | | | | | |
| District Zone or Street | Refer | Incr. | Total | Incr. | Total | Incr. | Total | Incr. | Total | Ave. WWF @ 80 GPCD (MGD) | Maximum Flow Factor | Maximum Flow (mgd) | Dry Weather Infiltration (mgd) | Design Average Flow (mgd) | Design Maximum Flow (mgd) | Wet Weather Infiltration (mgd) | Design Peak Flow (mgd) |
| Area "C-1" | | 172.00 | 172.00 | 7,052 | 7,052 | - | - | 7,052 | 7,052 | | | | | | | | |
| Area "C-2" | | 266.00 | 266.00 | 11,970 | 11,970 | - | - | 11,970 | 11,970 | | | | | | | | |
| Area "D" | | 300.00 | 300.00 | 14,400 | 14,400 | - | - | 14,400 | 14,400 | | | | | | | | |
| Area "A-1" | | 660.00 | 660.00 | 22,072 | 22,072 | - | - | 22,072 | 22,072 | | | | | | | | |
| Area "A-2" | | 82.00 | 82.00 | 2,728 | 2,728 | - | - | 2,728 | 2,728 | | | | | | | | |
| Area "F" | | 479.00 | 479.00 | 22,992 | 22,992 | - | - | 22,992 | 22,992 | | | | | | | | |
| Area "B" | | 180.00 | 180.00 | 8,460 | 8,460 | - | - | 8,460 | 8,460 | | | | | | | | |
| Area "E" | | 500.00 | 500.00 | - | - | 6,250 | 6,250 | 6,250 | 6,250 | | | | | | | | |
| Area "G" | | 170.00 | 170.00 | 4,080 | 4,080 | - | - | 4,080 | 4,080 | | | | | | | | |
| Total | | | 2809.00 | | 93,754 | | 6,250 | | 100,004 | 8.000 | 1.991 | 15.92 | 0.500 | 8.500 | 16.425 | 3.511 | 19.936 |

EXHIBIT 3 -- TRIBUTARY AREA FLOW PROJECTIONS


PROJECT SITE
MAKAIWA HILLS
MAKAKILO
KAPOLEI KNOLLS
KAPOLEI VILLAGES
KAPOLEI CITY
KO OLINA
SEE INSET BELOW
KAPOLEI PARKWAY
KO OLINA RELIEF INTERCEPTOR (FUTURE)
KAPOLEI INTERCEPTOR (FUTURE)
MAKAKILO INTERCEPTOR (EXIST)
42" INTERCEPTOR EAST KAPOLEI TO HONOLULU OR COMBINE 42" EAST KAPOLEI INTERCEPTOR WITH PROPOSED 54" MAKAKILO INTERCEPTOR AND USE ONE (1) 60" COMBINED INTERCEPTOR.
KO OLINA INTERCEPTOR (EXIST)
KAPOLEI BUSINESS-INDUSTRIAL PARK
CAMPBELL INDUSTRIAL PARK
BARBERS POINT
NAVAL AIR STATION
PACIFIC OCEAN
Barbers Point
INSET "A" NOT TO SCALE
LEGEND
EXISTING SEWER SYSTEM
FUTURE SEWER SYSTEM
FUTURE SEWER FORCE MAIN
SEWER NODE AND REFERENCE NUMBER FOR HYDRAULIC ANALYSIS
AVAILABLE CAPACITY
SOURCE: REGIONAL INTERCEPTOR SEWER SYSTEM IN EAST KAPOLEI ECI, DEC. 1991
NORTH
GRAPHIC SCALE IN FEET
0 1000 2000 4000
REGIONAL INTERCEPTOR SEWER SYSTEM OF THE KAPOLEI-KO OLINA AREA
Ewa, Oahu, Hawaii
PROPOSED REGIONAL INTERCEPTOR SEWER SYSTEM
EXHIBIT-4

| Sewer Location | | Tributary Area (Acres) | | Tributary Equivalent Population | | | | | | Wastewater Flow Computation | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Residential | | Other | | Total | | | | | | | | | |
| District Zone or Street | Refer | Incr. | Total | Incr. | Total | Incr. | Total | Incr. | Total | Ave. WWF @ 80 GPCD (MGD) | Maximum Flow Factor | Maximum Flow (mgd) | Dry Weather Infiltration (mgd) | Design Average Flow (mgd) | Design Maximum Flow (mgd) | Wet Weather Infiltration (mgd) | Design Peak Flow (mgd) |
| Ko Olina Resort | 1 | 600.00 | 600.00 | 39,549 | 39,549 | | - | 39,549 | 39,549 | 3.164 | 2.396 | 7.58 | 0.198 | 3.362 | 7.779 | 0.750 | 8.529 |
| KBIP (JCIP) | 2 | 850.00 | 850.00 | | - | 72,515 | 72,515 | 72,515 | 72,515 | 5.801 | 2.123 | 12.31 | 0.698 | 6.499 | 13.012 | 1.256 | 14.268 |
| BP Deep Harbor | 2 | 269.00 | 269.00 | | - | 10,752 | 10,752 | 10,752 | 10,752 | 0.860 | 3.109 | 2.67 | 0.376 | 1.236 | 3.051 | 0.739 | 3.790 |
| Camp Malakole | 2 | 65.00 | 65.00 | 2,588 | 2,588 | | | 2,588 | 2,588 | 0.207 | 4.134 | 0.86 | 0.091 | 0.298 | 0.947 | 0.178 | 1.125 |
| KBIP (Total) | | 1184.00 | 1184.00 | | | | | | 85,855 | 6.868 | 2.052 | 14.10 | 1.165 | 8.033 | 15.260 | 2.173 | 17.433 |
| Makaiiwa Hills | 3 | 735.00 | 735.00 | 12,000 | 12,000 | | - | 12,000 | 12,000 | 0.960 | 3.042 | 2.92 | 0.060 | 1.020 | 2.980 | 0.919 | 3.899 |
| Kapolei City | 4 | 766.00 | 766.00 | 27,278 | 27,278 | | - | 27,278 | 27,278 | 2.182 | 2.581 | 5.63 | 0.136 | 2.319 | 5.769 | 0.958 | 6.727 |
| Kapolei Knolls | 5 | 75.00 | 75.00 | 2,000 | 2,000 | | - | 2,000 | 2,000 | 0.160 | 4.353 | 0.70 | 0.010 | 0.170 | 0.706 | 0.094 | 0.800 |
| Kapolei Village | 6 | 823.00 | 823.00 | 24,255 | 24,255 | | - | 24,255 | 24,255 | 1.940 | 2.642 | 5.13 | 0.121 | 2.062 | 5.249 | 1.029 | 6.277 |
| Makakilo City | 7 | 971.00 | 971.00 | 31,700 | 31,700 | | - | 31,700 | 31,700 | 2.536 | 2.620 | 6.64 | 0.159 | 2.695 | 6.803 | 1.214 | 8.017 |
| ALL AREAS | | | 5154.00 | | 139,370 | | 83,267 | | 222,637 | 17.811 | 1.696 | 30.21 | 1.849 | 19.660 | 32.058 | 7.136 | 39.194 |
| East Kapolei & Adjacent Property Owners | | 2809.00 | 2809.00 | 93,754 | 93,754 | 6,250 | 6,250 | 100,004 | 100,004 | 8.000 | 1.991 | 15.92 | 0.500 | 8.500 | 16.425 | 3.511 | 19.936 |
| ALL AREAS | | | 7963.00 | | 233,124 | | 89,517 | | 322,641 | 25.811 | 1.575 | 40.65 | 1.613 | 27.424 | 42.261 | 9.954 | 52.215 |

Original Table III-1 prepared by Engineering Concepts, Inc.

Included in "Engineering Report for the Regional Interceptor Sewer System for the Developments of the Estate of James Campbell in the Kapolei Area" dated December 1991.

EXHIBIT 5 --PROJECTED WASTEWATER FLOWS FROM VARIOUS DEVELOPMENTS
REVISED TO ADD EAST KAPOLEI DEVELOPMENT AND ADJACENT PROPERTY OWNERS

********** PIPECAP **********
********** Version 2.50 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: East Kapolei
User: GRAY HONG BILLS & ASSOCIATES
Date: 2/15/1996 Thursday
Time: 15:00:15
Output: EXH6

| MANNING n | SPAN in | RISE in | SLOPE ft/ft | JUST FULL VELOCITY fps | JUST FULL DISCHARGE cfs | JUST FULL DISCHARGE AT So-.001 cfs | JUST FULL DISCHARGE AT So+.001 cfs |
|---|---|---|---|---|---|---|---|
| Circular | | | | | | | |
| .01300 | 63.00 | 63.00 | .001000 | 4.33 | 93.80 (60.63 MGD) | .0 | 132.7 |
| .01300 | 60.00 | 60.00 | .001000 | 4.19 | 82.36 (53.24 MGD) | .0 | 116.5 |
| .01300 | 42.00 | 42.00 | .001000 | 3.31 | 31.82 20.57 MGD) | .0 | 45.0 |
| .01300 | 30.00 | 30.00 | .004000 | 5.28 | 25.94 16.77 MGD) | 22.5 | 29.0 |
| .01300 | 30.00 | 30.00 | .003000 | 4.58 | 22.47 (14.52 MGD) | 18.3 | 25.9 |
| .01300 | 24.00 | 24.00 | .004000 | 4.55 | 14.31 (9.25 MGD) | 12.4 | 16.0 |
| .01300 | 21.00 | 21.00 | .004000 | 4.17 | 10.02 (6.48 MGD) | 8.7 | 11.2 |
| .01500 | 18.00 | 18.00 | .007000 | 4.31 | 7.62 (4.93 MGD) | 7.0 | 8.1 |
| .01500 | 15.00 | 15.00 | .005000 | 3.23 | 3.96 (2.56 MGD) | 3.5 | 4.3 |

Exhibit 6 -- Interceptor Capacities

Re: Campbell Estate Disclaimer

To Whom It May Concern:

The information contained in the attached materials represents the views of Schuler Homes, Inc. ("Schuler"), and has been prepared by or for Schuler from its own sources. This information does not necessarily reflect the views of the Estate of James Campbell (the "Estate"), and the Estate expressly disclaims any responsibility for the accuracy or completeness of such information. Nothing in the attached materials shall be deemed or construed in any way to represent the views of the Estate, or to bind or otherwise obligate the Estate in any way, all rights of the Estate being hereby expressly reserved. All inquiries regarding the Estate's position on any matters set forth in the attached materials should be directed to Ms. Jan Burns, Manager, Special Projects, Campbell Estate.

Exhibit 7

1001 Kamokila Boulevard, Kapolei, Hawaii 96707 Phone (808) 674-6674 Facsimile (808) 674-3111

# APPENDIX 1

**Preliminary Oversizing of East Kapolei Project Sewer Lines for Campbell Estate Property**

| Sewer Location | | Tributary Area (Acres) | | Tributary Equivalent Population | | | | | | Wastewater Flow Computation | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Residential | | Other | | Total | | | | | | | | | |
| District Zone or Street | Refer | Incr. | Total | Incr. | Total | Incr. | Total | Incr. | Total | Ave. WWF @ 80 GPCD (MGD) | Maximum Flow Factor | Maximum Flow (mgd) | Dry Weather Infiltration (mgd) | Design Average Flow (mgd) | Design Maximum Flow (mgd) | Wet Weather Infiltration (mgd) | Design Peak Flow (mgd) |
| Sewer "C" | Area "C" & A-2" | 520.00 | 520.00 | 21,750 | 21,750 | | - | 21,750 | 21,750 | 1.740 | 2.701 | 4.70 | 0.109 | 1.849 | 4.808 | 0.650 | 5.458 |
| Sewer "D-1" | 1/2 Area "D" | 150.00 | 150.00 | 7,200 | 7,200 | | - | 7,200 | 7,200 | 0.576 | 3.369 | 1.94 | 0.036 | 0.612 | 1.977 | 0.188 | 2.164 |
| Sewer "D" (Alternative) | Area "D" | 300.00 | 300.00 | 14,400 | 14,400 | | - | 14,400 | 14,400 | 1.152 | 2.933 | 3.38 | 0.072 | 1.224 | 3.451 | 0.375 | 3.826 |
| Sewer "AD-1" | 1/2 Areas "A-1" and "D" | 630.00 | 630.00 | 18,236 | 18,236 | | - | 18,236 | 18,236 | 1.459 | 2.798 | 4.08 | 0.091 | 1.550 | 4.173 | 0.788 | 4.960 |
| Sewer "AC" | Areas "C", "A-2" & 1/2 Area "A" | 850.00 | 850.00 | 32,786 | 32,786 | | - | 32,786 | 32,786 | 2.623 | 2.488 | 6.53 | 0.164 | 2.787 | 6.689 | 1.063 | 7.752 |
| Sewer "ACD-1 | Areas "A-1", "A-2", "C", & 1/2 Area "D" | 1330.00 | 1330.00 | 51,022 | 51,022 | | - | 51,022 | 51,022 | 4.082 | 2.277 | 9.30 | 0.255 | 4.337 | 9.550 | 1.663 | 11.213 |
| Sewer "ACD" | Areas "A", "C" & "D" | 1480.00 | 1480.00 | 58,222 | 58,222 | | - | 58,222 | 58,222 | 4.658 | 2.218 | 10.33 | 0.291 | 4.949 | 10.622 | 1.850 | 12.472 |
| Sewer "A" | Areas "A" thru "G" | 2809.00 | 2809.00 | 93,754 | 93,754 | 6,250 | 6,250 | 100,004 | 100,004 | 8.000 | 1.991 | 15.92 | 0.500 | 8.500 | 16.425 | 3.511 | 19.936 |

