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Kapolei Business II

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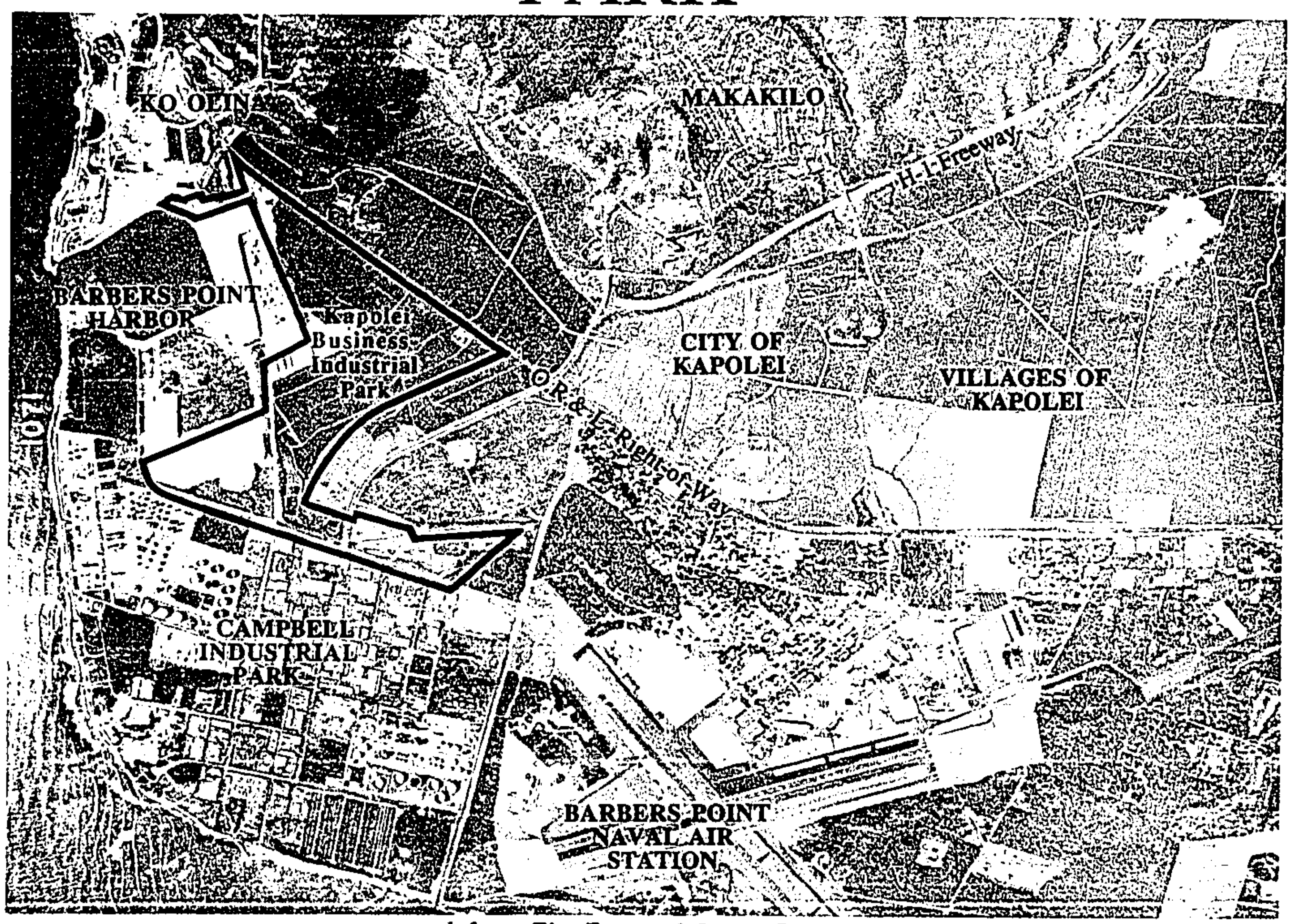
Final Environmental Impact Statement

KAPOLEI BUSINESS-INDUSTRIAL PARK



prepared for: The Estate of James Campbell
prepared by: William E. Wanket, Land Use Consultant

Volume II
Technical Appendices

April 1990

FINAL

ENVIRONMENTAL IMPACT STATEMENT

VOLUME II

KAPOLEI BUSINESS-INDUSTRIAL PARK

Ewa, Oahu

April 1990

Submitted pursuant to Chapter 343, Hawaii Revised Statutes, Environmental Impact Statement Regulations.

Prepared For: **THE ESTATE OF JAMES CAMPBELL**

For Submittal To: **DEPARTMENT OF GENERAL PLANNING**

Prepared by: **WILLIAM E. WANKET, INC.**

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Pacific Tower 660
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Honolulu, Hawaii 96813

VOLUME II

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Engineering Concepts, Inc.

APPENDIX A

PRELIMINARY ENGINEERING REPORT

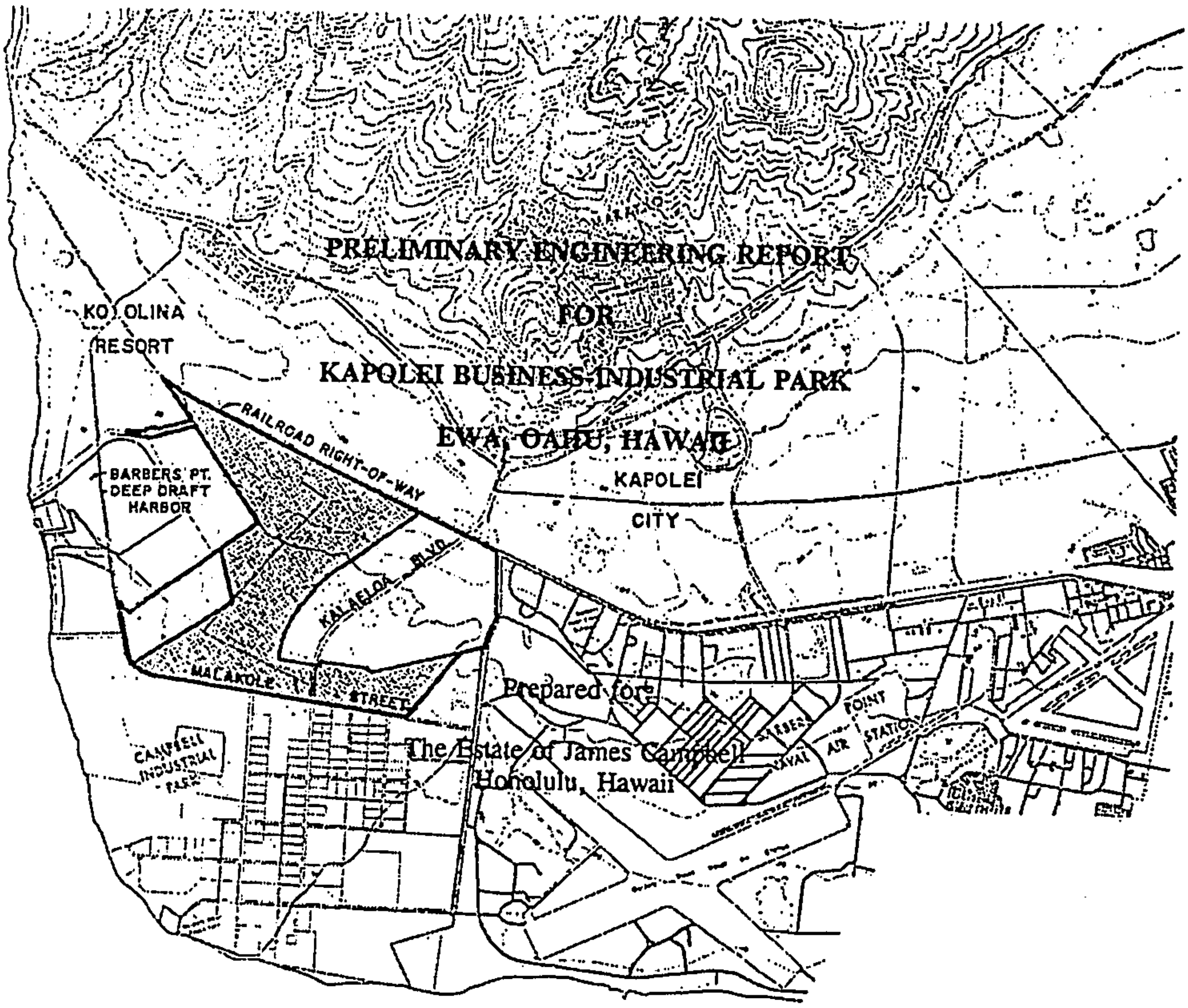
FOR

KAPOLEI BUSINESS-INDUSTRIAL PARK

EWA, OAHU, HAWAII

Prepared for:

The Estate of James Campbell
Honolulu, Hawaii



Prepared by:

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April 1990

PRELIMINARY ENGINEERING REPORT

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CORRECTION

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PRELIMINARY ENGINEERING REPORT

FOR

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EXECUTIVE SUMMARY

The proposed Kapolei Business-Industrial Park in Ewa, Oahu, will encompass 931 acres adjacent to Campbell Industrial Park and is planned to house waterfront industrial, general industrial, and commercial uses. Approximately 379 acres are currently designated industrial on the Development Plan. Preliminary engineering information pertaining to infrastructure for Kapolei Business-Industrial Park is addressed in this report.

The site is relatively flat and scattered with mounds and depressions. Elevations range from 5 to 75 feet MSL, with slopes of 0.5 to 5 percent. Current land uses include agriculture, coral mining, and a raceway park.

Drainage

There are no existing drainage improvements within the site. Runoff generated from the site and adjacent areas drains overland via sheet flow and small ditches to onsite depressions. With the exception of major storms, very little runoff is generated under existing conditions due to the agricultural use and infiltration characteristics of the soil. Estimated runoff for the amendment area under existing conditions ranges from 859 cfs for a 10-year, 1-hour storm to 1,262 cfs for a 100-year, 1-hour storm.

The proposed development will alter the character of the site by replacing existing vegetative cover with buildings, pavement, landscaped areas, and other improvements normally associated with industrial developments. Consequently, peak runoff generated onsite is expected to increase. Estimated runoff for the amendment area under developed conditions ranges from 1,141 cfs for a 10-year, 1-hour storm to 1,750 cfs for a 100-year, 1-hour storm.

Implementation of an underground onsite drainage system of catchbasins/manholes and pipe culverts, with conveyance to a major drainage channel running through the site to the ocean, is proposed to alleviate current flooding problems and prevent flooding resulting from runoff from the proposed development. The major drainage channel will be sized to accommodate runoff from the entire watershed based on the City and County of Honolulu's Storm Drainage Standards.

Soil Erosion

Soil erosion potential for the amendment area, KBIP site, and entire watershed is estimated by the Universal Soil Loss Equation (U.S. Soil Conservation Service). Under existing conditions, soil erosion potential for the amendment area is estimated to be 718 tons per year. The estimated soil erosion potential for the entire watershed is over 480,000 tons per year in comparison. After development, a reduction of soil erosion potential is expected due to: reduction of erodible surfaces;

Site grading and construction of storm drain system; and increase in landscaped areas. The resulting soil erosion potential for the developed amendment area and developed watershed is estimated to be 70 and about 265,000 tons per year, respectively.

In the short term, it is estimated that over 10,000 tons per year of soil erosion may result from grading the KBIP site. Implementation of mitigation measures will reduce this short term impact by about 50 percent. These mitigation measures include limiting grading to not more than 15 consecutive acres at a time and establishment of vegatation. Implementation of additional erosion control measures would lessen construction impacts even further.

Wastewater

There are no existing wastewater facilities within the site. Cesspools service tenants in the neighboring James Campbell Industrial Park. The existing Ko Olina Interceptor Sewer, Segment 1, serves the Ko Olina development to the north. Honouliuli Wastewater Treatment Plant (WWTP) (25 MGD capacity) is the nearest municipal treatment facility. The remaining capacity at this facility is committed; however, plant expansion to 38 MGD is anticipated in 1994.

Wastewater generated from Kapolei Business-Industrial Park is expected to be mainly of domestic composition, with some industrial discharges. Construction of pretreatment facilities will be required if industries are unable to meet City and County of Honolulu pretreatment standards prior to disposal into municipal sewers. The park development is expected to generate average wastewater flows of 5.5 MGD, with peak design flows expected to reach 15 MGD. The amendment area is anticipated to generate average flows of 2.2 MGD and peak flows of 6.8 MGD.

Management of the wastewater flows from the proposed development will be necessary to prevent negative health and environmental impacts. An underground collection system discharging to the Honouliuli WWTP is the proposed wastewater management scheme. In the event development of Kapolei Business-Industrial Park precedes completion of the Honouliuli W-WTP expansion, a temporary onsite treatment facility would be constructed to provide secondary wastewater treatment. Effluent disposal options include percolation/evaporation ponds, injection wells, and/or reuse for irrigation.

<u>Water</u>

Additional potable and nonpotable water demands will be generated by the proposed development. Preliminary hydraulic analysis indicates that the existing mains currently servicing the James Campbell Industrial Park should be adequate to accommodate the requirements of the proposed development. A water master plan will be prepared and submitted to the Board of Water Supply for their review and approval.

To mitigate increased water demands due to development in the Ewa area, implementation of a dual water system is proposed for Kapolei Business-Industrial Park, reducing its potable water requirement by about 65 percent.

The nonpotable infrastructure requirements are currently being studied and will depend on the location and quality of the nonpotable source.

The offsite water system will be adequate to service the initial development of the business-industrial park as well as the other planned developments in the Kapolei area. Ultimately, however, additional improvements to the water system will be required. Implementation of the improvements will be governed by development schedules of the proposed projects and will be coordinated by the Ewa Plain Water Development Corporation.

<u>Solid Waste</u>

The tenants of the existing industrial park are currently served by private refuse collection companies. Solid wastes are currently disposed of at the Waipahu incinerator, which may be at or near capacity.

Private refuse companies will be used to service tenants of the proposed Kapolei Business-Industrial Park, and it is anticipated that the new landfill site at Waimanalo Gulch and the H-Power waste energy recovery facility will be able to accommodate wastes from the proposed development.

Power and Communications

Hawaiian Electric Company (HECO) and Hawaiian Telephone Company (HawTel) currently serve the areas adjacent to the proposed business-industrial park. Preliminary consultations with HECO and HawTel indicate that service can be provided. The estimated range of the electrical load requirements for the entire Kapolei Business-Industrial Park is approximately 93.1 to 139.6 MVA, with the loads for the amendment area ranging from 55.2 to 82.8 MVA.

PRELIMINARY ENGINEERING REPORT
FOR THE
PROPOSED KAPOLEI BUSINESS-INDUSTRIAL PARK

INTRODUCTION

The Estate of James Campbell is proposing an expansion of the existing James Campbell Industrial Park in Ewa, Oahu (TMK: 9-1-14:Por. 2; 9-1-15:Por. 1, 15, 16). The expansion, known as Kapolei Business-Industrial Park, will occupy an area of approximately 931 acres bounded by Malakole Road to the south, the railroad right-of-way to the north, the Barbers Point Harbor and Ko Olina to the west, and the Barbers Point Naval Air Station to the east (Figure 1). Approximately 379 acres of the 931 acres are currently designated industrial on the Development Plan Land Use Maps. The Estate of James Campbell is proposing to amend the Development Plan Land Use Maps for the remaining 552 acres (amendment area) to accommodate the planned expansion.

The objective of this report is to present preliminary engineering information pertaining to infrastructure requirements for the proposed Kapolei Business-Industrial Park in general and the amendment area in particular. Specifically, this report will address--

1. Background information on the proposed project;
2. Existing conditions;
3. Modifications after development; and
4. Impacts and mitigation of the proposed development.

PROJECT BACKGROUND

The proposed Kapolei Business-Industrial Park is planned to include waterfront industrial (I-3), general industrial (I-2), and commercial (B-2) uses. The amendment area is proposed to contain approximately 424 acres in general industrial, 109 acres in waterfront industrial, and 19 acres in commercial uses. Approximately 56.5 acres of the waterfront industrial are planned to accommodate future expansion of the Barbers Point Harbor facilities.

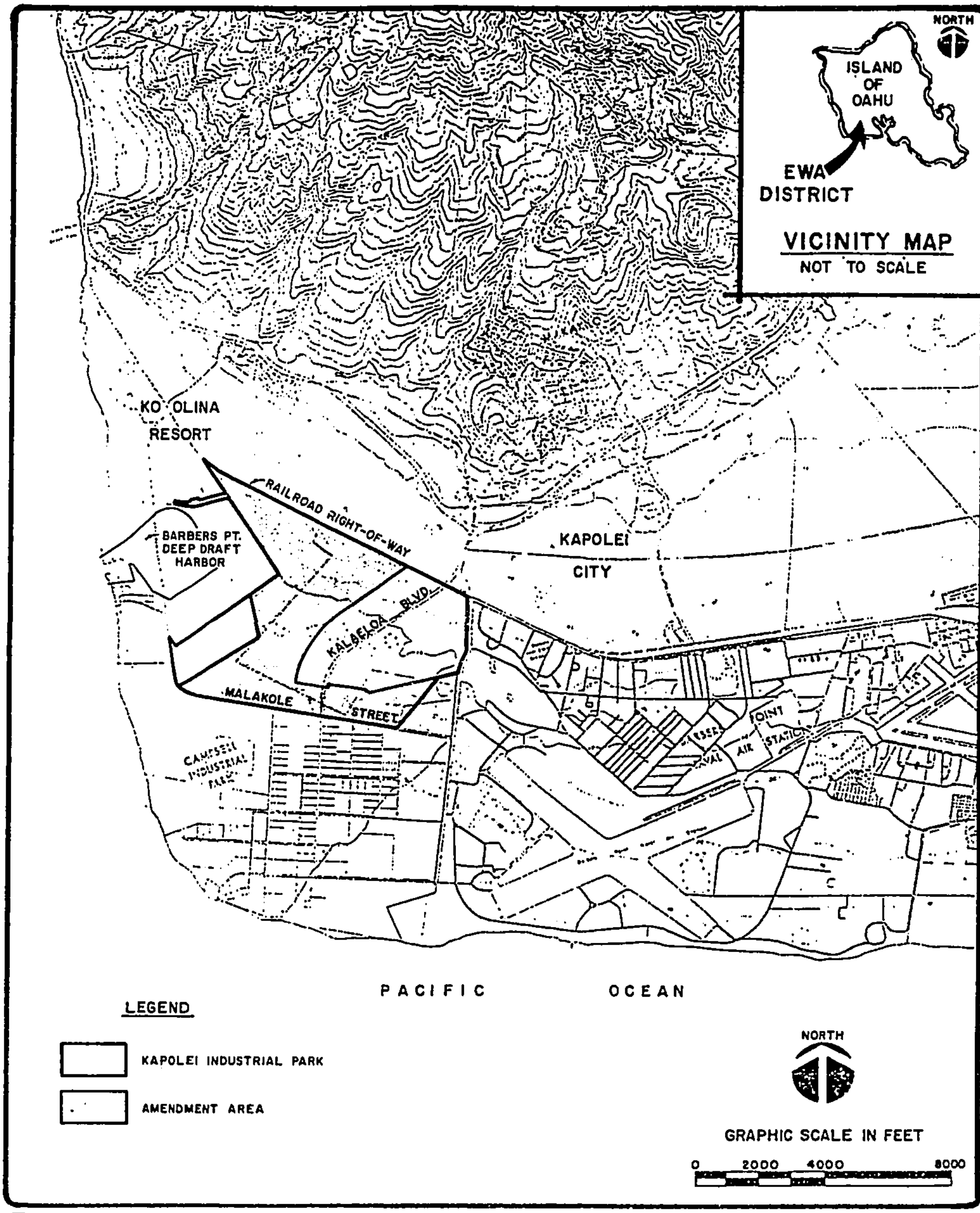

fig. 1 Location Map

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

Prepared By: ENGINEERING CONCEPTS, INC.

Land Use and Zoning

The amendment area is currently designated an Agricultural District by the State. An application for land use designation change to Urban will need to be submitted.

The amendment area is currently zoned either AG-1 or AG-2. An application for a zone change will need to be submitted to the City.

As previously mentioned, 379 acres of the proposed Kapolei Business-Industrial Park are currently designated Industrial on the Development Plan Land Use Map. Of the 379 acres, approximately 315 acres are designated Urban by the State and zoned I-2 by the City. The remaining area, approximately 64 acres which are currently zoned Ag-2, will require applications to the State for land use change and to the City for zone change.

Existing Uses

Current land uses within the amendment area include agricultural uses, coral mining, and a raceway park (Figure 2). The existing JCIP is located immediately makai of the amendment area. Phase I of the Ko Olina resort is currently under construction, as are the shore facilities for the Barbers Point Harbor. Also adjacent to the amendment area is the desalinization plant, which is under construction in the parcel already designated Industrial on the DP map. The plant, located in the northwest corner of the business-industrial park expansion area, is a project by the State Department of Land and Natural Resources to develop a nonpotable source of water for irrigation from brackish water.

Oahu Sugar Company (OSCo) currently leases a portion of the amendment area for sugar cane cultivation. According to OSCo maps, Field 004 encompasses an area of approximately 260 acres. The OSCo lease expires in the year 1995.

The Estate also uses a portion of the land for agricultural purposes. A nursery covering approximately 10 acres is located near the intersection of Kalaeloa Boulevard and Malakole Road.

Coral mining operations are currently performed by Hawaiian Cement for the manufacture of cement and concrete products. The Hawaiian Cement option area extends over approximately 267 acres in the northwest corner of the expansion area. The Hawaiian Cement agreement extends beyond the year 2000.

Hawaii Raceway Park, located in the southeast corner of the amendment area, recently reopened after years of inactivity due to insurance problems. The raceway park occupies

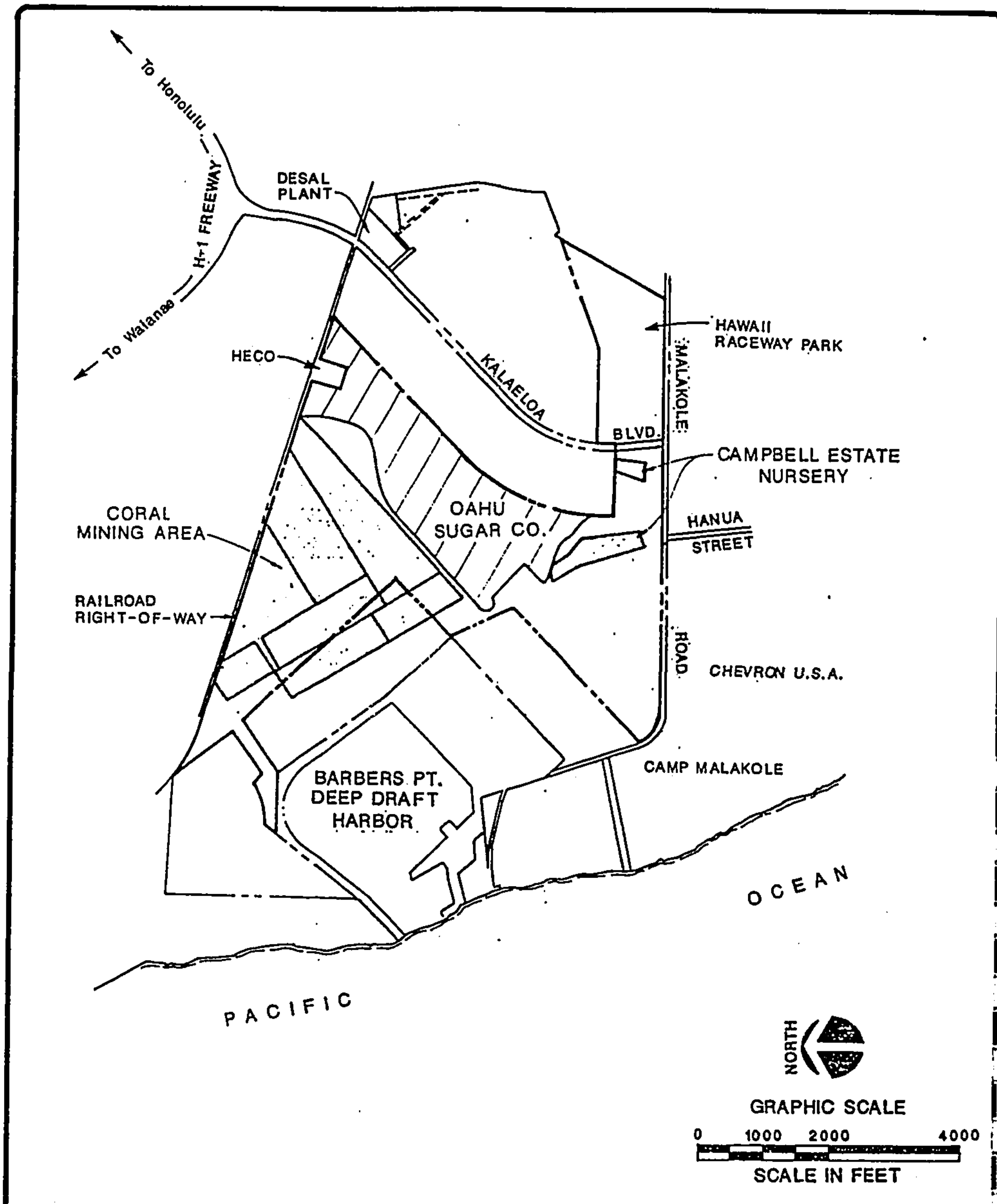

fig. 2 Existing Uses

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

Prepared By: ENGINEERING CONCEPTS, INC.

66 acres of the amendment area as well as a portion of the adjacent parcel owned by the United States government. The lease for the raceway park ends in the year 1991.

Climate

The climate of the Kapolei Business-Industrial Park area is relatively warm and dry and is typical of the climate throughout the Ewa Plains. Tradewinds from the northeast occur much of the time, with occasional Kona winds.

The normal temperature range for the area is from the high 60s (Fahrenheit) to the low 90s. Rainfall is light, with an average annual rainfall of approximately 20 inches.

Topographic Features

The natural topography of the amendment area is flat, with mounds and depressions scattered over the site (Figure 3). Elevations range from approximately 5 feet mean sea level (MSL) near the intersection of Kalaeloa Boulevard and Malakole Road to approximately 75 feet MSL near the northwest corner of the amendment area. Slopes of less than 0.5 percent to 5 percent are found on the site. In general, the amendment area slopes from the railroad right-of-way to Malakole Road, with an average slope of approximately 1 percent.

A large coral stockpile from the excavation of the harbor occupies an area of approximately 105 acres in the southwest corner of the property. Approximately 50 acres of the stockpile encroaches into the amendment area.

The offsite watershed exhibits varying terrain, extending from the railroad right-of-way to the crest of the Waianae Range at an elevation of approximately 2,400 feet MSL. The area immediately north of the site up to the H-1 freeway is currently planted in sugar cane and is relatively flat, with slopes similar to those found in the business-industrial park site. The topography of the watershed area above the freeway ranges from gently sloping areas (1 to 10 percent) adjacent to the freeway to steep slopes in excess of 50 percent along the gulches. Several plateaus with slopes ranging from 5 to 25 percent are located in the upper watershed area. The area above the freeway is currently covered with grass, scrub brush, and trees, with bare areas of rock and pockets of erosion also evident.

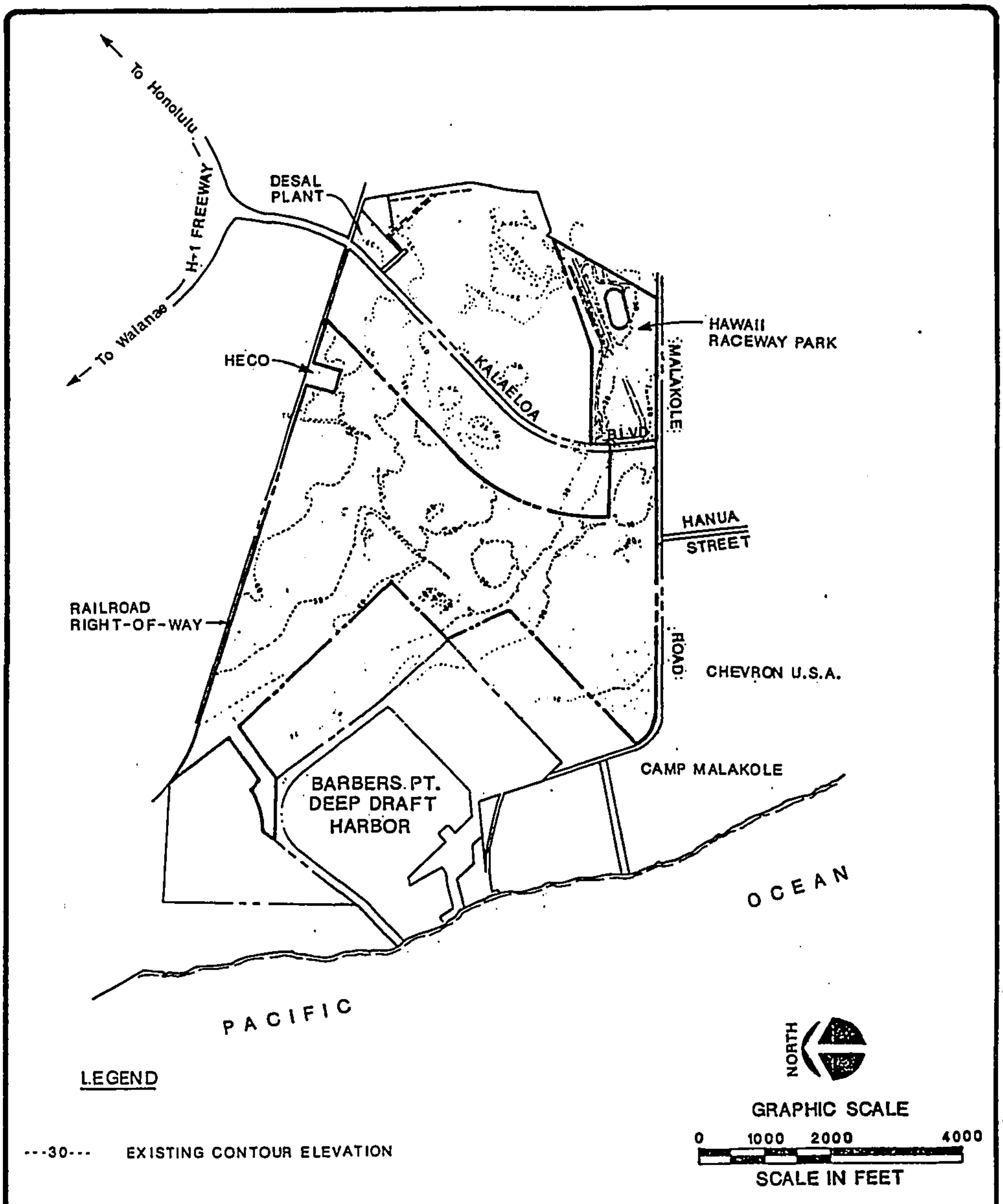

fig. 3 Topographic Map

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

Prepared By: ENGINEERING CONCEPTS, INC.

Soils

According to the Soil Survey by the U.S. Department of Agriculture Soil Conservation Service, the existing soil types currently found in the amendment area (Figure 4) include:

- Coral Outcrop (CR) -- Coral or cemented calcareous sand with a thin layer of friable red soil material in cracks, crevices, and depressions
- Ewa silty clay loam, moderately shallow, 0 to 2 percent slopes (EmA) -- Soil found on alluvial fans and terraces. Surface layer is dark reddish-brown silty clay loam about 18 inches thick. Subsoil is about 42 inches thick and is dark reddish-brown and dark-red silty clay loam. Substratum is coral limestone, sand, or gravelly alluvium. The soil is neutral with moderate permeability. Runoff is slow and the erosion hazard is slight.
- Honouliuli clay, 0 to 2 percent slopes (HxA) -- Occurs in low land along coastal plains. The soil is dark reddish-brown, very sticky, and very plastic throughout. The surface layer is about 15 inches. The soil is neutral to slightly alkaline with moderate permeability. Runoff is slow and erosion hazard is slight.
- Mamala stony silty clay loam, 0 to 12 percent slopes (MnC) -- A dark reddish-brown stony silty clay loam with a surface layer of about 6 inches thick. The subsoil is a dark reddish-brown silty clay loam about 11 inches thick. The substratum is coral limestone or consolidated calcareous sand. The soil is neutral to slightly alkaline with moderate permeability. Runoff is very slow and erosion hazard is slight to moderate.

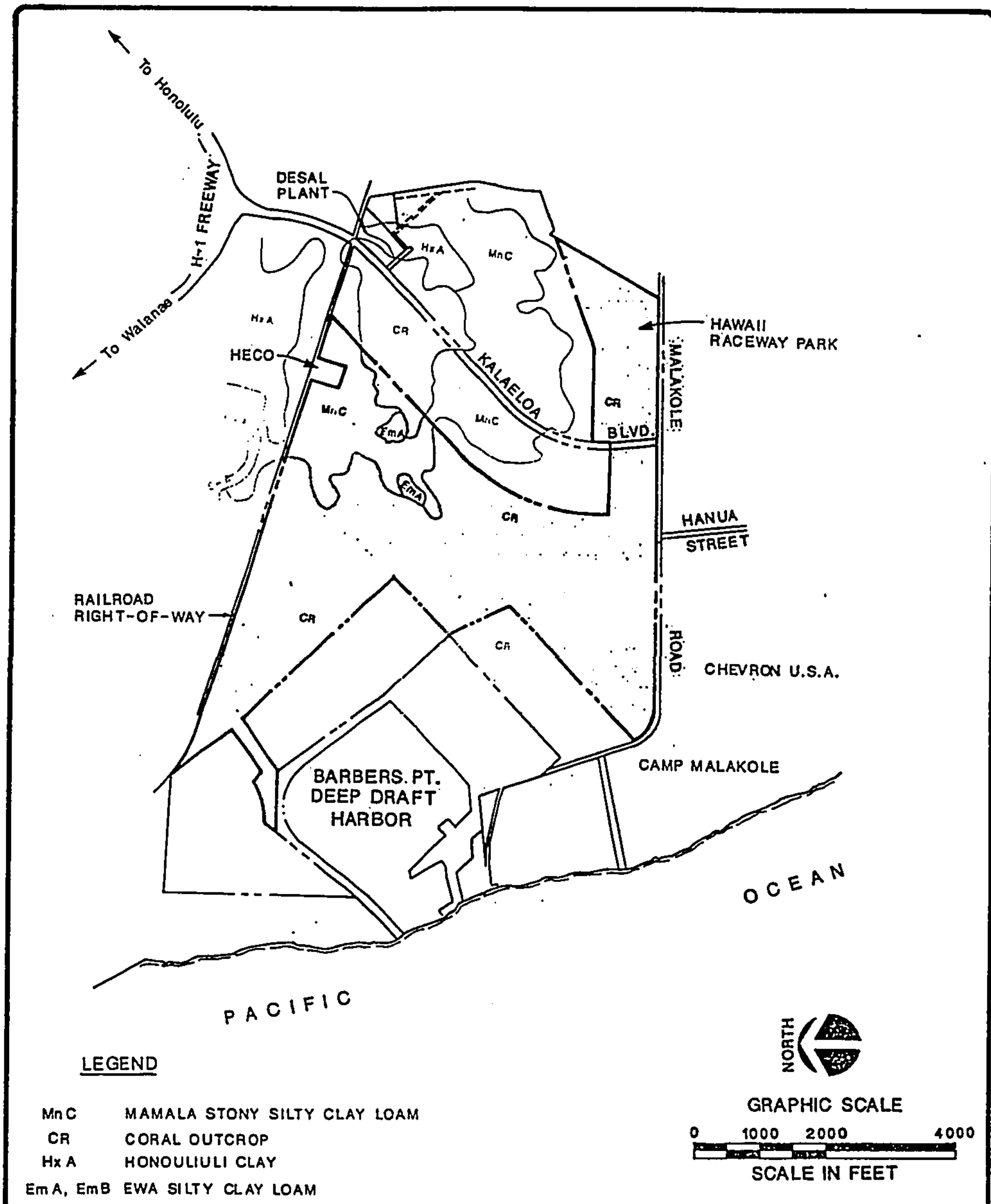

fig. 4 Soils Map

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

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DRAINAGE

Existing Conditions

The watershed in which most of the amendment area is located encompasses approximately 2,400 acres (Figure 5), reaching almost six miles inland.

Runoff from the area above the freeway is collected by three gulches: Awainui Gulch, Palailai Gulch, and an unnamed gulch. The three gulches converge just mauka of the freeway before crossing the H-1. The drainage way continues parallel to the freeway for a short distance before heading makai through the sugar cane fields. The drainage way crosses under the railroad right-of-way into the proposed project site, winding its way down to Malakole Road, where a defined drainage way ends.

There are no existing drainage improvements in the amendment area. Runoff generated on the site and from adjacent areas drains overland via sheet flow and small ditches to the depressions on the site. With the exception of major storms, very little runoff is generated under existing conditions due to the agricultural use and infiltration characteristics of the soil. Runoff from major storms flows to the depression near the Kalaeloa Boulevard/Malakole Road intersection, flooding the low-lying area. Small culverts along Malakole Road aid to relieve the ponding of runoff.

Kalaeloa Boulevard, Malakole Road, and the roadways in the existing industrial park contain underground drainage systems that collect and convey runoff to drainage ditches and channels, ultimately discharging into the ocean. A major drainage channel intended to serve the areas east of Kalaeloa Boulevard is located along the Barbers Point Naval Air Station boundary.