EXHIBIT A1-1 – PEAK FLOW CALCULATIONS

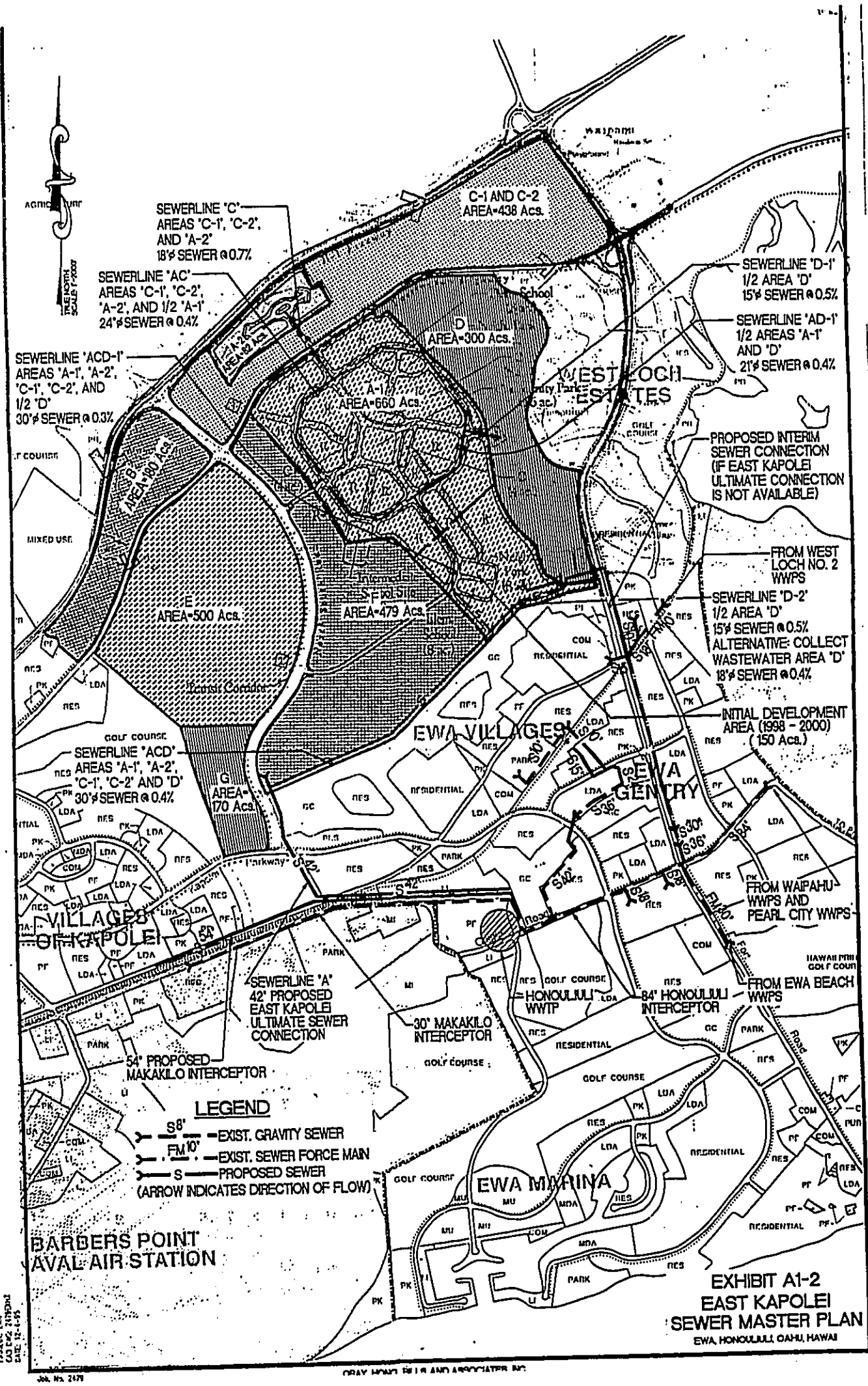



EXHIBIT A1-2
EAST KAPOLEI
SEWER MASTER PLAN
EWA, HONOLULU, OAHU, HAWAII

********** PIPECAP **********
********** Version 2.50 **********
********** COMPUTER-AIDED HYDROLOGY & HYDRAULICS **********

PROJECT: East Kapolei
User: GRAY HONG BILLS & ASSOCIATES
Date: 2/15/1996 Thursday
Time: 15:00:15
Output: EXHA13

| MANNING n | SPAN in | RISE in | SLOPE ft/ft | JUST FULL VELOCITY fps | JUST FULL DISCHARGE cfs | JUST FULL DISCHARGE AT So-.001 cfs | JUST FULL DISCHARGE AT So+.001 cfs |
|---|---|---|---|---|---|---|---|
| Circular | | | | | | | |
| .01300 | 63.00 | 63.00 | .001000 | 4.33 | 93.80 (60.63 MGD) | .0 | 132.7 |
| .01300 | 60.00 | 60.00 | .001000 | 4.19 | 82.36 (53.24 MGD) | .0 | 116.5 |
| .01300 | 54.00 | 54.00 | .001000 | 3.91 | 62.19 (40.20 MGD) | .0 | 87.94 |
| .01300 | 48.00 | 48.00 | .001000 | 3.61 | 45.42 (29.36 MGD) | .0 | 64.24 |
| .01300 | 42.00 | 42.00 | .001000 | 3.31 | 31.82 (20.57 MGD) | .0 | 45.0 |
| .01300 | 30.00 | 30.00 | .004000 | 5.28 | 25.94 (16.77 MGD) | 22.5 | 29.0 |
| .01300 | 30.00 | 30.00 | .003000 | 4.58 | 22.47 (14.52 MGD) | 18.3 | 25.9 |
| .01300 | 24.00 | 24.00 | .004000 | 4.55 | 14.31 (9.25 MGD) | 12.4 | 16.0 |
| .01300 | 21.00 | 21.00 | .004000 | 4.17 | 10.02 (6.48 MGD) | 8.7 | 11.2 |
| .01500 | 18.00 | 18.00 | .007000 | 4.31 | 7.62 (4.93 MGD) | 7.0 | 8.1 |
| .01500 | 15.00 | 15.00 | .005000 | 3.23 | 3.96 (2.56 MGD) | 3.5 | 4.3 |

Exhibit A1-3 -- Interceptor Capacities

# APPENDIX 2

**Proposed 42" Sewer Alignment within HECO 138 KV Easement**

Gray • Hong • Bills & Associates, Inc.
CONSULTING ENGINEERS

Brian L. Gray, P.E.
Daniel S.C. Hong, P.E.
David B. Bills, P.E.
Roy T. Aoki, P.E.
Beverly G. Ing, P.E.
Michael H. Nojima, P.E.
Raymond M. Santo, P.E.

119 Merchant Street, Suite 607
Honolulu, Hawaii 96813
Telephone: (808) 521 0306
Fax: (808) 531 8018

# MEMORANDUM

TO: Mr. Mike Angotti
Mr. Harvey Goth
Schuler Homes, Inc.

FROM: David B. Bills DB
Gray, Hong, Bills & Associates, Inc.

SUBJECT: East Kapolei
42-inch Sewer Intercepter

DATE: November 8, 1994

The preliminary trunk sewer report shows an intercepter extending from the makai side of the East Kapolei project to the corridor for the existing 30-inch intercepter which enters the Honouliuli Treatment Plant.

We are enclosing a more detailed alignment showing the proposed 42-inch intercepter being installed on the westerly boundary and within the 75-foot Hawaiian Electric easement. We have been informed that the Hawaiian Electric easement is not exclusive and this could be a reasonable location. The enclosed preliminary plan shows 42-inch intercepter from Pole 29 to Pole 33 of the new 138 kv line alignment. This proposed alignment would allow connection of sewer from the north/south road alignment to the Honouliuli sewer intercepter corridor. Pole 33 is approximately where the north/south corridor alignment starts to swing east and the sewer would be located outside the north/south roadway corridor.

Should you have any questions regarding this matter, please contact our office.

DB:am
2479
Encl. as above

cc: Ron Katahara - MK Engineers, Ltd.
Bill Liu - Department of Wastewater Management