Runoff from the amendment area as well as the entire watershed was estimated for 10-, 50-, and 100-year storms under existing conditions and are listed in Table 1. One-hour rainfall intensities used in the analysis were 1.9 inches per hour for the 10-year storm, 2.4 inches per hour for the 50-year storm, and 2.7 inches per hour for the 100-year storm. The amendment area was divided into five subareas, as shown on Figure 6. Drainage areas D and E are not part of the main watershed shown on Figure 5. Area D drains to the existing drainage channel along the Barbers Point Naval Air Station boundary, while Area E drains toward the Barbers Point Harbor.

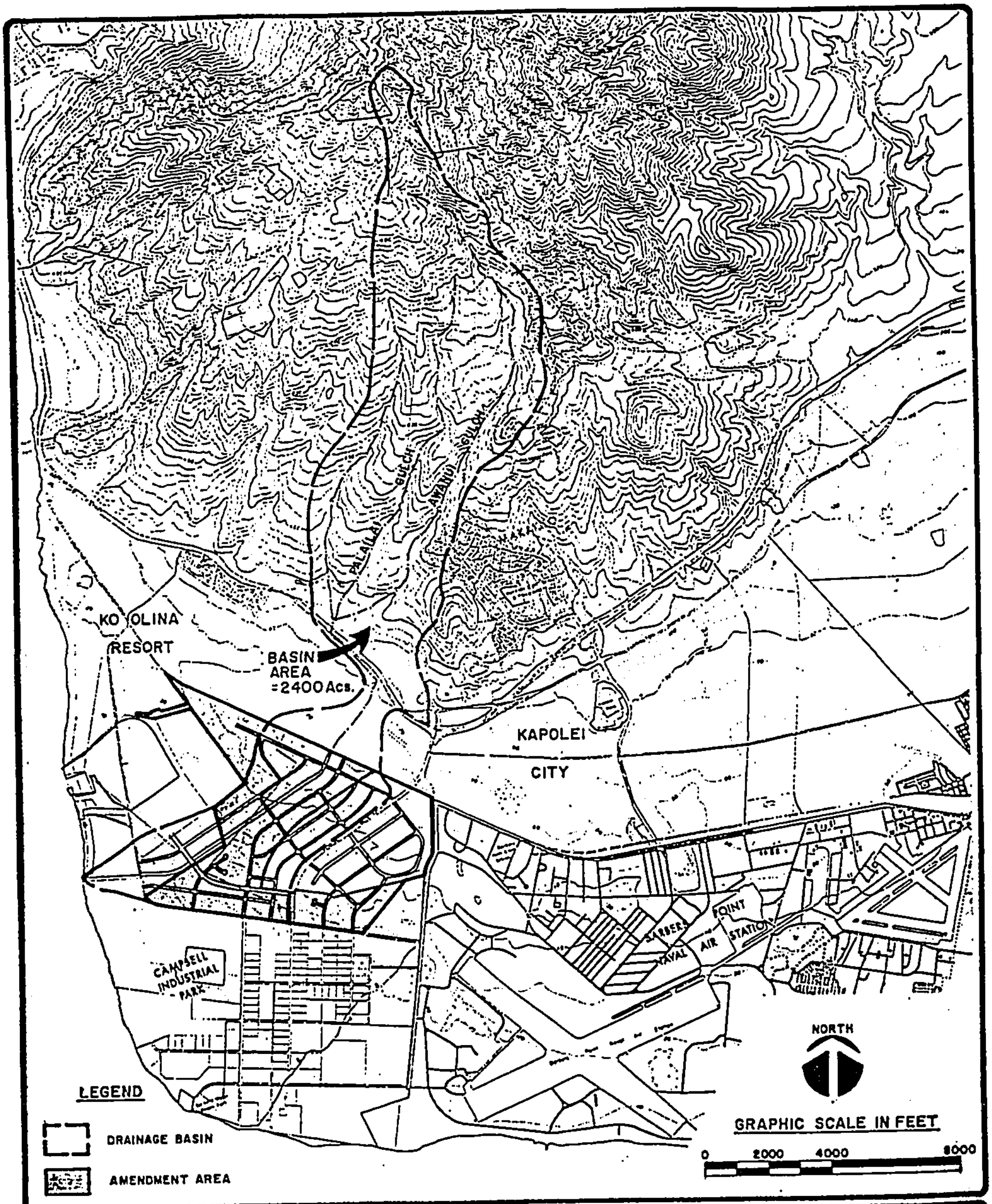

fig. 5	Drainage Basin	KAPOLEI BUSINESS-INDUSTRIAL PARK EWA, OAHU, HAWAII Prepared By:ENGINEERING CONCEPTS, INC.

TABLE 1
EXISTING RUNOFF (1-HR DURATION)

Area	Acres	10-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
A	146	227	308	361
B	127	217	301	226
C	94	112	154	180
D	67	83	115	134
E	118	220	307	361
Total Amendment Area	992	859	1185	1262
Total Watershed	2400	2000	3018	3661

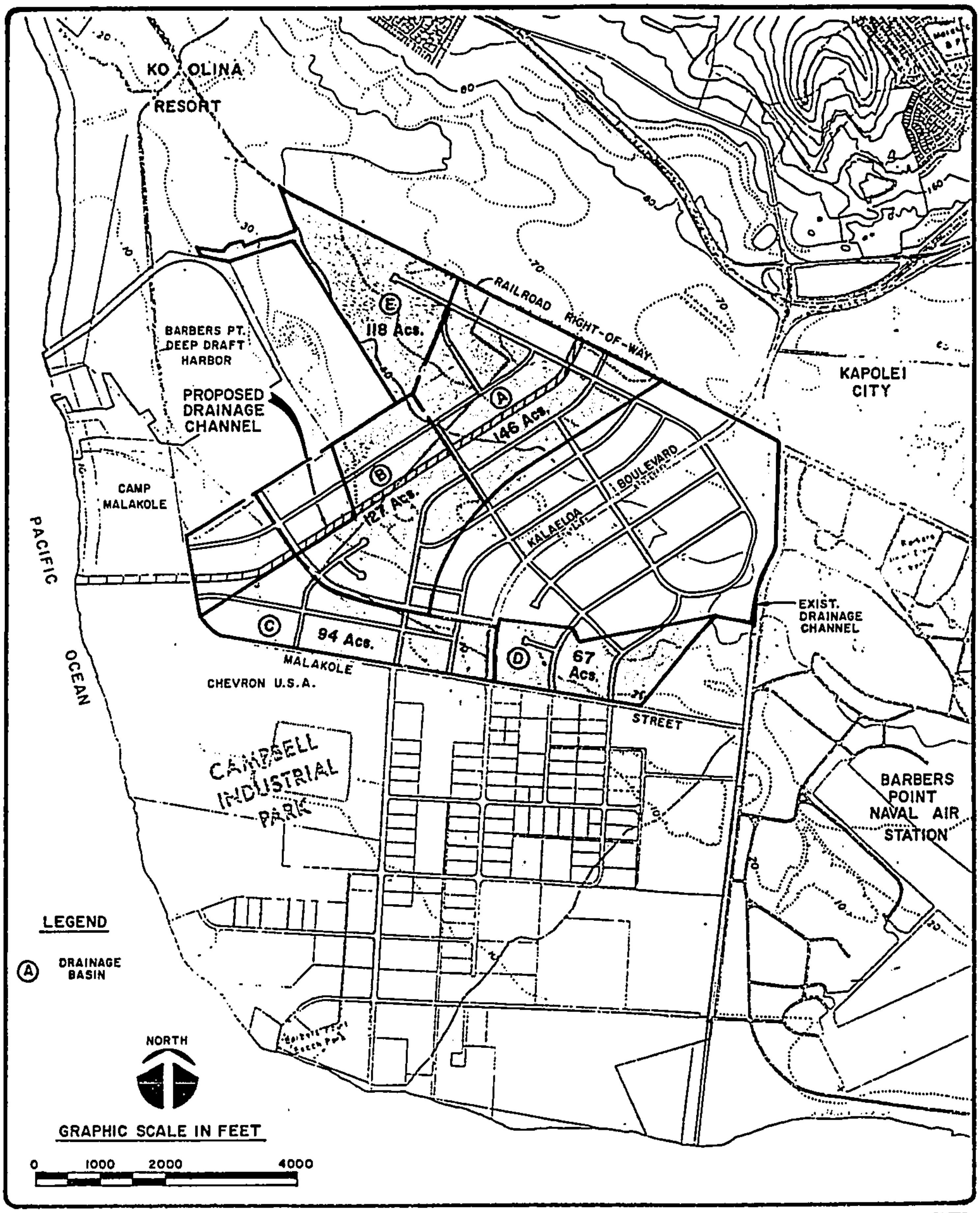

fig. 6 **Onsite Drainage Areas**

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII
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Flood Hazard

The amendment area is designated Zone D in the Flood Insurance Rate Map, indicating areas in which flood hazards are undetermined (Figure 7).

Modifications after Development

The proposed development will alter the character of the site. The vegetative cover currently found onsite would be replaced by buildings, paved areas, formal landscaped areas, and other improvements normally associated with industrial developments. Consequently, peak runoff generated onsite will increase.

Peak runoff rates under developed conditions were estimated for the 10-, 50-, and 100-year storms with a duration of one hour. The 10- and 50-year runoff was estimated using the Soil Conservation Services' TR-20 hydrology program, while the 100-year runoff was based on Plate 6 of the Storm Drainage Standards (May 1988), City and County of Honolulu, Department of Public Works. Future runoff for the entire watershed also considered the possibility of future development mauka of the industrial expansion site. Ko Olina is proposing to extend its development into the area between the railroad right-of-way and the freeway. Long range plans for the Ewa/Kapolei area indicate the possibility of development occurring on the lands immediately mauka of the freeway and atop the plateaus. Future runoff estimates are shown in Table 2, with the percent increase shown in Table 3.

Impact and Mitigation

Development of the Kapolei Business-Industrial Park, including the amendment area, will increase the runoff generated onsite. Without proper mitigative measures, major flooding problems will result due to the flat slopes found within the project site. Flooding may not be limited to the proposed Kapolei Business-Industrial Park site but may also reach the existing industrial park makai of the amendment area.

Mitigative measures proposed for the Kapolei Business-Industrial Park must also consider the overall increase in runoff for the entire watershed. Future development of the offsite watershed may significantly increase the runoff passing through the site from the mauka areas.

The major element of the proposed drainage improvements is a large drainage channel running through the Kapolei Business-Industrial Park site from the railroad right-of-way to the

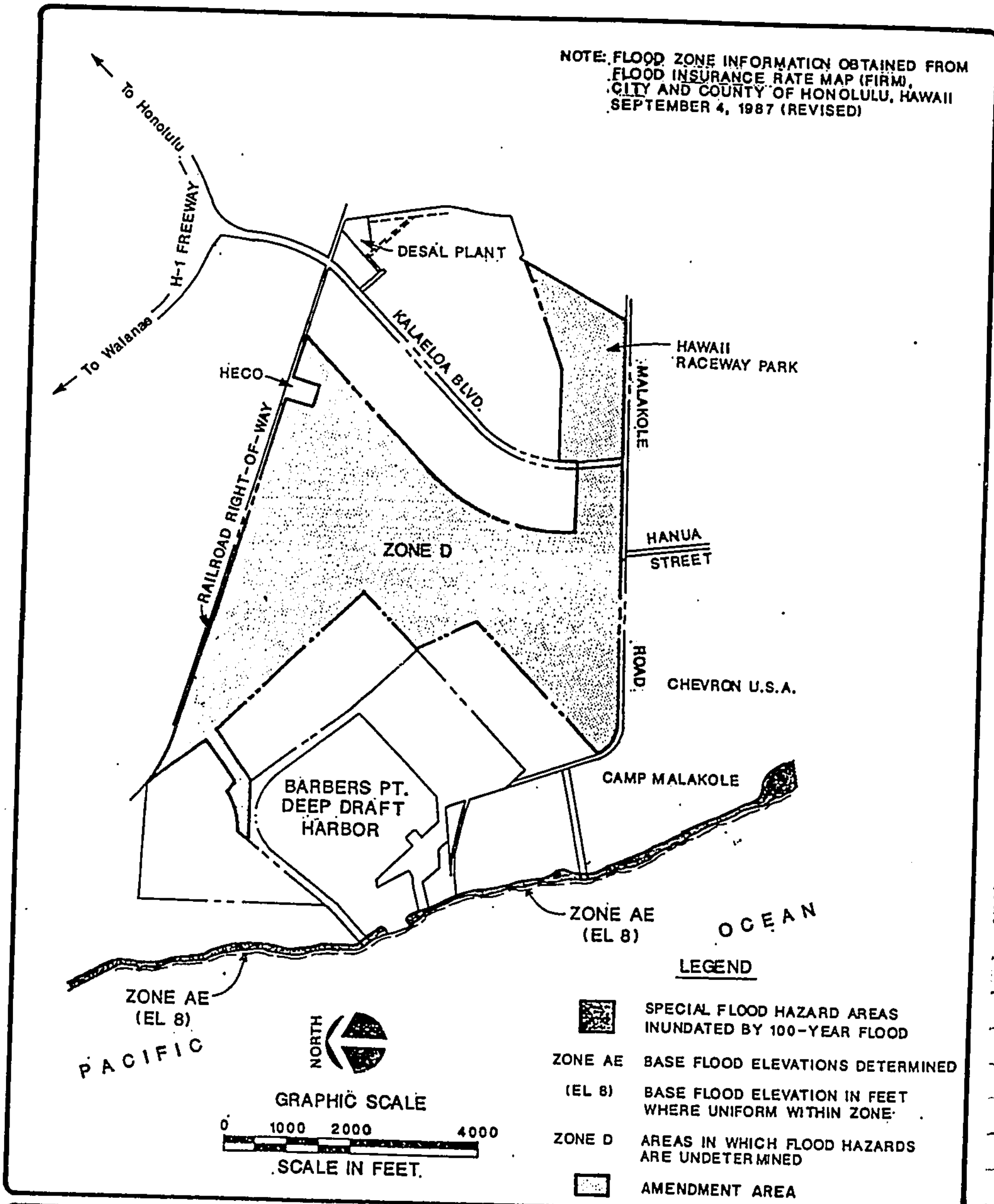

fig. 7 Flood Map

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

Prepared By: ENGINEERING CONCEPTS, INC.

TABLE 2

FUTURE RUNOFF (AMENDMENT AREA)

Area	Acres	10-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)*
A	146	296	387	650
B	127	291	381	600
C	94	147	193	500
D	67	109	143	380
E	118	298	389	500
Total Amendment Area	552	1141	1493	1750
Total Watershed	2400	2639	3772	5200

* City and County of Honolulu Storm Drainage Standards, Plate 6

==

TABLE 3

PERCENT INCREASE

Area	Acres	10-Yr (%)	50-Yr (%)	100-Yr (%)
A	146	33	27	80
B	127	34	27	165
C	94	31	25	178
D	67	31	24	184
E	118	35	27	40
Total Amendment Area	552	33	26	39
Total Watershed	2400	33	25	42

ocean (see Figure 6). The drainage channel will be sized to accommodate the peak runoff rate from Plate 6 of the City's Storm Drainage Standards. Preliminary analysis of the drainage requirements indicates that a trapezoidal channel with a bottom width of approximately 70 feet wide and 8 feet deep will be needed to convey runoff through the site. It is anticipated that the channel will be excavated in hard coral and will not require concrete lining. A 150-foot wide strip of land below the project site has been set aside for the drainage way. This parcel runs from the ocean to Malakole Road between the Chevron, USA property and Camp Malakole. Construction of this portion of the channel will require various permits, and studies are currently being performed to prepare for the various permit applications.

It is anticipated that the onsite runoff will be handled by an underground drainage system consisting of catchbasins/manholes and pipe culverts. Runoff would be collected and conveyed to the major drainage channel for ultimate discharge into the ocean. The onsite drainage system for Area D (Figure 6) will collect and convey runoff for discharge at the existing drainage channel along the Barbers Point Naval Air Station boundary. Drainage Area E is located in an area used for coral mining, resulting in lower elevations. Runoff from this localized area may need to be directed toward the harbor. All onsite drainage improvements will be designed in accordance with City and County standards.

Implementation of the major drainage channel and onsite drainage system will alleviate the flooding problems currently experienced in the area as well as prevent flooding as a result of runoff from the proposed development.

SOIL EROSION

Site Characteristics

The KBIP site is divided into six subareas for the purpose of calculating soil erosion potential (Figure 8). These subareas represent sites that vary in soil erosion potential characteristics such as terrain and drainage network.

Subareas A, B, and C are within the amendment area. The entire KBIP development includes subareas A, B, C, D, E, and F.

The offsite watershed is divided into four subareas for calculation of soil erosion potential.

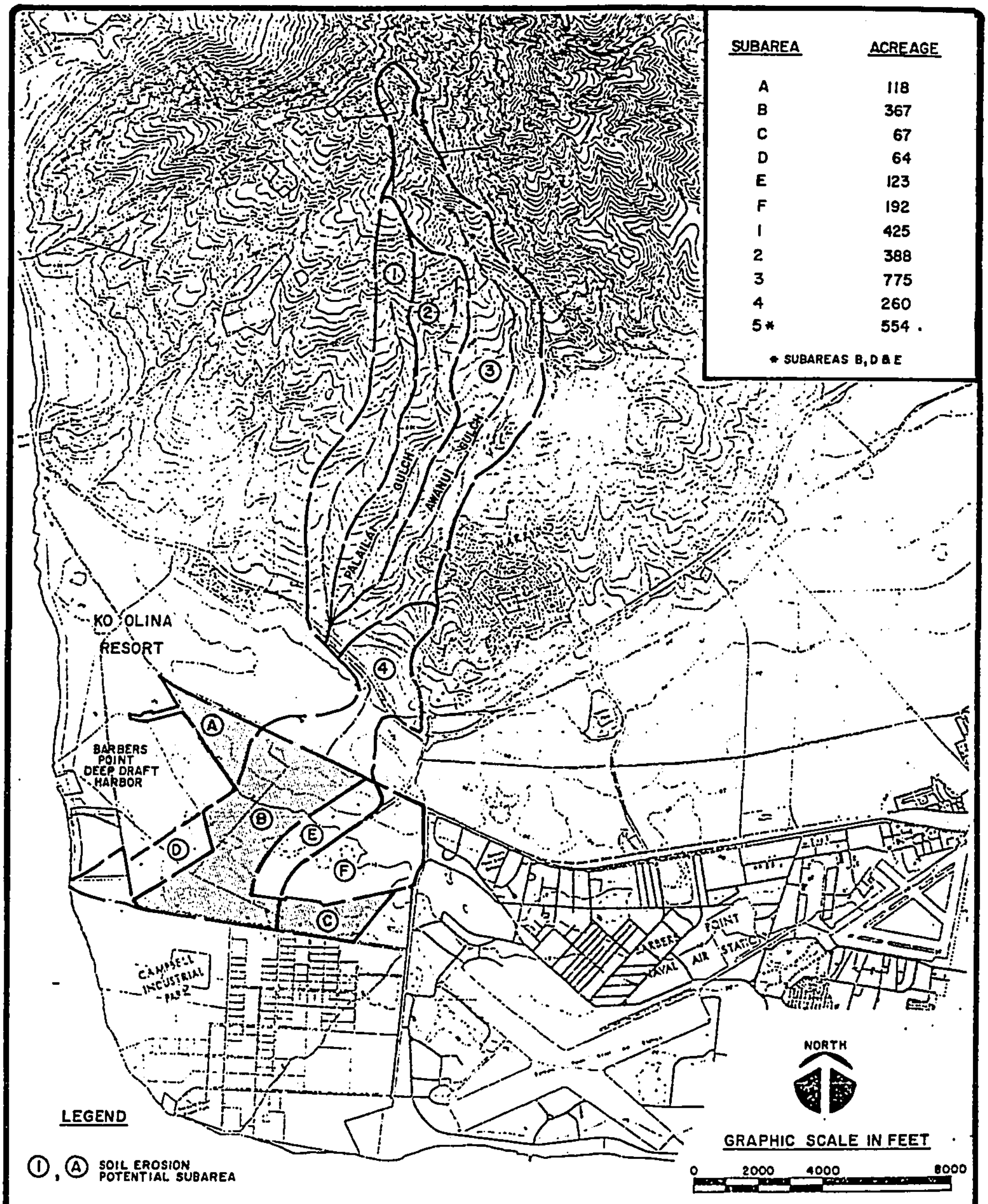

fig. 8 **Soil Erosion Potential Subareas**

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII
Prepared By: ENGINEERING CONCEPTS, INC.

Calculation of Soil Erosion Potential

The U.S. Department of Agriculture, Soil Conservation Service, uses the Universal Soil Loss Equation (USLE) to estimate long-term annual soil losses from sheet and rill erosion. The equation is used to estimate erosion on forest land, farm fields, construction/development sites, and other areas. Soil losses can be estimated for present conditions or for a future condition. The soil loss equation is--

$$A=RKLSCP$$

where:
- A=soil loss (tons per acre per year)
- R=rainfall factor
- K=soil erodibility factor
- L=slope length factor
- S=slope gradient factor
- C=cover and management factor
- P=erosion control practice factor

The existing soil erosion potentials for each subarea, the amendment area, KBIP development, and the entire watershed are listed in Table 4.

Impact and Mitigation

Long-term Impacts. Based on the USLE, the soil erosion potential of the amendment area, the entire KBIP development, and the entire watershed should decrease after development. This decrease in soil erosion is due to the reduction of erodible surfaces (increase in buildings and pavement); reduction of length and slope of overland flow due to site grading and construction of the storm drain system; and increase in landscaped areas (reduction of bare ground).

Short-term Impacts. Construction will involve land disturbing activities that result in soil erosion. These land disturbing activities include removal of existing vegatation (clearing and grubbing), leveling, removing and replacing soil.

The USLE can be used to estimate soil erosion potential based on these short-term construction impacts. For purposes of calculation, it is assumed that the areas will be exposed for a period of two years.

In the short term, an estimated 10,141 tons per year of soil erosion may result from the

TABLE 4 - SOIL EROSION POTENTIAL

		Existing Conditions (tons/year)	After Development (tons/year)	Reduction After Development (%)
Subarea	A	82	14	83
	B	567	48	92
	C	69	8	88
	D	173	8	95
	E	141	17	88
	F	230	39	83
	1	98,600	42,835	57
	2	112,582	45,343	60
	3	255,897	174,360	32
	4	14,477	2,013	86
	5	881	73	92
Total Amendment* Area		718	70	90
Total KBIP Development	**	1,262	134	89
Total Watershed***		482,437	264,624	45

* Subareas A, B, C

** Subareas A, B, C, D, E, F

*** Subareas 1, 2, 3, 4, 5

KBIP development during the grading period.

Mitigation measures can be implemented to reduce short-term soil erosion. For example, limiting grading to not more than 15 consecutive acres at a time and seeding half of the area will reduce estimated soil erosion potential for the site by 53 percent to 5375 tons per year.

Additional erosion control measures would lessen construction impacts even further. These are--

1. Minimize time of construction.
2. Retain existing ground cover until latest date before construction.
3. Early construction of drainage control features.
4. Use of temporary area sprinklers in nonactive construction areas when ground cover is removed.
5. Station water truck on site during construction period to provide for immediate sprinkling, as needed, in active construction zones (weekends and holidays included).
6. Use temporary berms and cut-off ditches, where needed, for control of erosion.
7. Thorough watering of graded areas after construction activity has ceased for the day and on weekends.
8. Sod or plant all cut and fill slopes immediately after grading work has been completed.

Grading and Erosion Control Plans will be prepared in compliance with Chapter 23, Revised Ordinances of Honolulu.

WASTEWATER FACILITIES

Existing Conditions

The proposed Kapolei Business-Industrial Park site, including the amendment area, currently remains undeveloped, with no existing wastewater facilities onsite. The tenants of the existing James Campbell Industrial Park are serviced by cesspools.

The nearest municipal treatment facility, the Honouliuli Wastewater Treatment Plant (WWTP) is located approximately 2.6 miles east of the proposed business-industrial park. The Honouliuli WWTP, a primary treatment facility, is currently operating near its 25 million gallons per day (MGD) design capacity, with the remaining capacity already committed. A plant expansion to increase the capacity to 38 MGD is currently being designed and is tentatively scheduled to be completed by 1994. The Department of Health, however, may require secondary treatment for flows above 25 MGD, which may delay this schedule.

An existing force main/gravity interceptor sewer (Ko Olina Interceptor Sewer, Segment 1) runs parallel to the railroad right-of-way above the site to serve the Ko Olina development.

Modifications after Development

The proposed business-industrial park will be developed to accommodate light industrial and maritime-related uses, with some areas set aside for heavy industrial uses. The wastewater generated from the park is expected to be mainly of domestic composition, with some industrial discharges. Discharges from industrial facilities will be required to meet the City and County of Honolulu's pretreatment standards. The construction of industrial pretreatment facilities will be required for industries unable to meet the City's pretreatment standards.

The business-industrial park development is expected to generate average wastewater flows of 5.5 MGD. Peak design flows are expected to reach 15 MGD. The amendment area is expected to generate approximately 2.2 MGD and 6.8 MGD of average and peak wastewater flows respectively.

Impact and Mitigation

The proposed business-industrial park will generate wastewater flows that currently do not exist. Management of these flows will be necessary to prevent negative health and environmental impacts. Preliminary conversations with Department of Health (DOH) personnel indicate that DOH will require the Kapolei Business-Industrial Park, including the amendment area, to be served by an underground collection system discharging to the Honouliuli WWTP. DOH has established a policy to eliminate the use of cesspools and limit the use of septic tank systems. A project the size of Kapolei Business-Industrial Park would not likely be allowed to use septic tanks. Consequently, the proposed developments will be served by an underground collection system in compliance with the DOH directive.

Wastewater generated from the proposed development will be collected by a series of gravity sewers and conveyed to a centralized wastewater pumping station. The wastewater would then be pumped via force main to a main trunk sewer running along the railroad right-of-way for transport to Honouliuli WWTP. The onsite collection system, pump station and force main will be designed in accordance with the standards of the City and County of Honolulu, Division of Wastewater Management. It is intended that the collection system, pump station and force main be dedicated to the City. Major elements of the onsite system are conceptually shown on Figure 9.

The existing Ko Olina interceptor sewer was oversized in the design phase to accommodate some additional flows from Campbell Estate projects, mainly the flows from the proposed Kapolei City. It was not anticipated that the proposed business-industrial park would be required to collect and transport its sewage to the Honouliuli WWTP. Consequently, the existing segment 1 of the Ko Olina interceptor sewer does not have the capacity to accommodate both the Kapolei Business-Industrial Park and the Kapolei City projects. A parallel sewer will ultimately be required to handle the additional flows. However, it is anticipated that initial phases of both developments would be able to share the available capacity.

The existing Ko Olina interceptor sewer currently ties in temporarily to the Makakilo interceptor sewer at Barbers Point Access Road, taking advantage of the available capacity of the Makakilo interceptor from Barbers Point Access Road to the treatment plant. The Kapolei interceptor sewer (formerly segment 2 of the Ko Olina interceptor) is currently being planned and will run parallel to the Makakilo interceptor sewer from Barbers Point Access Road to Honouliuli WWTP (Figure 10). Flows from segment 1 of the Ko Olina interceptor will be diverted to the Kapolei interceptor sewer. The Kapolei interceptor is being planned to accommodate all of the proposed developments in the Kapolei area, including the proposed business-industrial park.

In the event the business-industrial park development precedes completion of the Honouliuli WWTP expansion, the wastewater generated from the development will be collected by the onsite sewer system and transported to a temporary wastewater treatment facility located within the boundaries of the development. The temporary treatment facility, if required, would provide secondary treatment of the wastewater.

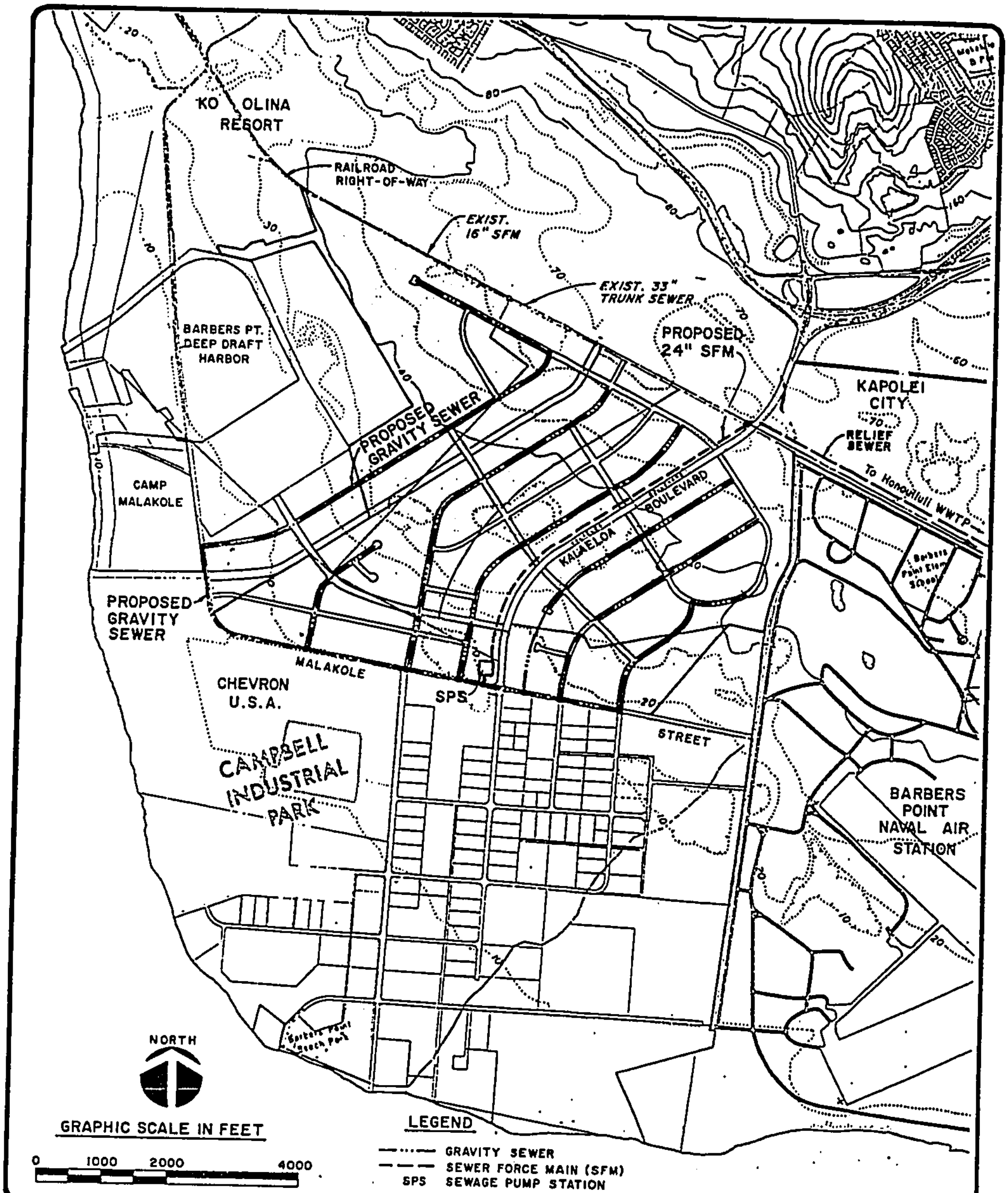

fig. 9 Proposed Sewer System

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

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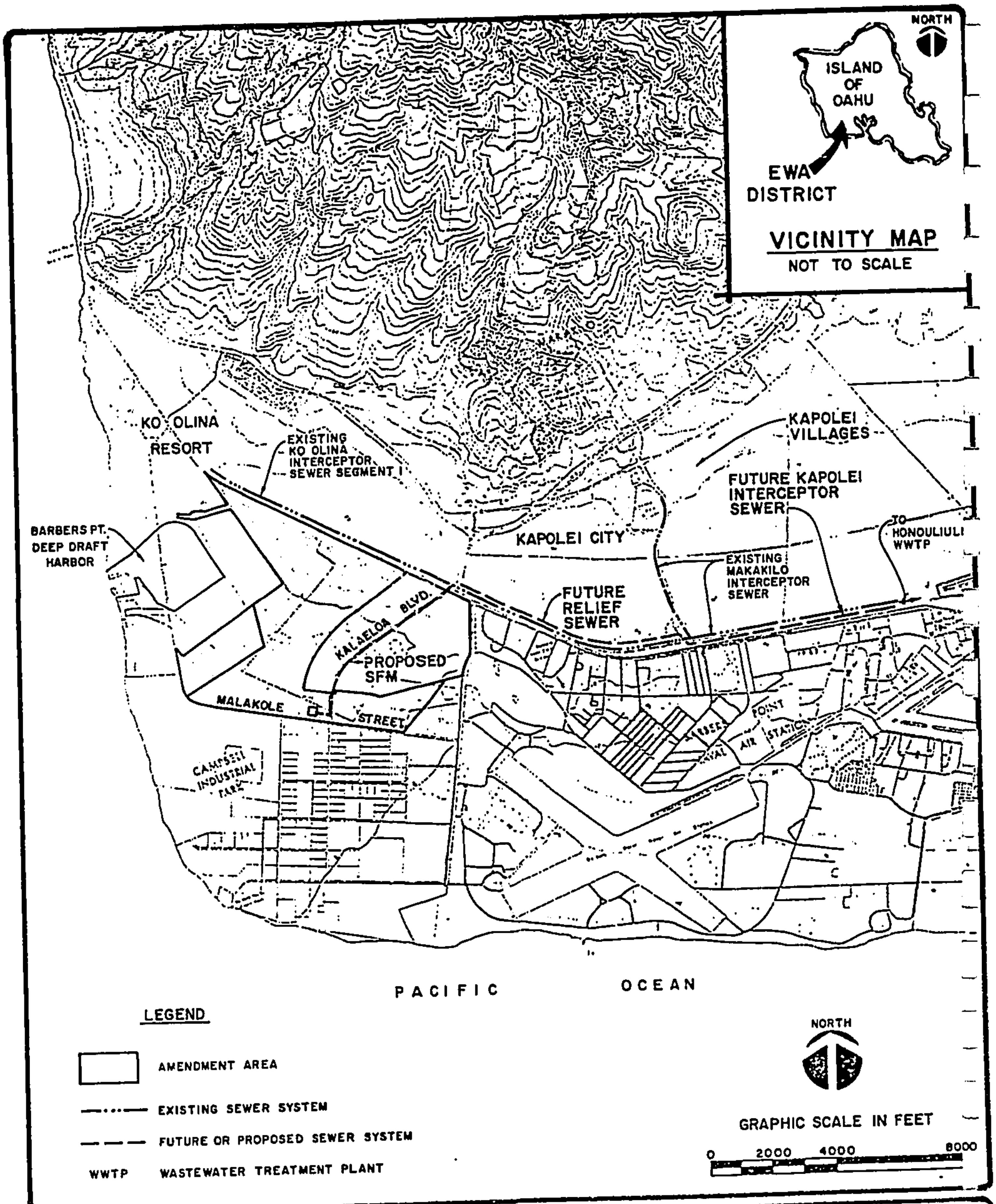

fig. 10 **Regional Wastewater Facilities**

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

Prepared By: ENGINEERING CONCEPTS, INC.

Effluent disposal options include percolation/evaporation ponds, injection wells below the underground injection control (UIC) line (Malakole Road), reuse for irrigation, or a combination of the alternatives. Should the temporary treatment plant be required, all government standards and regulations pertaining to wastewater treatment facilities will be followed.

Implementation of the wastewater facilities will be done in phases, according to the development schedule of the project.

WATER FACILITIES

Existing Conditions

The existing industrial park is currently served by 24-inch and 20-inch Board of Water Supply (BWS) mains in Kalaeloa Boulevard to Malakole Road (Figure 11). Within Malakole Road, a 20-inch main runs toward the harbor, with a 16-inch main heading toward Barbers Point Naval Air Station. The water source is found near Waipahu in the vicinity of the Kunia Interchange. The Hoaeae Wells, Kunia Wells I and II, as well as the Waipahu Wells, feed the water system serving the Ewa/Kapolei area. It is estimated that the existing industrial park has an average daily water demand of approximately 5.3 MGD, with maximum daily demands and peak hour demands of 7.1 and 12.2 MGD respectively.

The Estate of James Campbell is a member of the Ewa Plain Water Development Corporation, which was established to assess the water system requirements and coordinate the improvements for all of the developments in the Ewa Plain. The Ewa Water Master Plan by Belt, Collins & Associates identifies the required infrastructure to serve the development, including the business-industrial park. Some of the identified improvements have already been completed.