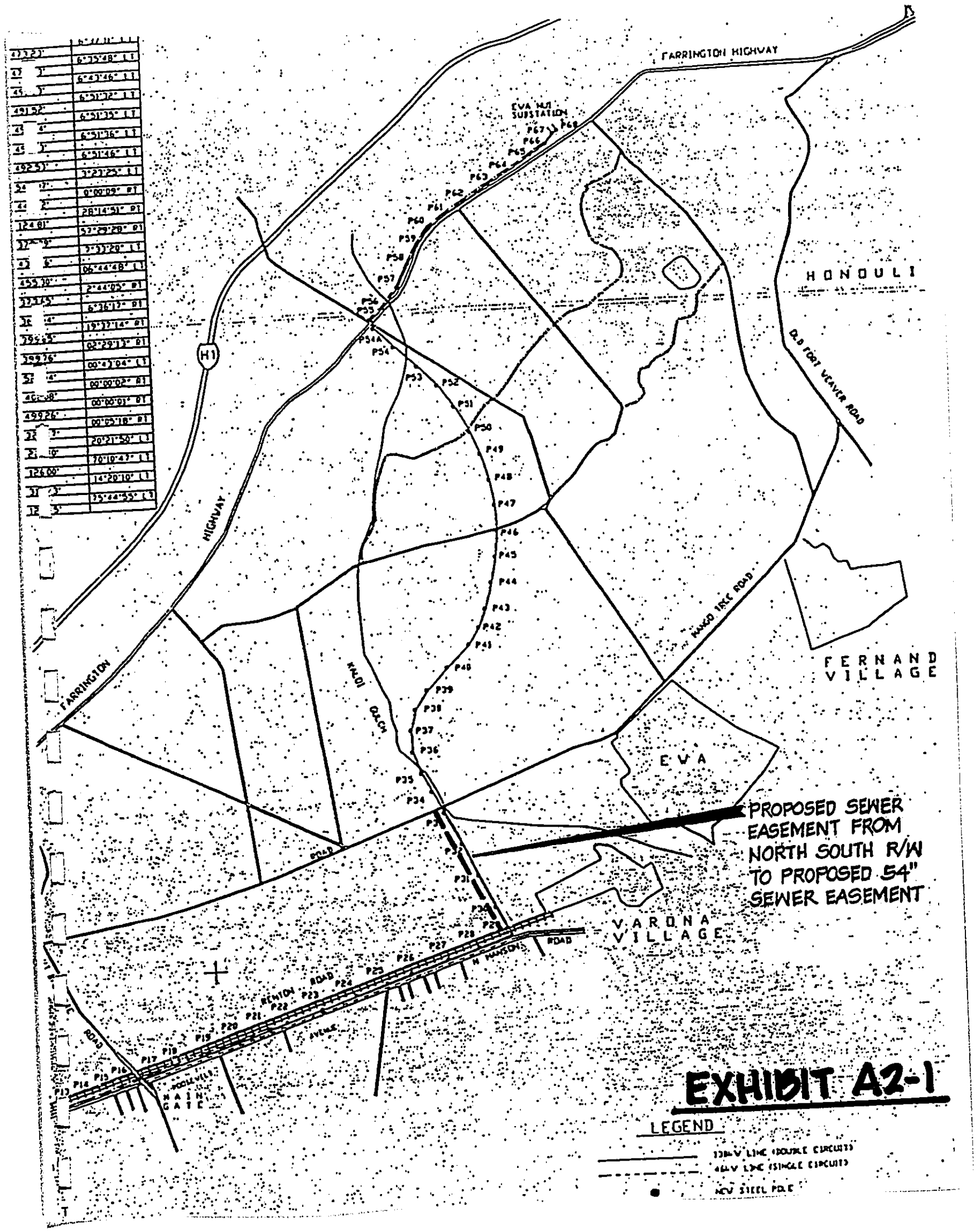
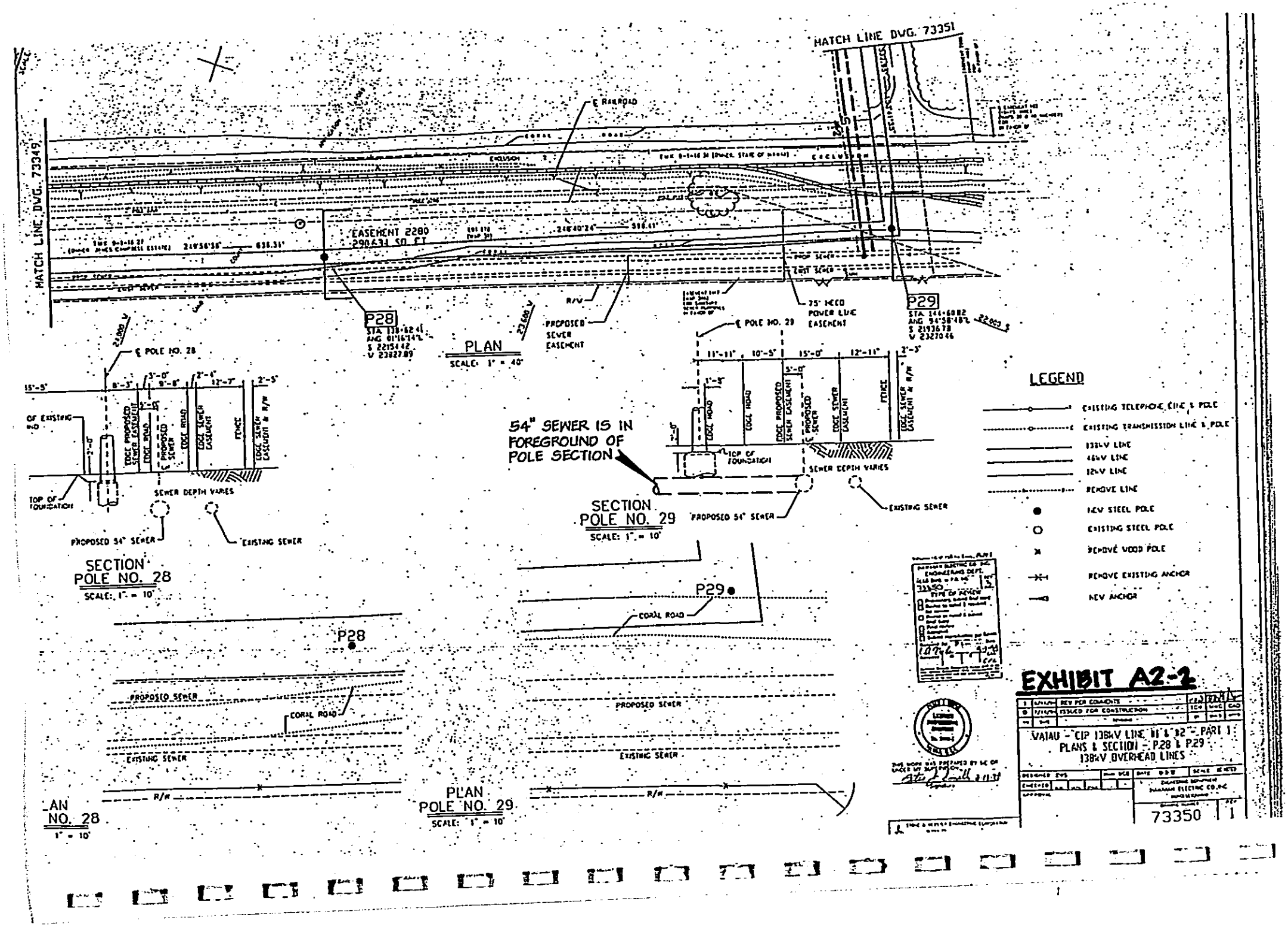
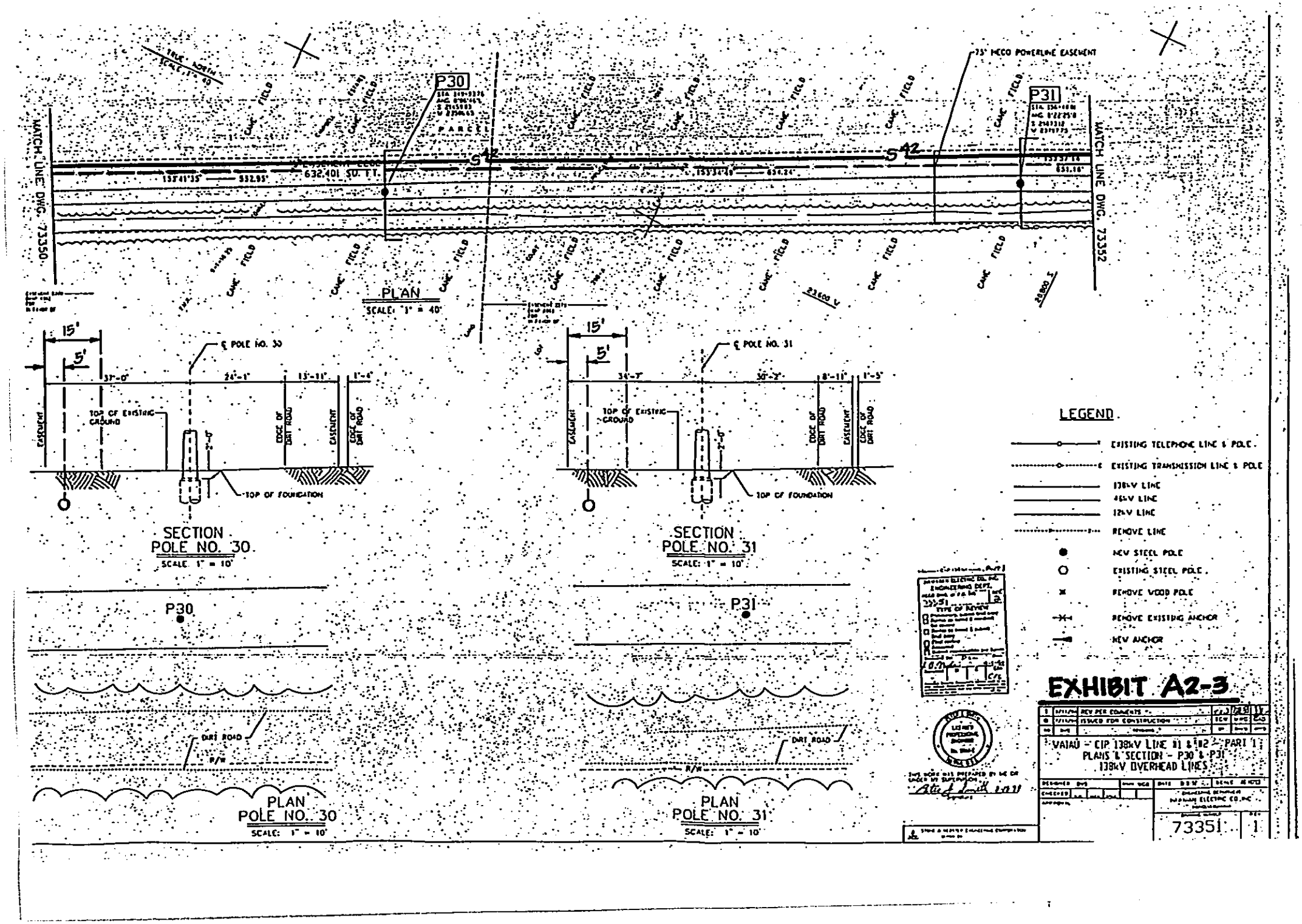
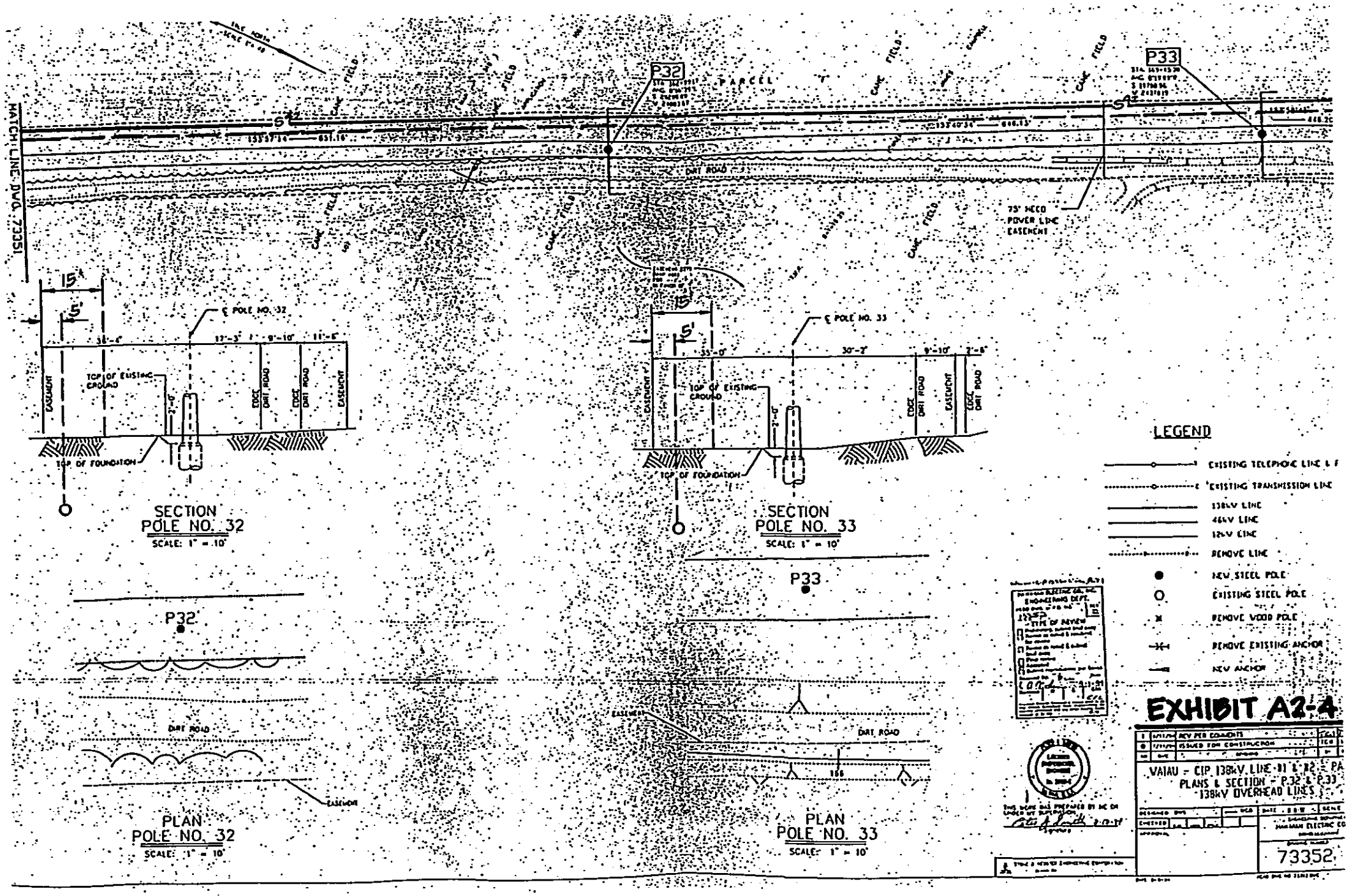

FARRINGTON HIGHWAY
EWA NUI SUBSTATION
HONOULI
OLD FORT WEAVER ROAD
MANGO TREE ROAD
FERNAND VILLAGE
EWA
VARONA VILLAGE
FARRINGTON HIGHWAY
H1
KALOI GULCH
RENTON ROAD
N HANSON ROAD
MAIN GATE
PROPOSED SEWER EASEMENT FROM NORTH SOUTH R/W TO PROPOSED 54" SEWER EASEMENT
LEGEND
NEW STEEL POLE

EXHIBIT A2-1


MATCH LINE DWG. 73349
MATCH LINE DWG. 73351
℄ RAILROAD
EASEMENT 2280
290633 SQ. FT.
P28
P29
PROPOSED SEWER EASEMENT
75' HECO POWER LINE EASEMENT
PLAN
SCALE: 1" = 40'
℄ POLE NO. 28
℄ POLE NO. 29
54" SEWER IS IN FOREGROUND OF POLE SECTION
TOP OF FOUNDATION
SEWER DEPTH VARIES
PROPOSED 54" SEWER
EXISTING SEWER
SECTION POLE NO. 28
SCALE: 1" = 10'
SECTION POLE NO. 29
SCALE: 1" = 10'
CORAL ROAD
PROPOSED SEWER
EXISTING SEWER
R/W
PLAN NO. 28
1" = 10'
PLAN POLE NO. 29
SCALE: 1" = 10'
LEGEND
EXISTING TELEPHONE LINE & POLE
EXISTING TRANSMISSION LINE & POLE
138kV LINE
46kV LINE
12kV LINE
REMOVE LINE
NEW STEEL POLE
EXISTING STEEL POLE
REMOVE WOOD POLE
REMOVE EXISTING ANCHOR
NEW ANCHOR
EXHIBIT A2-2
REV FOR COMMENTS
ISSUED FOR CONSTRUCTION
VAIAU - CIP 138kV LINE #1 & #2 - PART 1
PLANS & SECTION - P28 & P29
138kV OVERHEAD LINES
73350
1


MATCH LINE DWG. 73350
MATCH LINE DWG. 73352
TRUE NORTH
SCALE: 1" = 40'
P30
P31
PARCEL
632,401 SQ. FT.
S42
S42
75' HECO POWERLINE EASEMENT
CANE FIELD
PLAN
SCALE: 1" = 40'
15'
5'
℄ POLE NO. 30
℄ POLE NO. 31
TOP OF EXISTING GROUND
EASEMENT
EDGE OF DIRT ROAD
TOP OF FOUNDATION
SECTION POLE NO. 30
SCALE: 1" = 10'
SECTION POLE NO. 31
SCALE: 1" = 10'
DIRT ROAD
R/W
PLAN POLE NO. 30
SCALE: 1" = 10'
PLAN POLE NO. 31
SCALE: 1" = 10'
LEGEND.
EXISTING TELEPHONE LINE & POLE
EXISTING TRANSMISSION LINE & POLE
138kV LINE
46kV LINE
12kV LINE
REMOVE LINE
NEW STEEL POLE
EXISTING STEEL POLE
REMOVE WOOD POLE
REMOVE EXISTING ANCHOR
NEW ANCHOR
EXHIBIT A2-3
VAIAU - CIP 138kV LINE #1 & #2 - PART 1
PLANS & SECTION - P30 & P31
138kV OVERHEAD LINES
73351
1


MATCHLINE DWG. 73351
P32
P33
PARCEL
DIRT ROAD
CANE FIELD
73' HECO POWER LINE EASEMENT
℄ POLE NO. 32
℄ POLE NO. 33
TOP OF EXISTING GROUND
TOP OF FOUNDATION
EASEMENT
EDGE DIRT ROAD
SECTION POLE NO. 32
SCALE: 1" = 10'
SECTION POLE NO. 33
SCALE: 1" = 10'
PLAN POLE NO. 32
SCALE: 1" = 10'
PLAN POLE NO. 33
SCALE: 1" = 10'
LEGEND
EXISTING TELEPHONE LINE & F
EXISTING TRANSMISSION LINE
138kV LINE
46kV LINE
12kV LINE
REMOVE LINE
NEW STEEL POLE
EXISTING STEEL POLE
REMOVE WOOD POLE
REMOVE EXISTING ANCHOR
NEW ANCHOR
EXHIBIT A2-4
VAIAU - CIP 138kV LINE #1 & #2 - PA
PLANS & SECTION - P.32 & P.33
138kV OVERHEAD LINES
73352