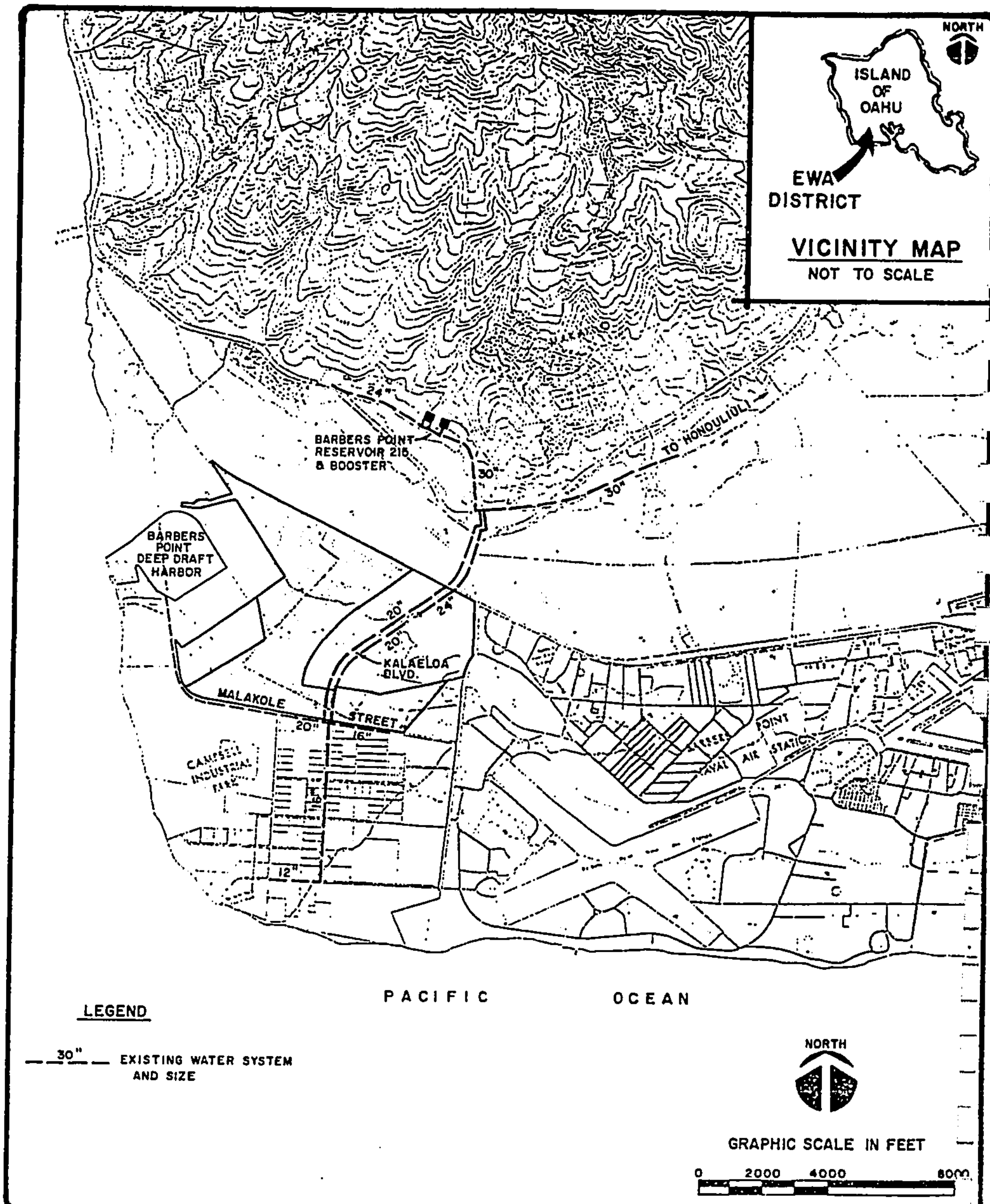

fig. 11 Existing Water Facilities (Partial)

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

Prepared By:ENGINEERING CONCEPTS, INC.

Modifications after Development

The proposed Kapolei Business-Industrial Park, including the amendment area, will almost double the area of industrial development from the existing industrial park. Buildings and paved areas will replace the existing vegetation and open areas currently found on the site. Consequently, additional water demands through the BWS system will be generated by the proposed development; however, water currently used for irrigation will no longer be required. The anticipated water demands for the amendment area and the Kapolei Business-Industrial Park are listed below.

	Potable Water (MGD)			Nonpotable Water (MGD)		
	Ave	Max	Peak	Ave	Max	Peak
Amendment Area	0.78	1.18	2.35	1.87	2.80	5.60
Kapolei Business-Industrial Park	1.32	1.98	3.97	3.14	4.72	9.44

Water

Impacts and Mitigation

Initial review of the Ewa Water Master Plan and a preliminary hydraulic analysis using data from the master plan as the basis, indicates that the 24-inch and 20-inch mains in Kalaeloa Boulevard should be able to accommodate demands from the proposed project. A water master plan for the project will be prepared and submitted to the Board of Water Supply for their review and approval.

The offsite water system will be adequate to service the initial development of the business-industrial park as well as the other planned developments in the Kapolei area. Ultimately, however, additional improvements to the regional water system will be required. The Ewa Water Master Plan indicates that a parallel main in Farrington Highway from the Honouliuli booster station near the Kunia Interchange to Makakilo will eventually be needed. Other improvements such as storage tanks and additional pump requirements are also identified in the master plan. Implementation of the improvements will be governed by development schedules of the proposed projects and will be coordinated by the Ewa Plain Water Development Corporation.

All the proposed developments in the Ewa area will be placing additional demands on the potable water supply. Consequently, an additional well field is in the process of being developed in upper Honouliuli that will satisfy some of the potable water requirements for the proposed developments, including the Kapolei Business-Industrial Park. Currently, five wells have been completed, with a sixth well scheduled to be completed shortly. Approximately 6.7 million gallons of potable water will be supplied by these six wells. Additional sources of potable water are being investigated to meet the demands of the developments in the Ewa/Kapolei area.

The proposed business-industrial park, as a mitigative measure, is planning to implement a dual water system that will use potable water for domestic uses and nonpotable water for irrigation and other nonconsumptive uses. The Board of Water Supply's (BWS) design criterion for dual systems in industrial areas reduces the potable water requirements by approximately 65 percent. The BWS's dual water system criterion for average daily demand in industrial areas is 1,421 gpd per acre for potable water and 3,379 gpd per acre for nonpotable water. This compares to 4,000 gpd per acre for an all potable system.

The onsite water system for the Kapolei Business-Industrial Park will connect to the mains in Kalaeloa Boulevard and will be designed in accordance with BWS standards. Preliminary analysis indicates that 12- and 16-inch water lines will be needed to serve the potable water and fire protection requirements for the business-industrial park, including the amendment area.

The nonpotable infrastructure requirements are currently being studied and will depend on the location and quality of the nonpotable source.

In general, the proposed Kapolei Business-Industrial Park, including the amendment area, has been provided for in the planning of the regional water system, resulting in minimal impact to the existing system.

SOLID WASTE

Existing Conditions

With the exception of Hawaii Raceway Park, which is located in the portion of the amendment area east of Kalaeloa Boulevard, the existing business-industrial park site does not generate solid wastes. The tenants of the existing industrial park are serviced by private refuse collection companies, with the solid wastes being disposed of at the Waipahu incinerator.

Impacts and Mitigation

The proposed project will generate additional solid wastes from the area. Private refuse collectors will service the development.

Current waste disposal facilities may be inadequate to handle additional wastes. The Palailai landfill has been closed and the Waipahu incinerator may be at or near capacity. The City and County of Honolulu, however, is currently in the process of establishing a new landfill site in Waimanalo Gulch and development of the H-POWER waste energy recovery facility is under way. The H-POWER facility is expected to accommodate most of Oahu's solid waste.

POWER AND COMMUNICATIONS

Existing Conditions

The majority of the proposed business-industrial park site is currently not served by Hawaiian Electric Company (HECO) and Hawaiian Telephone Company (HawTel). Only the raceway park, occupying a portion of the amendment area east of Kalaeloa Boulevard requires electrical and telephone service.

HECO and HawTel provide service to the existing industrial park as well as to the adjacent developments of Ko-Olina (currently under construction) and Barbers Point Naval Air Station. An existing HECO substation is located within the amendment area, adjacent to the railroad right-of-way and west of Kalaeloa Boulevard (Figure 12). Several overhead lines are found traversing the business-industrial park site.

Probable Impacts

The proposed Kapolei Business-Industrial Park will place additional demands on the utility systems. For planning purposes, HECO has indicated that electrical unit loads for industrial developments may range from 100 KVA/acre to 150 KVA/acre. Based on the information provided by HECO, the projected load requirements are estimated at 93.1 to 139.6 MVA for the entire business-industrial park and 55.2 to 82.8 MVA for the amendment area. Preliminary consultations with HECO and HawTel indicate that service can be provided to the project.

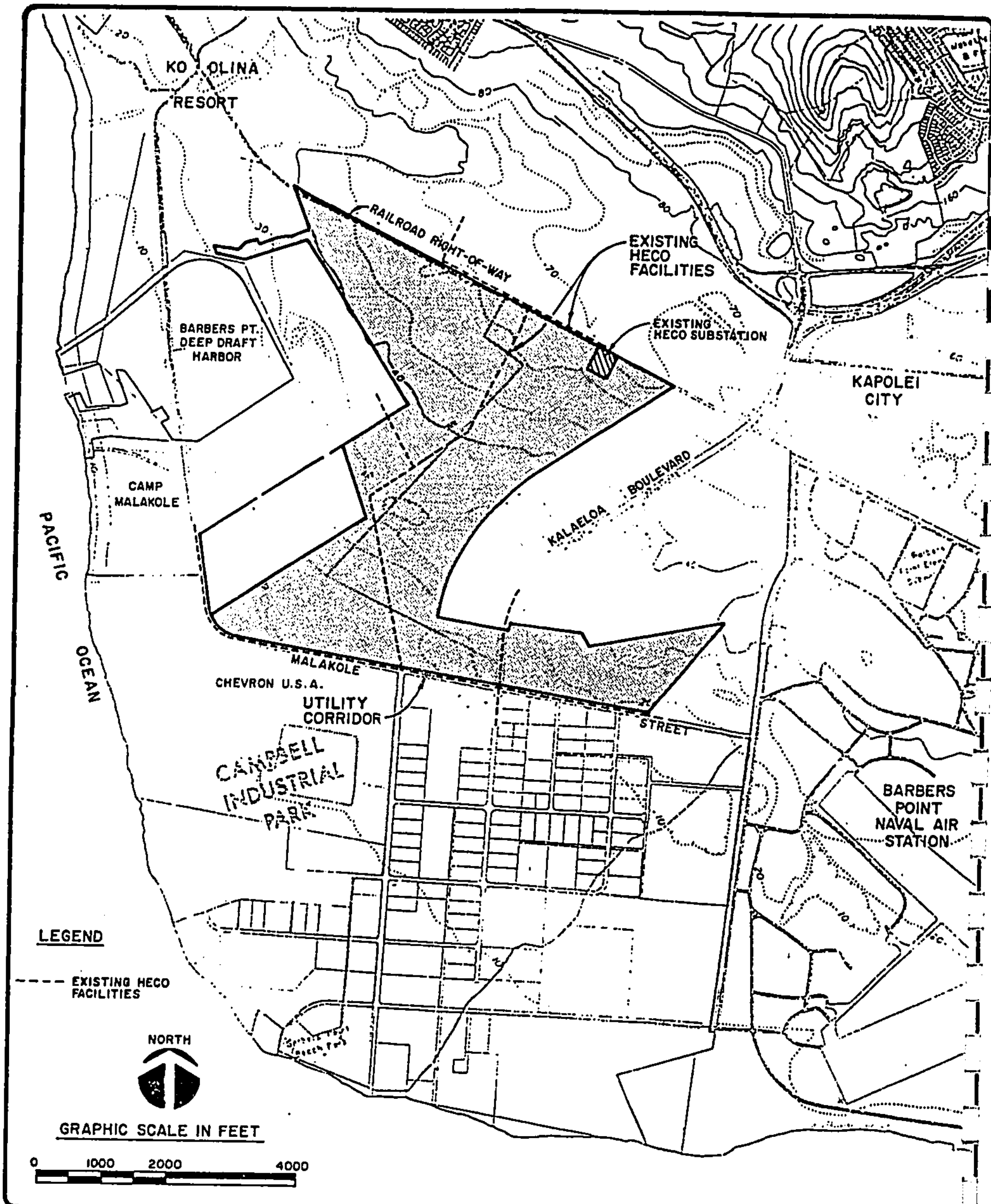

fig. 12 **Existing HECO Facilities**

KAPOLEI BUSINESS-INDUSTRIAL PARK
EWA, OAHU, HAWAII

Prepared By: ENGINEERING CONCEPTS, INC.

PROFESSIONAL QUALIFICATIONS

OF

ENGINEERING CONCEPTS, INC.

Submitted by:

Engineering Concepts, Inc.
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PROFESSIONAL QUALIFICATIONS

GENERAL QUALIFICATIONS

Engineering Concepts, Inc. is an engineering consulting firm capable of providing professional services for civil, environmental, and structural engineering projects. Our staff of six registered engineers, one assistant engineer, and one designer/draftsman has extensive experience in planning and design; environmental assessments and reports; engineering feasibility studies; construction specifications and cost estimates; and construction management services. Our engineers have worked on several major golf courses in Hawaii in Kaneohe, Waikane, Waialua, Kahuku, and Pupukea. With our individual and combined capabilities, our prime objective is to provide our clients with high quality work on a timely basis.

SPECIFIC CAPABILITIES

To fulfill our clients' needs, Engineering Concepts, Inc. offers the following services:

1. In close coordination with clients and planners, provide conceptual development infrastructure plans and preliminary construction cost estimates.

2. Provide engineering feasibility studies delineating alternatives, assessments, and ramifications for the various development programs.

3. Provide engineering assistance for the processing of land use and zoning changes, special use permits, conservation district use applications, U.S. Army Corps of Engineers' permit applications, and other permits required by the Federal, State, and County governments and agencies.

4. Provide environmental impact assessments (EIA) and statements (EIS) for proposed improvements utilizing field, laboratory, and consultant services to evaluate the significant impacts and develop mitigating measures.

5. Provide coordination and consultation with affected government agencies to process planning and design documents for approval. Services include graphic and oral presentations at public meetings.

6. Provide wastewater system engineering services that include water quality analysis; development of wastewater management and facilities master plans; and design of collection and transmission piping systems, lift stations, and treatment plants, including effluent and sludge disposal facilities.

7. Provide water system engineering services that include hydrologic investigation and analysis for water supply; water quality analysis; development of water master plans; system hydraulic analysis; and design of above and below ground water sources, pumping stations, reservoirs, transmission and distribution piping systems, and irrigation systems.

8. Provide storm drainage system engineering services that include hydrologic studies; determination of drainage area, rainfall, and runoff; flood analysis and flood hazard reports; preparation of drainage master plans; identification of erosion and silt control measures; and design of collection, transmission, retention, and disposal facilities.

9. Provide highway/road engineering services that include traffic measurement and analysis; development of design criteria; determination of optimum road alignment and grade; design of pavement, drainage, and utility systems, intersections, traffic signs and pavement markings, pedestrian facilities, and bikeways; and prepare traffic detour and phasing plans.

10. Provide structural engineering consulting services.

11. Provide construction management services that include establishing contract requirements; preparation and review of cost estimates; conducting preconstruction conferences; reviewing schedules and shop drawings; reviewing and processing payment requests; and preparing as-built drawings.

ENGINEERING CONCEPTS, INC.

CONSULTING ENGINEERS

CRAIG S. ARAKAKI **CIVIL ENGINEER**

Education:	University of Hawaii, B.S. in Civil Engineering, 1980
Registration:	Civil Engineer, Hawaii, Certificate #5510, 1983
Professional Affiliation:	American Society of Civil Engineers
Areas of Special Competence:	Land Development Subdivision Planning and Design Grading and Roadways Water Systems Wastewater Systems Drainage Studies

Work Experience:

1987 - Present	Engineering Concepts, Inc., Honolulu, Hawaii, Associate
1980 - 1987	M&E Pacific, Inc., Honolulu, Hawaii, Project Engineer
1980	Hawaiian Dredging & Construction Co., Honolulu, Hawaii, Cost Engineer
1978 - 1980	Walter Lum Associates, Honolulu, Hawaii, Laboratory Technician

General Background:

Mr. Arakaki has been responsible for the planning and design of land development projects including field investigations and the preparation of preliminary engineering reports, infrastructure master plans, construction plans, specifications, and cost estimates for various site improvements such as roads, grading, drainage systems, water transmission and distribution systems, and sewerage systems. He has also been involved in the coordination, review, and approval processes required by government agencies and utility companies.

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Specific Project Experience:

Mr. Arakaki has been responsible for the development of construction plans, specifications, and cost estimates for various commercial, residential, resort, and industrial developments.

- Design of the residential subdivision and the water booster pump station and reservoir for the Waialae-Iki V subdivision.
- Design of site improvements for Kaiser Medical Clinic.
- Design of site work, including utility and drainage improvements, for Waterfront Row, a shopping/restaurant complex.
- Design of site improvements for two proposed hotels on Lanai.
- Design of site improvements for Haleakala Gardens and Village, a residential development on the island of Maui.
- Design of site improvements for Mililani Town Center, a 50-acre shopping complex.
- Design of site improvements for Intelect Building on the Dole Iwilei Cannery property.
- Preliminary engineering during the planning phase for a proposed 1,000-acre Ewa Marina development, including the preparation of water, drainage, and grading master plans.

He assisted in the development of construction plans, specifications, and cost estimates on various projects for the U.S. Navy in Hawaii, Guam, and Diego Garcia, BIOT.

He was responsible for the comparison of the Board of Water Supply's (BWS) Hydraulic Computer Model software program with the WADSY Computer Model Program. Computer models were developed for the Wahiawa and Waipahu water systems for comparison. Work included identifying inadequacies and recommending possible improvements to the BWS program.

Projects:

Residential Development
- Mililani Town Subdivision (Oahu, Hawaii)
- Ahikoe Subdivision (Oahu, Hawaii)
- Waialae-Iki Unit V Subdivision (Oahu, Hawaii)
- Koele Subdivision (Lanai, Hawaii)
- Ewa Marina Community (Oahu, Hawaii)
- Kona 44 Subdivision (Hawaii)
- Haleakala Gardens and Village (Hawaii)

Commercial/Industrial Centers
- Kaiser Medical Clinic, Hawaii Kai (Oahu, Hawaii)
- Mililani Town Center (Oahu, Hawaii)
- Dole Vehicle Maintenance Facility (Oahu, Hawaii)
- Intelect Building (Oahu, Hawaii)
- Waterfront Row (Kailua-Kona, Hawaii)
- Kapolei Shopping Center (Oahu, Hawaii)
- James Campbell Industrial Park (Oahu, Hawaii)

Resort Development
- Turtle Bay Hilton Hotel (Oahu, Hawaii)
- Manele and Koele Hotels (Lanai, Hawaii)

Federal Government
- Diego Garcia Multidiscipline Projects
- Navy Public Works Center Miscellaneous Projects (Guam)
- Erosion Protection, Kaneohe MCAS (Oahu, Hawaii)

APPENDIX B

Botanical Survey Campbell Estate Commercial-Industrial Project Ewa District, Island of Oahu

Char And Associates

APPENDIX B

BOTANICAL SURVEY

CAMPBELL ESTATE COMMERCIAL-INDUSTRIAL PROJECT

'EWA DISTRICT, ISLAND OF O'AHU

by

Winona P. Char

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

Prepared for: WILLIAM E. WANKET, INC.

October 1989

EXECUTIVE SUMMARY

In August 1989 a botanical survey was conducted of the proposed ±552-acre project site. Three major vegetation types were recognized on the subject property. Actively cultivated sugar cane fields along with the weedy species associated with agricultural lands covered more than 60% of the site. Uncultivated areas were occupied by kiawe forests and sugar cane fields.

A total of 95 vascular plant species was found, of which 84 (88.5%) were introduced, 2 (2%) were originally of Polynesian introduction, and 9 (9.5%) were native. None of the natives are considered threatened or endangered species.

The property proposed for development contains little of botanical interest or concern as introduced plants are the dominant components of the vegetation. Almost all of the site appears to have been disturbed to some degree at one time or another.

BOTANICAL SURVEY
CAMPBELL ESTATE COMMERCIAL-INDUSTRIAL PROJECT
'EWA DISTRICT, ISLAND OF O'AHU

INTRODUCTION

The project site encompasses roughly ±552-acres, most of which is under active sugar cane cultivation. Smaller areas are occupied by kiawe forest, abandoned sugar cane fields now largely overgrown with weedy shrubs, and the Hawaii Raceway Park. The land is presently zoned "Agriculture". Campbell Estate will be making a request to amend the 'Ewa Development Plan Land Use Map with the following land use changes: 423.59 acres for "Industrial"; 109.30 acres for "Maritime Industrial"; and 19.20 acres for "Commercial".

Field studies to assess the botanical resources on the site were conducted in August 1989. The primary objectives of the field studies were to (1) describe the major vegetation types; (2) inventory the terrestrial, vascular flora; and (3) search for threatened and endangered plant species on the project site.

SURVEY METHODS

Prior to undertaking the field survey, a search was made of the literature pertinent to the project site. Topographic maps and aerial photographs were examined to determine access, vegetation patterns, terrain characteristics, and potential logistical and technical problems. Access onto most parts of the project site was provided by a number of unpaved, cane haul roads which transect the property.

A walk-through survey method was used. Notes were made on plant associations and distribution, substrate types, exposure, etc. Plants which could not be positively identified in the field were collected for later determination in the herbarium and for comparison with the recent taxonomic literature. The species recorded are indicative of the season ("rainy" vs. "dry") and environmental conditions under which this survey was conducted. A survey taken during the wetter months (November through January) would no doubt yield slight variations in the species list especially of the weedy, annual plants.

DESCRIPTION OF THE VEGETATION

Portions of the project site were inventoried during the U. S. Fish and Wildlife Service's 'Ewa Plains Botanical Survey (Char and Balakrishnan 1979). The survey focused on locating threatened and endangered plant species and also remnant native plant communities. No plants considered threatened or endangered by the Federal and/or State governments were found on the proposed project site; nor were any significant remnant native plant communities found on the subject property.

In this report, three major vegetation types are recognized and described: (1) Cane fields; (2) Kiawe forest; and (3) Abandoned cane fields. Landscape plantings around the Hawaii Raceway Park and along Malakole Road are not included in the species checklist at the end of this report. Field studies concentrated on less disturbed areas as the kiawe forest and rock piles and scrub within the cane fields as these less disturbed areas are more likely to harbor native plant species.

1. Cane Fields

Cane fields along with their associated network of cane haul roads and irrigation system cover roughly more than 60% of the subject property. Sugar cane (*Saccharum officinarum*) is one of the most efficient and productive of all crops. The plants grow rapidly and shade out any competing weedy species; only the nut grass (*Cyperus rotundus*) has adapted-well to such growing conditions. Other weedy species tend to occur along the margins of fields where there is less competition from the cane and more light and nutrients available. Roadsides, the OR & L right-of-way, and drainageways also support a varied assortment of such weedy or ruderal (wasteside) plants. These include buffel grass (*Cenchrus ciliaris*), swollen finger grass (*Chloris barbata*), spiny amaranth (*Amaranthus spinosus*), sow thistle (*Sonchus oleraceus*), and golden crownbeard (*Verbesina encelioides*). A few shrubby species and young trees such as kiawe (*Prosopis pallida*), 'opiuma (*Pithecellobium dulce*), koa-haole (*Leucaena leucocephala*), two species of *Pluchea*, and castor bean (*Ricinus communis*) are associated with the drainageways and roadsides.

2. Kiawe Forest

This vegetation type is found bordering Malakole Road, around the deep-draft harbor, and on parts of the Hawaii Raceway Park. Trees vary from 20 to 35 ft. in height and usually support an understory (or subcanopy) of koa-haole shrubs.

Ground cover composition varies. Where the canopy cover is closed (the crowns of the trees interlocking) and the coralline substrate exposed, ground cover consists almost exclusively of dense mats of Chinese violet (*Asystasia gangetica*). If there is a layer of shallow soil, than scattered patches of Guinea grass (*Panicum maximum*) and buffel grass can be found. In some areas, as on the old Gilbert Village site (near the HECO substation and OR & L line), the kiawe trees are scattered and the cover is open; buffel grass forms a dense, undulating carpet up to 3 ft. high. A few large trees of China berry (<u>Melia azedarach</u>), Chinese banyan (<u>Ficus microcarpa</u>), mango (<u>Mangifera indica</u>), and sea grape (<u>Coccoloba uvifera</u>) occur on the former village site.

Portions of the forest have been cleared along Malakole Road and a coconut (<u>Cocos nucifera</u>) nursery started. Also in this area is a small pond which received run-off water from the adjacent cane fields. It is now largely overgrown with California grass (<u>Brachiaria mutica</u>) and there is no open body of water.

3. <u>Abandoned Cane Fields</u>

This vegetation type covers the smallest area on the project site and is found adjacent to the kiawe forest near Malakole Road. The fields appear to have been recently taken out of cultivation as scattered clumps of sugar cane are still present. Vegetation consists primarily of pluchea (<u>Pluchea symphytifolia</u>) shrubs, 3 to 6 ft. high, with clumps of swollen finger grass inbetween the shrubs. Also common are smaller shrubs of 'ilima (<u>Sida fallax</u>) and scattered plants of tree tobacco (<u>Nicotiana glauca</u>) and castor bean. Woody, perennial components tend to invade from the nearest seed source. Thus young koa-haole shrubs and kiawe tree saplings are found in the areas bordering the nearby kiawe forest.

DISCUSSION AND RECOMMENDATIONS

A large portion of the project site, more than 60%, consists of actively cultivated fields of sugar cane. Uncultivated areas support kiawe forests and abandoned sugar cane fields. The Hawaii Raceway Park is also found on the project site.The majority of the plants inventoried during the field studies are introduced or alien species. Of a total of 95 plants, 84 (88.5%) are introduced; 9 (9.5%) are native; and 2 (2%) are originally of Polynesian introduction. Among the native plants, one is endemic, i. e., native only to the Hawaiian Islands, and eight are indigenous, i. e., native to the islands and elsewhere.

None of the native species are officially listed threatened or endangered species; nor are any candidate or proposed for such status (U. S. Fish and Wildlife Service 1985; Herbst 1987). The one endemic species, the kupala vine (Sicyos pachycarpus), is found throughout the Hawaiian Islands in leeward coastal situations.

There is little of botanical interest or concern on the project site as a large portion of it consists of actively cultivated sugar cane fields; uncultivated areas support a forest of the introduced kiawe or abandoned cane fields now largely overgrown with weedy plants,mainly shrubs and grasses. The proposed industrial and commercial development should not have a significant negative impact on the total island populations of the species involved as they occur in similiar lowland environments throughout the islands.

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PLANT SPECIES CHECKLIST -- Campbell Estate Commercial-Industrial Project, 'Ewa, O'ahu

Following is a checklist of all those terrestrial, vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants (Monocots and Dicots) follow Wagner _et_ _al_. (in press). In most cases, common English and/or Hawaiian names are in accordance with St. John (1973) or Porter (1972).

For each species the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used:
   - E = endemic = native only to the Hawaiian Islands
   - I = indigenous = native to the islands and also to one or more other geographic area(s)
   - P = Polynesian = plants originally of Polynesian introduction prior to Western contact (1778); not native
   - X = introduced or alien = all those plants brought to the islands by humans, intentionally or accidentally, after Western contact; not native.
4. Presence (+) or absence (-) of a particular species within each of three vegetation types recognized on the project site (see text for discussion):
   - c = Cane fields
   - k = Kiawe forest
   - a = Abandoned cane fields

Scientific name	Common name	Status	Vegetation type c	k	a
MONOCOTS					
ARECACEAE (Palm Family)					
Cocos nucifera L.	coconut, niu	P	-	+	-
COMMELINACEAE (Spiderwort Family)					
Commelina benghalensis L.	hairy honohono	X	+	-	-
Commelina diffusa N. L. Burm.	honohono	X	+	-	-
CYPERACEAE (Sedge Family)					
Cyperus rotundus L.	nutgrass	X	+	-	+
POACEAE (Grass Family)					
Brachiaria mutica (Forrsk.) Stapf	California grass	X	+	+	+
Cenchrus ciliaris L.	buffel grass	X	+	+	+
Chloris barbata (L.) Sw.	swollen finger grass, mau'ulei	X	+	+	+
Cynodon dactylon (L.) Pers.	Bermuda grass, manienie	X	+	-	+
Digitaria insularis (L.) Mez. ex Ekman	sourgrass	X	-	-	+
Eleusine indica (L.) Gaertn.	wire grass	X	+	-	-
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	love grass	X	-	-	+
Leptochloa uninervia (K. Presl.) Hitchc. & Chase	leptochloa	X	+	-	-
Panicum maximum Jacq.	Guinea grass	X	+	+	+
Panicum maximum var. trichoglume Eyles ex Robins	green panicgrass	X	+	-	-
Saccharum officinarum l.	sugar cane, ko	P	+	-	+
Setaria verticillata (L.) P. Beauv.	bristly foxtail	X	+	-	+

Scientific name	Common name	Status	Vegetation type c	k	a
DICOTS					
ACANTHACEAE (Acanthus Family)					
Asystasia gangetica (L.) T. Anderson	Chinese violet	X	-	+	+
AMARANTHACEAE (Amaranth Family)					
Achyranthes aspera L.	achyranthes	X	-	+	-
Alternanthera sessilis (L.) DC.	alternanthera	X	+	-	-
Amaranthus spinosus l.	spiny amaranth, pakai kuku	X	+	-	+
Amaranthus viridus L.	slender amaranth, pakai	X	+	-	-
ANACARDIACEAE (Mango Family)					
Mangifera indica L.	mango, manako	X	-	+	-
Schinus terebinthifolius Raddi	Christmas berry, wilelaiki	X	-	-	+
APIACEAE (Carrot Family)					
Ciclospermum leptophyllum (Pers.) Sprague	fir-leaved celery	X	+	-	+
ASTERACEAE (Sunflower Family)					
Ageratum conyzoides L.	maile hohono	X	+	-	+
Calyptocarpus vialis Less.	hierba del cabello	X	-	-	+
Conyza bonariensis (L.) Cronq.	hairy horseweed, ilioha	X	+	-	-
Conyza canadensis (L.) Cronq.	Canada fleabane	X	+	-	+
Crassocephalum crepidioides (Benth.) S. Moore	crassocephalum	X	+	-	-
Eclipta alba (L.) Hassk.	false daisy	X	+	-	-
Emilia fosbergii Nicolson	red pualele	X	+	-	+
Flaveria trinervia (Spreng.) C. Mohr.	flaveria	X	-	+	-
Lactuca serriola L.	wild lettuce	X	-	-	+
Pluchea indica (L.) Less.	Indian pluchea	X	+	+	+
Pluchea symphytifolia (Mill.) Gillis	pluchea	X	+	+	+

Scientific name	Common name	Status	Vegetation type c	k	a
Pluchea X fosbergii Cooperr. & Galang	hybrid pluchea	X	-	-	+
Sonchus oleraceus L.	sow thistle, pualele	X	+	-	-
Verbesina encelioides (Cav.) Benth. & Hook.	golden crownbeard	X	+	-	+
Xanthium strumarium var. canadense (Mill.) Torrey & A. Gray	cocklebur	X	+	-	-
BORAGINACEAE (Heliotrope Family)					
Heliotropium curassavicum L.	kipukai, nena	I	-	-	+
Heliotropium procumbens var. depressum (Cham.) Fosb.		X	-	-	+
CAPPARACEAE (Caper Family)					
Cleome gynandra L.	spider flower, honohina	X	+	-	+
CHENOPODIACEAE (Goosefoot Family)					
Atriplex semibaccata R. Br.	Australian saltbush	X	-	-	+
Atriplex suberecta Verd.	saltbush	X	+	-	+
Chenopodium murale L.	'aheahea	X	+	-	-
CONVOLVULACEAE (Morning-glory Family)					
Ipomoea indica (J. Burm.) Merr.	koali-'awania	I	-	+	-
Ipomoea obscura (L.) Ker-Gawl.	field bindweed	X	+	-	-
Ipomoea triloba L.	little bell	X	+	-	+
Jacquemontia ovalifolia (Choisy) H. Hallier	pa'u-o-Hi'i-aka	I	+	-	-
Merremia aegyptia (L.) Urb.	hairy merremia, koali kua hulu	X?	+	+	+
CUCURBITACEAE (Gourd Family)					
Coccinia grandis (L.) Voight	coccinia	X	+	+	+
Momordica charantia L.	wild bittermelon	X	+	+	+
Sicyos pachycarpus Hook. & Arnott	kupala	E	-	+	-

Scientific name	Common name	Status	Vegetation type c	k	a
EUPHORBIACEAE (Spurge Family)					
Chamaesyce hirta (L.) Millsp.	hairy spurge, garden spurge	X	+	-	+
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X	+	-	+
Chamaesyce prostrata (Aiton) Small	prostrate spurge	X	+	-	+
Euphorbia cyathophora J. A. Murray	false poinsettia	X	+	+	-
Euphorbia graminea Jacq.		X	-	+	-
Euphorbia heterophylla L.	fireplant	X	+	-	-
Ricinus communis L.	castor bean, koli	X	+	-	+
FABACEAE (Pea Family)					
Acacia farnesiana (L.) Willd.	klu	X	-	+	+
Chamaecrista nictitans (L.) Moench	partridge pea, lauki	X	+	-	-
Crotalaria incana L.	fuzzy rattlepod, kukae hoki	X	+	-	+
Desmanthus virgatus (L.) Willd.	virgate mimosa	X	+	-	+
Leucaena leucocephala (Lam.) de Wit.	koa-haole	X	+	+	+
Macroptilium lathyroides (L.) Urb.	cow pea	X	+	-	-
Pithecellobium dulce (Roxb.) Benth.	'opiuma	X	+	+	+
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X	+	+	+
Senna occidentalis (L.) Link	coffee senna, 'auko'i	X	+	-	-
LAMIACEAE (Mint Family)					
Leonotis nepetifolia (L.) R. Br.	lion's ear	X	+	+	+
LAURACEAE (Laurel Family)					
Cassytha filiformis L.	kaunaoa-pehu	I	-	+	-
MALVACEAE (Mallow Family)					
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X	-	+	+
Malva parviflora L.	cheeseweed	X	+	-	-
Malvastrum coromandelianum (L.) Garcke	false mallow, hauuoi	X	+	-	+

Scientific name	Common name	Status	Vegetation type c	k	a
Sida fallax Walp.	'ilima	I	-	+	+
Sida rhombifolia L.	Cuba jute	X	+	-	-
Sida spinosa L.	prickly sida	X	+	-	+
MELIACEAE (Mahogany Family)					
Melia azedarach L.	China berry, neem	X	-	+	-
MORACEAE (Mulberry Family)					
Ficus microcarpa L. f.	Chinese banyan	X	-	+	+
MORINGACEAE (Moringa Family)					
Moringa oleifera Lam.	horseradish tree	X	-	+	-
MYOPORACEAE (Myoporum Family)					
Myoporum sandwicense A. Gray	naio	I	-	+	-
PASSIFLORACEAE (Passion Flower Family)					
Passiflora foetida L.	red-fruited passion flower, pohapoha	X	-	-	+
PLANTAGINACEAE (Plantain Family)					
Plantago major L.	common plantain, lau-kahi	X	+	-	-
POLYGONACEAE (Buckwheat Family)					
Antigonon leptopus Hook. & Arnott	Mexican creeper, chain-of-hearts	X	-	+	-
Coccoloba uvifera (L.) L.	sea grape	X	-	+	-
PORTULACACEAE (Purslane Family)					
Portulaca oleracea L.	common purslane, pigweed	X	+	-	+
SOLANACEAE (Nightshade Family)					
Capsicum annuum L.	chili pepper, nioi	X	-	+	-
Lycopersicon pimpinellifolium (Jusl.) Mill.	wild tomato, currant tomato	X	+	-	+

Scientific name	Common name	Status	Vegetation type c	k	a
Nicotiana glauca R. C. Graham	tree tobacco	X	-	-	+
Physalis angulata L.		X	+	-	-
Solanum americanum Mill.	popolo	I?	+	-	-
Solanum seaforthianum Andr.	blue potato vine	X	-	+	-
STERCULIACEAE (Cocoa Family)					
Waltheria indica L.	'uhaloa, hi'aloa	I?	+	-	+
VERBENACEAE (Verbena Family)					
Lantana camara L.	lantana, lakana	X	-	-	+
Verbena litoralis Kunth	weed verbena, owi	X	-	-	+

APPENDIX C

Campbell Drainage Channel, Ewa District, Island of Oahu

Char And Associates

APPENDIX C

CAMPBELL DRAINAGE CHANNEL

'EWA DISTRICT, ISLAND OF O'AHU

by

Winona P. Char

CHAR & ASSOCIATES
Botanical/Environmental Consultants
Honolulu, Hawaii

Prepared for: WILLIAM E. WANKET, INC.

October 1989

CAMPBELL DRAINAGE CHANNEL
'EWA DISTRICT, ISLAND OF O'AHU

INTRODUCTION

Improvements are planned for an existing drainage that services the area near the State's deep-draft harbor and Campbell Industrial Park. The majority of the drainage at present passes through actively cultivated sugar cane fields; where it nears the coast, it runs adjacent to the Standard Oil Refinery.

A survey to inventory the botanical resources along the proposed drainage channel was conducted on 18 August 1989. The primary objectives of the survey were to (1) inventory the terrestrial vascular flora; (2) describe the vegetation along the drainage channel; and (3) search for any threatened and endangered plants along its entire length.

SURVEY METHODS

Prior to the field survey, a search was made of the botanical literature pertinent to the project site to familiarize the principal investigator with other plant studies conducted in the same general area. Aerial photographs and project site maps were examined to determine vegetation patterns, access points, boundaries, and reference points. Access onto the portion mauka of Malakole Road was by a number of cane haul roads which transit the area; makai of Malakole Road, an overgrown footpath follows along almost the entire length of the existing drainage.

A walk-through survey method was used. Areas most likely to harbor native plants, as along the makai portion, were surveyed more intensively. Notes were made on plant associations and distribution, substrate types, topography, exposure, etc. Species identifications were made in the field and plants which could not be positively identified were collected for later determination in the herbarium and for comparison with the taxonomic literature. The species inventoried are indicative of the season ("rainy" vs. "dry") and environmental conditions under which the survey was taken. A survey taken during the wetter, rainy season (about October through January) would no doubt yield slight variations in the species list especially of the weedy, annual taxa.

DESCRIPTION OF THE VEGETATION

Vegetation in the general area of the drainage channel was described and mapped during the U. S. Fish and Wildlife Service sponsored 'Ewa Plains Botanical Survey (Char and Balakrishnan 1979). Recently, a flora study was made of lands bordering a portion of the drainage for Campbell Estates' proposed ±552-acre industrial and commercial project site (Char 1989). Most of the vegetation consisted of sugar cane fields with smaller areas covered by kiawe forest and fallow fields.

In this survey, the drainage channel passes through two major vegetation types -- cane fields and the kiawe/pickleweed community.

Where the drainage crosses sugar cane fields, it is often overgrown with dense mats of California grass (*Brachiaria mutica*). Along its banks, small clumps of koa-haole (*Leucaena leucocephala*) and castor bean (*Ricinus communis*) as well as a few trees of kiawe (*Prosopis pallida*) and 'opiuma (*Pithecellobium dulce*) are found. Often forming dense patches between the shrubs and trees are buffel grass (*Cenchrus ciliaris*) and Guinea grass (*Panicum maximum*). Weedy species associated with the adjacent cane fields are also found along the drainage. These commonly include fuzzy rattlebox (Crotalaria incana), pigweed (Portulaca oleracea), two species of Amaranthus, and wild bittermelon (Momordica charantia).

Where the drainage nears the coast, makai of Malakole Road, it borders the Standard Oil Refinery and an open kiawe forest with a ground cover dominated by tangled mats of pickleweed (Batis maritima). Pickleweed is a slat water tolerant plant and is found in areas that are subjected to periodic inundation by sea water and in areas where the salinity of the soil is high. Pluchea shrubs, 3 to 6 ft. high, are common along the drainage and all three species are present. In places, 'akulikuli (Sesuvium portulacastrum) and swollen finger grass (Chloris barbata) are abundant. Besides the 'akulikuli, other natives found along this part of the drainage include kipukai (Heliotropium curassavicum), 'ilima (Sida fallax), and a few shrubs of the false sandalwood or naio (Myoporum sandwicense).

DISCUSSION AND RECOMMENDATIONS

The proposed improvements to the existing drainage channel will affect vegetation dominated almost exclusively by introduced species. California grass, koa-haole, Guinea grass, buffel grass, and an assortment of other weedy plants occur where the drainage crosses agricultural lands mauka of Malakole Road. Near the coast, makai of Malakole Road, the drainage crosses an open kiawe forest with large areas covered by pickleweed. Soil salinity in this area is high.

Of a total of 62 plant species inventoried, 55 (89%) are introduced or alien; six (10%) are indigenous, i.e. native to the islands and also elsewhere; and one (1%) is originally of Polynesian introduction (refer to species checklist at end of report). No endemic species, i.e. native only to the islands were found.

No officially listed threatened or endangered plants occur along the drainage site; nor are any plants candidate or proposed for such status on the site (U. S. Fish and Wildlife Service 1985; Herbst 1987). Although *Achyranthes rotundata*, an officially listed endangered species, has been found on the adjacent Camp Malakole property (Char and Balakrishnan 1979; Whistler 1985), it does not occur on or near the drainage site. *Achyranthes* is found on exposed coralline substrate; the wet, highly saline soils around the drainage channel would not provide suitable habitat for the *Achyranthes*.

The proposed improvements should not have a significant impact on the total island populations of the species involved as the majority are introduced species. If landscaping is planned for the drainage area, then native plants such as naio, 'ilima, 'akulikuli, etc., should be considered. Such lowland native species are adapted to the local conditions of the area and would require less maintenance and water over the long term.

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SPECIES CHECKLIST -- Campbell Drainage Channel

Following is a checklist of all those vascular plant species inventoried during the field studies. Plant families are arranged alphabetically within each of two groups: Monocots and Dicots. Taxonomy and nomenclature of the flowering plants (Monocots and Dicots) are in accordance with Wagner et al (in press). In most cases, common English and/or Hawaiian names follow St. John (1973) or Porter (1972).

For each species the following information is provided:

1. Scientific name with author citation.
2. Common English and/or Hawaiian name, when known.
3. Biogeographic status. The following symbols are used:
   - I = indigenous = native to the Hawaiian Islands and also to one or more other geographic area(s)
   - P = Polynesian = plants originally of Polynesian introduction prior to Western contact (1778); not native
   - X = introduced or alien = all those plants brought to the islands intentionally or accidentally after Western contact; not native.

Scientific name	Common name	Status
MONOCOTS		
COMMELINACEAE (Spiderwort Family)		
Commelina benghalensis L.	hairy honohono	X
Commelina diffusa N. L. Burm.	honohono	X
CYPERACEAE (Sedge Family)		
Cyperus rotundus L.	nutgrass	X
POACEAE (Grass Family)		
Brachiaria mutica (Forssk.) Stapf	California grass	X
Cenchrus ciliaris L.	buffel grass	X
Chloris barbata (L.) Sw.	swollen finger grass, mau'ulei	X
Digitaria insularis (L.) Mez. ex Ekman	sourgrass	X
Eleusine indica (L.) Gaertn.	wiregrass	X
Eragrostis tenella (L.) Beauv. ex Roem. & Schult.	lovegrass	X
Leptochloa uninervia (K. Presl.) Hitchc. & Chase	leptochloa	X
Panicum maximum Jacq.	Guinea grass	X
Panicum maximum var. trichoglume Eyles ex Robyns	green panic grass	X
Saccharum officinarum L.	sugar cane, ko	P
Setaria verticillata (L.) Beauv.	bristly foxtail	X
DICOTS		
AIZOACEAE (Fir-marigold Family)		
Sesuvium portulacastrum (L.) L.	'akulikuli	I
AMARANTHACEAE (Amaranth Family)		
Achyranthes aspera L.	achyranthes	X
Amaranthus spinosus L.	spiny amaranth, pakai kuku	X
Amaranthus viridus L.	amaranth, pakai	X
ASTERACEAE (Sunflower Family)		
Ageratum conyzoides L.	maile hohono	X
Conyza bonariensis (L.) Cronq.	hairy horseweed, ilioha	X
Crassocephalum crepidioides (Benth.) S. Moore	crassocephalum	X
Eclipta alba (L.) Hassk.	false daisy	X
Pluchea indica (L.) Less.	Indian pluchea	X
Pluchea symphytifolia (Mill.) Gillis	pluchea	X

Scientific name	Common name	Status
Pluchea X fosbergii Cooperr. & Galang	hybrid pluchea	X
Sonchus oleraceus L.	sow thistle, pualele	X
Verbesina encelioides (Cav.) Benth. & Hook.	golden crownbeard	X
Xanthium strumarium var. canadense (Mill.) Torr. & A. Gray	cocklebur	X
BATIDACEAE (Saltwort Family)		
Batis maritima L.	pickleweed	X
BORAGINACEAE (Heliotrope Family)		
Heliotropium curassavicum L.	kipukai, nena	I
CHENOPODIACEAE (Goosefoot Family)		
Atriplex semibaccata R. Br.	Australian saltbush	X
Atriplex suberecta Verd.	saltbush	X
Chenopodium murale L.	'aheahea	X
CONVOLVULACEAE (Morning-glory Family)		
Ipomoea obscura (L.) Ker-Gawl.	field bindweed	X
Ipomoea triloba L.	little bell	X
Jacquemontia ovalifolia (Choisy) H. Hallier	pa'u-o-Hi'iaka	I
Merremia aegyptia (L.) Urb.	hairy merremia, koali kua hulu	X?
CUCURBITACEAE (Gourd Family)		
Coccinia grandis (L.) Voight	coccinia	X
Momordica charantia L.	wild bittermelon	X
EUPHORBIACEAE (Spurge Family)		
Chamaesyce hirta (L.) Millsp.	hairy spurge	X
Chamaesyce hypericifolia (L.) Millsp.	graceful spurge	X
Chamaesyce prostrata (Aiton) Small	prostrate spurge	X
Ricinus communis L.	castor bean, koli	X
FABACEAE (Pea Family)		
Acacia farnesiana (L.) Willd.	klu	X
Chamaecrista nictitans (L.) Moench	partridge pea, lauki	X
Crotalaria incana L.	fuzzy rattlebox, kukae hoki	X
Desmanthus virgatus (L.) Willd.	virgate mimosa	X
Leucaena leucocephala (Lam.) de Wit.	koa-haole	X
Macroptilium lathyroides (L.) Urb.	cow pea	X
Pithecellobium dulce (Roxb.) Benth.	'opiuma	X
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X

Scientific name	Common name	Status
LAMIACEAE (Mint Family)		
Leonotis nepetifolia (L.) R. Br.	lion's ear	X
MALVACEAE (Mallow Family)		
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	X
Sida fallax Walp.	'ilima	I
Sida spinosa L.	prickly sida	X
MYOPORACEAE (Myoporum Family)		
Myoporum sandwicense A. Gray	false sandalwood, naio	I
PLANTAGINACEAE (Plantain Family)		
Plantago major L.	common plantain, lau-kahi	X
PORTULACACEAE (Purslane Family)		
Portulaca oleracea L.	common purslane, pigweed	X
SOLANACEAE (Nightshade Family)		
Lycopersicon pimpinellifolium (Jusl.) Mill.	wild tomato, currant tomato	X
Nicotiana glauca R. C. Graham	tree tobacco	X
Physalis angulata L.	physalis	X
STERCULIACEAE (Cocoa Family)		
Waltheria indica L.	'uhaloa, hi'aloa	I?

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EDUCATION

Master of Science (M.S.) degree in the Botanical Sciences, University of Hawaii, Manoa. December 1983. Area of specialization: Plant taxonomy with special emphasis on the native Hawaiian flora. M.S. thesis topic: "A revision of the Hawaiian species of Sesbania (Leguminosae)."

Bachelor of Arts (B.A.) in the Botanical Sciences, University of Hawaii, Manoa. May 1970.

Graduate of Kaimuki High School. June 1965.

EXPERIENCE

Botanical Consultant - 1976 to present; self-employed. Field investigation, data analysis, and preparation of findings for the biological section in Environmental Impact Statements (EIS). The scope of work involves: (1) a discussion of rare, threatened or endangered plant species found on the study site; (2) a general description of the major vegetation types found on the study site; (3) an inventory of the flora on the study site; (4) the identification of areas of potential environmental problems or concerns; and (5) a summary of the extant botanical knowledge of the study site.

Natural Area Biologist, SR-21 - July 1985 to June 1986. One year funding. Natural Area Reserves System (NARS), State Department of Land and Natural Resources. Major duties: Plan, develop, and direct native and non-native plant and animal surveys within the reserves system. Evaluate existing and potential impact of non-native species within each reserve. Develop site-specific management programs as well as direct on-site management activity. Supervise a lower-level NARS biologist and, when available, part-time and volunteer workers.

Horticulturist, SR-18 - May 1978 to September 1979. Honolulu Botanic Gardens, City and County Department of Parks and Recreation. Major duties: Program director, Exceptional Trees Program. Working with the City Administration and the City Council in establishing a permanent staff organization and Arborist Advisory Committee necessary to fulfill the Exceptional Trees' Law; documentation and identification of the Exceptional Trees designated by the City and County Ordinance; identification of additional trees to the list. End of contract; left to complete M.S. degree program.

INTERESTS

Hiking, fishing native plants, bonsai, photography, trivia collector.

Member of the following organizations:

- Hawaiian Botanical Society. Life membership. Served as Chairman, Science Fair Committee, 1981, 1983. Secretary 1978, 1979. Director 1977. Native Coastal Plants Committee 1986.

- The Nature Conservancy. Sponsor 1986.

Community service:

- The Nature Conservancy. Resource person. Scientific Advisory Committee.

- State Department of Education (DOE). Resource person and lecturer, native plants and island ecosystems.

- Marine Advisory Program, Sea Grant, University of Hawaii. Resource person, strand vegetation.

PERSONAL BACKGROUND

One-quarter Hawaiian, that's why the active interest in native plants and island ecosystems. Single, 5 ft. 5 in. tall, roughly 128 lbs. Born 16 May 1947(a baby boomer).
References will be furnished on request.

PUBLICATIONS

Char, W. P. 1976. Field studies of the Sesbania complex on the island of Hawaii. Pacific Tropical Botanical Garden Bulletin 6(2): 41.

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Hiking, fishing native plants, bonsai, photography, trivia collector.

Member of the following organizations:

- Hawaiian Botanical Society. Life membership. Served as Chairman, Science Fair Committee, 1981, 1983. Secretary 1978, 1979. Director 1977. Native Coastal Plants Committee 1986.

- The Nature Conservancy. Sponsor 1986.

Community service:

- The Nature Conservancy. Resource person. Scientific Advisory Committee.

- State Department of Education (DOE). Resource person and lecturer, native plants and island ecosystems.

- Marine Advisory Program, Sea Grant, University of Hawaii. Resource person, strand vegetation.

PERSONAL BACKGROUND

One-quarter Hawaiian, that's why the active interest in native plants and island ecosystems. Single, 5 ft. 5 in. tall, roughly 128 lbs. Born 16 May 1947(a baby boomer).
References will be furnished on request.

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APPENDIX D

Survey of the Avifauna and Feral Mammals at the Proposed Campbell Commercial-Industrial Site, Ewa, Oahu

Phillip L. Bruner

APPENDIX D

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT THE PROPOSED
CAMPBELL COMMERCIAL-INDUSTRIAL SITE, EWA, OAHU

Prepared for

William E. Wanket Inc.

by

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28 August 1989

SURVEY OF THE AVIFAUNA AND FERAL MAMMALS AT THE PROPOSED CAMPBELL COMMERCIAL-INDUSTRIAL SITE, EWA, OAHU

INTRODUCTION

The purpose of this report is to summarize the findings of a three day (27 July, 5, 18 August 1989) bird and mammal field survey at the proposed Campbell Commercial-Industrial Site, Ewa, Oahu (see Fig. 1). Also included are references to pertinent literature as well as unpublished reports.

The objectives of the field survey were to:

1- Document what bird and mammal species occur on the property or may likely occur given the range of habitats available.

2- Provide some baseline data on the relative abundance of each species.

3- Supplement these findings with published and/or unpublished data.

4- Evaluate the possible changes that might occur in the bird and mammal populations following the proposed development on the property.

GENERAL SITE DESCRIPTION

The proposed project property is located on the west shore of Oahu at Campbell Industrial Park (see Fig. 1). The site presently contains sugar cane fields, scrubby second growth patches of vegetation and some urban facilities ie. auto racing park, nursery and land fill dumping. The overall habitat could best be described as dry parkland and cultivated fields. Aside from sugar cane the dominant plants in the area are: Kiawe (Prosopis pallida) and Koa Haole (Leucaena leucocephala).

Weather during the field survey was generally clear mornings with occasional cloudy periods in the afternoons. Winds were NE trades.

STUDY METHODS

Field observations were made with the aid of binoculars and by listening for vocalizations. These observations were concentrated during the peak activity periods of early morning and late afternoon. Attention was also paid to the presence of tracks and scats as indicators of bird and mammal activity.

At various locations (see Fig.1) eight minute counts were made of all birds seen or heard. Between these count stations walking tallys of birds seen or heard were also kept. These counts provide the basis for the population estimates given in this report. A special effort was made to census the specific area of the property designated as a "drainage ditch" (Fig.1). Data from this sector are reported separately in Table 1 of results.

Observations of feral mammals were limited to visual sightings and evidence in the form of scats and tracks. No attempts were made to trap mammals in order to obtain data on their relative abundance and distribution.

Scientific names used herein follow those given in the most recent American Ornithologist's Union Checklist (A.O.U. 1983), Hawaii's Birds (Hawaii Audubon Society 1984), Field Guide to the Birds Hawaii and the Tropical Pacific (Pratt et al. 1987), Mammal species of the World (Honacki et al. 1982) and Hawaiian Coastal Plants (Merlin 1980).

RESULTS AND DISCUSSION

Resident Endemic (Native) Land Birds:

No endemic land birds were recorded during the course of the field survey. The only likely endemic species which might occasionally forage in the area are the Hawaiian Owl or Pueo (*Asio flammeus sandwichensis*) and the Hawaiian Stilt (*Himantopus mexicanus knudseni*). Pueo are diurnal and can be found in upland forest as well as lowland grasslands and agricultural fields. Stilt are opportunistic and will forage in flooded fields where they search for invertebrate prey. This site apparently was inhabited by a variety of endemic birds in the past given the fossil evidence recovered from the "sink-holes" located on the makai protions of the property (pers. comm. A. Ziegler-zoologist formerly with the Bishop Museum, Honolulu.

Resident Indigenous (Native) Birds:

No resident indigenous land birds were recorded. The only potential species is the Black-crowned Night Heron (*Nycticorax nycticorax*). This species is opportunistic and may forage in flooded ditches and other temporary wet areas when such are available on the property.

Resident Indigenous (Native) Seabirds:

Seabirds typically nest on offshore islands which are free from disturbance by dogs, cats, mongooses and rats. However, there are areas on the main islands were predators lack access and nesting can be successful (Bruner 1988). Fossil evidence indicates seabirds have occurred on the property in the past (pers. comm. A. Ziegler). No seabirds were found during the survey and it is unlikely any would nest at this site due to an abundance of predators. Seabirds such as the Great Frigatebird (*Fregata minor*) may be seen overhead.

Migratory Indigenous (Native) Birds:

Only one species of migratory shorebird was found during the survey - Pacific Golden Plover (Pluvialis fulva). Plover are probably the most common migratory species in Hawaii. They prefer open areas such as mud flats,fields and lawns. Plover arrive in Hawaii in early August and depart to their arctic breeding grounds during the last week of April. Johnson et al. (1981) and Bruner (1983) have shown plover are extremely site-faithful on their wintering grounds and many establish foraging territories which they vigorously defend. Such behavior makes it possible to acquire a fairly good estimate of the abundance of plover in any one area. These populations likewise remain relatively stable over many years. A total of ten plover were recorded,all on the final day of the survey. Time did not permit a determination of how many of these plover were territorial residents and how many were passing through the area on their migration further south. The only other likely migratory species that may occur on the property is the Ruddy Turnstone (Arenaria interpres).

Exotic (Introduced) Birds:

A total of 17 species of exotic birds were found during this field survey. Table 1 shows the species recorded on this survey and their relative abundance. The most abundant species were Zebra Dove (Geopelia striata), Red-vented Bulbul (Pycnonotus cafer), Japanese White-eye (Zosterops japonicus), Chestnut Mannikin (Lonchura malacca) and Nutmeg Mannikin (Lonchura punctulata). Exotic species not recorded on the actual survey but which potentially could occur at this locality include: Japanese Bush-warbler (Cettia diphone) and Ring-necked Pheasant (Phasianus colchicus). The habitat is probably too dry for White-rumped Shama (Copsychus malabaricus) and too open for Melodious Laughing-thrush (Garrulax canorus). The abundance and wide variety of finch and finch-like birds at this site is due to the dry brushy/grassy habitat which these species prefer.

Red-vented Bulbul have become one of Oahu's most abundant species in recent years. The adaptability of this species to a wide variety of habitats and its remarkable population increase have been well documentd (Williams 1983, Williams and Giddings 1984, and Williams and Evenson 1985).

Java Sparrow (Padda oryzivora) have also experienced a population increase and expansion in recent years (Pratt et al. 1987). Their occurrence at this site was not unexpected.

Feral Mammals:

The only feral mammals observed during the survey were cats and the Small Indian Mongoose (Herpestes auropunctatus). Without a trapping program it is difficult to conclude much about the relative abundance of rats, mice, cats and mongooses at this site, However, it is likely that their numbers are typical of what one would find elsewhere in similar habitat on Oahu.

Records of the endemic and endangered Hawaiian Hoary Bat (Lasiurus cinerus semotus) are sketchy but the species has been reported from Oahu (Tomich 1986). None were observed on this field survey. However, bats have been observed in urbanized habitat elsewhere in Hawaii (Bruner 1985).

CONCLUSION

A brief field survey can at best provide a limited perspective of the wildlife present in any given area. Not all species will necessarily be observed and information on their use of the site must be sketched together from brief observations and the available literature. The number of species and the relative abundance of each species may vary throughout the year due to available resources and reproductive success. Species which are migratory will quite obviously be a part of the ecological picture only at certain times during the year. Exotic species sometimes prosper for a time only to later disappear or become a less significant part of the ecosystem (Williams 1987). Thus only long term studies can provide the insights necessary to acquire a complete understanding of the bird and mammal populations in a particular area. However, when brief studies are coupled with data gathered from other similar studies the value of the conclusions drawn are significantly increased.

The following are some broad conclusions related to bird and mammal activity on this property:

1- The present environment provides a limited range of habitats which are utilized by the typical array of exotic birds one would expect at this elevation and in this type of environment on Oahu.

2- Doves and finches could decline in abundance as a result of habitat changes brought about by the proposed development. House Sparrows (Passer domesticus) and Common Myna (Acridotheres tristis) should increase in abundance following urbanization.

3- In order to obtain more data on mammals, a trapping program would be required. The brief observations of this survey did not reveal any unusual mammal activity.

4- The section of the site designated for a drainage canal was specifically censused throughout its entire length and did not contain any unusual or distinctive habitat nor did the fauna found in this area differ significantly from that recorded elsewhere on the property.

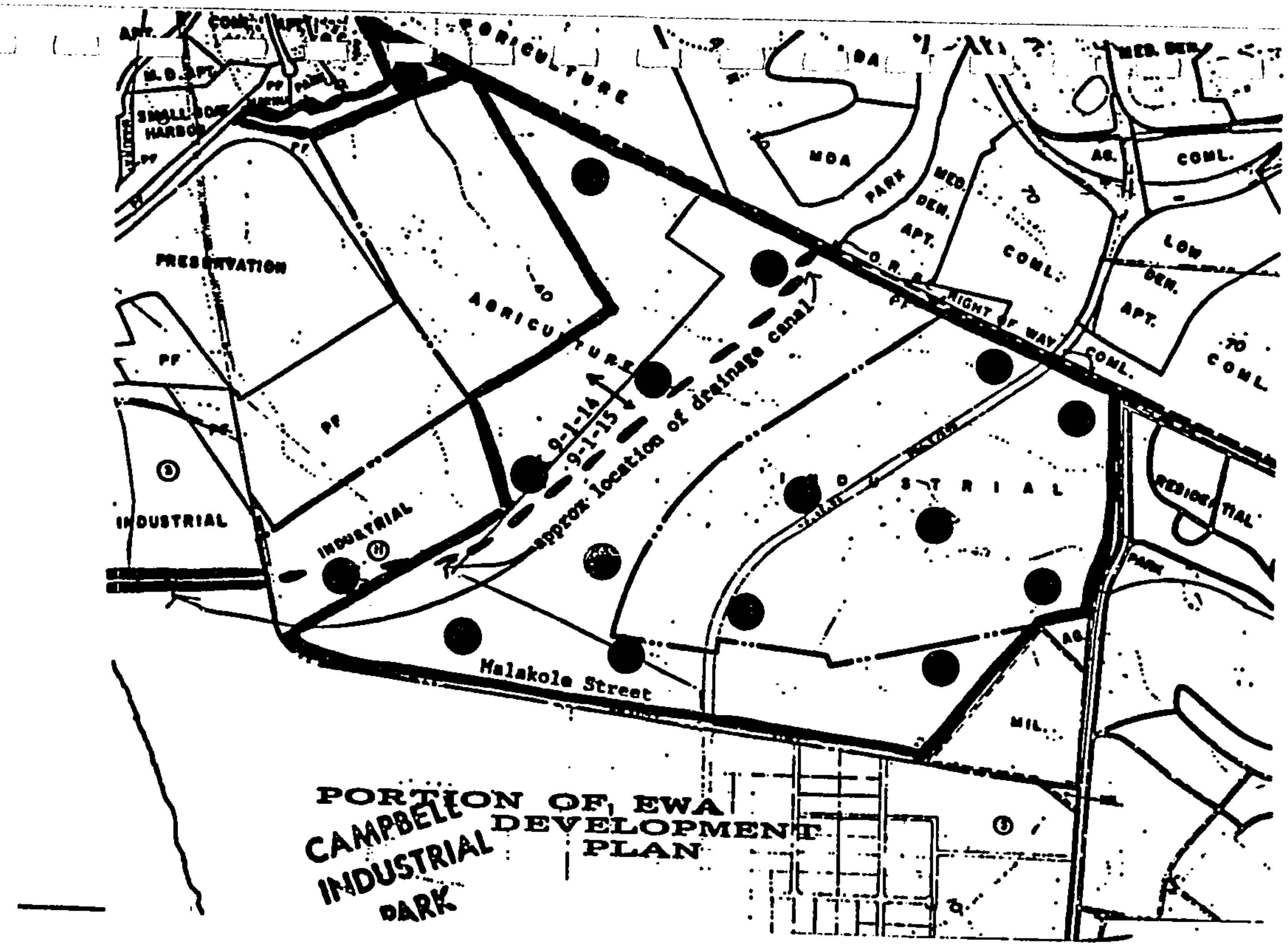

Fig. 1 Project site with eight minute census stations indicated by solid circles.

TABLE 1

Relative abundance of exotic birds at the Campbell Commercial-Industrial Site, Ewa, Oahu.

COMMON NAME	SCIENTIFIC NAME	RELATIVE ABUNDANCE*	
		Sector 1	2
Barn Owl	<u>Tyto alba</u>	R= 1	-
Cattle Egret	<u>Bubulcus ibis</u>	R= 1	-
Spotted Dove	<u>Streptopelia chinensis</u>	U= 4	U= 4
Zebra Dove	<u>Geopelia striata</u>	A= 16	A=12
Common Myna	<u>Acridotheres tristis</u>	U= 2	U= 3
Red-vented Bulbul	<u>Pycnonotus cafer</u>	A= 15	A=11
Northern Mockingbird	<u>Mimus polyglottos</u>	-	R= 1
Northern Cardinal	<u>Cardinalis cardinalis</u>	U= 2	U= 2
Red-crested Cardinal	<u>Paroaria coronata</u>	U= 3	U= 2
Japanese White-eye	<u>Zosterops japonicus</u>	A= 10	A=12
House Sparrow	<u>Passer domesticus</u>	U= 2	C= 6
House Finch	<u>Carpodacus mexicanus</u>	C= 7	C= 8
Java Sparrow	<u>Padda oryzivora</u>	R= 6	-
Red Avadavat	<u>Amandava amandava</u>	U= 4	U= 2
Common Waxbill	<u>Estrilda astrild</u>	C= 5	U= 4
Chestnut Mannikin	<u>Lonchura malacca</u>	A= 10	C= 6
Nutmeg Mannikin	<u>Lonchura punctulata</u>	A= 15	A=11

* (see page 12 for key to symbols)

KEY TO TABLE 1

Relative abundance = number of individuals observed during walking survey or frequency on eight minute counts in appropriate habitat.

A= abundant (10+) on 8 min. counts

C= common (5-10) on 8 min. counts

U= uncommon (less than 5) on 8 min. counts

R= recorded but not on 8 min. counts (number which follows is the total recorded over the course of the entire survey)

Sector= region of property

1= overall site minus the census data from the drainage ditch sector.

2= census data from proposed drainage ditch area only.

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Biographical Data

Born: Salt Lake City, Utah 4-8-44
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Educational Preparation

B.S. Biology Church College of Hawaii 1970
M.S. Zoology Louisana State University 1974
Graduate work University of Hawaii 1976-1986

Work Experience

Academic Advisor and part time instructor BYU-H 1974-1978
Assistant Professor of Biology and Director, Museum of Natural History at BYU-H 1978-present
Environmental Consultant

Research

1970-1971 Ornithological survey of French Polynesia
1976, 1978 " " " Micronesia
1977 " " " Samoa, Fiji, Tonga
1979-present Behavorial ecology study of the wintering behavior of Pacific Golden Plover at BAFS, Oahu
1984 Ornithological survey of Austral Islands, French Polynesia
1985, 1987 " " " Southern Marquesas Islands, French Polynesia
1986-present Morphometric study of Black-crowned Night Heron in Hawaii.

Literature

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A field guide to the birds of Hawaii and the tropical Pacific. Princetton University Press. 1987. 500pp.

Other associated professional experience:

President, Hawaii Audubon Society 1986,1987
Animal Species Advisory Commission - State of Hawaii 1988-1992

Previous Ornithological Survey/Work Experience

Contractor: Ahuimanu Productions
Project:
1- Ornithological survey of Hawaiian Wetlands. 1977.
2- Avifaunal survey of the central Koolau range, Oahu. 1978.

Contractor: The Hawaii State Dept. of Planning and Economic Develop.
Project:
1- Avifaunal survey of Kawainui Marsh, Oahu. 1981.

Contractor: AECOS
Project:
1- Master plan for Kahului Airport - Kanaha Pond and adjacent lands, Maui. 1981.

Contractor: R. M. Towill Corporation
Project:
1- An avifaunal and feral mammal survey of Kokohead and Puu Papaa, Oahu, for a GTE Mobilnet Project. 1984.

Contractor: VTN Pacific, Inc.
Project:
1- An Avifaunal and feral mammal survey of property designated for a Loran-C Station, Barrigada, Guam. 1984.

Contractor: Belt,Collins and Associates
Project:
1- An avifaunal and feral mammal survey of Punahoolapa, Oahu. 1978.
2- An avifaunal and feral mammal survey of Princeville Phase II, Kauai. 1979.
3- An avifaunal and feral mammal survey of Mahukona Properties, Hawaii. 1979.
4- An avifaunal and feral mammal survey of Ninini Point, Kauai. 1980.
5- An avifaunal and feral mammal survey of the Waipio Peninsula and the area adjacent to the Incinerator, Oahu. 1980.
6- An avifaunal and feral mammal survey of property for the Kahuku Seafood Farms, Oahu. 1980.
7- An avifaunal and feral mammal survey of Olohana Properties and Mauna Loa Lands, Hawaii. 1980.
8- An avifaunal and feral mammal survey of Kohala Makai I, Hawaii. 1981.
9- An avifaunal and feral mammal survey of the Wailua-Haleiwa Wastewater Facilities, Oahu. 1982.
10- An avifaunal and feral mammal survey for the proposed Ford Island Causeway, Oahu. 1984.
11- An avifaunal and feral mammal survey of Mauna Lani, Hawaii. 1984.
12- An avifaunal and feral mammal survey of Mauna Kea Properties, Hawaii. 1984.

Previous Ornithological Survey/Work Experience (cont.)

Contractor: Belt, Collins and Associates (cont.)
Project:
13- An avifaunal and feral mammal survey of Waikoloa Beach Resort Property, Hawaii. 1984.
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15- An avifaunal and feral mammal survey of the Foster Petroleum Corp. proposed light industrial park property, Kilauea, Kauai. 1985.
16- An avifaunal and feral mammal survey of property proposed for development at Parker Ranch, Hawaii. 1985.
17- An avifaunal and feral mammal survey of Kapalua Development Subdivision, Honokahua, Lahaina, Maui. 1986.
18- An avifaunal and feral mammal survey of Mokule'ia property designated for possible development of the Waialua-Haleiwa Wastewater Facility. 1986.

Phillips Brandt Reddick and Associates

1- An avifaunal and feral mammal survey of property proposed for development at Makalawena, North Kona, Hawaii. 1986.

Black and Veatch

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1- Densities and population sizes of urban birds in Waikiki Beach. 1986.

1987-1988 Projects

1- Avifaunal and feral mammal survey of Hawaiian Riviera Resort property at Ka'u, Hawaii. Belt Collins and Assocaites. 1987.

2- Avifaunal and feral mammal survey of property located at Kunia, Central Oahu. William E. Wanket Inc. 1987.

3- Avifaunal and feral mammal survey of Maili Kai property, Maili, Waianae district, Oahu. Phillips Brandt Reddick. 1988.

4- Survey of the avifauna and feral mammals at Grove Farm Properties, Poipu, Kauai. Belt Collins and Associates. 1988.

5- Survey of the avifauna and feral mammals at Makena 700 Property, Makena, Maui. Phillips Brandt Reddick. 1988.

6- Survey of the avifauna and feral mammals at Palauea Lands, Makena, Maui. Phillips Brandt Reddick. 1988.

1987-1988 Projects (cont.)

7- Survey of the avifauna and feral mammals on the Shigekane and Midkiff/Morris property, Nuuanu, Oahu, Hawaii. Belt Collins and Associates. 1988.

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9- Survey of the avifauna and feral mammals at Koko Head and Koko Crater, Oahu, Hawaii. Belt Collins and Associates. 1988.

10- Survey of the avifauna and feral mammals at Keauhou resort project property, Kona Hawaii. 1988

11- Mariana Common Moorhen (Gallinula chloropus guami) and the problems posed by transmission lines. 1988

12- Survey of the avifauna and feral mammals at the proposed Waihee golf course site, Waihee, Maui. 1988

13- Survey of the avifauna and feral mammals at Waikoloa village property, Waikoloa, Hawaii. 1988

14- Field survey of the avifauna and feral mammals at Grove Farm properties, Lihue/Puhi, Kauai. 1988

15- Avifaunal and feral mammal survey of Royal Kunia-phase II property located at Kunia, Central Oahu. 1988

16- Survey of the avifauna and feral mammals at Kaupulehu property, Hawaii. 1988

17- Survey of the avifauna and feral mammals at South Beach mauka, Kaanapali, Maui. 1988

18- A review of the 1984 report entitled: an avifaunal and feral mammal survey of lands involved in the Ford Island causeway project, Oahu.

1989 Projects

1- Survey of the avifauna and feral mammals at the proposed West Hawaii sanitary landfill project, North Kona, Hawaii. 1989.

1989 Projects (cont.)

2- Survey of the avifauna and feral mammals of two parcels of land adjacent to old Kalanianaole Highway, Windward, Oahu. 1989. Prepared for Gordon A. Chapman, Consulting Services.

3- Survey of the avifauna and feral mammals at Oceanic Institute property, Oahu, Hawaii. 1989. Prepared for Applied Analysis Inc.

4- Avifaunal survey of wet areas located on the site of a proposed Golf Course at Waihee, Maui. 1989. Prepared for Belt Collins and Associates.

5- Field survey of the avifauna and feral mammals at Kalaupapa, Molokai; Phase I and II report. 1989. Prepared for Edward K. Noda and Associates

6- Avifaunal and feral mammal survey of Campbell estate property, Kahuku, Oahu. 1989. Prepared for William E. Wanket Inc.

7- Survey of the avifauna and feral mammals at Mauna Lani Marina south Kohala,Hawaii. 1989. Prepared for Belt Collins and Associates

8- Survey of the avifauna and feral mammals at Queen Liliuokalani Trust property, Kailua, Kona, Hawaii. 1989. Prepared for Belt Collins and Associates.

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APPENDIX E

An Archaeological Assessment for the Proposed Kapolei Business-Industrial Park, Honouliuli, 'Ewa, O'ahu

Cultural Surveys Hawaii

An Archaeological Assessment for the Proposed Kapolei Business/Industrial Park Honouliuli, 'Ewa, O'ahu

By
Hallett H. Hammatt, Ph.D.
David W. Shideler, M.A.

Prepared for
William E. Wanket
Land Use Consultant

by
Cultural Surveys Hawaii
November, 1989

Abstract

Cultural Surveys Hawaii was asked to undertake an archaeological assessment for the approximately 552-acre proposed Kapolei Business/Industrial Park (TMK 9-1-14: Portion of 2 and TMK 9-1-15: 1, 12, 13, 15, and 16) by Mr. William E. Wanket, Land Use Consultant.

Preceding the development of the Barbers Point Harbor, extensive archaeological and paleontological salvage projects were undertaken under the auspices of the State Department of Transportation, U.S. Army Corps of Engineers, and the Campbell Estate. Despite these many studies and the massive impacts of harbor construction, coral rubble stockpiling, sugar cane cultivation, and other activities within the proposed Kapolei Business/Industrial Park, there are still a number of specific areas of archaeological and paleontological concern. These include most notably Archaeological Survey Area D, which has not had an adequate archaeological survey or subsurface testing, the unstudied homestead area along the north boundary of the project area which has potential for particularly significant fossil avifauna finds within its sinkholes; and the many fossil avifauna laden sinkholes located just NW of the intersection of Malakole and Powerline Roads. An assessment of the archaeological and paleontological remains extant is provided and a discussion of appropriate mitigation measures is presented.

The proposed drainage extension as presently planned would traverse an area that has been extensively studied and massively impacted and is not anticipated to impact any significant cultural or archaeological remains.

Acknowledgments

The authors would like to thank Dr. Alan Ziegler for sharing his expertise on the Barbers Point Sinkholes and loaning us his extensive library on Barbers Point archaeology and paleontology. A number of individuals familiar with the history and complexities of Barbers point archaeology and paleontology were consulted in the background work for this study. These people include Dr. Alan Ziegler, paleozoological consultant, Mr. Aki Sinoto of the Bishop Museum, Dr. Joyce Bath of the Historic Preservation Office, Mr. Chuck Streck of the U.S. Corps of Engineers and Mr. Bertell Davis of the University of Hawaii, Department of Anthropology.