**Preliminary Sizing for Sewer Lines for**

**East Kapolei Project Alone**

| Sewer Location | | Tributary Area (Acres) | | Tributary Equivalent Population | | | | | | | | | Was |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Residential | | Other | | Total | | | | | |
| District Zone or Street | Refer | Incr. | Total | Incr. | Total | Incr. | Total | Incr. | Total | Ave. WWF @ 80 GPCD (MGD) | Maximum Flow Factor | Maximum Flow (mgd) | V In |
| Sewer "C" | Area "A-2" | 82.00 | 82.00 | 2,728 | 2,728 | | - | 2,728 | 2,728 | 0.218 | 4.091 | 0.8 | |
| Sewer "AD-1" | 1/2 Area "A-1" | 330.00 | 330.00 | 11,036 | 11,036 | | - | 11,036 | 11,036 | 0.883 | 3.093 | 2.73 | |
| Sewer "AC" | Areas "A-2" & 1/2 Area "A-1" | 412.00 | 412.00 | 13,764 | 13,764 | | - | 13,764 | 13,764 | 1.101 | 2.960 | 3.2 | |
| Sewer "ACD-1 | Areas "A-1", "A-2" | 742.00 | 742.00 | 24,800 | 24,800 | | - | 24,800 | 24,800 | 1.984 | 2.631 | 5.22 | |
| Sewer "ACD" | Areas "A-1", "A-2" | 742.00 | 742.00 | 24,800 | 24,800 | | - | 24,800 | 24,800 | 1.984 | 2.631 | 5.2 | |
| Sewer "A" | Areas "A-1", "A-2" | 742.00 | 742.00 | 24,800 | 24,800 | | - | 24,800 | 24,800 | 1.984 | 2.631 | 5.22 | |

EXHIBIT A3-1 – PEAK FLOW CALCULA

| Sewer Location | | Tributary Area (Acres) | | Tributary Equivalent Population | | | | | | | | | | Was |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Residential | | Other | | Total | | | | | | |
| District Zone or Street | Refer | Incr. | Total | Incr. | Total | Incr. | Total | Incr. | Total | Ave. WWF @ 80 GPCD (MGD) | Maximum Flow Factor | Maximum Flow (mgd) | W In | |
| Ko Olina Resort | 1 | 600.00 | 600.00 | 39,549 | 39,549 | | - | 39,549 | 39,549 | 3.164 | 2.396 | 7.58 | | |
| KBIP (JCIP) | 2 | 850.00 | 850.00 | | - | 72,515 | 72,515 | 72,515 | 72,515 | 5.801 | 2.123 | 12.31 | | |
| BP Deep Harbo | 2 | 269.00 | 269.00 | | - | 10,752 | 10,752 | 10,752 | 10,752 | 0.860 | 3.109 | 2.67 | | |
| Camp Malakole | 2 | 65.00 | 65.00 | 2,588 | 2,588 | | | 2,588 | 2,588 | 0.207 | 4.134 | 0.86 | | |
| KBIP (Total) | | 1184.00 | 1184.00 | | | | | | 85,855 | 6.868 | 2.052 | 14.10 | | |
| Makaiiwa Hills | 3 | 735.00 | 735.00 | 12,000 | 12,000 | | - | 12,000 | 12,000 | 0.960 | 3.042 | 2.92 | | |
| Kapolei City | 4 | 766.00 | 766.00 | 27,278 | 27,278 | | - | 27,278 | 27,278 | 2.182 | 2.581 | 5.63 | | |
| Kapolei Knolls | 5 | 75.00 | 75.00 | 2,000 | 2,000 | | - | 2,000 | 2,000 | 0.160 | 4.353 | 0.70 | | |
| Kapolei Village | 6 | 823.00 | 823.00 | 24,255 | 24,255 | | - | 24,255 | 24,255 | 1.940 | 2.642 | 5.13 | | |
| Makakilo City | 7 | 971.00 | 971.00 | 31,700 | 31,700 | | - | 31,700 | 31,700 | 2.536 | 2.620 | 6.64 | | |
| ALL AREAS | | | 5154.00 | | 139,370 | | 83,267 | | 222,637 | 17.811 | 1.696 | 30.21 | | |
| East Kapolei Project alone | | 742.00 | 742.00 | 24,800 | 24,800 | - | - | 24,800 | 24,800 | 1.984 | 2.631 | 5.22 | | |
| ALL AREAS | | | 5896.00 | | 164,170 | | 83,267 | | 247,437 | 19.795 | 1.661 | 32.87 | | |

Original Table III-1 prepared by Engineering Concepts, Inc.
Included in "Engineering Report for the Regional Interceptor Sewer System for the Developments of the Estate of James Campbell in the Kapolei Area" dated December 1991.

EXHIBIT A3-2 --PROJECTED WASTEWATER
REVISED TO ADD EAST KAPOLEI DEVELOPME

| MANNING n | SPAN in | RISE in | SLOPE ft/ft | VELOCITY fps | DISCHARGE cfs | So-.001 cfs | So+.001 cfs |
|---|---|---|---|---|---|---|---|
| Circular | | | | | | | |
| .01300 | 60.00 | 60.00 | .001000 | 4.19 | 82.36 (53.24 MGD) | .0 | 116.5 |
| .01300 | 54.00 | 54.00 | .001000 | 3.91 | 62.19 (40.20 MGD) | .0 | 87.94 |
| .01300 | 24.00 | 24.00 | .003000 | 3.94 | 12.39 (8.01MGD) | 10.1 | 14.3 |
| .01300 | 21.00 | 21.00 | .004000 | 4.17 | 10.02 (6.48 MGD) | 8.7 | 11.2 |
| .01500 | 18.00 | 18.00 | .004000 | 3.26 | 5.76 (3.72 MGD) | 5.0 | 6.4 |
| .01500 | 12.00 | 12.00 | .007000 | 3.29 | 2.58 (1.67 MGD) | 2.4 | 2.8 |

Exhibit A3-3 -- Interceptor Capacities

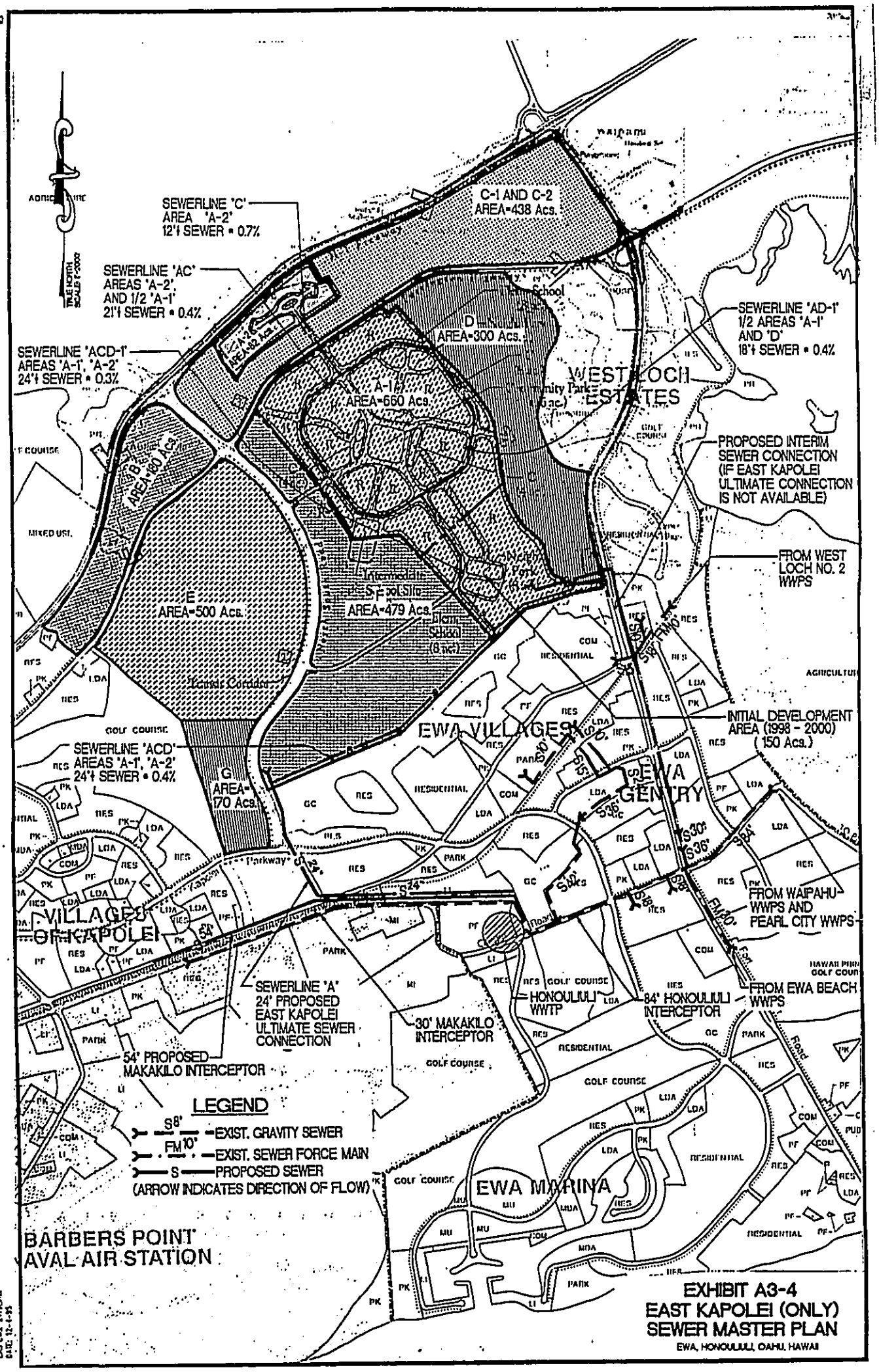



EXHIBIT A3-4
EAST KAPOLEI (ONLY)
SEWER MASTER PLAN
EWA, HONOULIULI, OAHU, HAWAII

M

# PRELIMINARY DRAINAGE STUDY, WEST LOCH DRAINAGE BASIN, EAST KAPOLEI PROJECT, DECEMBER 1, 1995

GRAY, HONG, BILLS & ASSOCIATES

# PRELIMINARY DRAINAGE STUDY

## WEST LOCH DRAINAGE BASIN
## EAST KAPOLEI PROJECT

## HONOULIULI, EWA, OAHU, HAWAII

Prepared for

SCHULER HOMES, INC.
828 Fort Street, 4th Floor
Honolulu, Hawaii 96813

Prepared by

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Revised December 1, 1995

(Addendum Added April 18, 1996)

2479-1

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## LIST OF EXHIBITS


Exhibit 1. East Kapolei Project - Preliminary Concept Plan

Exhibit 2. East Kapolei Drainage Map

Exhibit 3. Ewa by Gentry-East Offsite Drainage Plan with Proposed East Kapolei Detention/Channel

Exhibit 4. East Kapolei Channel Section "A-A" (Asing Park)

Exhibit 5. East Kapolei Channel Section "B-B" (Asing Park)

Exhibit 6. East Kapolei Preliminary Channel Profile (Asing Park)

Exhibit 7. East Kapolei Pedestrian Overpass (Asing Park)

Exhibit 8. East Kapolei Basin & Channel Plan (31 Ac. Site)

Exhibit 9. East Kapolei Typical Channel Section (31 Ac. Site)

Exhibit 10. East Kapolei Typical Channel Profile (31 Ac. Site)

Exhibit 11. Campbell Estate Disclaimer

## 1. PROJECT DESCRIPTION

The proposed East Kapolei Project by Schuler Homes, Inc. is located in Honouliuli, Ewa, Oahu (see Exhibit 1). The project site is between Ewa Villages and H-1 Freeway, west of Fort Weaver Road and east of the proposed North-South Road. The entire project covers a total of 794 acres of land, of which 52 acres is to be used for offsite infrastructures.

The proposed East Kapolei Project is a master-planned residential community of approximately 8,000 residential units. Neighborhood parks, elementary and intermediate schools, and small localized commercial areas are being proposed as part of the preliminary concept plan.

The purpose of this study is to summarize the various drainage patterns, constraints, concept drainage improvements and alternatives for the East Kapolei Project and adjacent tributary land. More detailed drainage studies and reports will be done as appropriate for the various stages of planning, land use process, zoning and design.

## 2. EXISTING TOPOGRAPHY

The project site is located within the Ewa Plain of Leeward Oahu. The land was recently taken out of sugar cane production and is now fallow. The property is relatively flat with elevations ranging from 220 feet above mean sea level (M.S.L.) at the mauka boundary at H-1 to elevation 55 feet above M.S.L. at Fort Weaver Road. The surface of the site slopes mauka to makai at approximately 1.6%.

## 3. EXISTING DRAINAGE

The East Kapolei Project is within the West Loch drainage basin. The entire West Loch drainage basin extends from below the H-1 Freeway to the shoreline, encompassing approximately 2.6 square miles and several different developments. The areas west of Fort Weaver Road and north of Ewa Villages (includes project site and EJC property) presently contribute relatively low flows because they remain undeveloped. However, upon development of these areas, storm runoff will be substantially increased.

### 3.1 DRAINAGE PATTERN

Runoff from the upper limits of the drainage area flows from H-1 Freeway, across Farrington Highway, through the project site and to the northeast Ewa Village boundary. Storm runoff then flows either along the cane haul road, which crosses under Fort Weaver Road, or over Fort Weaver Road in the vicinity just mauka of the Elderly Housing project.

The existing cane haul road is within easement "2680" on the future Asing Park site owned by the City and County of Honolulu, Department of Housing and Community Development (DHCD) (TMK: 9-1-17:66). Although Oahu Sugar Company has an easement for the cane haul road, the easement will probably be terminated since the Oahu Sugar Company is being dissolved. The cane haul road runs from the project site to the existing detention basin. Any runoff collected by the road ponds at the low-point at the underpass until it is forced out toward the basin.

Storm runoff from the Elderly Housing site, a portion of the Ewa Villages site (via two 54" pipe culverts under Fort Weaver Road), the East Kapolei project site, and Campbell Estate land flows into an existing siltation/detention basin. This basin was built within TMK: 9-1-10: por. 2 just southeast of the West Loch subdivision in conjunction with the West Loch Estates project. Overflow from the basin sheet-flows toward the West Loch basin of Pearl Harbor.

## 3.2 HYDROLOGY

The drainage basin and storm runoff flows for the project area were analyzed in this study using aerial contour maps, the **Ewa District Runoff Map** (revised July 9, 1993) prepared by Engineering Concepts, Inc. and the **"Drainage Report for Ewa by Gentry-East Phase 1"** May 1995, prepared by Park Engineering. The drainage map for the West Loch drainage basin is shown as Exhibit 2.