In addition, a discussion of environmental and land development concerns related to the study area was held with Mr. Oswald Stender and Ms. Susan Sublett of the Campbell Estate and Mr. William Wanket. We greatly appreciate the information and views provided by these people and hope that we have been able to present an accurate representation.We would like to thank Mr. William Wanket for his support and coordination. Word processing was performed by Dr. Vicki Creed of Windword Processing.

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Introduction

Cultural Surveys Hawaii was asked to undertake an archaeological assessment for the proposed Kapolei Business/Industrial Park (Figs 1-4) and for the proposed drainage right-of-way within the Park (Fig. 5) by Mr. William E. Wanket, Land Use Consultant. The scope of this study contains 6 points as follows:

1. Determination of present land conditions, location, and identification of any archaeological/paleontological sites presently extant in the project area and assessment of their condition;

2. Review of past archaeological/paleontological studies within the project area, particularly to address sigficance and potential of remaining features;

3. Assessment of potential impacts of land reclassification and future development on the surviving archaeological sites;

4. Location of sensitive areas which may contain buried cultural/paleontological materials, particularly related to the proposed drainage channel;

5. Assessment of the scientific value of the remaining sink hole area (Malakole area). Of particular importance will be the definitions of exact boundaries of the area;

6. Presentation of recommendations for addressing archaeological concerns in future development within the project area, including preservation areas, possible archaeological monitoring of some construction activities or other appropriate actions.

Work accomplished included a reconnaissance of the proposed Kapolei Business/Industrial Park, extensive literature survey, and consultation with archaeologists and a paleontologist familiar with the area.

Regrettably, a brief discussion of site nomenclature must be undertaken. The Bishop Museum has one site numbering system and the State of Hawaii has a different one. The first five major archaeological surveys (Lewis, 1970; Barrera, 1975;

Sinoto, 1971, 1978, and 1979) all utilized the Bishop Museum system as had the previous sporadic investigations (Emory, Kikuchi, Green, Sinoto). As a result, many of those familiar with the Barbers Point Sites refer to them by the Bishop Museum site numbering system in which every site in Honouliuli *ahupua'a* begins with "50-Oa-B6-". The big sink in Area D, presently surrounded by a chainlink fence, is numbered 50-Oa-B6-22. This typically gets abbreviated as B6-22. The State of Hawaii has a site numbering system that utilizes quad maps and every site at Barbers Point begins with 50-80-12- and thus Sink B6-22 is also known as 50-80-12-9545, which typically gets abbreviated as "Site 9545."

In theory, a corresponding state number exists for each museum number but this is sometimes not the case. To complicate matters it is a common practice for archaeologists to use "temporary numbers" in the field (ex. Barrera's T1, T2, etc.). Sometimes these temporary numbers are deaccessioned or lumped. In the case of Bertell Davis' research several documents were produced utilizing his temporary site numbering scheme of Davis and Griffin, 1978.

Another problem arises in the numbering of paleontological sites. The museum began by numbering certain non cultural bird bone containing sinkholes within their general site system and thus Bishop Museum Site B6-203 is State Site 1700 which is simple enough but it applies to only a few tested sinkholes. In the case of the ongoing research on sinkholes in the proposed sinkhole park and reserve area, in which commonly there is no clue to any previous site nomenclature, new systems have evolved. Ziegler and Earl Neller have utilized a numbering system such as SPA III HL-2 which means something like Spoils Area 3, *Hui Lama* (a Kamehameha Schools Club), Site 2. Trying to sort out the Byzantine site numbering systems of Barbers Point is an augean task but in actuality it is usually fairly clear what any extant site is known as.

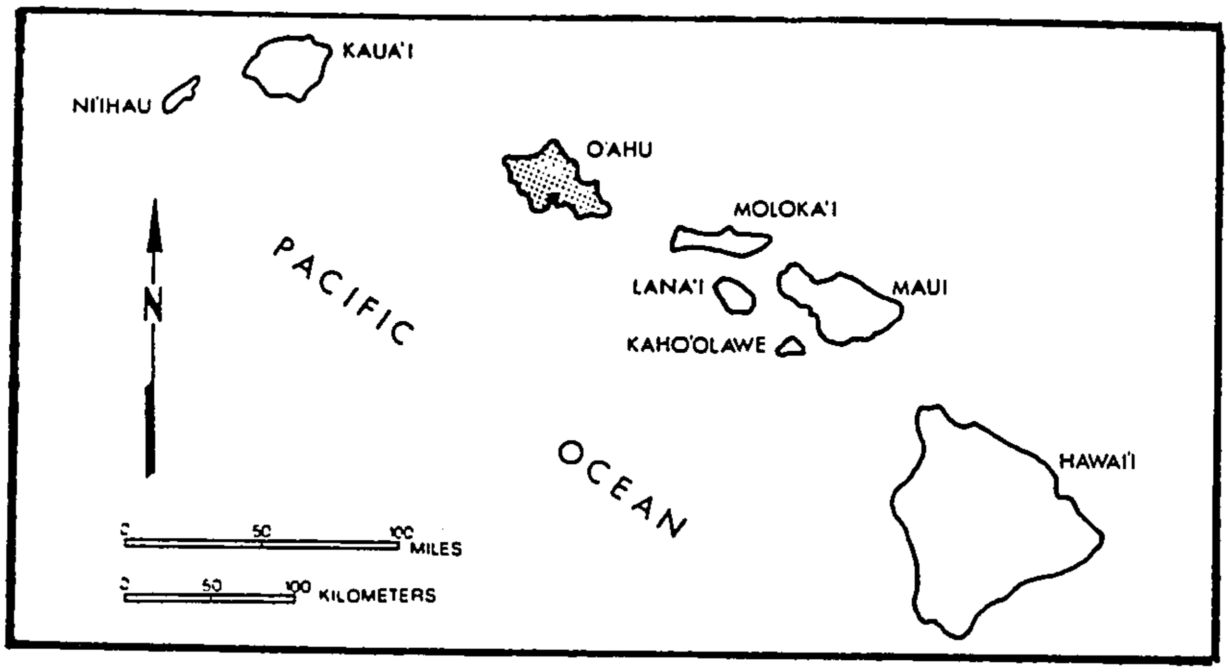


Figure 1 State of Hawaii

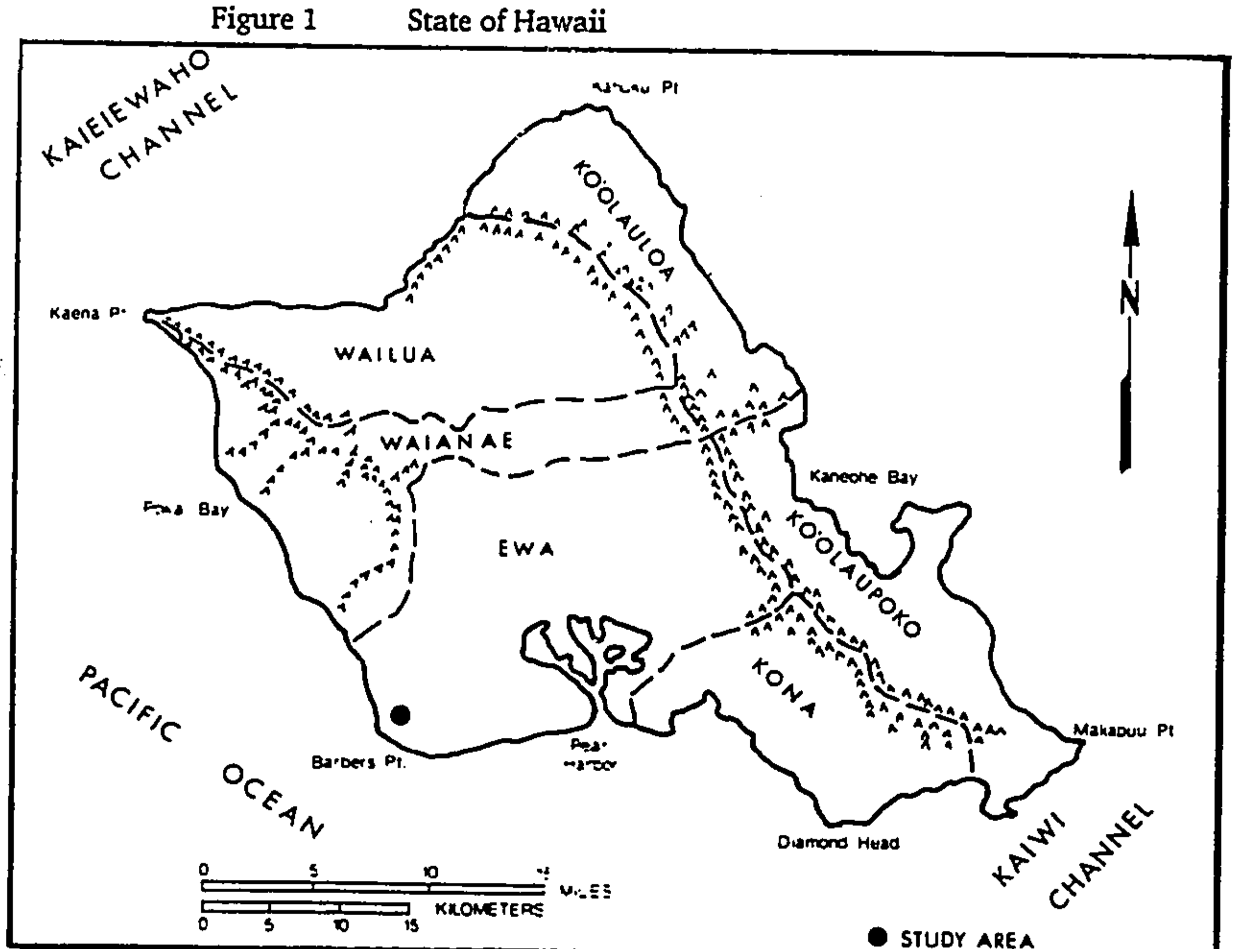


Figure 2 General Location Map, O'ahu Island

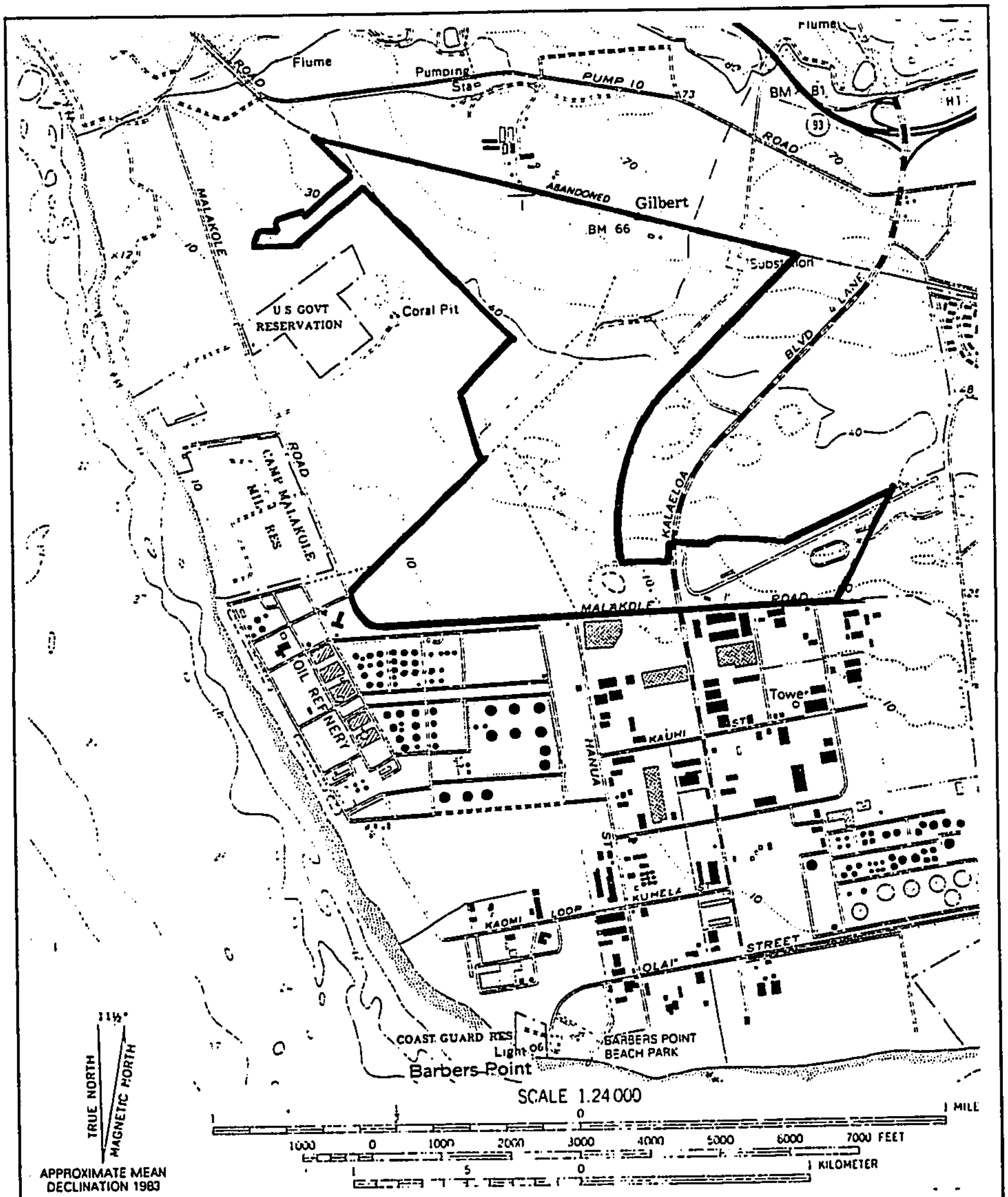
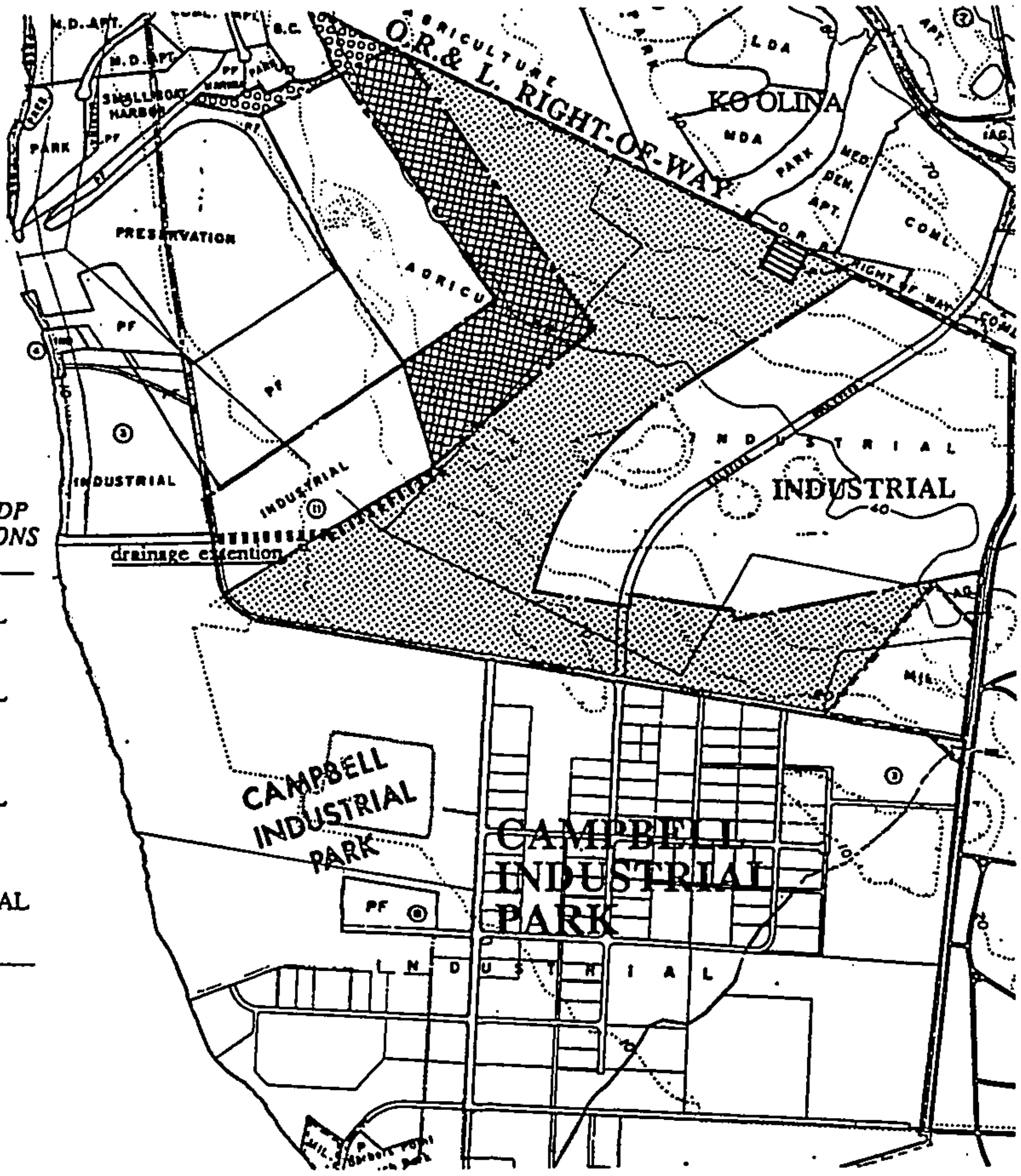


Figure 3 U.S.G.S. Ewa Quad Map, Showing Project Area

Figure 4 Aerial Photo of Barbers Point, Showing Project Area



PROPOSED DP DESIGNATIONS

INDUSTRIAL
419.99 ac.

INDUSTRIAL
(MARITIME)
109.30 ac.

INDUSTRIAL
(HECO)
3.60 ac.

COMMERCIAL
19.20 ac.

552.09 ac.

Figure 5 Kapolei Business/Industrial Park Proposed Development Plan Showing Drainage Extension

Review of Past Archaeological/Paleontological Studies

The proposed Kapolei Business/Industrial Park lies within the ancient Hawaiian land division *ahupua'a* of Honouliuli, Ewa, O'ahu.

The first effort to record sites at Honouliuli was by Thrum (1907:46) and is a reference to *a heiau on Kapolei hill, Ewa-size and class unknown. Its walls thrown down for fencing.* (Pu'u Kapolei is a mile north of the present study area.)

In his surface survey of 1930 archaeologist J. Gilbert McAllister recorded the specific locations of important sites, and the general locations of less important sites (at least at *Honouliuli). McAllister recorded seven specific sites at* Honouliuli (numbered 133-139; McAllister 1933:107-108) and these became the first seven sites in the Bishop Museum's Site Numbering System (Oa-B6-1 through Oa-B6-7). The nearest of these to the present project area is McAllister Site 138, the Pu'u Kapolei *heiau* which is a mile distant from the project area and will be discussed further. However, McAllister includes a rather general site description (Site 146; McAllister 1933:109) as follows:

Ewa coral plains, throughout which are remains of many sites. The great extent of old stone walls, particularly near the Pu'uloa Salt Works belongs to the ranching period of about 75 years ago. It is probable that the holes and pits in the coral were formerly used by the Hawaiians. Frequently the soil on the floor of larger pits was used for cultivation, and even today one comes upon bananas and Hawaiian sugar cane still growing in them. They afford shelter and protection, but I doubt if previous to the time of Cook there was ever a large population here.

These Hawaiian sites of the Ewa coral plains would be the subject of some 37 archaeological reports in the 1970s and 1980s.

Between McAllister's 1930 study and the flurry of work which began in 1969, there are only a few sporadic pieces of research which are not well documented. "In 1933, Dr. Kenneth P. Emory examined a well-preserved house site and a possible *heiau* in the western part of the coral plain; these sites were later destroyed by sugar-cane planting" (Sinoto 1976:1). In 1979, William Kikuchi removed a number of burials from a burial cave site (Bishop Museum Site Oa-B6-10) at the Standard Oil Refinery which was subsequently destroyed (Barrera, 1975:1). In 1960, Yoshi Sinoto and Elspeth Sterling visited a house site (B.M. Site Oa-B6-8). In 1966, Lloyd Soehren "carried out salvage excavations at B.M. Site 50-Oa-B6-13 (a possible fishing shrine) before the site was destroyed by construction" (Barrera, 1975:1). In 1969, artifacts were recovered from a beach midden site (B6-14) by Roger Green.

In the Fall of 1969, Mr. Ellis Cross, a supervisory employee at the nearby oil refinery on the coast, informed Dr. Sinoto that he had found house sites and walls at various locations on Campbell Estate land, near Campbell Industrial Park and the coral quarry (Lewis, 1970:2).

This resulted in a number of visits by Dr. Sinoto and student volunteers in late 1969 and early 1970. A University of Hawaii graduate student, Mr. Ernest Lewis did a preliminary survey and test excavations for a graduate seminar in Polynesian Archaeology and donated his report to the Bishop Museum (Lewis, 1970).

As Barrera (1975:3) points out there are "a number of discrepancies and inconsistencies." "For example, some sites mentioned in the [Lewis] text are not indicated on any of his maps, and some sites shown on his maps are not discussed in the report" (Barrera, 1975:3). However, taken for what it professes to be "a preliminary report of a preliminary survey" (Lewis, 1970:3), is useful. Lewis provides a good summary of historical accounts (pages 4-18) and early maps of the region and a summary of significant aspects of the geography and geology of the study area. Lewis also provided an extensive bibliography suggesting directions for further historical research.

Lewis conducted a surface survey which located some 22 archaeological sites, 15 or 16 of which fall within the proposed Kapolei Business/Industrial Park. Of particular note are the twelve sites that are believed to still be extant in the kiawe forest in the NW portion of the proposed Kapolei Park (archaeological Survey Area D) (Fig. 6). In 1975, William Barrera of the Bishop Museum, under contract with the U.S. Army Corps of Engineers, conducted an archaeological reconnaissance survey for the proposed Barber's Point Harbor. Barrera relocated nine of Lewis' sites, three of Lewis' sites were possibly relocated and one was not relocated. Among the Lewis sites that Barrera documents as destroyed was one (B6-21; Barrera, 1975:13) within or very near the NW portion of the proposed Kapolei Park. Barrera recorded twelve previously unidentified sites, of which three are believed to be still extant in the NW portion of the proposed Kapolei Business/Industrial Park (Archaeological Survey Area D).

The Bishop Museum did another archaeological survey in 1975 in association with a proposed drainage channel that ran along the west boundary of the Barbers Point Naval Air Station (Oshima, 1975). This project was just east of the proposed Kapolei Business/Industrial Park. The marginal nature and the poor condition of the sites encountered were thought to merit no further research (Oshima, 1975:4).

The U.S. Army Corps of Engineers continued the archaeological research in 1976 by requesting another survey (Sinoto, 1976) of the cultural remains in the area previously surveyed in 1970 (Lewis) and 1976 (Barrera) (Figs 7, 8). Sinoto designated four survey areas (A, B, C, and D) but only Area D lies within the proposed Kapolei Park (Fig. 6). Sinoto's work includes mapping of 68 new archaeological sites and more complete mapping of 30 previously recorded sites. Sinoto (1976) documents 24 sites in the NW portion of the proposed Kapolei Park (Archaeological Survey Area D). The Table (Table 1) on the following page summarizes the data on these sites.

With the possible exception of a University of Hawaii archaeology field school run by Mr. Bertell Davis in the late 1970s (Davis; March, June, August, 1979) and a brief paleontological research endeavor by Aki Sinoto and Smithsonian Institution paleontologist Storrs Olson in the large sink (State #9545, BM# B6-22), which hasn't been written up yet, no further work has been undertaken in Area D. Aki Sinoto considers his 1976 work as a reconnaissance survey and recommends an inventory level survey with locational

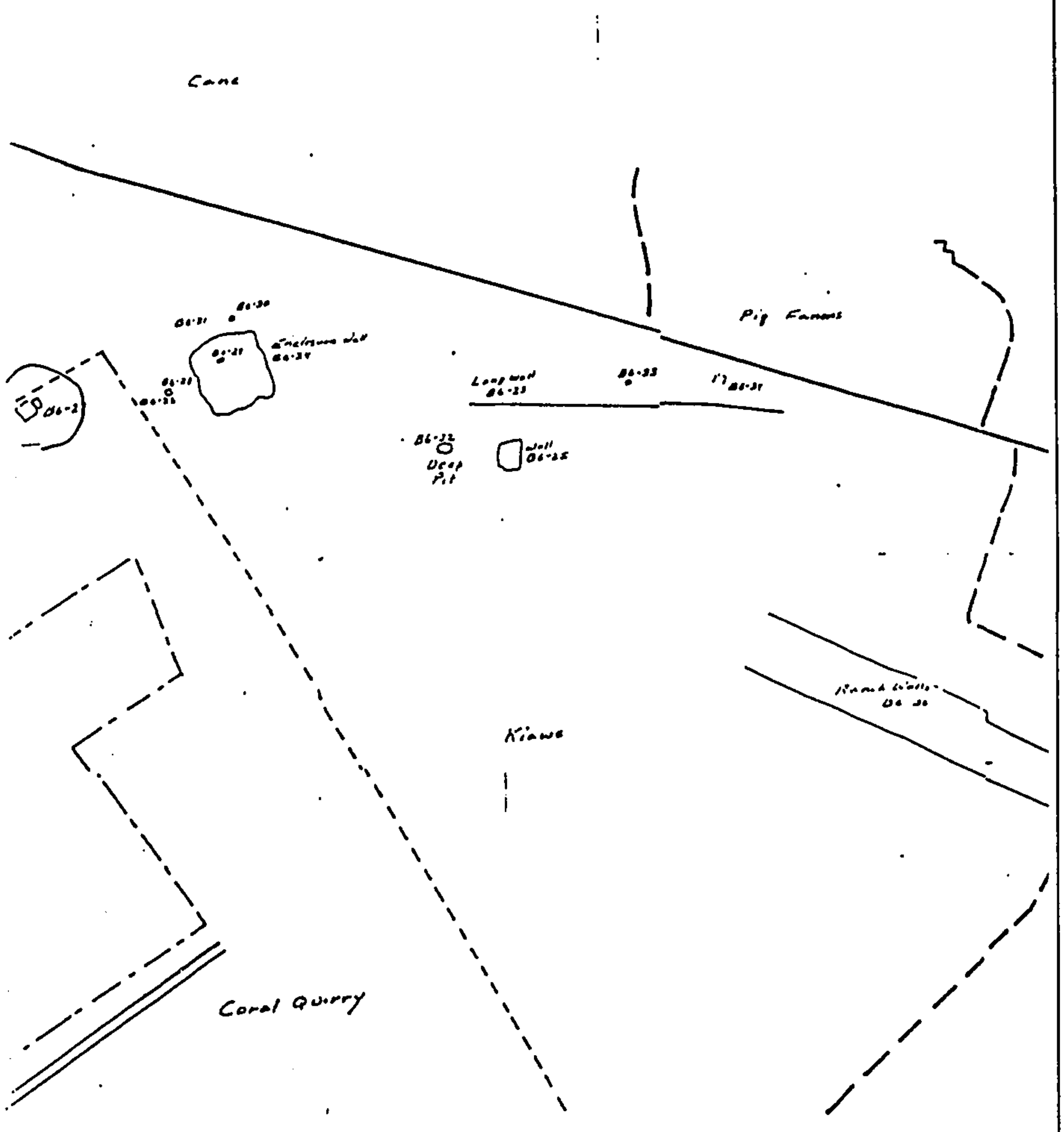


Figure 6 Lewis' Map of Sites Lying Within Sinoto's Archaeological Survey Zone D in NW Portion of Proposed Kapolei Business/ Industrial Park.

and plan mapping in addition to test excavation and mapping (Personal Communication).

The 1976 recommendations presented by Mr. Aki Sinoto (Table 1) will clearly need to be updated to account for recent findings or changing priorities of archaeological research. For example, under today's standards it would be appropriate to test all sites within Survey Zone D and a much more specific goal-oriented paleontological research program could be developed for the paleontological sinks. Mr. Bertell Davis of the University of Hawaii is of the opinion that all sites should be tested and that analysis should stress landsnail analysis palynology and dating of small charcoal samples through newly developed techniques (Mr. Bertell Davis, Personal Communication, Nov. 1989).

Table 1: Bishop Museum Area D Sites, Descriptions and Recommendations from Sinoto, 1976

State Site #(50-80-12-)	Bishop Museum #(50-Oa-B6-)	Description	Recommendation
9545	22	Large Sinkhole	Preserve
9546	23	Wall	–
9547	24	Enclosure	Test Excavation
9548	25	Enclosure	–
9551	28	Cluster(130 mound SE walls)	Test Excavation
–	29	Mound	Test Excavation
9552	30	Mound Cluster	Test Excavation
–	31	Cluster of Mounds	–
–	32	Platform	–
–	33	*Ahu*	–
–	34	Terrace,Mounds Paved Area, Enclosure	–
–	35	Enclosure	–
–	36	Two Parallel Walls	–
9607	111	*Ahu* Complex	Test Excavation
9617	121	Enclosure	Test Excavation
9624	128	*Ahu*	–
9625	129	*Ahu*	Test Excavation
9627	131	Enclosure	Test Excavation
9628	132	Cist	–
9629	133	Enclosure	Test Excavation
9630	134	C-shape	Test Excavation
9631	135	Mound Cluster	Test Excavation
9632	136	Cluster	–
9633	137	Sink	Salvage

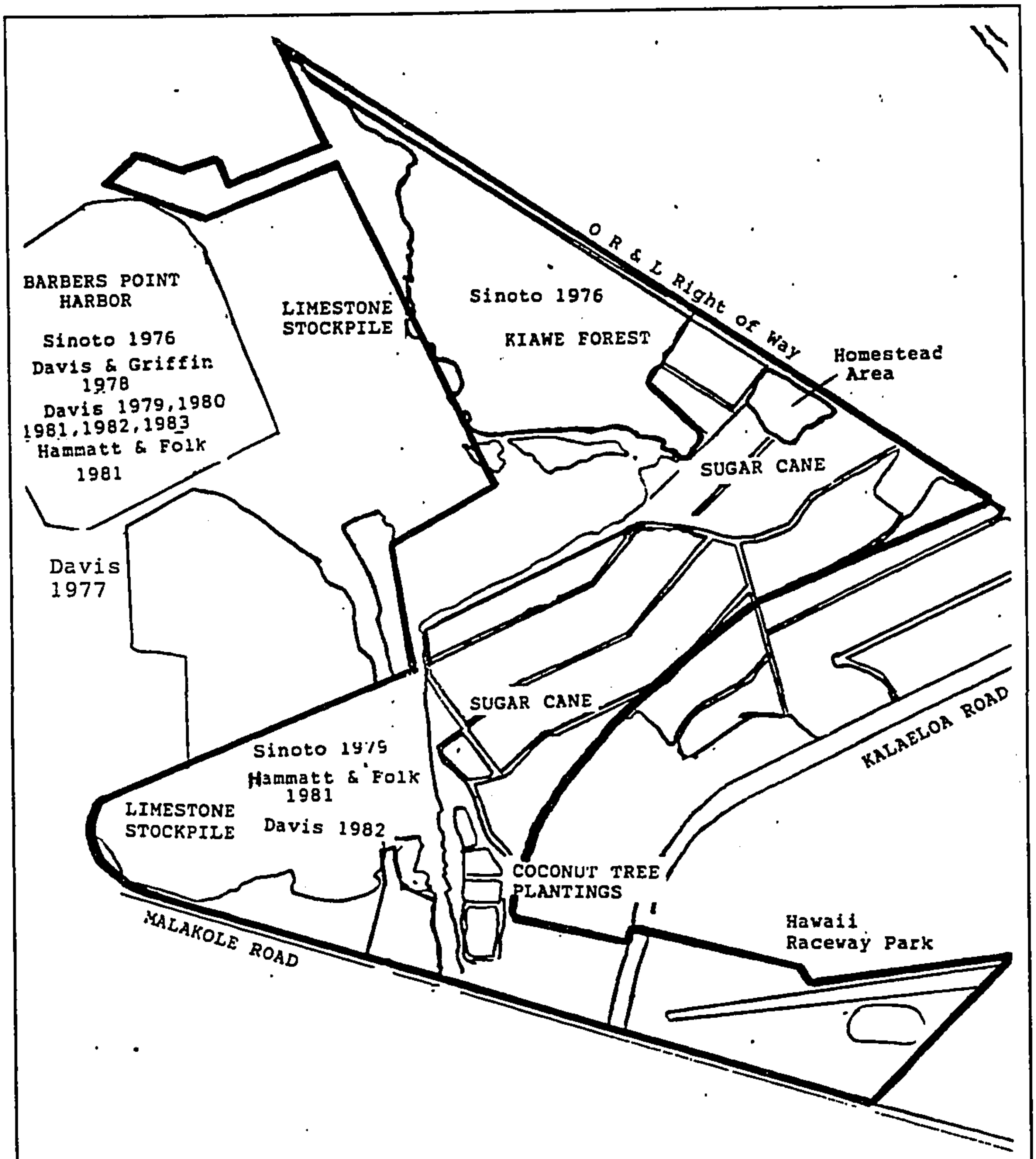
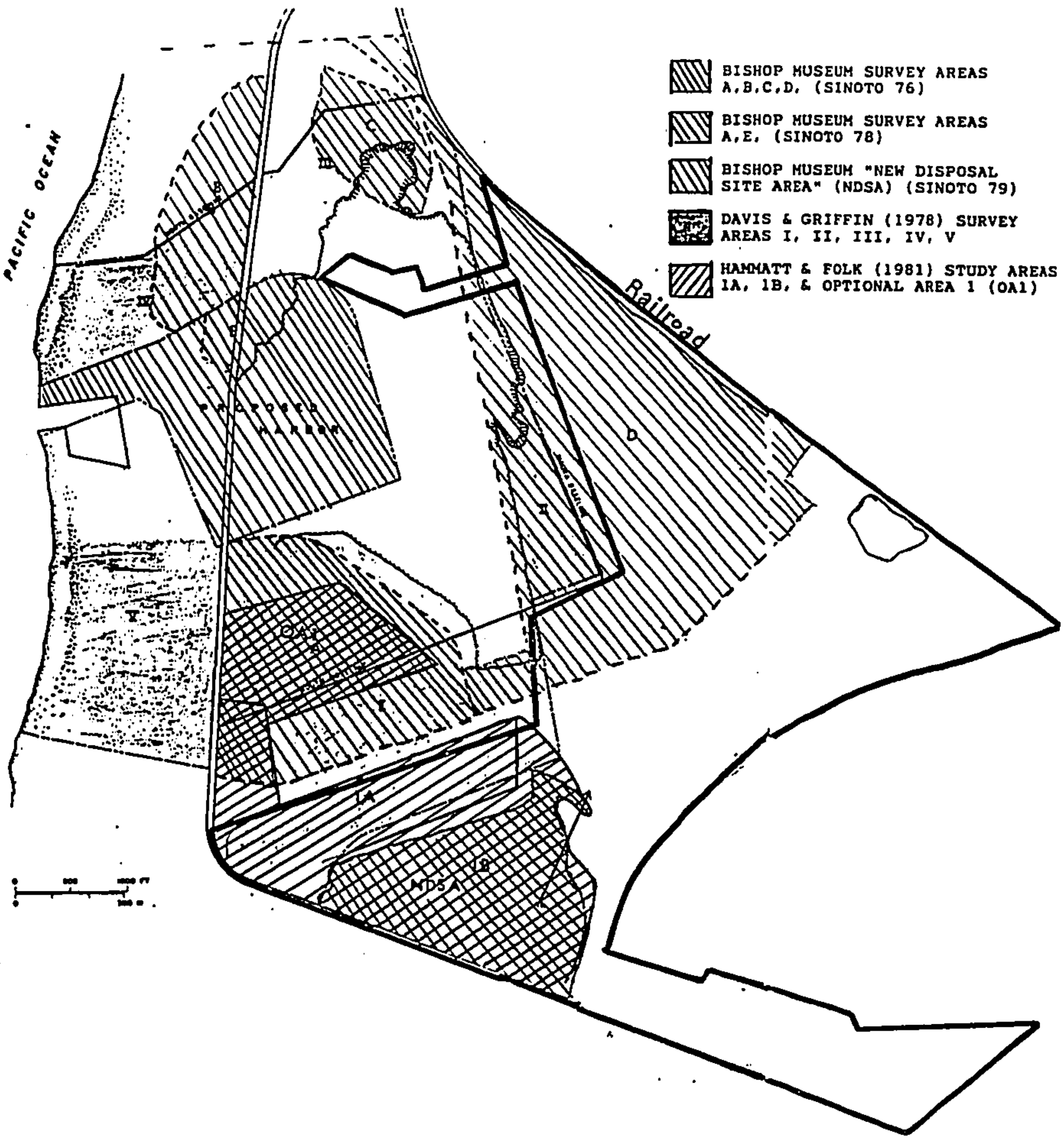


Figure 7 Project Area, Showing Land Use and General Areas of Previous Archaeological Research.



Adapted from Davis & Griffin, 1978

Figure 8 Map of Archaeological Surveys in the Vicinity of the Western Portion of the Project Area.