The Park Engineering report shows a total drainage basin area of 1,607 acres. As discussed in the Park Engineering report, for purposes of hydrologic analysis, land belonging to the City and County, Estate of James Campbell, and the State of Hawaii was considered as one watershed, the other two watersheds being the Gentry and Navy lands. In the report an average discharge per acre was computed by dividing the peak discharge by the total drainage area. This was used to determine peak discharges for each landowner. The peak discharge per acre for the City & County/State/Campbell watershed, based on the SCS method, was 2.98 cfs/acre. Using Plate 6, the peak discharge per acre was 2.67 cfs/acre.

Our analysis indicates that the West Loch drainage basin is roughly 1,684 acres -- 5% larger than estimated by the Park Engineering report. The 77 acre increase is accounted for in a revision of the western boundary of the State/Campbell tributary area (referred to in this report as "East Kapolei/Campbell Estate").

Table 1 compares storm runoff values applying the SCS Method and the Storm Drainage Standards of the City and County of Honolulu, Plate 6, "Design Curves for Peak Discharge Versus Drainage Area for More Than 100 Acres." The SCS peak discharge values for the City and County, East Kapolei and Campbell tributary areas were based on the 2.98 cfs/acre average discharge per acre developed by Park Engineering discussed above and will need to be verified during design based on the larger tributary area. The Plate 6 peak discharge values are based on a total flow of 3,000 cfs for a 1,116 acre watershed (City and East Kapolei/Campbell Estate), averaging 2.69 cfs/acre.

| | DRAINAGE AREA (Acres) | | SCS PEAK DISCHARGE (cfs) | | PLATE 6 PEAK DISCHARGE (cfs) | |
|---|---|---|---|---|---|---|
| | Incr. | Cumulative | Incr. | Cumulative | Incr. | Cumulative |
| Between H-1 & Farrington | 160 | 160 | 477 | 477 | 430 | 430 |
| East Kapolei & Campbell Estate west of Fort Weaver | 760 | 920 | 2,268 | 2,745 | 2,044 | 2,474 |
| Ewa Villages (City & County) | 75 | 995 | 224 | 2,969 | 202 | 2,676 |
| Elderly Housing (City & County) | 90 | 1,085 | 269 | 3,238 | 241 | 2,917 |
| East Kapolei (east of Fort Weaver) | 31 | 1,116 | 92 | 3,330 | 83 | 3,000 |
| Gentry | 245 | 1,361 | 965 | 4,295 | 965 | 3,965 |
| U.S. Navy | 323 | 1,684 | 835 | 5,130 | 1,180 | 5,145 |
| Total | 1,684 | -- | 5,130 | -- | 5,145 | -- |

Table 1. Summary of Drainage Area and Peak Discharge

## 4. EXISTING CONSTRAINTS

Existing constraints that affect the regional drainage for the West Loch basin are:

1. Inadequate drainage improvements under existing Fort Weaver Road.
2. An inadequate drainage culvert through the Elderly Housing project.
3. An unimproved seaward terminus of the West Loch basin.

## 5. PROPOSED ONSITE DRAINAGE IMPROVEMENTS

Within the proposed development, drainage improvements are to include catch basins, underground drain lines, culverts and channels. All improvements would be designed in accordance with applicable drainage standards of the City and County of Honolulu.

## 5.1 CANE HAUL ROAD

In order for runoff from the project site to reach the detention basin, water from the area must either be channelized along the existing cane haul road through the future park; or must pass through the Ewa Village Golf Course, under Fort Weaver Road and through the Elderly Housing Development. The option of passing through the Elderly Housing Development would involve upgrading the culvert crossing at Fort Weaver Road and constructing an additional drain line between existing buildings in the Elderly Housing. Should the earlier projects have included this work within their scope, it is estimated that construction of this latter option would have cost roughly $2-$3 million. However, due to the difficulties, expense, and undesirable disruption associated with this option, it is proposed that improvements be made along the cane haul road at a cost between $5-$6 million.

It is proposed that a reinforced concrete rectangular channel sized to carry the 100-year peak flow will continue from the project's southeast boundary, under Fort Weaver Road and then along the existing cane haul road (known as Balfour Boulevard). Balfour Boulevard runs within an easement in the future Asing park. A six-foot high chain link fence will be installed on both walls and the ground alongside the channel will be graded to drain toward the channel (see Exhibits 4 & 5). A preliminary channel profile is shown on Exhibit 6.

A pedestrian overpass linking the West Loch Subdivision Phase 2 to the park is proposed as shown on Exhibit 7. Without the overpass, access from West Loch subdivision to the park is not possible due to elevation differences averaging 7' to 20' between the cane haul road and the ground on either side.

## 5.2 MODIFICATION OF EXISTING DETENTION BASIN

A box culvert will be constructed under the O.R. & L. Co. right-of-way to connect the channel to the existing detention basin. The existing basin will be modified, creating an unlined channel from the existing basin to the proposed Ewa by Gentry-East basin (see Exhibits 3 & 8). The channel will be trapezoidal with 2:1 (H:V) side slopes, approximately 950 feet long and with an 80-foot wide base (see Exhibit 9). The channel will serve to convey the runoff from the existing basin to the new basin as well as to provide additional storage. The basin and channel will provide approximately 35 acre-feet of storage, which, when combined with the Gentry basin will meet 2-year 24-hour detention requirements. The actual storage requirement is being coordinated with Park Engineering in conjunction with the Gentry improvements.

The hydraulic grade line (HGL) was approximated using the slope-area method. Weir flow was assumed at the Gentry overflow structure. Sections were taken through the Gentry channel and the East Kapolei channel. Assuming uniform flow, the rise in the HGL would be insignificant, roughly 0.4 feet from the overflow structure (19.4 ft. M.S.L.) to the existing basin on the 31-acre parcel (19.8 ft. M.S.L.) With a channel slope of 0.2%, velocity within the channel will be less than 3 feet per second (see Exhibit 10).

The Ewa by Gentry-East Phase I detention basin includes a berm with top elevation at 20.0 ft. M.S.L. along a portion of the O. R. & L. boundary. It is proposed that the berm be extended through the 31-acre parcel to provide at least 1 foot freeboard above the HGL.

The berm serves mainly to prevent flood waters from inundating the existing O. R. & L. Co. right-of-way, by confining water to the Campbell property. It also serves to protect two low-lying areas within the West Loch Subdivision. The sewage pump station, with a finished floor elevation of 16.3, is below the ultimate HGL (19.4 ft. M.S.L.). Several lots along the cul-de-sac at Road "H" have finished pad elevations ranging from elevation 18.5 to 20.0. The buildings, however, have adequate freeboard above the ultimate HGL, with finished floor elevations at approximately 20.6. The berm will serve to provide an extra degree of protection for this area (see Exhibit 8).

### 5.3 DEDICATION OF IMPROVEMENTS

It is proposed that the entire storm drainage system from H-1 to the Ewa by Gentry-East detention basin be constructed to meet City and County of Honolulu, Department of Public Works standards and be dedicated to the City. Dedication of the entire system is important since it is unlikely that the FHA will agree to insure mortgages for projects in which a private drainage system handles offsite storm drainage.

The channel within the existing easement within the future Asing Park would be dedicated to the City and County of Honolulu and would come under the jurisdiction of the Department of Public Works for maintenance. The pedestrian overpass would also be under the jurisdiction of the City and County of Honolulu.

It is proposed that the 31-acre parcel, with the channel, berm and basin improvements, be dedicated to the City and County of Honolulu. Approximately 40% of the 31-acre site is above the ultimate HGL and is, therefore, usable for development.

## 6. EWA BY GENTRY-EAST PHASE I PROJECT

The Ewa by Gentry-East Phase I project is proposing to construct a drainage channel and a detention basin with an outlet near the wildlife refuge (See Exhibit 3). The **"Drainage Report for the Ewa by Gentry-East Phase I Offsite Drainage Plan"** (approved May 25, 1995 by the Department of Public Works) prepared by Park Engineering indicates that the detention basin was designed to include storm runoff, under developed conditions, from tributary areas including the Gentry-East Phase I development, the City and County of Honolulu, the U.S. Navy, and land presently owned by the Estate of James Campbell and the State of Hawaii. The East Kapolei project comprises the State of Hawaii land and a portion of the Estate of James Campbell land. This area will be referred to as East Kapolei/Campbell Estate in the following discussion.

The proposed improvements consist of an unlined channel leading from the Gentry project to an unlined detention basin. The detention basin has outlet works consisting of 3-24" orifices and an emergency spillway. The drainage plan assumed that the existing siltation/detention basin on the 31-acre site was to remain. Runoff from the basin would sheet-flow into the new siltation/detention basin.

The original design of the detention basin was developed for "interim" and "ultimate" conditions. It was assumed that the existing restriction, i.e., either the Fort Weaver Road/Elderly Housing culverts or the Fort Weaver Road underpass, would need to be upgraded to convey the "ultimate" drainage west of Fort Weaver to West Loch, as originally masterplanned. The "interim" condition refers to the area before drainage restrictions are removed.

Schuler Homes is now negotiating a cost-sharing agreement with Gentry for the construction of the detention basin to meet requirements for ultimate development of the watershed. The channel and detention basin will provide a 2-year 24-hour storage volume of approximately 195 acre-feet at a maximum stage of 15.0 feet M.S.L. Any additional storage required for the East Kapolei project will be provided by Schuler Homes on the adjacent 31-acre parcel. This is discussed in Section 5.2. The outlet works will be constructed with a width of 200 feet and height of 15.0 feet M.S.L.

We are in the process of coordinating with Park Engineering to identify final design parameters. A preliminary comparison of drainage area, peak discharge and storage requirements are summarized below in Tables 2, 3, and 4.

| Drainage Basin | Area (Acres) | |
|---|---|---|
| | Interim Conditions | Ultimate Conditions |
| East Kapolei/Campbell Estate | 31 | 951 |
| City & County of Honolulu | 165 | 165 |
| Gentry | 245 | 245 |
| U.S. Navy | 323 | 323 |
| Totals | 764 | 1,684 |

**Table 2. Comparison of Drainage Areas Under Interim & Ultimate Conditions**

| Drainage Basin | Area (Acres) | | Composite SCS Peak Discharge(cfs) | |
|---|---|---|---|---|
| | Incr. | Cumulative | 2-year | 100-year |
| East Kapolei/Campbell Estate | 951 | 951 | 776 | 2,837 |
| City & County of Honolulu | 165 | 1,116 | 132 | 493 |
| Gentry | 245 | 1,361 | 280 | 965 |
| U.S. Navy | 323 | 1,684 | 100 | 835 |
| Totals | 1,684 | -- | 1,288 | 5,130 |

**Table 3. Composite Peak Discharge**

| Storm Frequency | Ultimate Conditions | | | |
|---|---|---|---|---|
| | Peak Inflow (cfs) | Peak Outflow (cfs) | Max Stage (ft. M.S.L.) | Storage (ac.-ft.) |
| 2-Year | 1,288 | 150 | 15 | 195 |
| 100-Year | 5,127 | | 19.4 | 287 |

**Table 4. Detention Basin Characteristics**

## 7. CONCLUSION AND RECOMMENDATIONS

Existing drainage master plans indicate that storm runoff from the project site and adjacent Campbell lands within the West Loch drainage basin eventually discharges into West Loch near the existing detention basin. There are presently no defined drainage ways to convey storm runoff from the project site to the West Loch shoreline. This project proposes to construct a channel/culvert from the project boundary to the Fort Weaver Road underpass. A concrete-lined rectangular channel is to be built within the existing cane haul road to the existing detention basin. A pedestrian overpass will be constructed from the Asing Park to the West Loch subdivision.

The existing detention basin will be modified to accommodate the transmission of the runoff from the East Kapolei project, Estate of James Campbell and City and County of Honolulu land, to the Gentry detention basin and outlet. A grassed trapezoidal channel will be excavated from the existing basin to the Gentry basin. The channel and basin will provide approximately 35 acre-feet of storage, which, when combined with the Gentry basin, will meet 2-year 24-hour detention requirements. A berm will be constructed 10 feet from the existing O. R. & L. Co. right-of-way to protect adjacent low-lying areas within the West Loch subdivision.

It is proposed that all drainage improvements and the pedestrian overpass be built to City and County of Honolulu standards and be dedicated to the City.

## 8. ADDENDUM

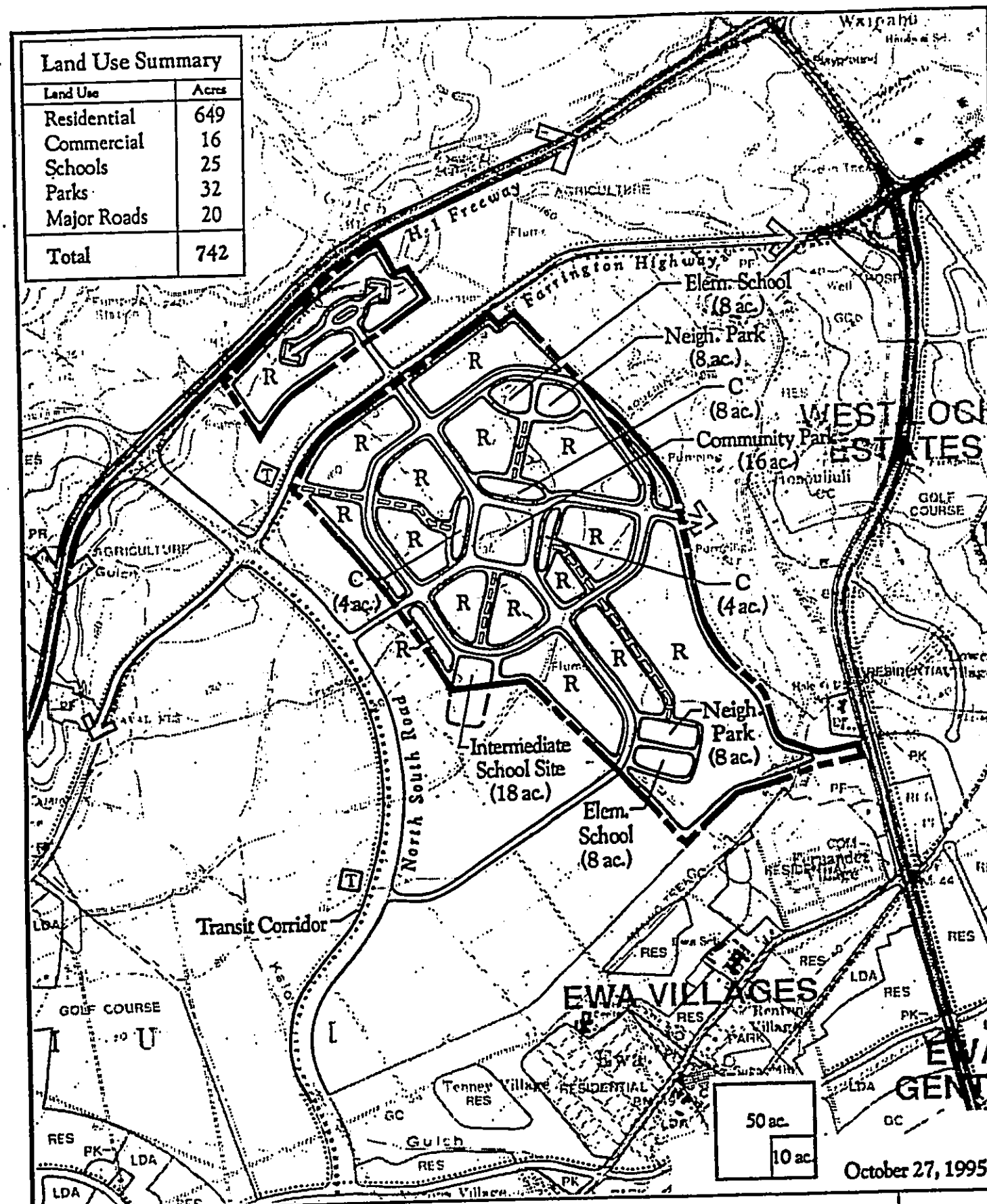
The drainage study herein contained dated December 1, 1995 estimated that the West Loch watershed was 1,684 acres, approximately 77 acres larger than included in the ***Drainage Report for Ewa by Gentry-East, Phase 1*** (Park Engineering, 1995). Based on the increased drainage area and corresponding increase in runoff, it was estimated that the hydraulic grade line (HGL) at the overflow would increase by 1 foot, to elevation 19.4 MSL. The project proposal included modification of the existing detention basin within the 31-acre site and excavation of a grassed trapezoidal channel from the existing basin to the Gentry basin, providing roughly 35-acre feet of storage. The proposed improvements, in combination with the Gentry detention basin, were to provide the required 2-year 24-hour detention.

Section 3.1 of the drainage study describes the existing drainage pattern, stating that any runoff collected by the cane haul road ponds at the low-point until it is forced out toward the basin. Based on current research, runoff which falls onto the road will flow through an existing inlet structure at the low-point and then into the West Loch Fairways drainage system.

We are currently working with Park Engineering to confirm the limits of the watershed and the HGL. Based on current negotiations between Schuler Homes, Inc. and Gentry, a joint detention basin will be constructed to accommodate the runoff from the total West Loch watershed. Additional storage will be provided within the 31-acre site, which when combined with the proposed Gentry detention basin will accommodate the total runoff. The berm proposed by Gentry for protection of the Wildlife Refuge and the berm proposed in the 31-acre parcel will have 1-foot minimum freeboard above the HGL The portion of the 31-acre site used for the drainage improvements will be dedicated to the City and County of Honolulu.

The drainage study will be revised at a later date to reflect the final improvements.

| Land Use Summary | |
|---|---|
| Land Use | Acres |
| Residential | 649 |
| Commercial | 16 |
| Schools | 25 |
| Parks | 32 |
| Major Roads | 20 |
| Total | 742 |




# Preliminary Concept Plan

# EAST KAPOLEI PROJECT

Schuler Homes, Inc.