An important aspect of this first research (1976) by Sinoto was the identification of the presence of numerous avifaunal skeletal remains which led to the contacting of Storrs Olson, Associate Curator of Birds at the Smithsonian Institution. After a field inspection of sites and a brief review of the recovered material he knew that many extinct endemic species, new species, and even new genera were present. Olson stated that:

> *The various limestone sinks...contain probably the most extensive fossil avifauna in Hawaii with many new species endemic to the island. Such fossils have not and probably cannot be found anywhere else on the island. Furthermore, the nature of preservation is such as to insure that virtually complete skeletons can probably be assembled for most species. Thus, there is much highly significant and totally new biological and paleontological information that can be obtained at the Barbers Point site.*
>
> *Destruction of any of the potential fossil sinks would result in the loss of many specimens, some possibly unique, since one sinkhole might contain species absent in another. Also, the fauna of one sinkhole might not be coetaneous with that of another, the age of a deposit being determined by when a sinkhole first formed. Therefore, an investigation of the fauna of different sinks might show changes in species composition and changes in morphology within a species through time. Finally, it would also be desirable to retain some sinks intact as fossil "banks" should some new technique or different information be desired in the future. The fossil deposits at Barbers Point are a unique and irreplaceable resource* (Olson in Sinoto, 1976:74).

In 1977, Aki Sinoto (1978) undertook salvage archaeological and paleontological excavations in the barge harbor area (in Areas A and E; Fig. 8), but these researches were just NW (outside) of the proposed Kapolei Park.

Sinoto's work for the Corps of Engineers (1978) included preliminary sampling and analytical studies of avifaunal remains and terrestrial gastropods (land snails) and a geological study of the emerged coral reef based on the excavation of one sink hole.

To complete the archaeological survey of the entire area to be affected by the harbor and support facilities, the Corps contracted for survey of the areas designated as Optional Area 1 and Study Area 1a (Davis, 1978) and Area 1b (Sinoto, 1979) (Fig. 8). Those surveys by Davis and Sinoto located numerous archaeological sites, as well as sinks of late Pleistocene to early Holocene age which are of considerable paleontological interest. A small portion of the Davis (1978) survey area and all of the Sinoto (1979) survey area (labeled NDSA in Fig. 8) lie within the proposed Kapolei Park.

Sinoto's (1979) work shows that, although sinks containing remains of extinct species are dispersed throughout the study area, only 3 out of 19 sinks tested (or 16%) contained extinct species. However, this amounts to a considerable number of sinks as Sinoto estimated the total number of testable sinks in the 1979 study area (which lie totally within the proposed Kapolei Park) as between 1,100 and 2,500 (Sinoto, 1979:34). The majority of Sinoto's New Disposal Site Area has been utilized for a chemical dump and coral stockpiling. That portion which remains is the Malakole Sink Area.

In 1979, Berteli Davis carried out "emergency excavations" (Davis, 1979; a,b,c) within the area he had previously designated as Area II, located immediately west of the proposed Kapolei Business/Industrial Park. These excavations were carried out "in advance of the quarriers and it is believed that all sites in this area were salvaged or lost."

There was also in 1979 an archaeological reconnaissance survey of a proposed waterline route down the east side of Kalaeloa Blvd. and then east along the north side of Malakole St. While much of this route lies within the proposed Kapolei Business/Industrial Park, "No archaeological sites were found along the proposed waterline route" and it was noted that "this area is either presently in sugar cane cultivation or has been used for this purpose in the past" (Cleghorn, 1979:5).

Hammatt and Folk (1981) undertook archaeological testing and salvage excavations in three adjoining parcels designated Study Areas 1A, 1B and Optional Area 1 (Fig. 8). Of 138 archaeological sites, 88 sites were tested and 26 were excavated. Associated paleontological studies show that the limestone solution sinks and surrounding terrain were a major habitat of many fossil birds. Appendix 1 of this report by Storrs Olson and Helen James, lists over 30 species of extinct fossil birds identified at Barbers Point.

Research since and shortly before 1981 within the project area has been undertaken by Mr. Bertell Davis (Davis, 1980, 1982). The most voluminous study was undertaken by Cleghorn, Sinoto and Davis (in preparation). this work started in 1982 and concentrated in Stockpile Area III , as well as the marsh area to the east. Although a brief description of the proposed work is contained in a proposal presented to Campbell Estate (McCoy et al., 1982) the report documenting the research is not yet available. Another comprehensive document in preparation concerned partly with the study area is a Ph.D. dissertation by Mr. Bertell Davis entitled *Human Settlement in Pristine Insular Environments* (Davis, in preparation).

The extensive archaeological and paleontological research conducted as a preliminary to development of West Beach (Ko'olina) bordering Barbers Point to the north is certainly relevant to the work accomplished within the project area. It is the second area of the 'Ewa Plain in which major data recovery was accomplished.

Preliminary surveys were conducted by Barerra (1979, 1984, 1986) and Intensive Survey and Data Recovery was conducted by Davis (1986). Over 600 sinkholes were identified in the area along with around 180 surface sites, many of them similar in function to those at Barbers Point. In 1985 A. Haun reported on a survey of the Naval Air Station at Barbers Point (Haun, 1985) which lies along the coast to the southeast of the harbor area.

Results of Fieldwork

On Thursday 11/2/1989 the authors and zoologist Dr. Alan Ziegler made a field inspection of the proposed Kapolei Business/Industrial Park. This field inspection included a general reconnaissance of the entire Kapolei Park area but the investigation focused on four areas in particular: 1) the Malakole Sinkhole area; 2) the Area D archaeological survey zone; 3) the area around Hawaii Raceway Park; and 4) the area along the O.R. and L. right-of-way.

The Malakole Sinkhole Area is located at the NW corner of Malakole Road and "Powerline"/Hanua Road (Fig. 9). This sinkhole area is bounded on the east by "Powerline Road," on the north by an industrial (chemical) dump, on the NW by a high mass of stockpiled coral rubble, on the west by a low-lying area, and on the south by Malakole Road (Fig. 16). The sinkhole area covers about 8 acres, and is roughly a parallelogram running along ""Powerline Road" for about 750' and along the Malakole Road for about 550'.

An inspection of a number of sinks was undertaken. Some of the sinks still have Polynesian cultigens (Noni, *Morinda citrifolia*; and Ti *Taetsia fructosa*) growing in them (Fig. 11). There are also native plants in the area (Fig. 12). There are clearly over a hundred sinks -- over 1 meter wide -- in this area and many of them contain an abundance of fossil bird bones (Figs 13-15). Much of this area has been chain-dragged and/or bulldozed, but these operations have had little effect on the sinks, other than to partially fill in a few of them with rubble. These sinks have considerable scientific value and because of the location and accessibility of the area, it should be protected and preserved. Many of the sinkholes are quite close to the Powerline Road, thus, the enclosing fence should be as close to the road as possible.

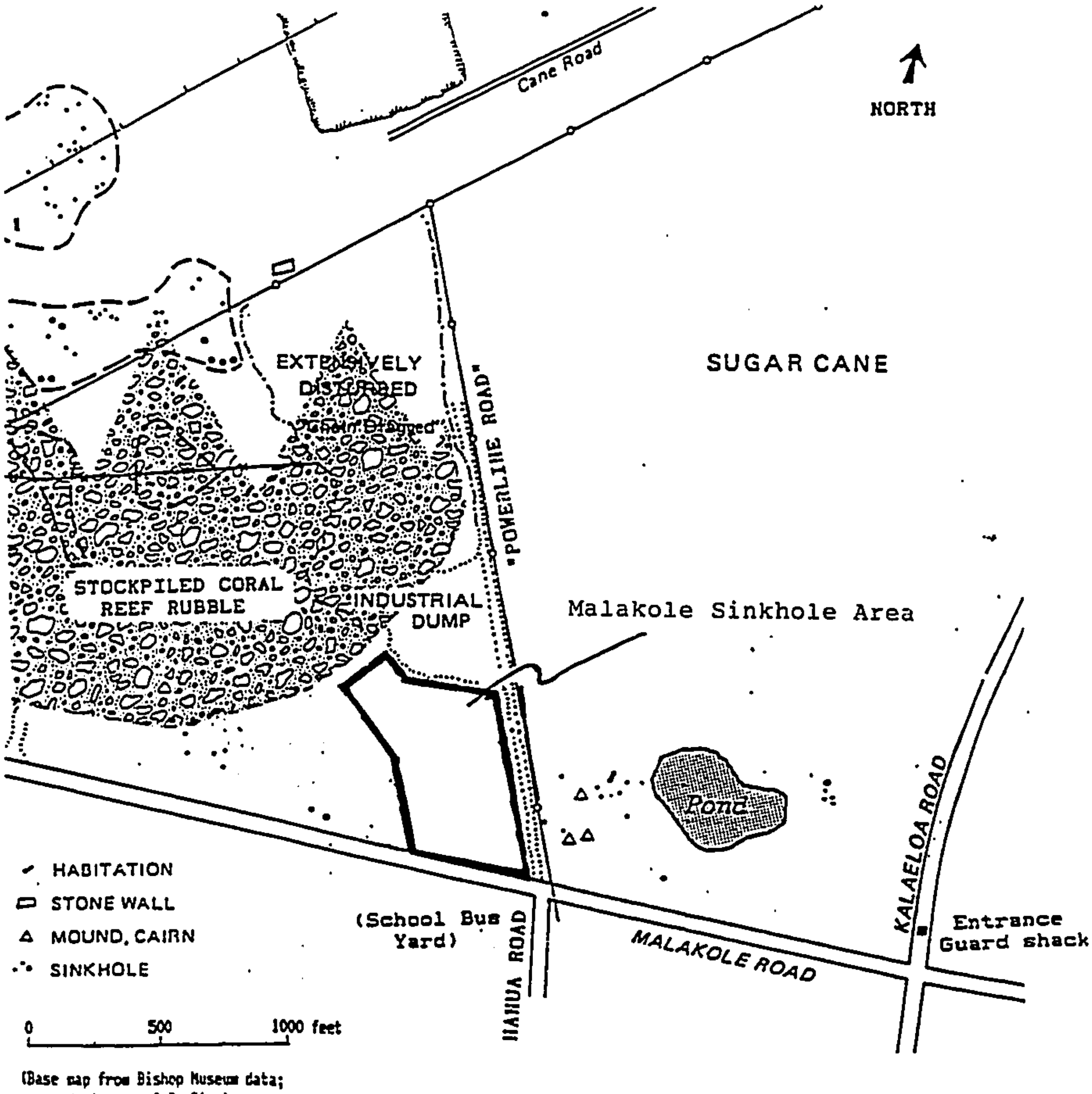


Figure 9 Map Showing Location of Malakole Sinkhole Area

Figure 10 General View of Malakole Sinkhole Area to NW toward Coral Storage Area

Figure 11 Noni (*Morinda citrifolia*) — a Polynesian Cultigen in a Sinkhole within the Malakole Sinkhole Area

Figure 12 Naio (*Myoporum sandwicense*) — a Native Tree within the Malakole Sinkhole Area

Figure 13 Dr. Ziegler with Fossil Avifauna in Malakole Sinkhole Area

Figure 14 View of a Sink with Standing Water in Malakole Sinkhole Area

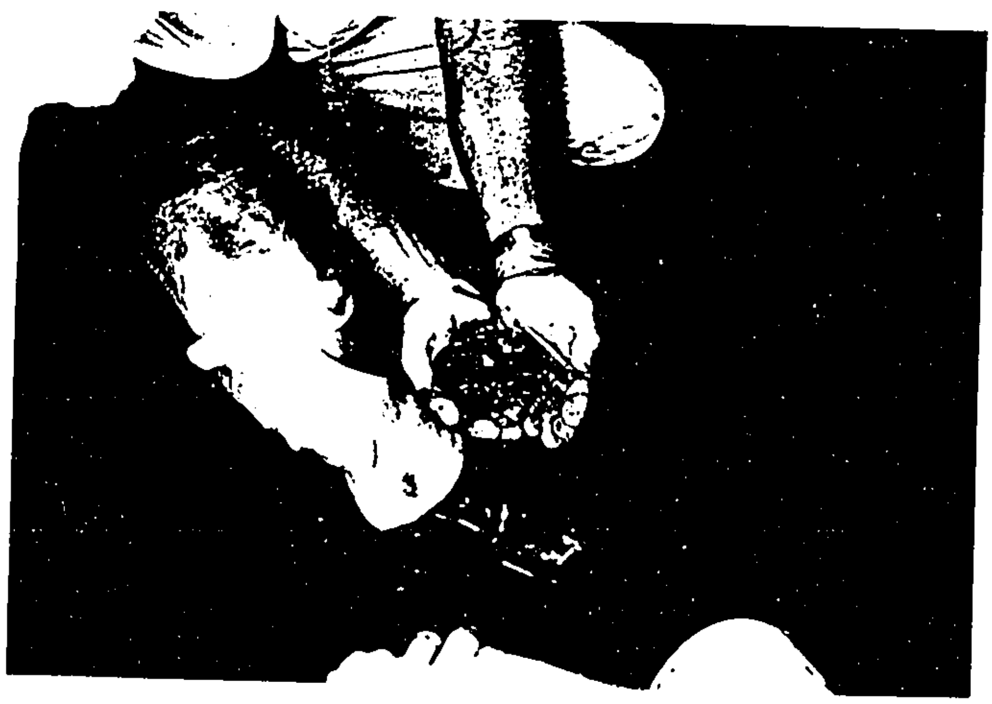


Figure 15 Dr. Ziegler Showing Abundance of Fossil Avifauna in a Sinkhole with Malakole Sinkhole Area

The second area of concentration during our field inspection was the Archaeology Survey Zone D area in the NW portion of the proposed Kapolei Business/Industrial Park (Figs 16-19).

An impressive rectangular chainlink and barb wire exclosure has been constructed around the large sinkhole (State Site # 9545, BM# B6-22). This was easily entered and we were as impressed as the earlier researchers (Lewis, Barrera, Sinoto) at the 6-meter drop and the size of the sink. This seems adequately preserved for the present. However, it had been Aki Sinoto's desire that the fence enclose some neighboring archaeological features as well (Personal Communication). We tentatively relocated a sink (State Site # 9633, BM Site # B6-137) which is supposed to still contain at least one burial. Other burials have been reported in the immediate area (Mr. B. Davis, Personal Communication, Nov. 1989). Our brief reconnaissance of this area suggested that there was a high probability of significant unrecorded archaeological sites and perhaps unrecorded paleontological sites as well.

Our third focus was the area around Hawaii Raceway Park in the SE portion of the proposed Kapolei Park. Foot and vehicle reconnaissance located no sites. We note in passing that the large parcel, just to the SE (outside of the proposed Kapolei Park), was recently bulldozed clear, leaving only one isolated sinkhole site — a testimony to the rapid pace of change in 'Ewa and to the rapid loss of natural and cultural resources in the area.

Our last area of focus was the north boundary of the proposed Kapolei Business/Industrial Park along the O.R. and L. right-of-way. The Oahu Railway and Land Company Right-of-Way (State Site # 80-12-9714) is listed on the National Register and efforts should be made during the development of the proposed Kapolei Park to keep the integrity of this right-of-way and associated railroad bed, rail, ties, etc. intact.

Figure 16 Quarried Portion of Area D; View to South Towards Coral Pile

Figure 17 Rectangular Enclosure Fence Around Large Sink Site (BM Site # B6-22, State Site # 9545); Dr. Ziegler for Scale. Background is Kiawe Thicket Typical of Area D

Figure 18 Interior of Large Sink (BM Site # B6-22; State Site # 9545), View to SE

Figure 19 Interior of Large Sink (BM Site # B6-22; State Site # 9545), View to SW, Showing Large *Ahu* Feature

A cane haul road runs parallel to the O.R. and L. alignment on the *makai* side and this road alignment should allow sufficient access to the north portion of the proposed park without causing any adverse impact to the *mauka* O.R. and L. alignment. The HECO transformer yard substation has been totally graded and is of no archaeological or paleontological concern. However, just to the NW is a quadrangular old homestead area which appears to have been utilized as late as the mid 1970s, but is now abandoned and dilapidated.

The perimeter of this area is largely in kiawe with the area around the house, shed, charcoal kiln, and pig pen bulldozed and largely in tall grasses (Figs 20-22). In the eastern margin of the property, a number of sinkholes near the sugarcane ditch, (more than 10) were observed (Fig. 23). Dr. Ziegler believes that these have potential for fossil avifauna remains and we recommend testing of a few of these sinks before development of this area. Any avifauna recovered from this area would be of particular interest, as no sinkholes on O'ahu have been excavated this far inland or at this high an elevation and it would be expected that any avifauna population recovered would differ significantly from those populations thus far recovered. Thus, these sinks have particular potential significance.

It should be noted that the proposed drainage extension, which begins at Malakole Road about 800' north of the SW corner of the proposed Kapolei Park, runs east to the edge of the proposed park, and then follows the edge of the proposed park for about 1,200' to where the western boundary of the proposed park jogs to the NNW, lies totally within an area that has been greatly studied and massively impacted and it seems exceedingly unlikely that any significant subsurface remains would be encountered during the course of the excavation for this drainage extension. No further work is indicated in this drainage alignment area.

Figure 20 Homestead Area; View to SW

Figure 21 View of Kiawe Charcoal Kiln in West Portion of Homestead Area

Figure 22 View of SW Portion of Homestead Area Showing Pig Pens

Figure 23 View of NE Portion of Homestead Area Showing Area of Limestone Sinkholes

Summary and Recommendations

Clearly, there has been major modern alteration of the landscape within most areas of the proposed Kapolei Business/Industrial Park. In most cases, recent impact on archaeological and paleontological resources has been mitigated by large scale data recovery, resulting in the production of an extensive body of archaeological and paleontological literature. The areas within the proposed park may be the most extensively studied of any area in the State of Hawai'i. This is a reflection of both the massive nature of the impact — Harbor dredging, coral stockpiling, industrial expansion, limestone quarrying — as well as the scientific importance of the area — study of settlement patterns, adaption to marginal arid environment, evolution of fossil avifauna and human exploitation of native fauna and early Hawaiian impact on previously unexploited area.

In the harbor area and coral stockpiling and quarrying localities, mitigation has been exclusively by means of data recovery — removal and scientific study of artifacts, midden, and bone assemblages before destruction of a particular area. However, within the present specific project area are a few relatively small parcels of land with extant archaeological and paleontological resources. Future land development associated with proposed plans for the Business/Industrial Park would result in complete destruction of these resources through vegetation clearing and land grading.

Each of these remaining areas containing extant archaeological and paleontological resources (Fig. 24) is briefly described and discussed below.

1. Bishop Museum Survey Zone D

This area is located within the NW portion of the proposed Kapolei Business/Industrial Park. It is bounded by the O.R. & L. Railroad right-of-way on the NE side and an active quarry and stockpile area on the west side. An archaeological reconnaissance was conducted here (1976)by Mr. Aki Sinoto of the

Bishop Museum. Sites previously identified by Lewis (1970) and Barrera (1975) were relocated and additional sites were discovered. Of the total 24 sites in the area Sinoto recommended further documentation of all sites and excavation of 12 sites, as well as preservation of the large sinkhole B6-22 (Sinoto, 1976:75). More recently, Sinoto has stated that the archaeological sites in Zone D would require further archaeological survey and excavation before development (Sinoto: Personal Communication, Nov. 1989). This area is virtually the only major portion of the entire project area which has not seen major data recovery of archaeological sites and such research would be a necessary preliminary to future development of this surviving kiawe forest. Survey and data recovery of this area should include complete testing of sites and incorporation of new techniques in dating and new insights from previous research in archaeology and paleontology.

1A. Sinkhole Site B6-22

This sinkhole in the northwestern portion of Survey Zone D referred to as B6-22, or State Site 9545 is one of the largest sites of its kind in the 'Ewa Plain. This site was tested in 1976 and shown to contain archaeological deposits as well as extinct fossil bird bones (Sinoto, 1986:50). Sinoto considered this site of major importance and recommended preservation of the entire sinkhole. At the present time, this sinkhole has been protected with a high and very substantial chainlink fence which encloses a square area around the sinkhole approximately 200' on a side. This fence will provide adequate protection for the site for many years to come.

This site is preserved by virtue of its great scientific value and management as "passive preservation" is sufficient.This

means that access should be limited to those with valid scientific interest. The present fence and locked gate is considered sufficient for this end and no further measures are recommended.

1B. Sinkhole B6-137

This small sinkhole lies 100 feet west of the B6-22 sinkhole. It is presently in an open areas recently cleared of vegetation and close to the cut bank of the limestone quarry. The sink contains at least one human burial. Additional burials are reported in the immediate vicinity (Davis, Personal Communication, Nov. 1989). Further archaeological investigation in Survey Zone D should evaluate this and other sites near B6-22 for the possibility of data recovery or preservation.

2. Large Enclosure in Cane Field

Within the cane field bordering Survey Zone D to the SE lies a large stone wall enclosure whose interior and exterior have been cultivated in cane for many years (Aki Sinoto, Personal Communication, Nov. 1989). This feature was not observed or located during the present field work. Its location should be determined and it should be documented and possibly tested before it is destroyed by Business/Industrial Park development.

3. Homestead Area

A small parcel in the north eastern portion of the project area, referred to as the Tongg Ranch (Davis, Personal Communication, Nov. 1989) has apparently never been placed in cane cultivation; probably because it consists of an elevated limestone formation. A portion of this area contains kiawe forest and fronting the O.R. and L. Railroad right-of-way is the abandoned remains of a homestead, including a house, large pig pen with concrete slabs and feeder containers, as well as an intact kiawe charcoal kiln. there is clear evidence that this homestead was occupied as late as the 1970s.

Approximately 10 limestone sinkholes were located in the south eastern portion of the parcel. These are considered potential paleontological sinks by Dr. Ziegler. Their potential value is increased by their relatively high elevation and distance from the coast. These characteristics may indicate significant differences in fossil avifauna assemblages compared to those documented in *makai* localities. Background research on the origin and history of this Homestead, as well as testing of at least 4 of these sinkholes is recommended before land alteration.

4. O'ahu Railway & Land Company Railroad Right-of-Way

The right-of-way for the O.R. and L. Railroad forms the NE boundary of the proposed Kapolei Business/Industrial Park. The railroad bed once formed a continuous line from Honolulu through Wai'anae and around Ka'ena Point. The right-of-way was placed on the National Register of Historic Places in 1975 as Site 80-12-9714. On the *makai* side of the railroad bed is a major cane haul road. This road presently forms an adequate buffer between the proposed development and the railroad right-of-way. Any widening or improvement of the road should be made in the *makai* direction to avoid impacting the railroad berm. No other management measures are considered appropriate at this time. Because of the length of the berm and its variable condition it would be reasonable, if necessary, to breach the site at certain places for access or drainage. However, this impact should be requested through Historic Sites Section of D.L.N.R. and should be kept to a minimum.

5. Malakole Sinkhole Area

There is an 8-acre parcel in the south central portion of the project area which is bounded by Malakole Road, the Powerline-Quarry Road, the coral stockpile, and an industrial dump. This area contains approximately 100 limestone sinkholes. It has been estimated that 80 percent of these contain fossil bird bone. Native flora, Ti, noni, and naio also grow in this area. Becauce of its accessibility, the close concentration of sinkholes, and its scientific value this parcel should be protected and preserved.

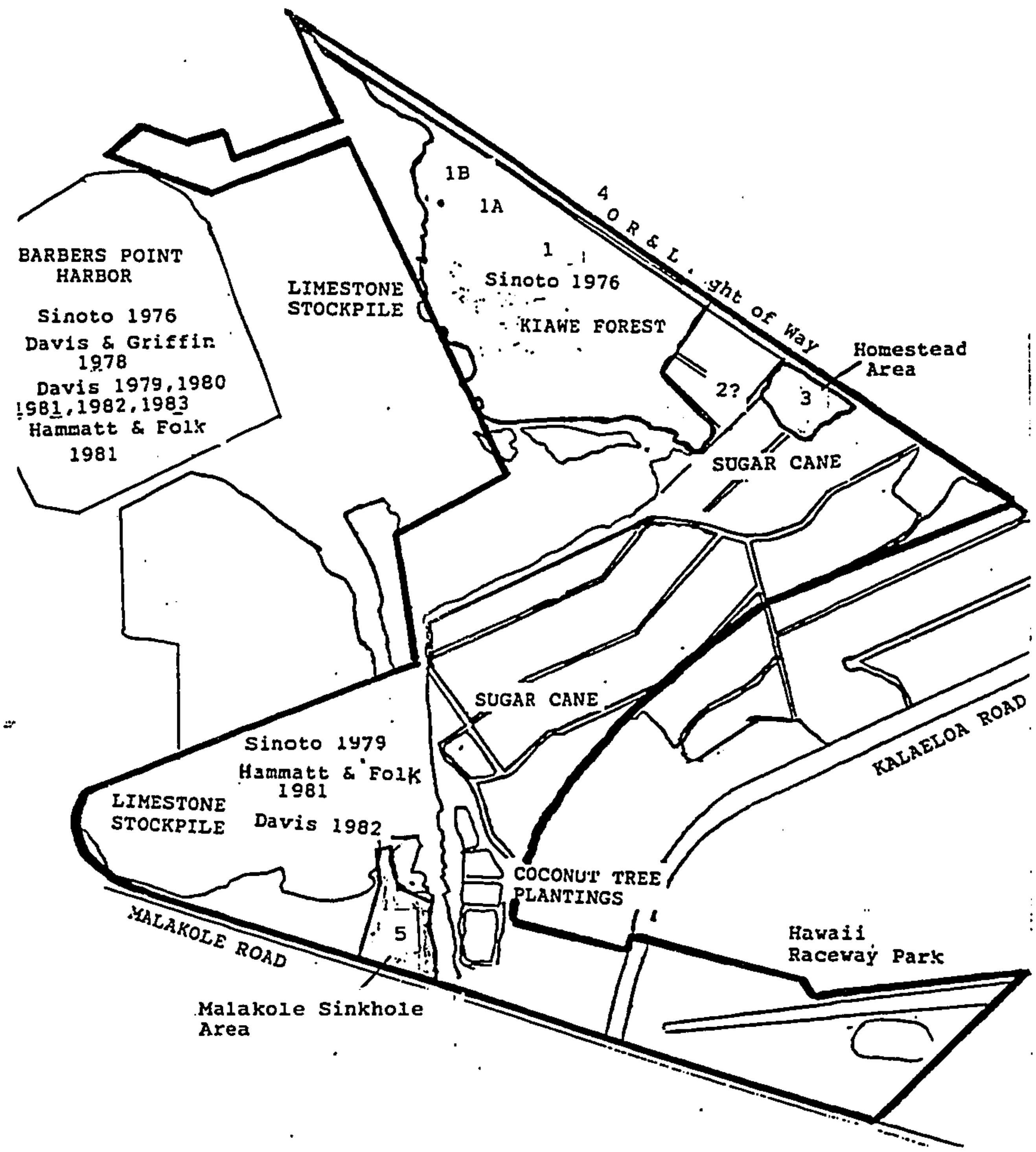


Figure 24 Map of Project Area Showing Areas of Archaeological and Paleontological Concern

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49 S. Kalaheo Avenue ◇ Kailua, Hawaii 96734
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Hallett H. Hammatt, Ph.D., owner and sole proprietor

Services: Cultural Surveys Hawaii is a small company offering expertise in archaeological reconnaissance, intensive surveys, excavations, site and area management and assessments, site stabilization and development. The emphasis is on a professional but realistic approach to archaeology and its relation to land development.

Cultural Surveys has an excellent record of timely completion of reports. The proprietor is not simply a name to be used in proposals but is a full-time participant in all phases of every project. This accounts for the consistency of the work and the first-hand nature of the reports.

Personnel and Associates

Hallett H. Hammatt, Ph.D. (Proprietor)

Twenty-six years experience in archaeology, 15 years in Hawaiian archaeology, directed and completed approximately 350 archaeological projects in Hawaii, involving work on all major islands and in most aspects of Hawaiian archaeology. Fourteen years experience in consulting with over 50 governmental agencies and private companies in Hawaii. Member of the Hawaii Historic Places Review Board for 10 years, expert witness at many public hearings.

Douglas Borthwick (Associate)

B.A. in Archaeology, graduate study in Pacific Islands Studies, 14 years experience in Hawaiian archaeology work on all major islands, specialty in site survey, artifact analysis, historical search.

David Shideler (Associate)

B.S. in Zoology, B.A. Anthropology, M.A. Environmental Health Management, 14 years experience in Hawaiian archaeology, founding member of the Hawaii Malacological Society, specialty in floral and faunal identification, ecology, analysis of faunal remains from archaeological sites.

Stephen Clark (Associate)

B.A. in Anthropology, 18 years experience in Hawaiian archaeology, field and laboratory studies, archaeological drafting.

Kirsten Nakamura (Associate)

Field and laboratory assistant, 14 years experience in archaeology, cataloging, illustration.

Mark Stride (Associate)

Field and laboratory assistant, 3 years experience in archaeology, field survey, excavation, cataloging.

Other Associates and Sub-Consultants

William Kikuchi, Ph.D.

Kauai Community College, Crafts Hawaii, volcanic glass dating, petrographic studies, Hawaiian fishponds.

Founded 1982

Michael Pietrusewsky, Ph.D.

University of Hawaii, Manoa, physical anthropology, osteological analysis.

Alan Ziegler, Ph.D.

Zoological Studies, faunal remains.

Other consultants in Hawaiian language, Hawaiian history, radiocarbon dating, botany, floral and faunal identification, planning.

Areas of Experience

Reconnaissance, survey, excavations, coring, site stabilization, site and area management, mapping, aerial survey, recovery of human burials, stratigraphy, historic search, fishponds, beach sites, cave sites, petroglyphs, survey of unaccessible areas, interpretive display development, historic archaeology, urban archaeology, federal and state regulations in historic preservation.

Field and Laboratory Equipment and Facilities

Cultural Surveys has a full range of field and laboratory equipment. The laboratory and office facility of 800 square feet is equipped with measuring and photographic equipment, scales, etc. and a Nikon petrographic microscope. There is also a sizable reference library on Hawaiian archaeology and history.

Clients

County

Kaua'i County
Maui County
Honolulu Board of Water Supply
Honolulu Department of Public Works

State

Division of State Parks
Hawaii Community Development Authority
Department of Transportation
Hawaii Housing authority
State Department of Agriculture
Hawaii Air National Guard
Department of Hawaiian Home Lands
Department of Accounting and General Services
Department of Business and Economic Development

Federal

U.S. Army Corps of Engineers
U.S. Air Force
National Radio Astronomy Observatory

Private and Non Profit Groups

Alexander and Baldwin
BPM Mining Corp
Belt, Collins and Associates
Bingham Engineering
CH2 M Hill
D.H. Realty
Dames and Moore
Engineering Concepts Inc.
*Friends of I'olani Palace
Gamlon Corp.
Hasigawa Komoten
Hawaii Omori Corp.
Hemmeter Resorts
Hida Okomoto and Associates
Imata and Associates
Kalani Sunset Corp
Kaluakoi Corp.
Kamehameha Investment Corp.
Joseph Kealoha Realtors
Keauhou-Kona Realty
Keauhou-Kona Resorts
Kodani Associates
Kohala Ranch
Lanai Company (Castle and Cook)
Landmark Suites
Lanihau Corp
*Liliu'okalani Trust
Lone Star Hawaii
M and E Pacific
MCM Planning
Marriott Hotels
Maunakea Properties
Moana Corp.
Oceanic Properties
Pacific Atlas Hawaii Inc.
Pacific Basin Resorts
Gerald Park, Urban Planner
Parsons Hawaii
Portugal and Associates
Princeville Corp.
Project Planners Hawaii
Signal Oil
Sports Shinko Group
Taiyo Fudosan
R.M. Towill
*Waioli Mission
Ward Pacific

* Non-profit

Archaeological Projects Directed

Major Projects (exceeding $40,000)

1989	Archaeological Survey of 2,400 acres, Kawaihae, Hawaii for Dept. of Hawaiian Homelands
1988	Archaeological Survey of 1000 acres at Kukuiula, Kaua'i for Alexander and Baldwin
1987	Archaeological Testing of Hawaii Air National Guard Facilities (Hickam Air Force Base)
1986	Archaeological Monitoring at Kaka'ako for Hawaii Community Development Authority
1985-86	Archaeological Excavations at Wai'anae Army Recreation Center, Poka'i Bay, Wai'anae, O'ahu for U.S. Army Corps of Engineers
1984	Archaeological Survey and Excavations for a 9-hole Golf Course Extension, Keauhou, Kona for Keauhou-Kona Resort
1983-84	Archaeological Survey and Excavation of 174 acres, Holualoa, Kona, for Gamlon Corp.
1981	A Management Plan for Archaeological Research at the Keauhou-Kona Resort, for Kamehameha Investment Corp.
1981	Archaeological and Paleontological Investigations at Barber's Point, Ewa, for U.S. Army Corps of Engineers
1980	Archaeological Excavations of a 155-acre parcel, Kona, for Pacific Basin Resorts
1979	Archaeological Investigations at Waioli Mission Hall, Hanalei, Kauai, for the Waioli Church and the State of Hawaii.
1978	Archaeological Survey of the Proposed Kiahuna Golf Village, Koloa, Kauai for Moana Corp.
1978	Archaeological Excavations at Ha'ena State Park, Ha'ena, Kaua'i, for State of Hawaii Division of State Parks

Geographical Experience

Oahu:	Bellows, Olomana, Kualoa, Waiahole, Kaneohe, Kaka'ako, I'olani Palace, Mokapu, Waipio, Pearl Harbor, Barber's Point, Waiau, Moanalua, Ewa beach, Wai'anae Valley, Poka'i Bay, Makaha, Makua, 'Ohikilolo, Keeau, Waimanalo, Nu'uanu, Kipapa, Luluku, Haula, La'ie, Kaena Pt., Urban Honolulu
Hawaii:	Hilo, Puna King's Landing, Waimea, Kohala, Ka'u, South Kona, Keauhou, Kahaluu, La'aloa, Holualoa, Kailua, Kaloko, Keahole, Lalamilo, Honalo, Kawaihae, Keala Kehe, South Point, Lanihau.
Kauai:	Lihue, Koloa, Poipu, Hanapepe, Waimea, Wailua, Hanalei Valley, Waioli, Ha'ena, Kapa'a, Princeville, Kilauea
Lanai:	Manele, Koele
Molokai:	West Molokai - Kaluako'i

Maui:	Ka'anapali, Wailuku, Kihei, Kahului, Haleakala
Kaho'o lawe:	Entire island site survey

Summary of Professional Experience in Hawaii

Directed over 350 archaeological investigations in Hawaii, including reconnaissance, survey, subsurface testing and coring, historical research, archaeological site and area management, site stabilization and reconstruction, intrepretive display development. These studies have involved work on O'ahu, Kaua'i, Lana'i, Moloka'i, Maui, Hawai'i Island and Kaho'olawe.

Investigations include small-scale reconnaissance, surveys of up to 3,000 acres, major excavations on all main islands, recovery of human burials, historic archaeology, investigation of beach sites, cave sites, mapping and investigation of Hawaiian fishponds and aerial surveys. Besides project reports, there are formal publications, professional papers, and research grants.

Special Contributions to Hawaiian Archaeology

- Discovery and documentation of the oldest known human occupation on Kaua'i (Ha'ena, 980 A.D.)
- Documentation of a previously unknown and one of the most complex Hawaiian irrigation systems in Hawai'i, Koloa, Kaua'i.
- Obtaining the first radiocarbon dates on Hawaiian fishponds with a coring technique especially designed for fishponds (Mokapu and Pu'uloa)
- Excavation of the most intact bone fishhook workshop in Hawai'i with documentation of raw materials and stages of manufacture (Kawakiu, Moloka'i)
- Developing the only complete archaeological record of an early Christian Mission Station in Hawai'i (Waioli, Hanalei, Kaua'i)
- Most complete mapping study of a segment of the Kona Field System (Pahoehoe, Kapalaalaea, La'aloa, Kona)
- Rediscovery of extensive Hawaiian agricultural and habitation complexes in upper Hanalei Valley only briefly reported on in 1931
- Rediscovery of Moka'ena Heiau, Ka'ena Point, O'ahu, thought to have been destroyed in 1940s.
- Disinterment of 120 human burials from storm drain excavations at Queen and Punchbowl Street and coordination of reburial in Kawaiaha'o Cemetery
- Excavation of monarchy materials on the grounds of I'olani Palace
- Ongoing cooperative educational project with Punahou School training High School Students in field archaeology

APPENDIX F

Noise Impact Assessment, Proposed Campbell Commercial-Industrial Center, Oahu

Darby And Associates

DARBY
& ASSOCIATES
ACOUSTICAL CONSULTANTS

APPENDIX F

J89-28
November 9, 1989

WILLIAM E. WANKET, INC.
Pacific Tower, Suite 1010
1001 Bishop Street
Honolulu, Hawaii 96813

Attention: Mr. William Wanket

Subject: Noise Impact Assessment, Proposed Campbell Commercial-Industrial Center, Oahu

Dear Mr. Wanket:

We have reviewed the plans of the proposed project and field noise measurements and analyses have been performed to assess the potential noise impact. The following is provided as a result of our study:

I. EXECUTIVE SUMMARY

A. Existing and future noise sources which may affect the proposed project site and its surroundings are:

1. Project generated noise -- industrial activities and truck movements.
2. Aircraft operations associated with Honolulu International Airport (HIA) and Naval Air Station Barbers Point (NASBP).
3. Traffic movements on Kalaeloa Boulevard, Malakole Road and the new access road or roads.
4. Existing industrial activities such as Chevron USA, Hawaiian Dredging & Construction Company - Precast Division, and sugar cane operations.
5. Existing raceway operations.