FEET 0 1000 2000

Helber Hastert & Fee, Planners

EXHIBIT

1

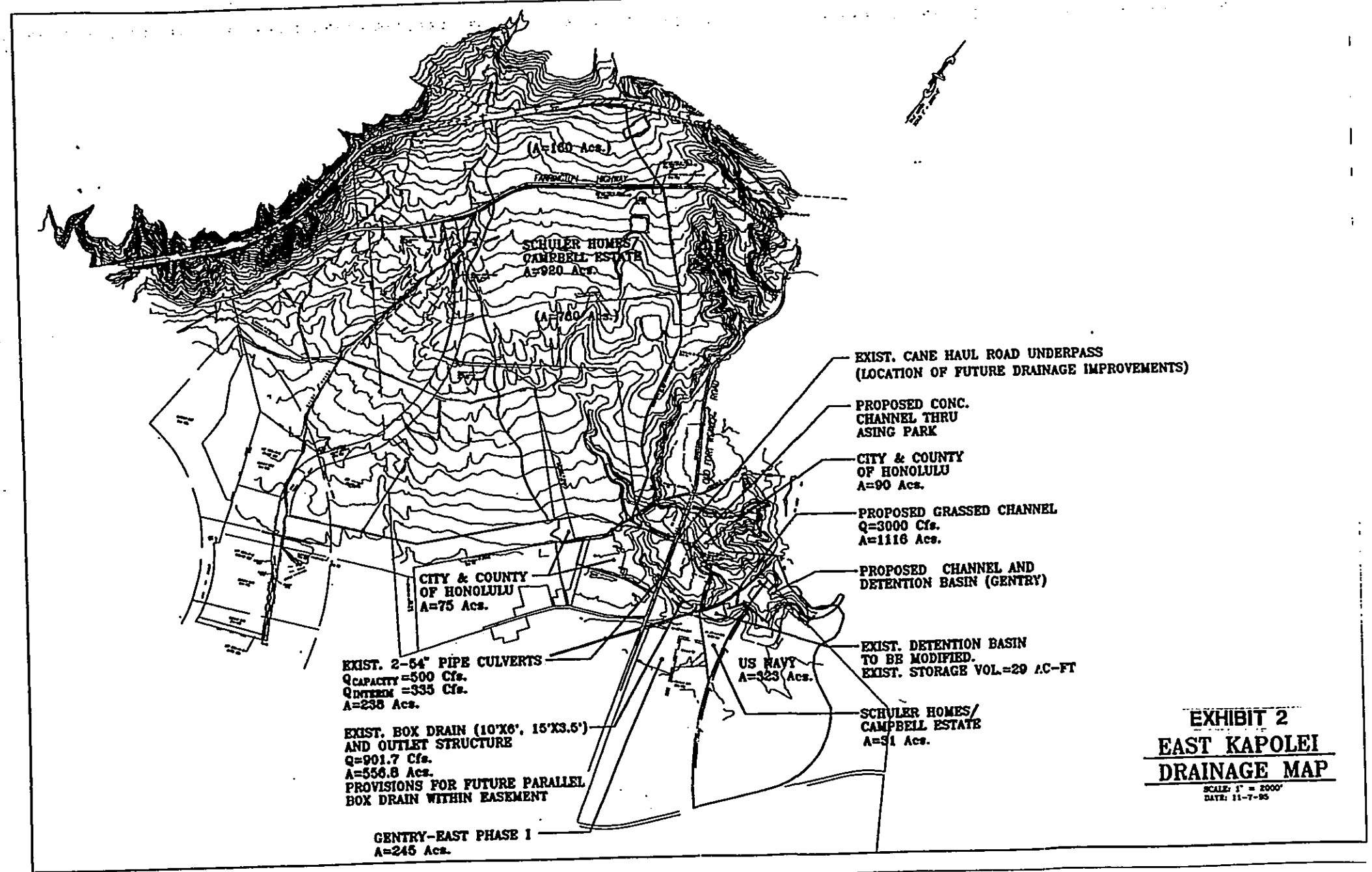



**EXHIBIT 2**

**EAST KAPOLEI**

**DRAINAGE MAP**

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DATE: 11-7-95

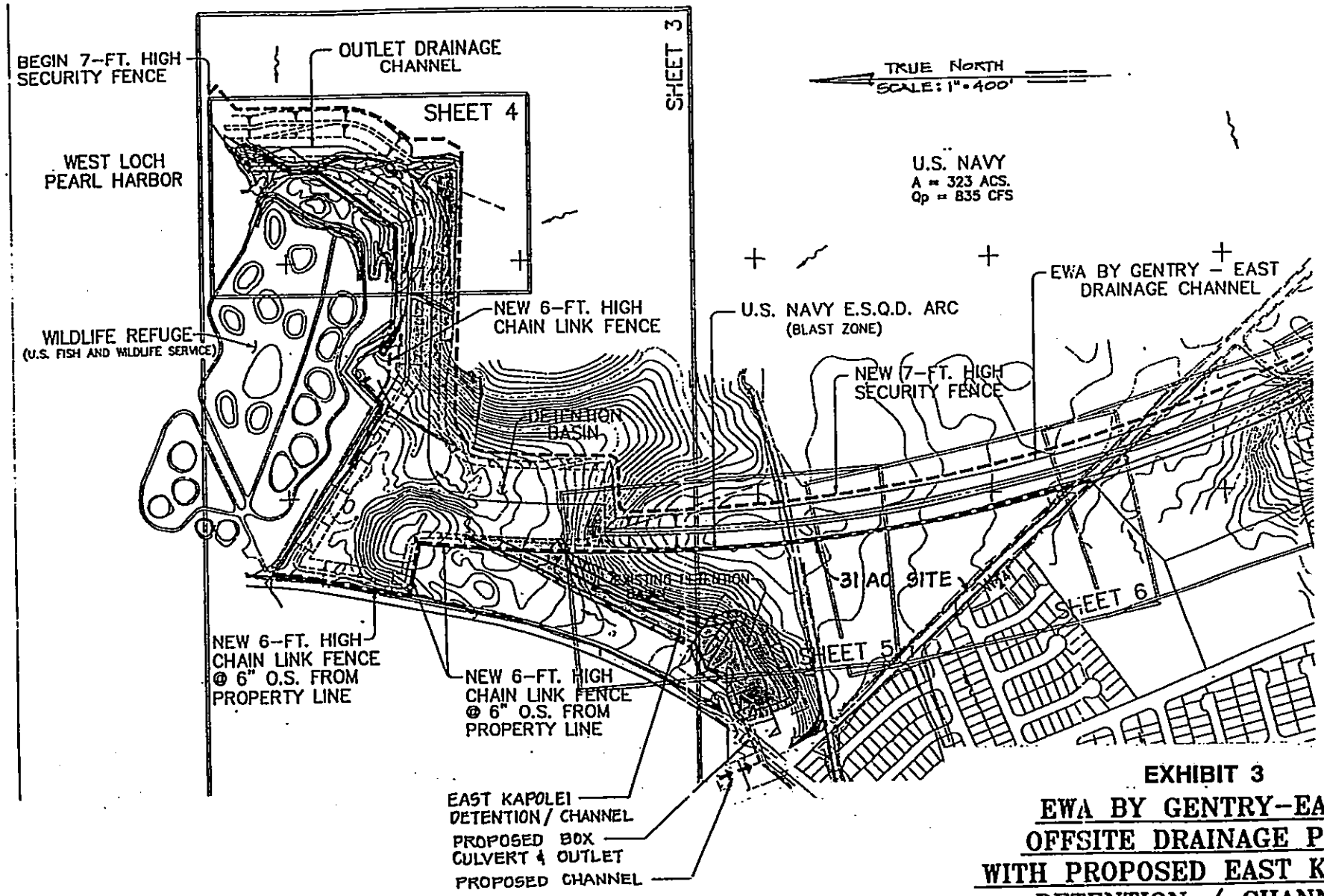



**EXHIBIT 3**

**EWA BY GENTRY-EAST OFFSITE DRAINAGE PLAN WITH PROPOSED EAST KAPOLEI DETENTION / CHANNEL**

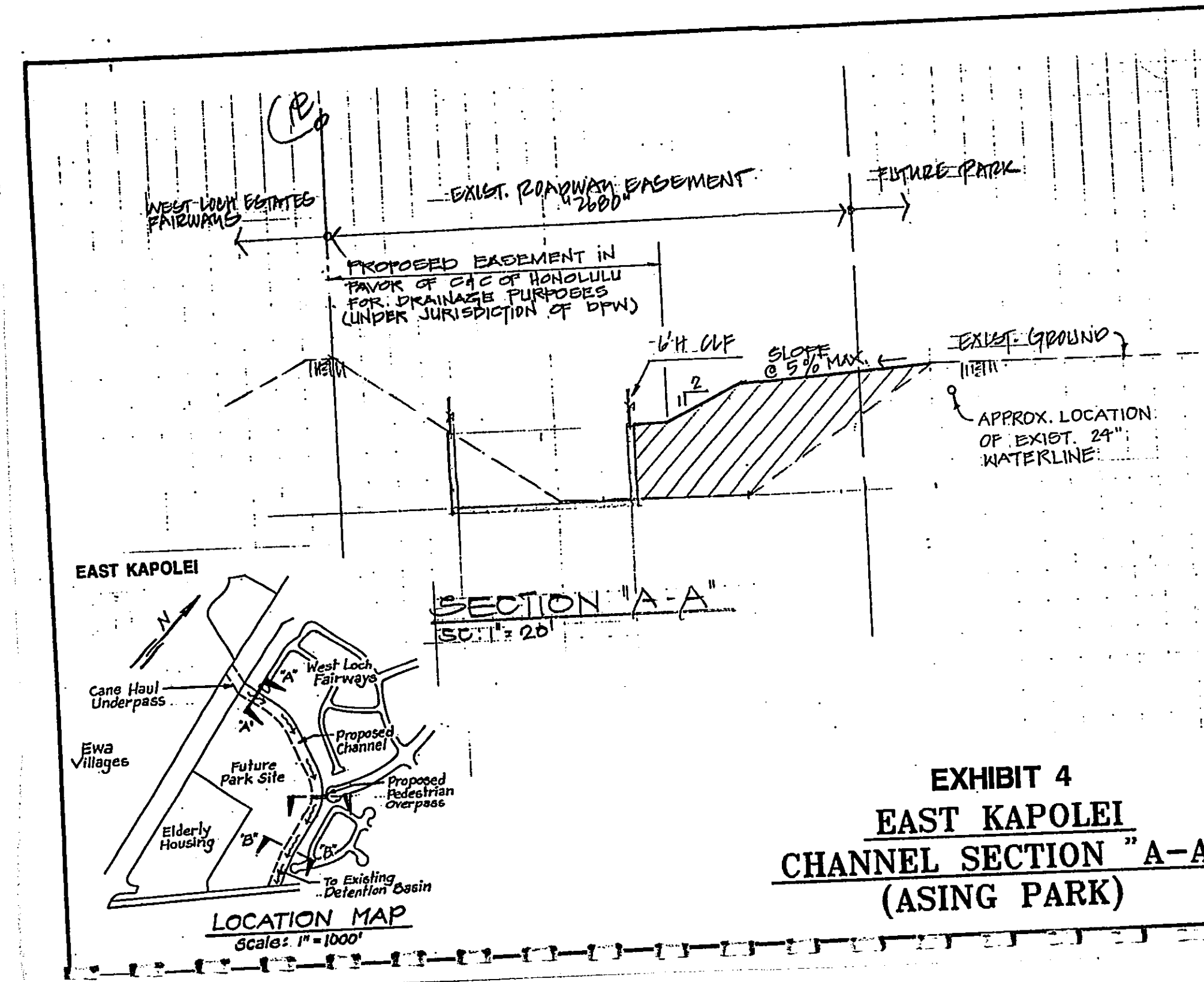
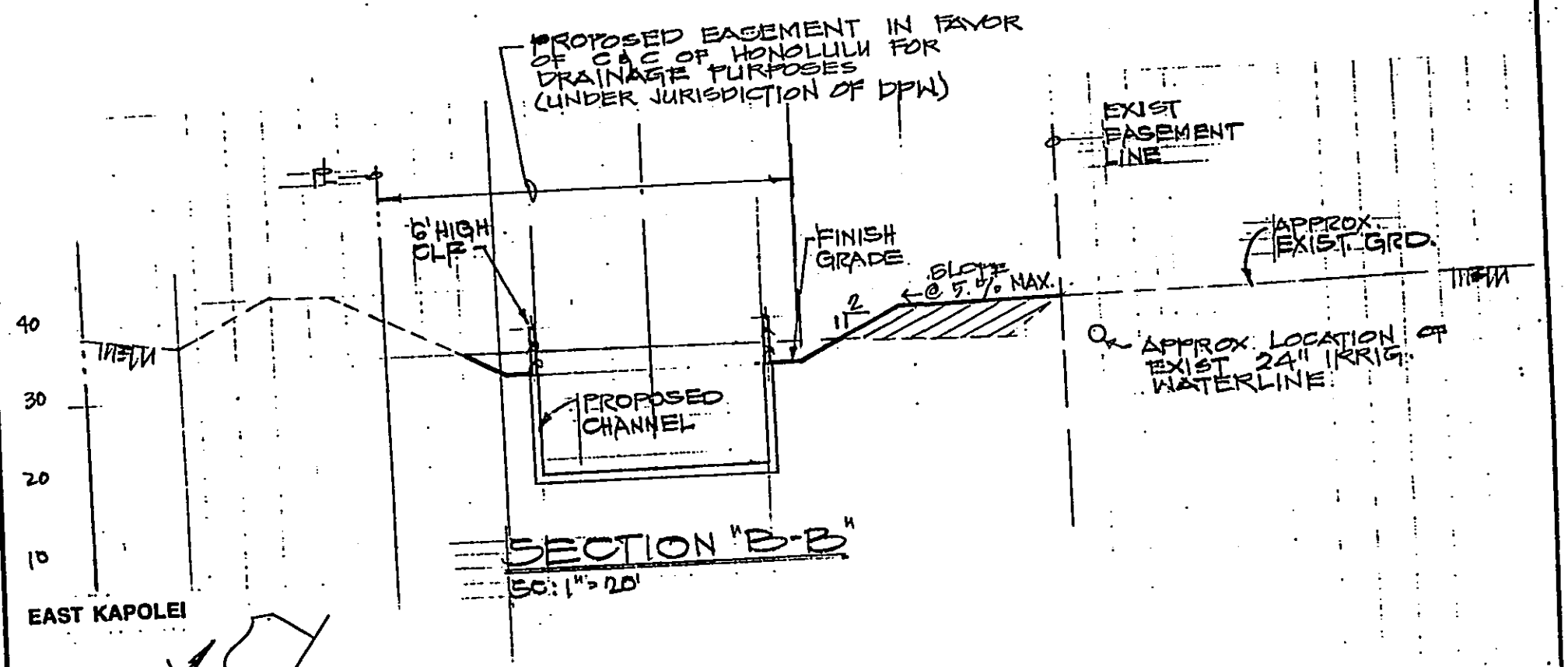



**EXHIBIT 4**

**EAST KAPOLEI**

**CHANNEL SECTION "A–A"**

**(ASING PARK)**



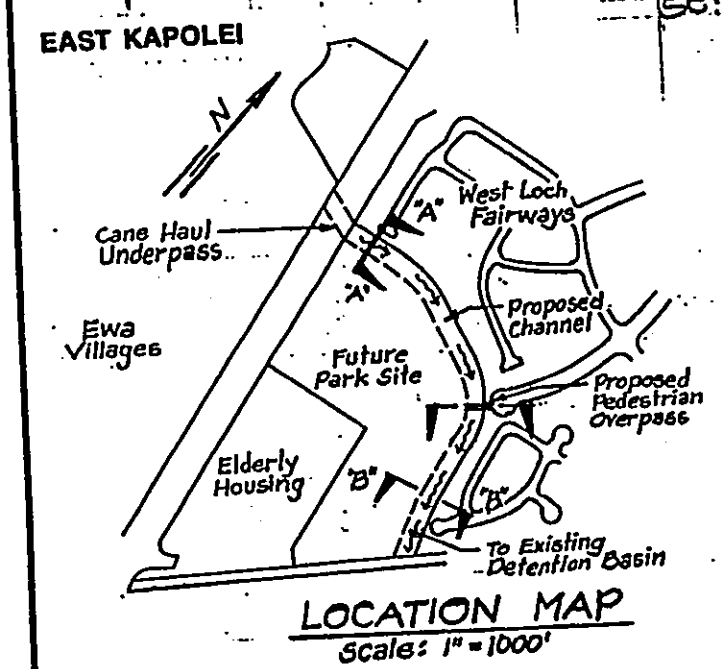




**EXHIBIT 5**

**EAST KAPOLEI**

**CHANNEL SECTION "B–B"**

**(ASING PARK)**

11/9/05

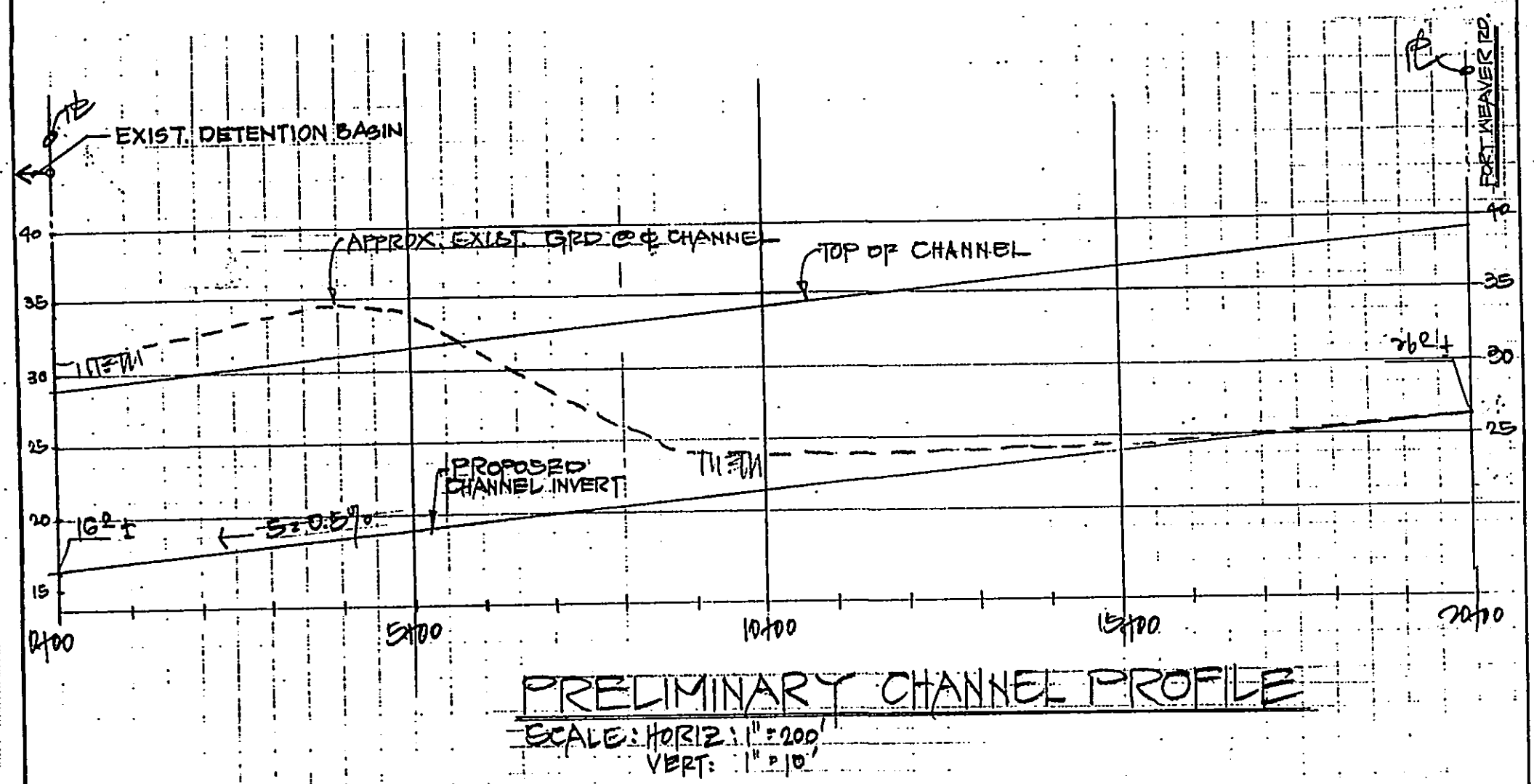
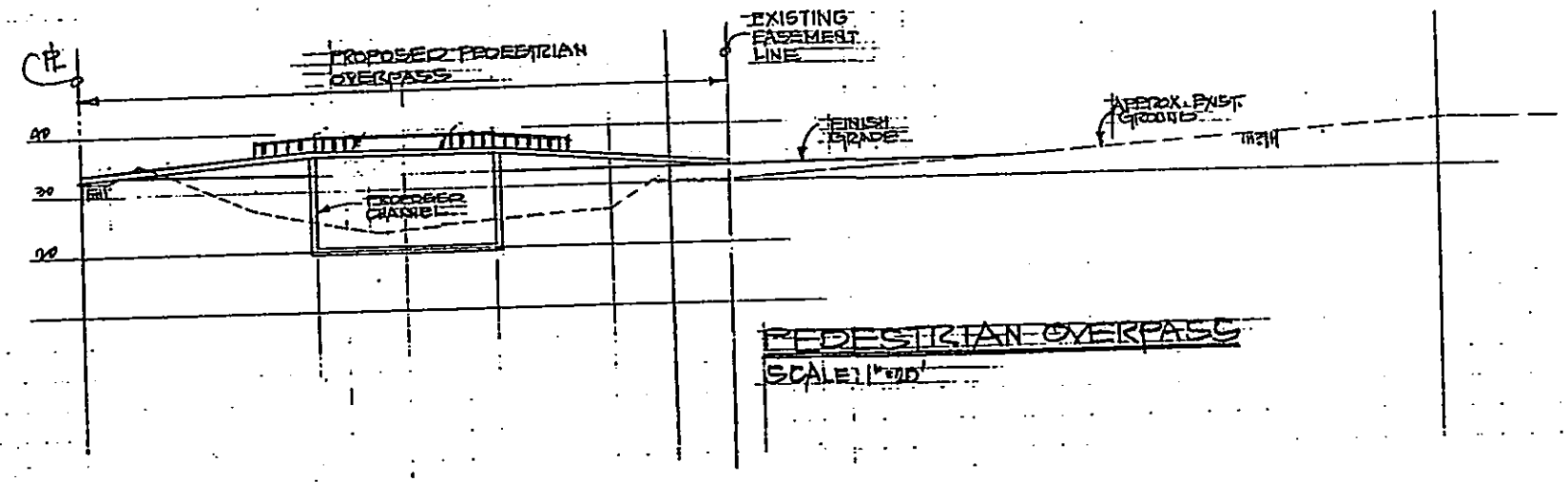