B. The aircraft generated Day-Night Average Sound Level (Ldn) [due to both HIA and NASBP] is less than 65 dB throughout the project site

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and is less than the 70 dB Ldn guideline for clear acceptability for commercial/industrial areas.

C. Noise from existing industrial and agricultural activities near the project site should not have any significant impact on the proposed development.

D. Various noise mitigation measures should be considered to minimize any potential noise impact due to the existing raceway and the proposed industrial activities within the project site. These include:

1. Compatible placement of the future businesses to create buffer zones between the proposed intensive industrial areas and the more noise sensitive locations.
2. Acoustical enclosures and walls.
3. Air conditioning/forced-air ventilation.
4. Interior acoustical finishes for sound absorption.
5. Raceway noise mitigation measures may involve either relocating the raceway or restricting nighttime racing activities.

E. The future traffic volumes on Kalaeloa Boulevard and on Malakole Road will be less with the project than without. Therefore, the project generated traffic should not, by itself, cause any significant noise impact on these existing roadways. However, traffic movements on a new access road may cause significant noise impact at the future noise sensitive areas to the north of the project site, and implementation of noise mitigation measures (e.g. noise barriers, sufficient setback distances, etc.) may be needed.

F. Noise due to construction of the project is not expected to cause any significant impact if the construction is completed prior to the development of future noise sensitive areas to the north of the project site. If not, special permits may be needed from the State Department of Health (DOH).

II. <u>PROJECT DESCRIPTION</u> -- The proposed project covers a total of 552.09 acres and includes the following developments:

- 419.99 acres of industrial (other than maritime and HECO) use
- 109.30 acres of maritime industrial use
- 3.60 acres of HECO industrial use
- 19.20 acres of commercial use
- Construction of a new drainage canal
- Construction of one or more access road(s).

The existing use of the project site is mainly for agricultural (primarily sugar canes), and industrial (quarry operation) activities. Also included within the project site is an existing raceway park, located at the southeastern corner of the site. The existing land uses adjacent to the project site include agricultural (sugar cane), commercial, light industrial (office spaces and warehouses) and intensive industrial (precasting, oil refinery, etc.). Noise sensitive land uses, such as low and medium density apartments and park areas, are proposed at locations near the northern boundary of the project site. Refer to Figures 1 and 2 for the vicinity map and the site plan.

III. <u>NOISE STANDARDS AND GUIDELINES</u> -- The Day-Night Average Sound Level (Ldn) is a single number rating of the adjusted average sound level over a 24-hour period and is a generally recognized noise descriptor commonly used for the determination of land use compatibility (refer to Appendix I for a more detailed explanation of Ldn). Several federal agencies and standards organizations have set forth land use compatibility guidelines, which specify that commercial, manufacturing and industrial uses are compatible without any mitigation measures for those areas with noise exposure of 70 dB Ldn or less. Locations where the Ldn ranges from 70 to 85 dB are still acceptable for such developments, provided that noise mitigation measures are implemented at noise sensitive locations (e.g., office areas). Locations where the Ldn exceeds 85 dB are generally not considered compatible for such uses.

Noise regulations set forth by the U.S. Environmental Protection Agency (EPA), and Department of Housing and Urban Development (HUD) specify 65 dB Day-Night Average Sound Level (Ldn) as a maximum allowable level for residential and other noise sensitive areas. Since the majority of homes in Hawaii is naturally ventilated, the State Department of Transportation (DOT) sets a guideline of 60 dB Ldn for aircraft noise. HUD also has a design goal of 45 dB for the interior spaces of dwelling units.

On Oahu, State and County noise regulations may be enforced whenever noise emissions exceed specified levels and cause complaints from neighboring properties. State Department of Health (DOH) and City and County of Honolulu Land Use Ordinance (LUO) noise regulations are expressed in terms of maximum allowable noise levels rather than Ldn, and they are presented in Tables 1 and 2. The DOH regulations use A-weighted sound levels and state that the allowable noise levels shall not be exceeded for more than ten percent during any twenty-minute period (Reference 1). Refer to Appendix II for a description of the A-weighted measure of sound level. The LUO regulations 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 (Reference 2). In addition, the DOH also specifies maximum allowable noise levels for vehicles, including trucks (see Table 3 for these levels) [Reference 3]. Note that the DOH and LUO regulations for the industrial or non-residential zones are equivalent to Ldn's of about 76 and 70 dB, respectively.

It is understood that there are plans to rezone certain portions of the existing agricultural land, adjacent to the northern and western property lines of the project site, for low and medium density apartment and park uses. The grandfather clause of the DOH noise regulations states that the appropriate DOH limits at a common boundary between different land uses depends "on the order of precedence in which uses were initiated". Therefore, assuming that the proposed commercial/industrial center is approved before the rezoning of the adjacent agricultural land for residential/park uses, the DOH noise limit for an industrial zone of 70 dBA would be allowed at the common property lines. Otherwise, more stringent levels ranging from 45 to 60 dBA would apply at the property lines.

IV. <u>DESCRIPTION OF THE EXISTING ACOUSTICAL CONDITION</u> -- Noise measurements have been obtained to assess the existing acoustical conditions at the project site. Figure 3 provides the measurement locations. The existing acoustical environment at the project site is affected by traffic movements on Kalaeloa, Malakole, and the quarry road; aircraft operations associated with Honolulu International Airport (HIA) and Naval Air Station Barbers Point (NASBP); existing industrial activities; wind in foliage (sugar cane and other vegetation); sugar cane operations; and racing activity at the Hawaii Raceway Park.

Noise generated by traffic movements on Kalaeloa, Malakole, and the quarry road dominate the acoustical environment at locations near these roads. Away from these roads, aircraft operations are the primary source of noise during the daytime hours. At times when there are no aircraft movements, the existing industrial activities and wind noise are the most audible sounds. When there are sugar cane field operations, such as harvesting and land preparation, noise from the heavy equipment dominates the acoustical environment. During raceway events, racing noise may be the dominant noise source. Note that the noise generated by the quarry activities is irrelevant to this study since the quarry will be subsequently replaced by the proposed development.

A. <u>Traffic Noise</u> -- Noise measurements were performed to assess the existing noise levels due to traffic movements on Kalaeloa Boulevard and on Malakole Road. The primary sources of traffic noise are the heavy truck movements on these streets, as they contribute up to about 90% of all traffic noise.

The measured data were used to calibrate the Federal Highway Administration (FHWA) Noise Prediction Model (Reference 4) for the purpose of estimating the existing noise levels at various distances from each of the streets, and the results of these analyses are shown in Figures 4 and 5. Each figure provides the average hourly noise level (HNL) at various distances from the centerline of the street for two types of conditions between the street and receiver; these are: "hard site" (no significant acoustically absorptive surfaces, i.e., asphalt covering, concrete, elevated receiver location, etc.) and "soft site" (light vegetation, dirt, etc.). As can be seen in the figures, the existing HNL at a distance of 100' is estimated to range from about 71 to 72 dBA due to traffic on Kalaeloa and about 61 to 64 dBA due to traffic on Malakole Road.

B. <u>Aircraft Noise</u> -- Flight activities at the HIA which affect the project site comprise civilian and military aircraft approaching to land on Runway 8L. Noise generated by touch-and-go activities, which overfly the project site, dominate the overall noise from aircraft associated with the NASBP. Refer to Figures 6 through 11 for the location of the flight tracks involved.

According to the latest HIA Ldn contour map for the existing (1987) and future (1992) years [Reference 5], the project site is exposed to an Ldn of less than 55 dB (see Figures 12 and 13). The latest Air Installation Compatible Use Zone (AICUZ) for NASBP (Reference 6) provides Ldn contour maps for NASBP operations alone and for the combined effect of HIA and NASBP operations. Two different annual average number of operations, namely, the 1987 and the "mean year", which averages the operations between 1983 and 1987, were used in the referenced AICUZ study. Using the mean year Ldn contour map, it is estimated that the project site is exposed to Ldn's generated by flight operations at NASBP of less than 65 dB (see Figure 14). The combined Ldn (due to HIA and NASBP operations) is less than 65 dB at all locations within the project site (see Figure 15).

Noise measurements were obtained on September 18 and 19, 1989 to further assist in evaluating the existing aircraft noise. During the measurements, a total of 43 aircraft events were observed and/or measured. For each of these events a maximum A-weighted sound level (Lmax) and the Sound Exposure Level (SEL), which also takes into account the duration of an event, were recorded where possible. Appendix III provides a complete listing of the data obtained together with details of the acoustical instrumentation used. Note that some aircraft events were inaudible or barely audible above the ambient level, and, therefore, measurements of the noise from these events were not feasible. A typical trade-wind condition (ENE, 10-15 knots) prevailed during the measurement periods.

Civilian aircraft (trans-ocean and interisland) flights occurred most frequently during the measurement periods. These flights typically generated noise levels of about 65 dBA Lmax and about 75 dBA SEL. Another frequently occurring aircraft event was the P-3 aircraft performing touch-and-go operations from NASBP, typically generating an Lmax of about 69 dBA and an SEL of about 78 dBA.

Other military aircraft flights associated with HIA and NASBP were also measured, however, due to the inadequate number of samples and/or a wide range of noise levels, it is inappropriate to assign typical Lmax and SEL values. The noisiest event measured was a KC-135 aircraft performing a touch-and-go operation at NASBP, and it generated an Lmax of 90 dBA and an SEL of 96 dBA.

During the Kona wind condition, which occurs approximately 5 to 10% of the time, the aircraft flight patterns reverse their directions and the nearest flight tracks associated with HIA are the departure tracks 11 and 13 (see Figure 7.) As can be seen from the figure, the departures do not overfly the project site and the distances involved are relatively large. The noise levels associated with these activities should be lower than those generated by the typical tradewind condition landings. Flight activities associated with the NASBP during the Kona wind condition should also generate lower noise levels than those during the typical tradewind condition.

C. <u>Existing Industrial Activity Noise</u> -- Noise from the Chevron USA refinery and from the Hawaiian Dredging and Construction Co.-Precast Division was audible at parts of the project site. Noise measurements were obtained at the nearest location within the project site to both of these premises and the results are summarized in Table 4. As can be seen in the table, the measured levels were, at most, 64 dBA.

There is considerable activity within the existing quarry area. However, as noted earlier, the quarry will not be involved in the proposed development.

D. <u>Sugar Cane Operations</u> -- The primary source of noise generated by sugar cane activities is the equipment used during cane harvesting and land preparation. Typically, sugar cane fields are harvested every two years. The equipment involved operates 24 hours per day and includes bulldozers (push rakes) and clam-shell cranes loading trucks. Land preparation for planting occurs typically every six years and involves a sequence of operations such as harrowing, plowing, leveling, and stone removal. According to the DOH's noise regulations mentioned earlier, sugar cane operations are allowed to generate 70 dBA for 10% of the time in any 20-minute period at the property line. However, the regulations also allow conditional permits for agricultural field preparation and harvesting provided that 95 dBA is not exceeded at the property line.

The closest portion of the existing sugar cane field which will remain near the project site is located adjacent to the northern property line (railroad right-of-way) of the project. Thus, it is possible, since the project and the sugar cane field share an essentially common property line, that a noise level of up to 95 dBA may be occasionally experienced at the northern project site boundary.

The Ldn generated by the truck movements on the existing cane haul road parallel to, and to the north of, the railroad right-of-way is not expected to contribute significantly to the noise exposure levels at the proposed development. Also, it is understood that the sugar cane fields immediately north of the subject site will eventually be phased out.

E. Raceway Park -- Hawaii Raceway Park is currently located at the southeastern corner of the project site on the mauka side of Malakole Road. It is understood that consideration is currently being given to relocate the raceway. However, for the time being the raceway is being used on Saturdays up to about 11 pm. Typical raceway events include drag racing and racing on a quarter-mile oval track. On Saturdays, raceway events would be the dominant noise source in areas near the southeastern corner of the project site. Noise from traffic on Kalaeloa Boulevard and Malakole Road is expected to be significantly lower on Saturdays compared to weekdays, further contributing to the dominance of raceway noise.

It is understood that there have been noise complaints from residents at Nanakai Gardens (about 2 miles north of the raceway park) due to the nighttime racing activities. There are residential areas within NASBP located between about 1500' to 5000' from the raceway park, however, no noise complaints have been reported from these areas. This is probably because the residential areas within NASBP are located at about same elevation as the raceway, and medium to thick foliage between the noise source and the receivers provides considerable ground absorption. On the other hand, Nanakai Gardens is located at a higher elevation and has direct line-of-sight to the raceway park.

V. <u>ASSESSMENT OF POTENTIAL NOISE IMPACT AND POSSIBLE MITIGATION MEASURES</u> -- Several different aspects of potential noise impact are discussed in this section. They include noise generated within the project site and its potential impact on other site occupants and on nearby future noise sensitive areas. Also discussed are potential effects of aircraft, traffic, raceway and construction noise as well as noise from existing industrial activities on the future site occupants.

A. <u>Project Generated Noise</u> -- Noise experienced in areas near maritime, industrial, and commercial operations depends not only on the intensity of the source, but also on the sound propagation conditions, determined largely by the elevation of the noise source; the presence of buildings causing shielding (or reflective sound buildup); the terrain, i.e., hard or soft; etc.

Table 5 from Reference 7 contains a summary of workplace noise levels measured in Kakaako, and is applicable to many conditions expected to exist in the project area. The following excerpt is also from Reference 7:

> "Practically all workplace activities, which involve the use of powered tools or machinery, will generate noise levels in excess of 65 dB at the operator position... Table 6 presents typical ranges of noise levels for various equipment which may be used in an individual workplace environment. The ultimate effect of noisy equipment on the spatial and temporal noise level distributions within a particular workplace depends upon a number of factors such as: the loudness, physical location, and frequency of operation of the noisy equipment; the interior architectural finishes and furnishings used in the workplace; and the extent to which partitions or enclosures are used to contain high level noise sources. The use of electronic paging systems will generally result in intermittent sound levels which are higher (by design) than the workplace noise levels.
>
> "Hearing damage criteria for the workplace is approximately 85 dB, and it is possible that noise levels in the workplace environment may ultimately be at or below the 85 dB level. However, it is not likely that equipment of the industrial types shown in Table 6 will be quieted to levels below 85 dB due to economic considerations. Therefore, it is reasonable to assume that workplace noise levels do and will continue to occur within a band of values, of approximately 65 to 85 dB with possible levels exceeding 85 dB for industrial operations.
>
> "The extent to which noise from one industrial or commercial activity leaks out to adjoining properties depends upon the construction and openness of intervening partitions (including floors and ceilings) and the setback distances to the property boundaries. It is possible to totally enclose a noisy business establishment with properly designed wall and ceiling/floor systems to prevent workplace noise from escaping to adjoining properties. However, considerations such as ventilation, material flow and customer servicing can make total enclosure impractical."

Examples of industrial activities that cannot reasonably have acoustic enclosures are container handling facilities, ship and boat maintenance and repair operations, truck terminals, salvage, scrap and junk storage, concrete batch plants and large saw mills. Table 7 presents the noise measurement data obtained at an existing container handling facility (Reference 8). During a 25 minute period, maximum noise levels of 72 to 80 dBA generated by trucks and forklifts were measured at a distance of about 100 to 150'.

Because of the favorable climate in Hawaii, many industrial buildings here are open or are naturally ventilated, whereas the same businesses on the mainland would have to be closed for heating or cooling purposes. Thus, noise can readily escape from typical Hawaiian industrial buildings unless they are either air conditioned or mechanically ventilated. Examples of activities which may be enclosed for noise containment in a mechanically ventilated or air conditioned building are: fabricating establishments, light manufacturing, processing, and packaging establishments, publishing plants, repair establishments, etc. Simple walls of metal decking or plywood panels would provide adequate noise containment. The major cost is the installation and operation of the air conditioning or mechanical ventilation systems, not heavy sound retardant building elements, e.g. walls, windows, doors, etc.

One of the most effective ways to minimize potential noise impact is compatible placement of future businesses within the project site, for example, by creating a buffer zone between the more noise sensitive areas (e.g. businesses with large amounts of office space) and the proposed intensive industrial areas. This can b achieved by separating the two types of activities as far as possible, and by using the intervening spaces for less intensive uses (e.g., light industry, warehousing, etc.).

As noted earlier, it is understood that certain portions of the existing agricultural land adjacent to the northern and western boundaries of the project site will be rezoned for low and medium density apartments and park areas. Any potential noise impact can be minimized by placing intensive industrial areas and any other noise-generating activities which could operate at night well away from the northern property line. The proper placement of buildings that would themselves cause minimal noise impact (e.g., light warehouses or commercial buildings with no nighttime activities) to act as noise barrier to the rest of the project site, would significantly reduce the potential noise impact at these future noise sensitive areas.

B. Traffic Noise -- The FHWA Noise prediction Model has been calibrated using the measured data. This calibrated model was then used along with the traffic data provided in Reference 9 to estimate the future noise levels with and without the project.

It is understood that a new access road will be provided between the site and Farrington Highway to the north. Although its location has not yet been defined, it may pass the future noise sensitive areas to the north of the project site close enough such that there could be a significant noise impact. Noise levels at various distances from the access road have been calculated and the results are provided in Figure 16. These calculations are based on the assumption that similar traffic conditions would exist on the new access road as on Kalaeloa Boulevard. As can be seen in the figure, the peak hour average noise level would be 65 dBA at distances ranging from about 450' to 1300', depending on the topography type ("hard" or "soft" surface). More precise noise levels can be calculated in the future when relevant information (exact location of the access road and the noise sensitive areas, traffic and topography conditions which control the noise levels, etc.) is made available. Possible mitigation measures, if needed (based on EPA and HUD noise regulations), would include construction of noise barriers (berms, walls, etc.), air-conditioning the future residences, providing sufficient setback distances and proper orientation of the buildings to minimize noise intrusion.

The referenced traffic study indicates that the future traffic volumes on Kalaeloa Boulevard and on Malakole Road will be <u>less</u> with the project compared to those without the project, due to the proposed new access road parallel to Kalaeloa Boulevard alleviating the traffic load on Kalaeloa and also on Malakole Road. The results of the traffic noise analyses are summarized in Table 8. As can be seen in the table, the future traffic noise levels on Kalaeloa and Malakole with the project are less than those without the project by about 3 to 4 dB. Therefore, the project generated traffic should not, by itself, cause any significant noise impact along both Kalaeloa and Malakole. These comparisons are based on the assumption that the future conditions which control the noise levels (hourly traffic distribution, average operating speed, vehicle type mix, topography between source and receiver) do not significantly change.

C. <u>Potential Impact Due to Aircraft, Traffic, and Existing Industrial, Agricultural and Raceway Activities</u> -- The aircraft generated Ldn (due to both HIA and NASBP) is less than 65 dB throughout the project site and well within the 70 dB Ldn guideline for clear acceptability for commercial/industrial areas. The existing industrial and agricultural activities are not expected to contribute significantly to the future overall Ldn level. It should, nevertheless, be noted that there may be individual events which generate noise levels which may cause some short-term disruptions. Such events are: loud military aircraft flyovers (KC-135, F-15, low flying SH-3 helicopters) and occasional sugar cane operations. However, their overall noise impact is not considered to be significant due to the short durations involved.

As stated earlier, the existing raceway is used on Saturdays until about 10 to 11 pm. Thus, there should not be any significant noise impact at the proposed project buildings and the existing commercial/industrial areas, although raceway noise may be audible within those buildings conducting business on Saturdays. The nearest portion of the possible future residential and park areas, immediately north of the project site, is located at a distance of about 5000' from the raceway. These future noise sensitive areas will also be at a higher elevation than the raceway (i.e., similar to Nanakai Gardens) and occupants of these areas may also experience some disturbance due to noise from raceway events. It is likely that noise levels at the raceway property line would exceed the appropriate DOH noise limits. Therefore, if the existing noise complaints persists and/or new complaints arise from the future noise sensitive areas, implementation of noise mitigation measures would be needed. These measures could include relocating the raceway or restricting any nighttime racing activities.

D. <u>Construction Noise</u> -- Development of the project site will involve grubbing, grading, and the construction of infrastructure and buildings. The various construction phases of a development project may generate significant amounts of noise; the actual amounts are dependent upon the methods employed during each stage of the process. Typical construction equipment noise ranges in dB(A) are shown on Figure 17. Jack hammers and pile drivers will probably be the loudest equipment used during construction activities.

Currently there are no noise sensitive areas in the immediate vicinity of the project site. However, it is possible that some portions of the project construction may occur after the completion of the previously discussed noise sensitive areas to the north of the project site. In cases where construction noise exceeds, or is expected to exceed, the DOH's "allowable" limits (see Table 1) at the northern property line (i.e., due to construction activity occurring in the vicinity of this property line), 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 a.m. and after 6:00 p.m. of the same day."

> "No permit shall allow construction activities which emit noise in excess of ninety-five dB(A)... except between 9:00 a.m. and 5:30 p.m. 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 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 level requirements defined in Reference 3.

Another possible scenario exists whereby construction noise may impact the already occupied businesses within the project. Assuming that most noise sensitive buildings are already air-conditioned or otherwise sound treated, such cases should not cause a significant impact, except for particularly loud construction activities (e.g., jack hammers, pile drivers, etc.) occurring directly adjacent to the noise sensitive land uses. A construction noise permit may be obtained in these cases.

Sincerely,

Ronald A. Darby, P.E.
President

Mike S. Lee
Senior Consultant

MSL;RAD:msl

REFERENCES

1. "Chapter 43 - Community Noise Control for Oahu", Department of Health, State of Hawaii, Administrative Rules, Title 11, November 6, 1981.

2. "Section 3.100, Noise Regulations", Land Use Ordinance, City and County of Honolulu, October 22, 1986.

3. "Chapter 42 - Vehicular Noise Control for Oahu", Department of Health, State of Hawaii, Administrative Rules, Title 11, November 6, 1981.

4. "FHWA Highway Traffic Noise Prediction Model", Federal Highway Administration, December, 1978

5. Existing (1987) and Future (1992) Ldn Noise Exposure Map, Honolulu International Airport Master Plan Update and Noise Compatibility Program, Prepared by KFC Airport, Inc., received on August 3, 1989

6. Naval Air Station Barbers Point Air Installation Compatible use Zone (AICUZ) Noise Contours and Supporting Data, Prepared by Harris Miller Miller & Hanson, Inc., July 1989

7. "Kaka'ako Supplemental Environmental Statement - Acoustic Study", Ebisu, Darby-Ebisu & Associates, August 20, 1984.

8. "Honolulu Waterfront Masterplan, Technical Series - Acoustic Study", Darby & Associates, February, 1989.

9. Draft Traffic Study for the subject project, prepared by Pacific Planning & Engineering, received on November 6, 1989.

APPLICABLE NOISE CRITERIA AND GUIDELINES FROM FEDERAL AGENCIES AND STANDARDS ORGANIZATIONS

1. "Noise Control and Compatibility Planning for Airports", Federal Aviation Administration, August 5, 1983.

2. Guidelines for Considering Noise in Land Use Planning and Control, Federal Interagency Committee on Urban Noise, June 1980.

3. "Environmental Protection-Planning in the Noise Environment", Department of the Air Force, the Army, and the Navy, June 15, 1978.

4. American National Standard for Sound Level Descriptors for Determination of Compatible Land Use, American National Standards, ANSI S3.23-1980, May 30, 1980.

5. "HUD Environmental Criteria and Standards, 24 CFR Part 51, "Federal Register, Volume 44, No. 135, July 12, 1979' amended 49 FR 880, January 6, 1984.

TABLE 1. ALLOWABLE NOISE LEVELS FOR VARIOUS ZONING DISCTRICTS
COMMUNITY NOISE CONTROL FOR OAHU
STATE OF HAWAII, DEPARTMENT OF HEALTH

NOTE: THE REGULATION STATES THAT THE ALLOWABLE LEVELS SHALL NOT BE EXCEEDED FOR TEN PERCENT OF THE TIME WITHIN ANY TWENTY MINUTE PERIOD

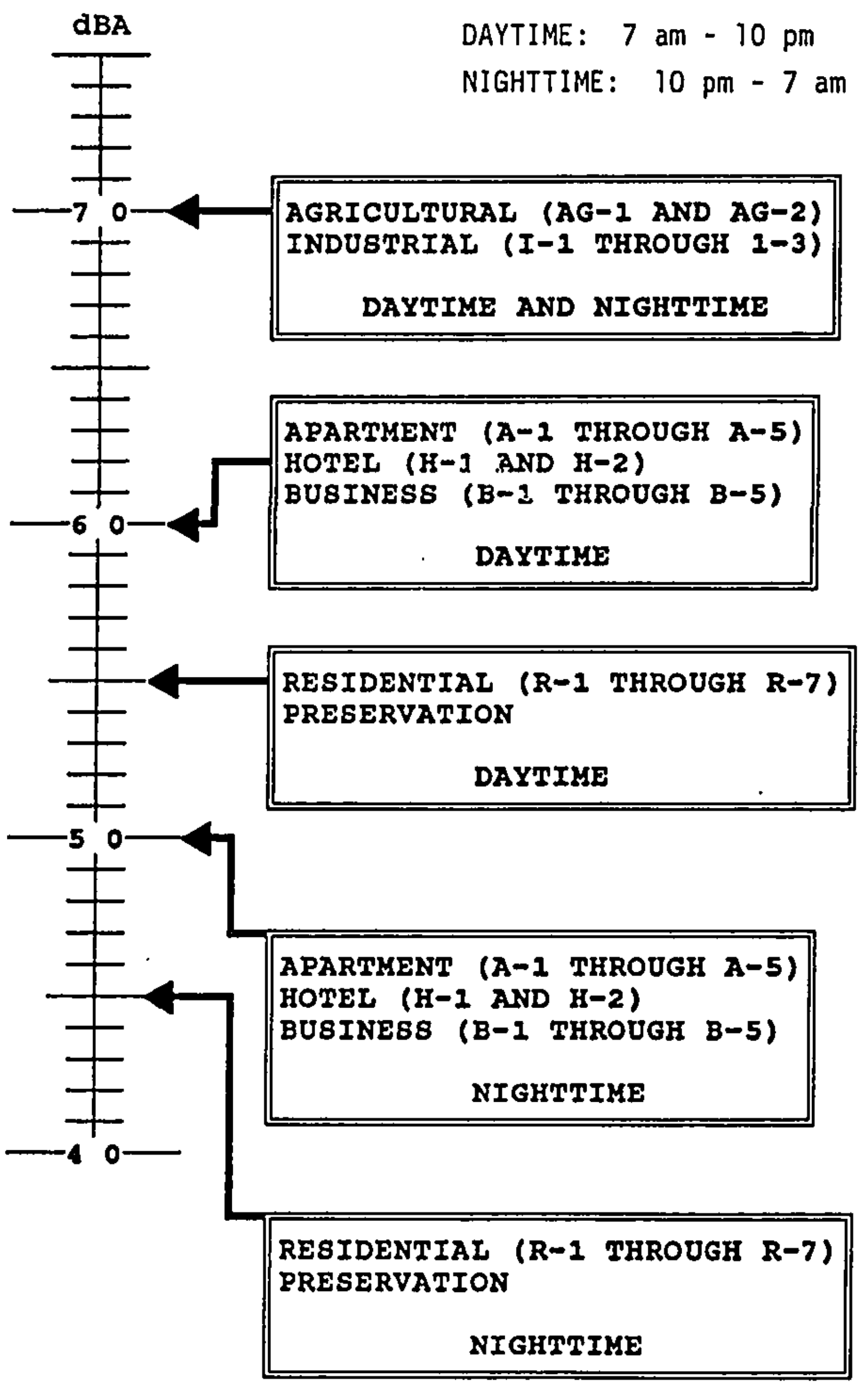

TABLE 2 MAXIMUM ALLOWABLE NOISE LEVELS VS OCTAVE BAND CENTER FREQUENCIES
CITY AND COUNTY OF HONOLULU LAND USE ORDINANCE

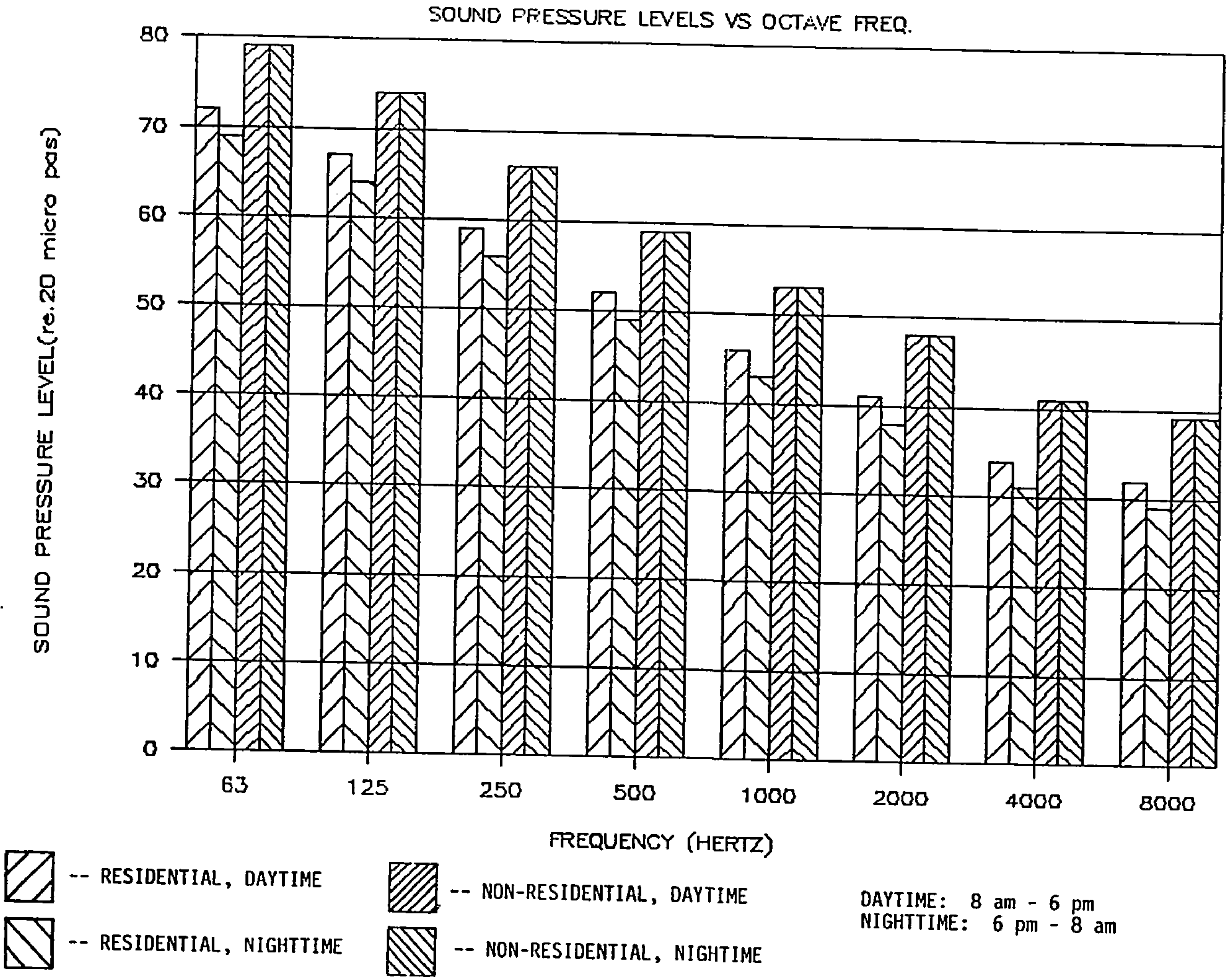

TABLE 3 VEHICULAR NOISE CONTROL FOR OAHU
STATE OF HAWAII, DEPARTMENT OF HEALTH

Noise Level Limits for Light Vehicles

Posted Speed Limit	Measurement Distance		
	20 ft.	25 ft.	50 ft.
25 mph or less	77 dBA	75 dBA	69 dBA
30	79	77	71
35	81	79	73
40	83	81	75
45	85	83	77
50	87	85	79
55	89	87	81
60 mph or more	91	89	83

[Eff. NOV 6 198[illegible]] (Auth: HRS §§342-3, 342-42)
(Imp: HRS §342-42)

Noise Level Limits for Heavy Vehicles

Posted Speed Limit	Time Periods When Applicable	Measurement Distance		
		20 ft.	25 ft.	50 ft.
35 mph or less	Day-time	92 dBA	90 dBA	84 dBA
	Evening	92	90	84
	Night Holiday Sunday	81	79	73
More than 35 mph	All	92	90	84
Truck routes	All	96	94	88

[Eff NOV 6 198[illegible]] (Auth: HRS §§342-3, 342-42)
(Imp: HRS §342-42)

TABLE 4 RESULTS OF THE NOISE MEASUREMENTS IN THE VICINITY OF THE EXISTING INDUSTRIAL AREAS

LOCATION NUMBER *	MEASMT. DATE	MEASMT. TIME	MEASURED LEVELS Leq (dBA)	HIGH (dBA)	LOW (dBA)	NOISE SOURCE
5	9-18-89	14:20-14:35	57.6	64.0	51.3	HAWAIIAN DREDGING & CONSTRUCTION CO- PRECAST DIV.
7	9-18-89	12:35-12:45	60.0	64.0	57.5	CHEVRON USA

* -- REFER TO FIGURE 3 FOR THE LOCATION OF THESE MEASUREMENT POSITIONS.