**EXHIBIT 6**

**EAST KAPOLEI**

**PRELIMINARY CHANNEL PROFILE**

**(ASING PARK)**



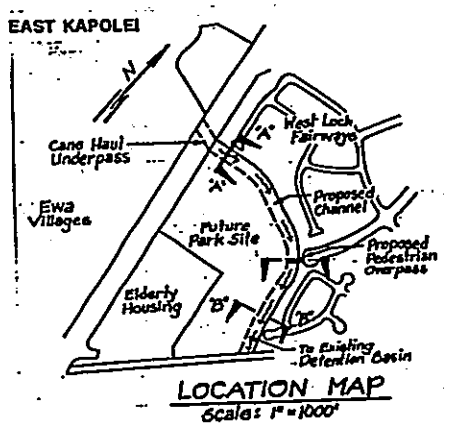




**EXHIBIT 7**
**EAST KAPOLEI**
**PEDESTRIAN OVERPASS**
**(ASING PARK)**

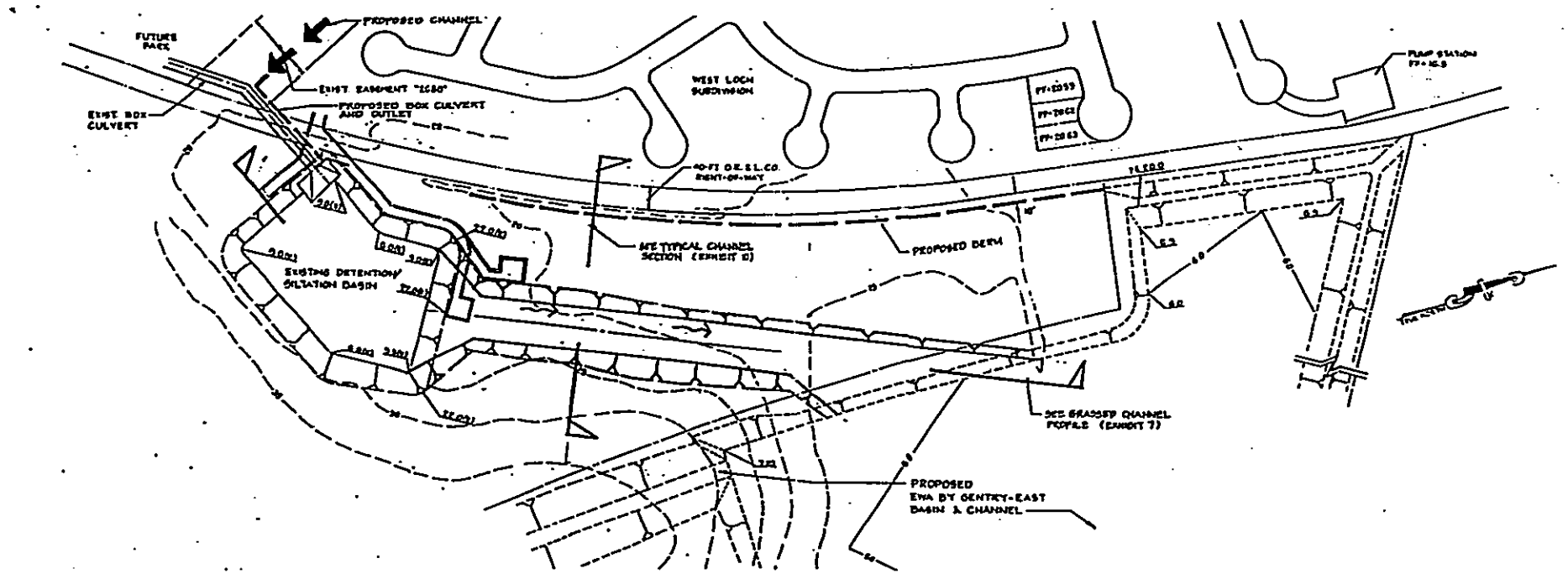



**EXHIBIT 8**

**EAST KAPOLEI**

**BASIN & CHANNEL PLAN**

**(31-AC. SITE)**

SCALE: 1" = 200'

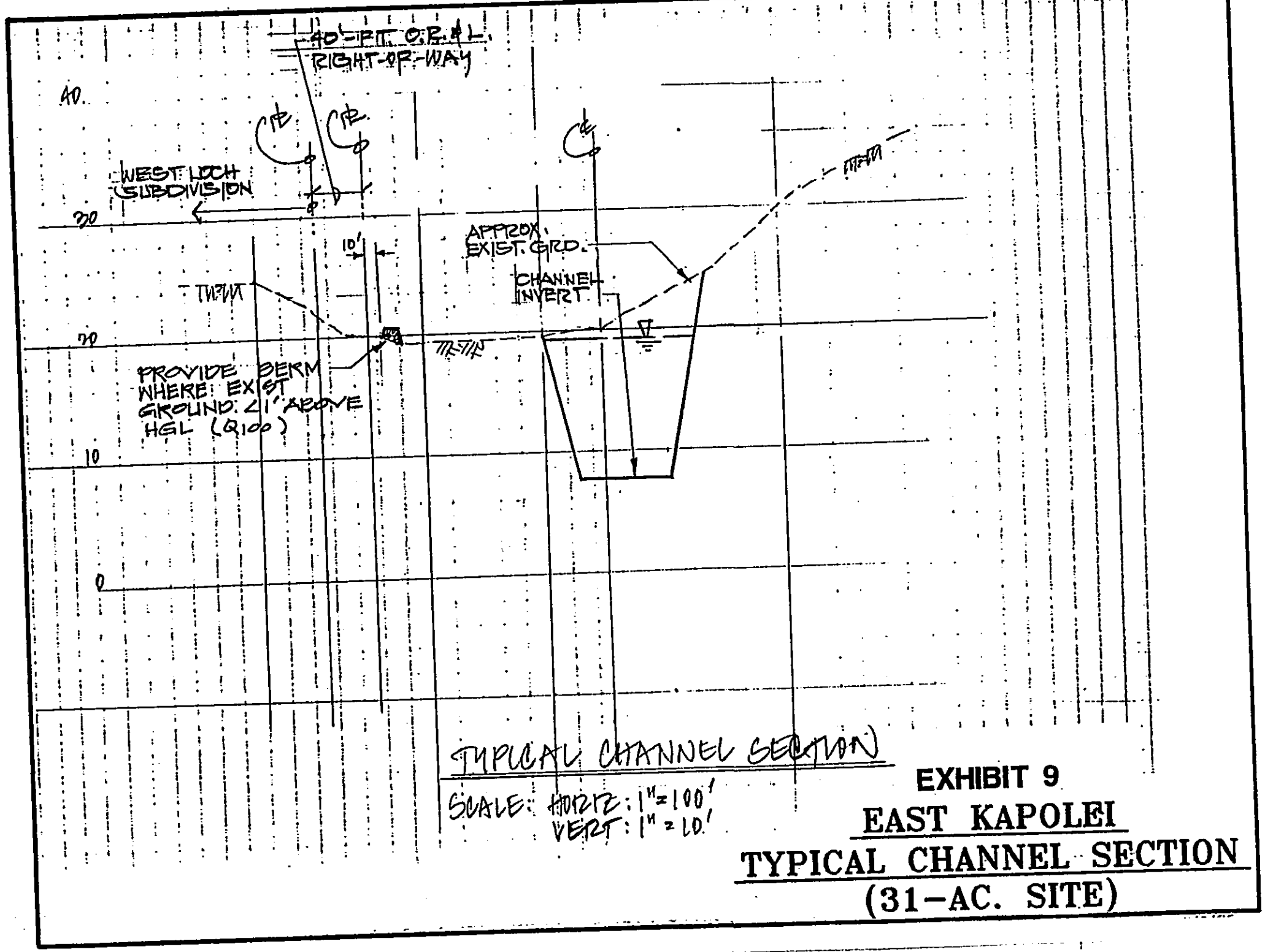



**EXHIBIT 9**

**EAST KAPOLEI**

**TYPICAL CHANNEL SECTION**

**(31-AC. SITE)**

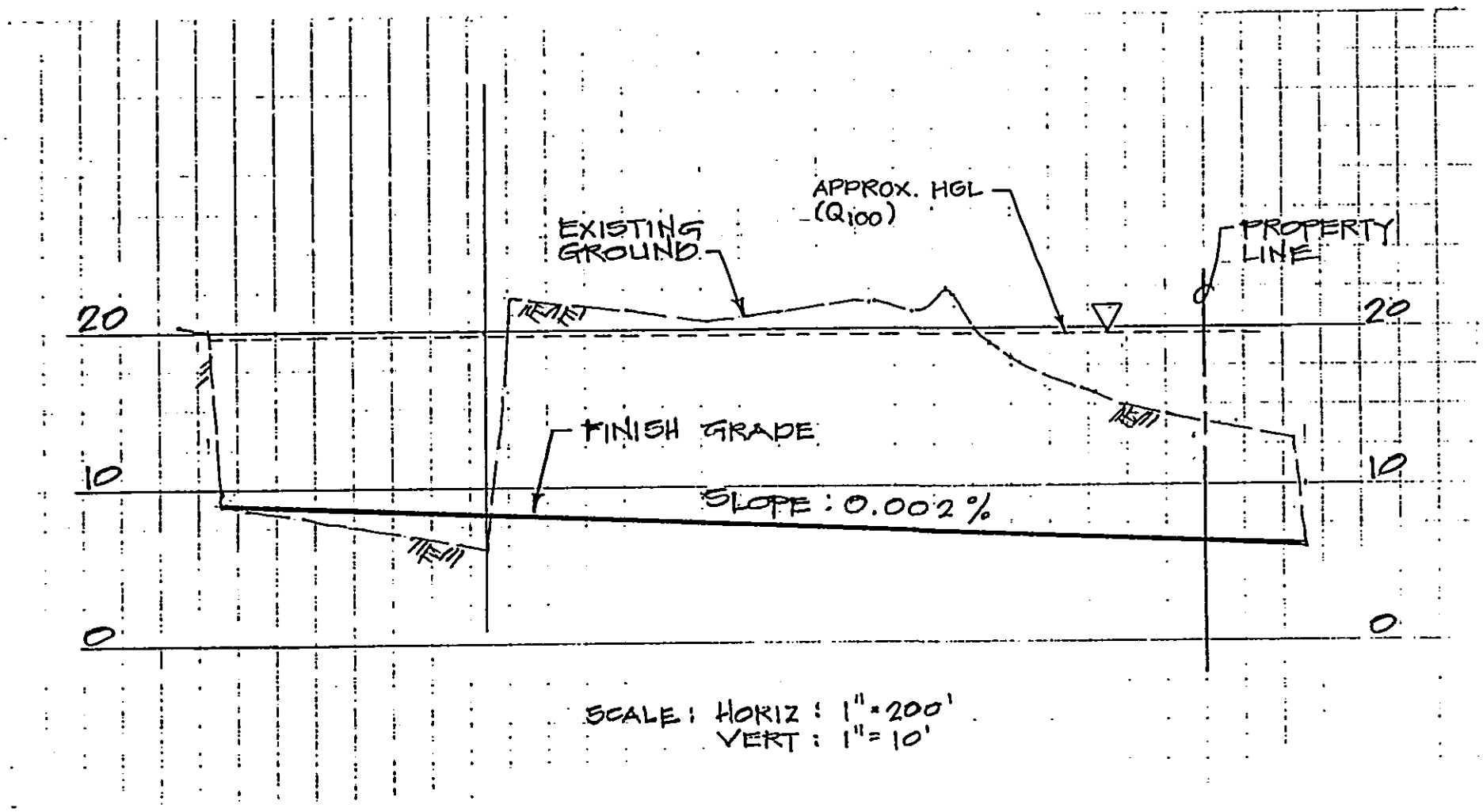



**EXHIBIT 10**

**EAST KAPOLEI**

**PRELIMINARY CHANNEL PROFILE**

**(31-AC. SITE)**

Re: Campbell Estate Disclaimer

To Whom It May Concern:

The information contained in the attached materials represents the views of Schuler Homes, Inc. ("Schuler"), and has been prepared by or for Schuler from its own sources. This information does not necessarily reflect the views of the Estate of James Campbell (the "Estate"), and the Estate expressly disclaims any responsibility for the accuracy or completeness of such information. Nothing in the attached materials shall be deemed or construed in any way to represent the views of the Estate, or to bind or otherwise obligate the Estate in any way, all rights of the Estate being hereby expressly reserved. All inquiries regarding the Estate's position on any matters set forth in the attached materials should be directed to Ms. Jan Burns, Manager, Special Projects, Campbell Estate.

EXHIBIT 11

1001 Kamokila Boulevard, Kapolei, Hawaii 96707 Phone (808) 674-6674 Facsimile (808) 674-3111

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## PROPOSED DRAFT REVISIONS TO EWA DP SPECIAL PROVISIONS

ARTICLE 3. EWA

PART I

DEVELOPMENT PLAN
SPECIAL PROVISIONS FOR EWA

SECTION 24-3.2 URBAN DESIGN PRINCIPLES AND CONTROLS FOR EWA

* * *

(b) Principles and Controls for Special Areas

* * *

(5) East Kapolei Planned Community

The East Kapolei Planned Community Special Area shall be developed with the urban uses generally identified in this subsection as an integral part of the larger growing Kapolei region. The area planned for development shall contain approximately 750 acres of land in two non-contiguous sites in East Kapolei. The area shall develop as a master planned residential community containing a mixture of residential uses; neighborhood commercial uses, public and quasi-public facilities; and park areas and facilities, all as generally shown on the Land Use Map of this Development Plan.

Development within the East Kapolei Planned Community shall be permitted in accordance with the Land Use and Public Facilities Maps of the Development Plan, and in accordance with the following development principles and standards:

(A) Residential development within the area shall be permitted to be developed as generally shown on the Land Use Map in densities ranging from single-family detached units in the 7 unit per acre net range to multi-family units in the 20 units per net acre range.

A total of about 8,000 residential units be permitted to be developed within the area.

(B) Public parks and recreation facilities within the area, shown on the Land Use Map and Public Facilities Map, as applicable, shall be developed.

(C) Supporting public facilities, infrastructure, roadways, utilities, and improvements thereto, shall be permitted to be developed in accordance with the Land Use Map and Public Facilities Map, as applicable.

(D) Permitted land uses with the area, shown on the Land Use Map, shall contain the following approximate acreages:

| | Acres |
|---|---|
| Low Density Apartment | 674 |
| Commercial | 16 |
| Public and Quasi-Public | 25 |
| Parks and Recreation | 35 |
| Total (Application Area) | 750 |

(E) Panoramic and other significant views from within and across the area shall be maintained and enhanced where possible.