TABLE 5 SUMMARY OF MEASURED WORKPLACE SOUND LEVELS

Business Establishment (Measurement Location)	Background Ambient Noise Level	Transient Noise Sources	
Auto Body Repair & Paint Shop (At Doorway)	71	Air Compressor: Grinding: Hammering:	78 dB 85 dB 75 dB
Tire Repair (Outside Entrance)	57	PA System: Pneumatic Wrench: Pneumatic Jack: Hammering:	80 dB 75 dB 72 dB 70 dB
Golf Club Manufacturing (At Doorway)	61	Grinding: Spray Painting: Hammering:	70 dB 68 dB 74 dB
Spray Paint Shop (At Doorway)	61	Air Gun:	74 dB
Upholstery Shop (At Doorway)	55	Stapler: Sewing Machine:	67 dB 63 dB
Auto Repair Shop Below Parking Deck (30 FT from Entrance)	62	Pneumatic Wrench: Hammering:	74 dB 72 dB
Auto Body Repair Shop (Outside and 8' from Entrance)	58	Hammering: PA System: Grinding:	74 dB 75 dB 65 dB
Warehouse (Outside on Sidewalk)	60	Container Loading:	75 dB

TABLE 6 RANGE OF INDUSTRIAL MACHINERY/EQUIPMENT SOUND LEVELS AT THE OPERATOR'S POSITION

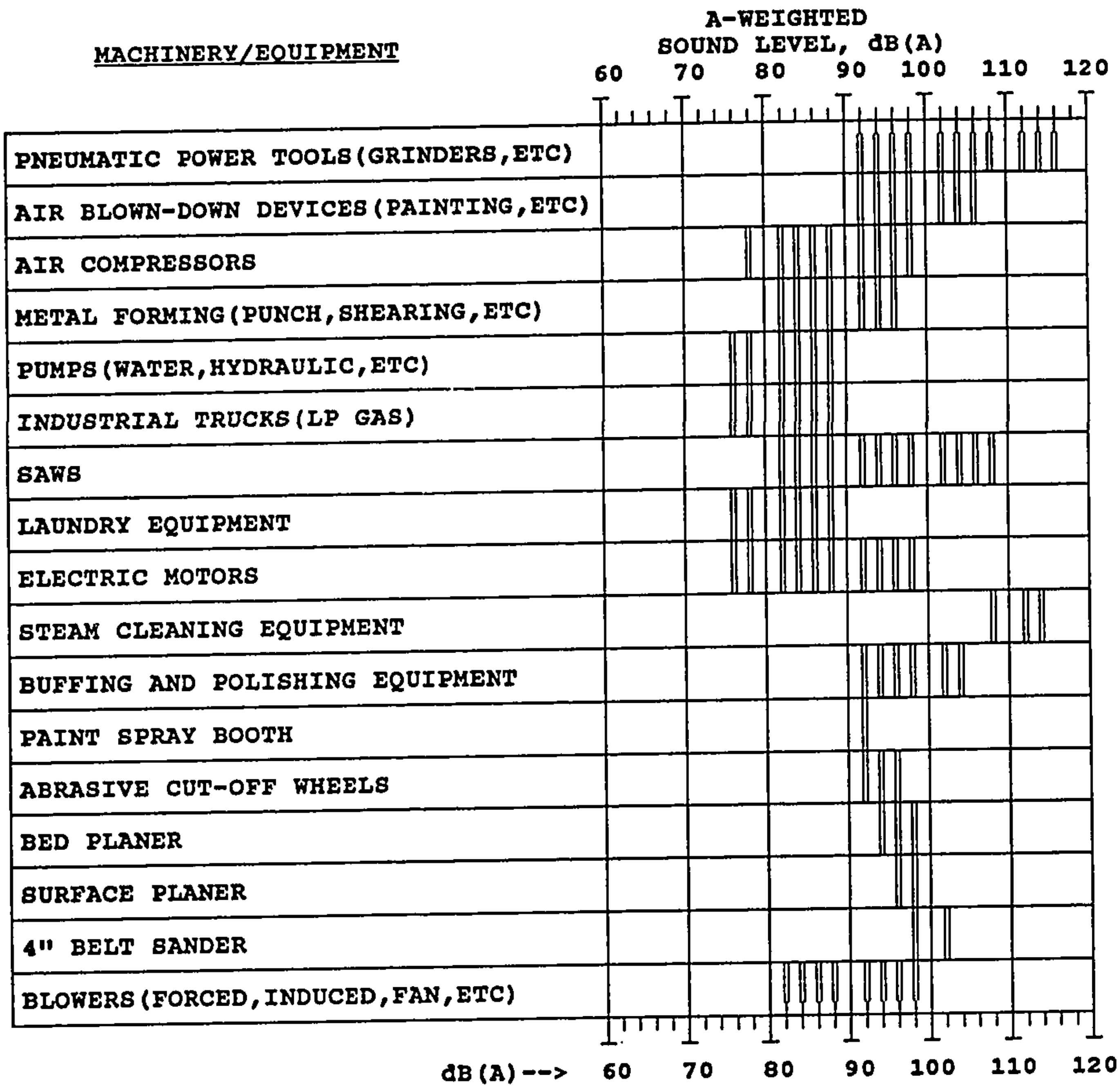

TABLE 7 SUMMARY OF MEASURED NOISE LEVELS ON AUGUST 30, 1988 AT FORT ARMSTRONG CONTAINER HANDLING FACILITY

Activity	(approx. feet) Distance to Source	dBA Maximum Noise Level
Incoming & Outgoing Trucks	100'	70-78
Loading & Unloading by Forklift	150'	72-78
Reverse Beep Alarm from Forklift	150'	72-76
Heavy Forklift	100'	73-80
Aircraft Flyover	-	70-74

TABLE 8. SUMMARY OF RELATIVE CHANGES IN TRAFFIC NOISE LEVELS

COMPARISON CASES	KALAELOA	MALAKOLE
EXISTING TO FUTURE WITH PROJECT	+3 TO +4 dB	+5 dB
EXISTING TO FUTURE WITHOUT PROJECT	+6 TO +7 dB	+8 TO +9 dB
FUTURE WITH PROJECT TO FUTURE WITHOUT PROJECT	-3 dB	-3 TO -4 dB

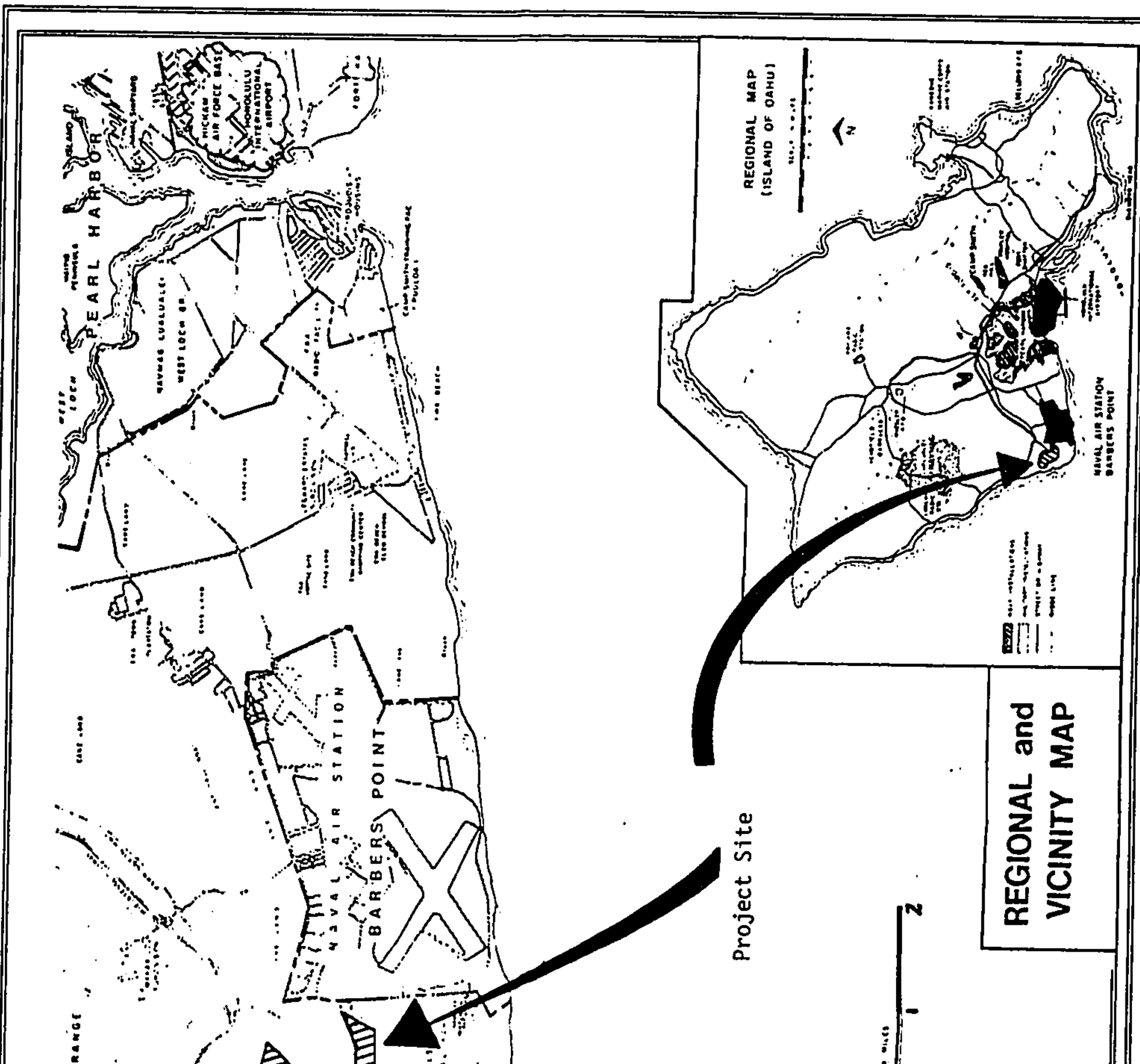

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FIGURE 1. PROJECT VICINITY MAP

AREA	ACRES	PROPOSED DP
1	419.99	Industrial
2	109.[illegible]	Industrial (Maritime)
3	3.60	Industrial (HECO)
4	19.20	Commercial
	552.09	TOTAL PROJECT AREA

EXISTING AND FUTURE (OTHER THAN THE PROJECT) USES

PRES	PRESERVATION
AGR	AGRICULTURE
LDA	LOW DENSITY APARTMENT
MDA	MEDIUM DENSITY APARTMENT
COML	COMMERCIAL
IND	INDUSTRIAL
GC	GOLF COURSE
PF	PUBLIC FACILITIES
PFM	PUBLIC FACILITIES MARINA
PARK	PARK & RECREATION

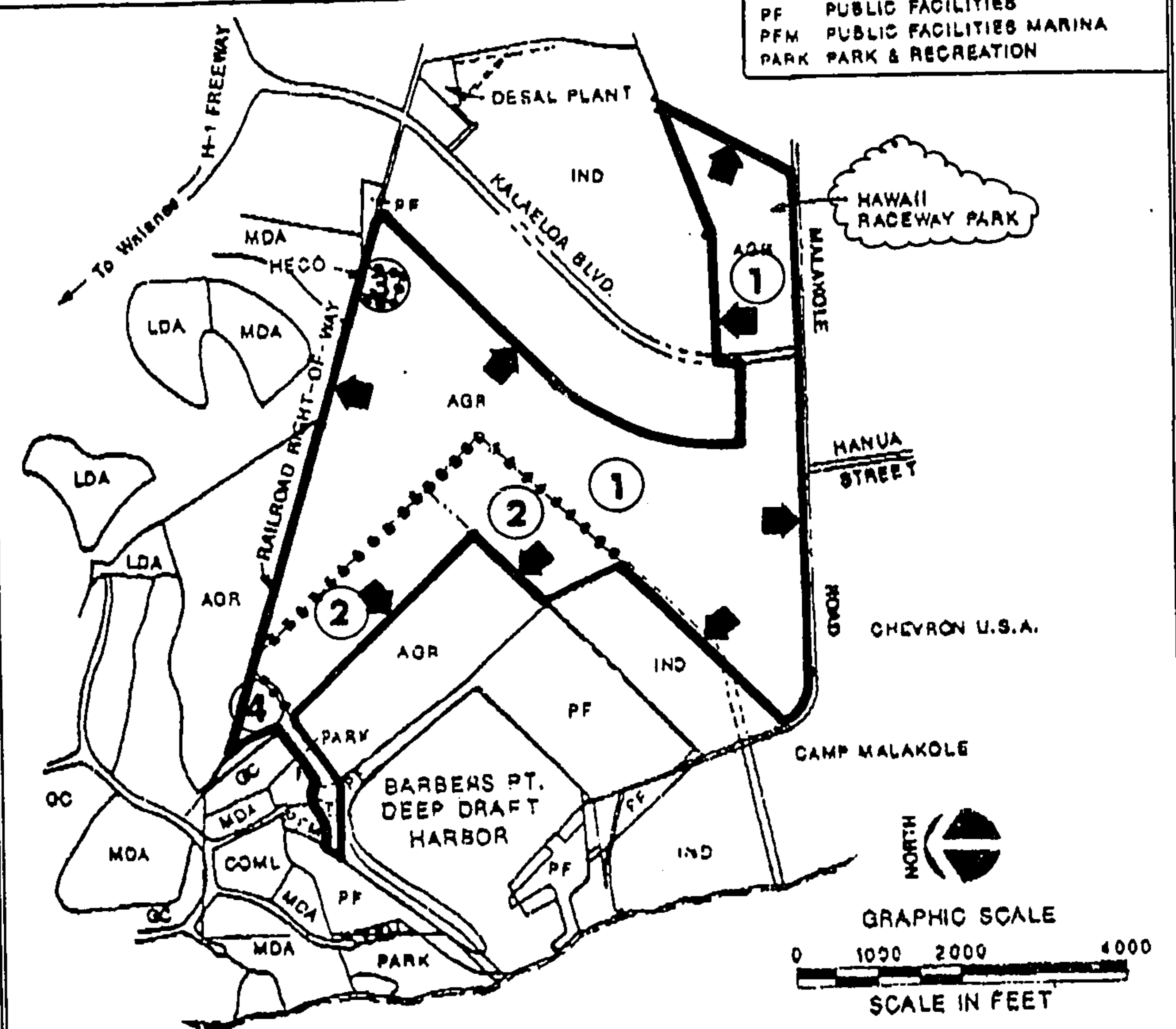

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FIGURE 2. PROJECT SITE PLAN AND ITS SURROUNDINGS

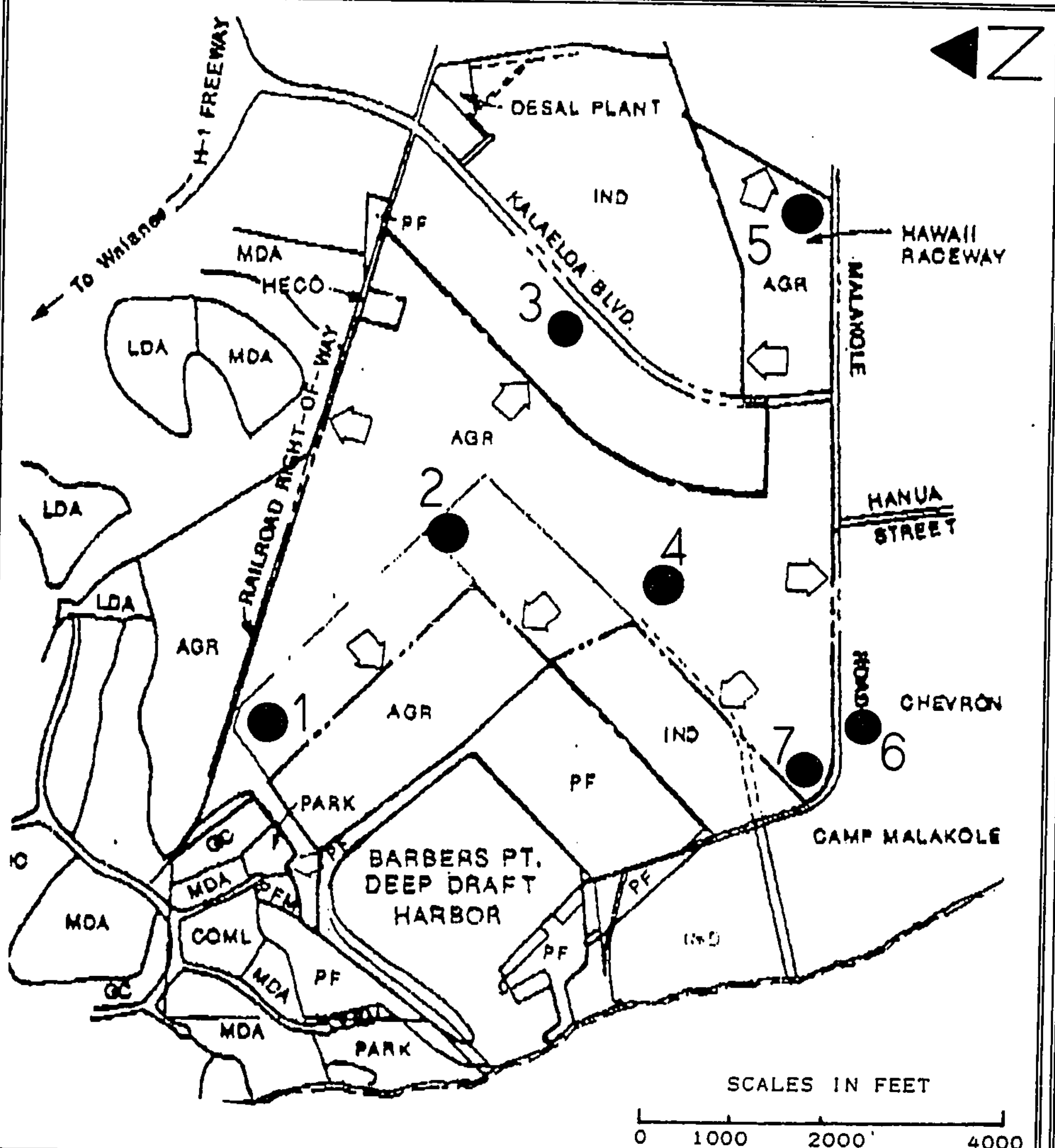

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FIGURE 3. LOCATION OF THE MEASUREMENT POSITIONS

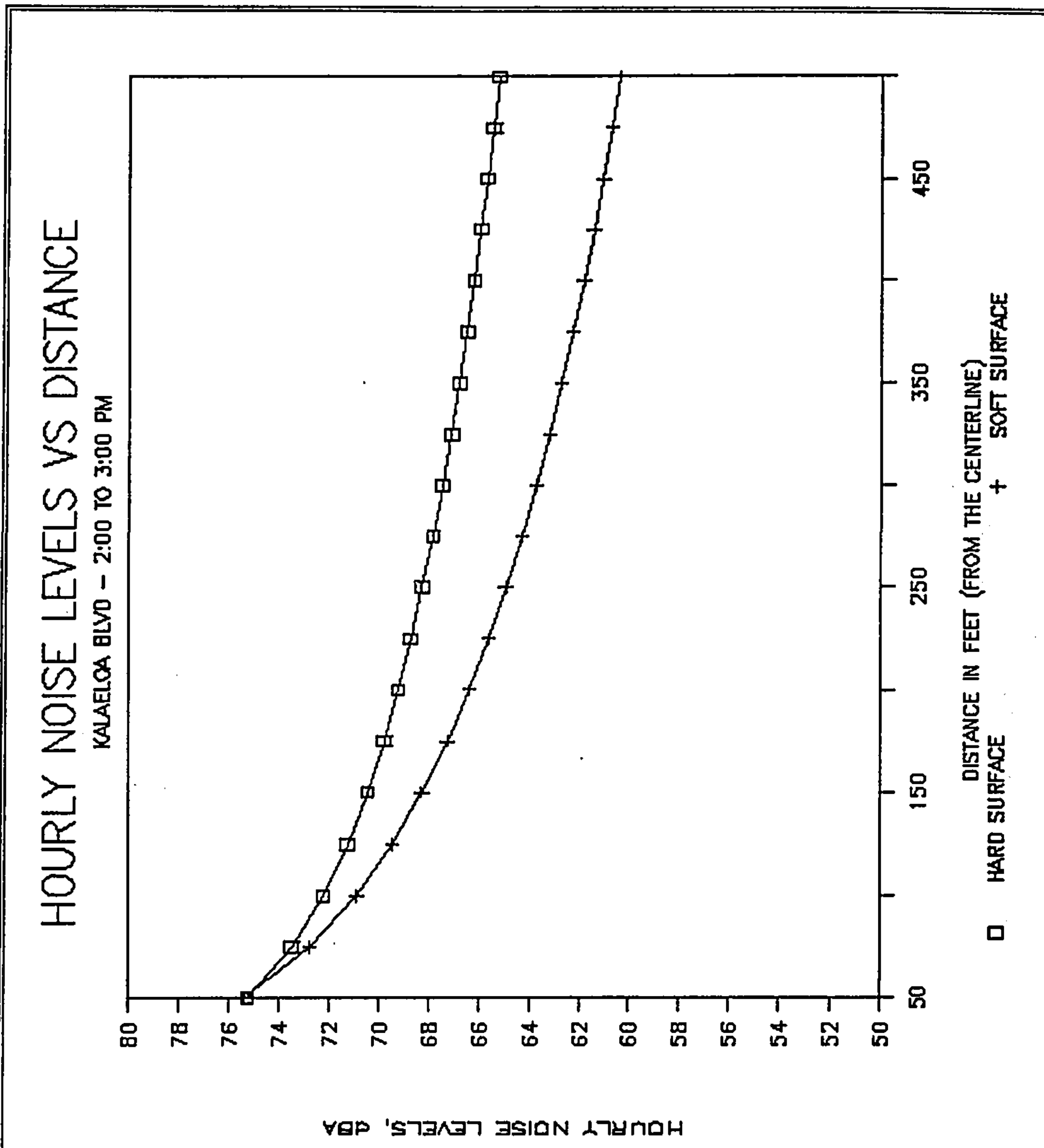

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FIGURE 4. HOURLY NOISE LEVELS VS DISTANCE FROM THE CENTER LINE OF KALAELOA BLVD.

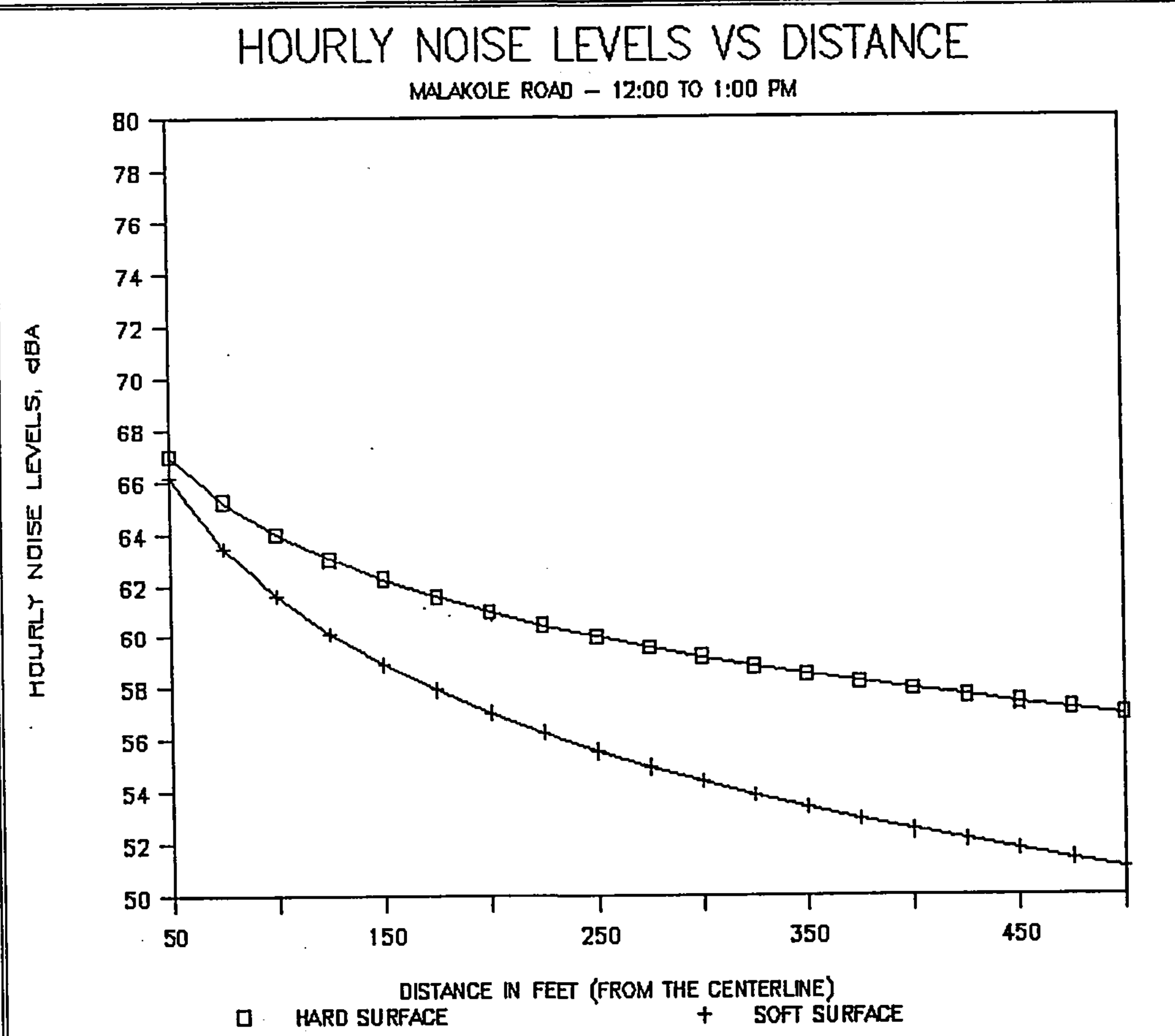

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FIGURE 5. HOURLY NOISE LEVELS VS DISTANCE FROM THE CENTER LINE OF MALAKOLE ROAD.

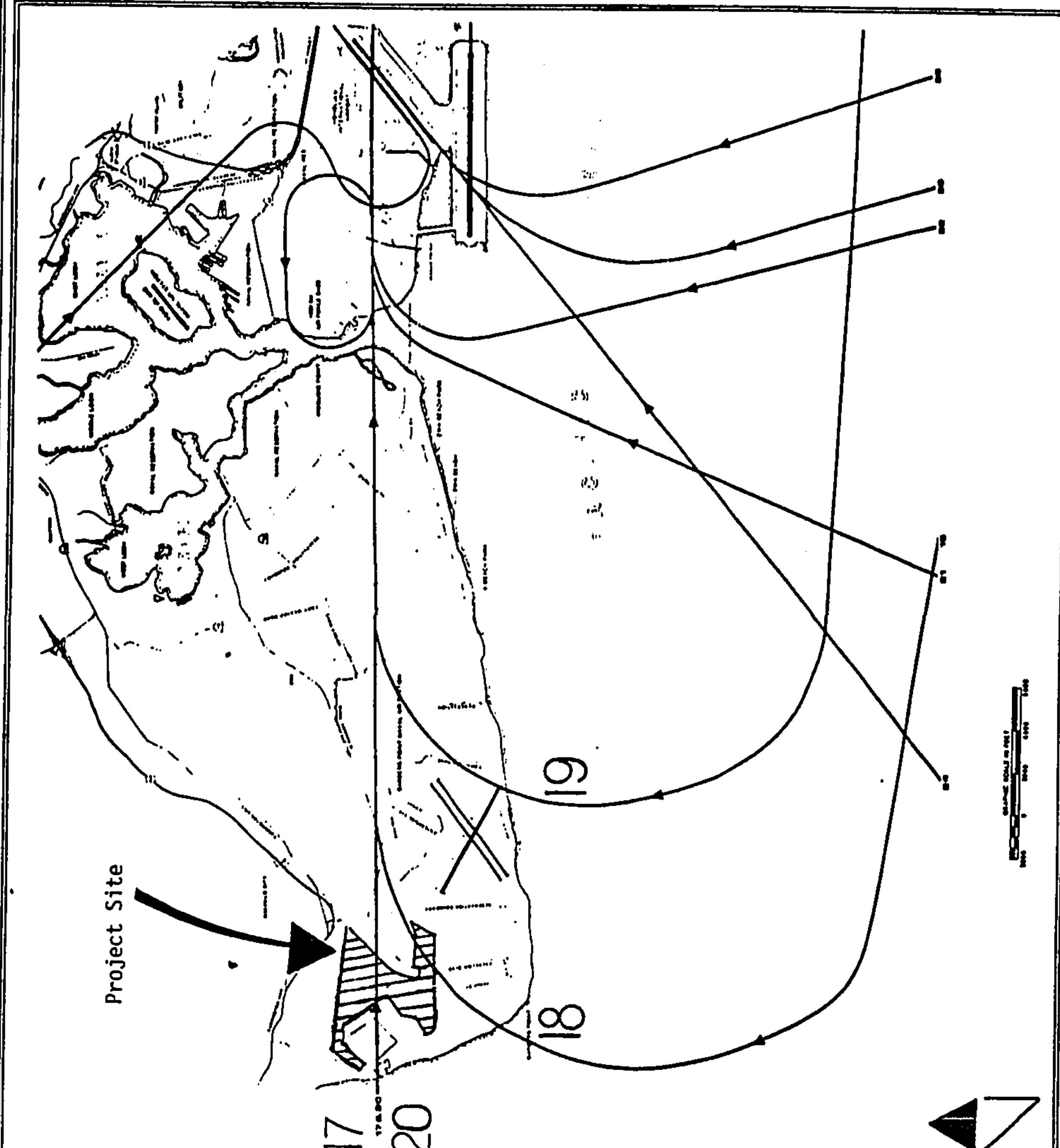

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FIGURE 6. HIA ARRIVAL FLIGHT TRACKS

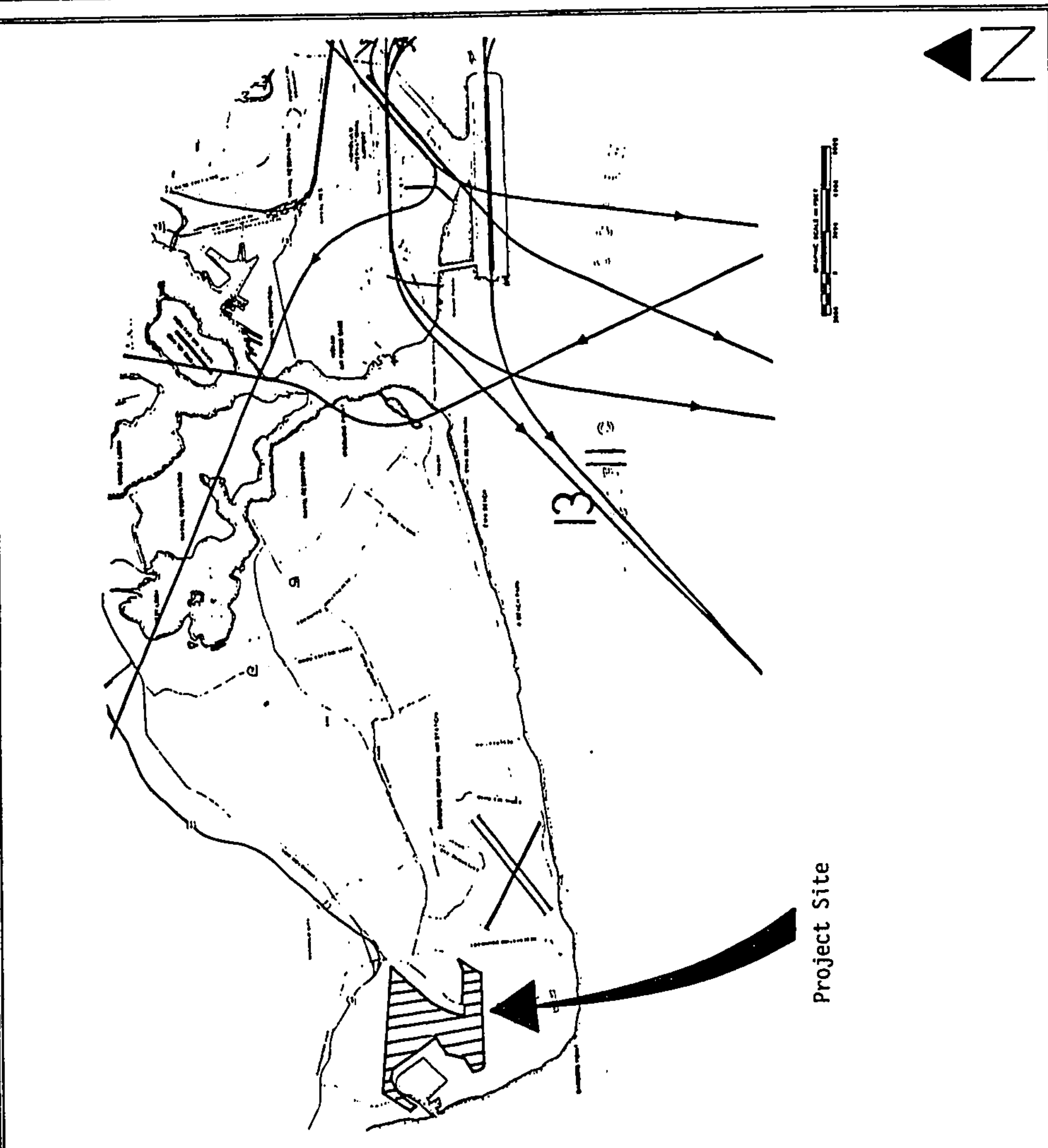

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FIGURE 7. HIA DEPARTURE FLIGHT TRACKS

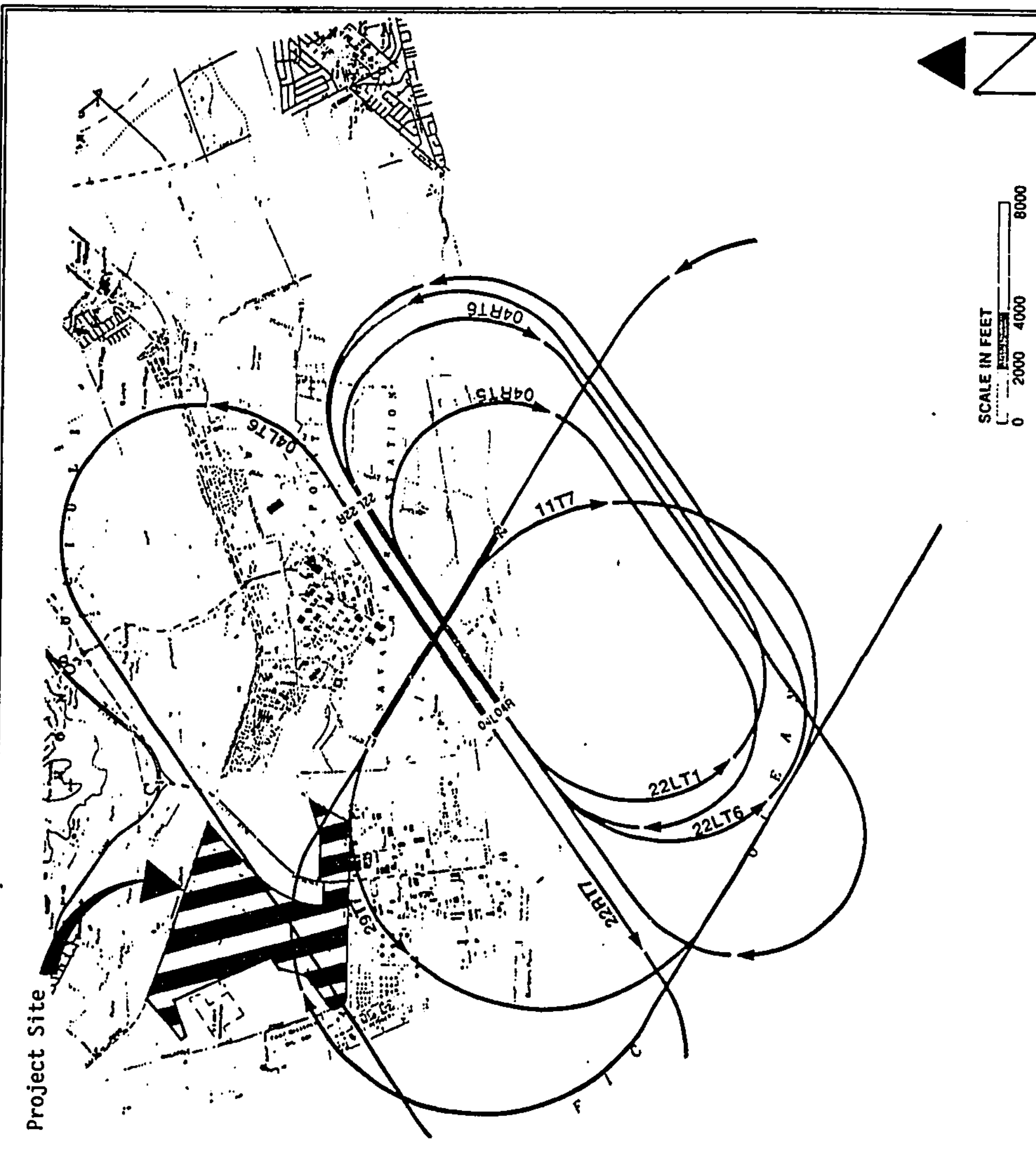

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FIGURE 8. NASBP TOUCH-AND-GO FLIGHT TRACKS

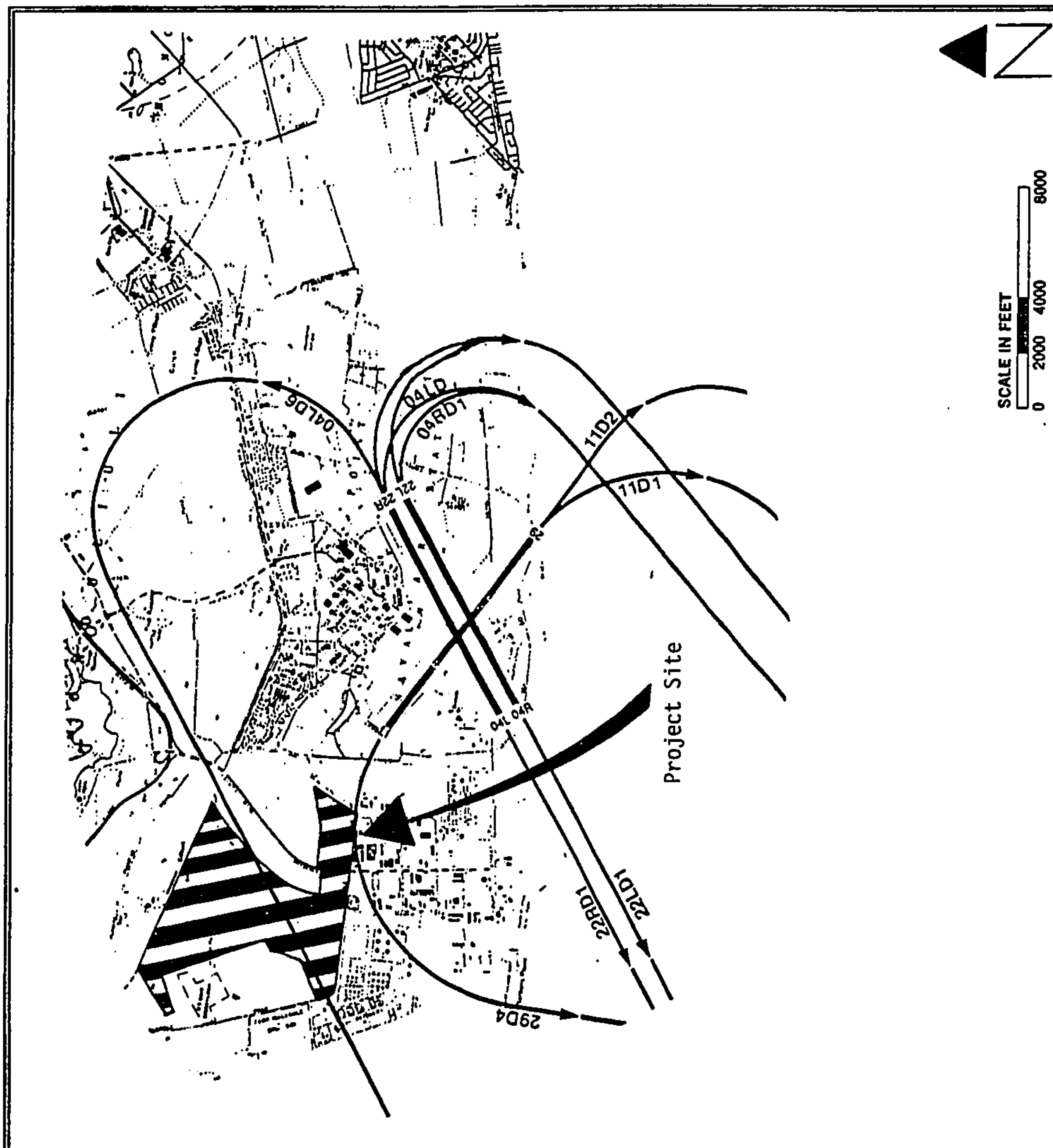

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FIGURE 9. NASBP FIXED WING DEPARTURE FLIGHT TRACKS

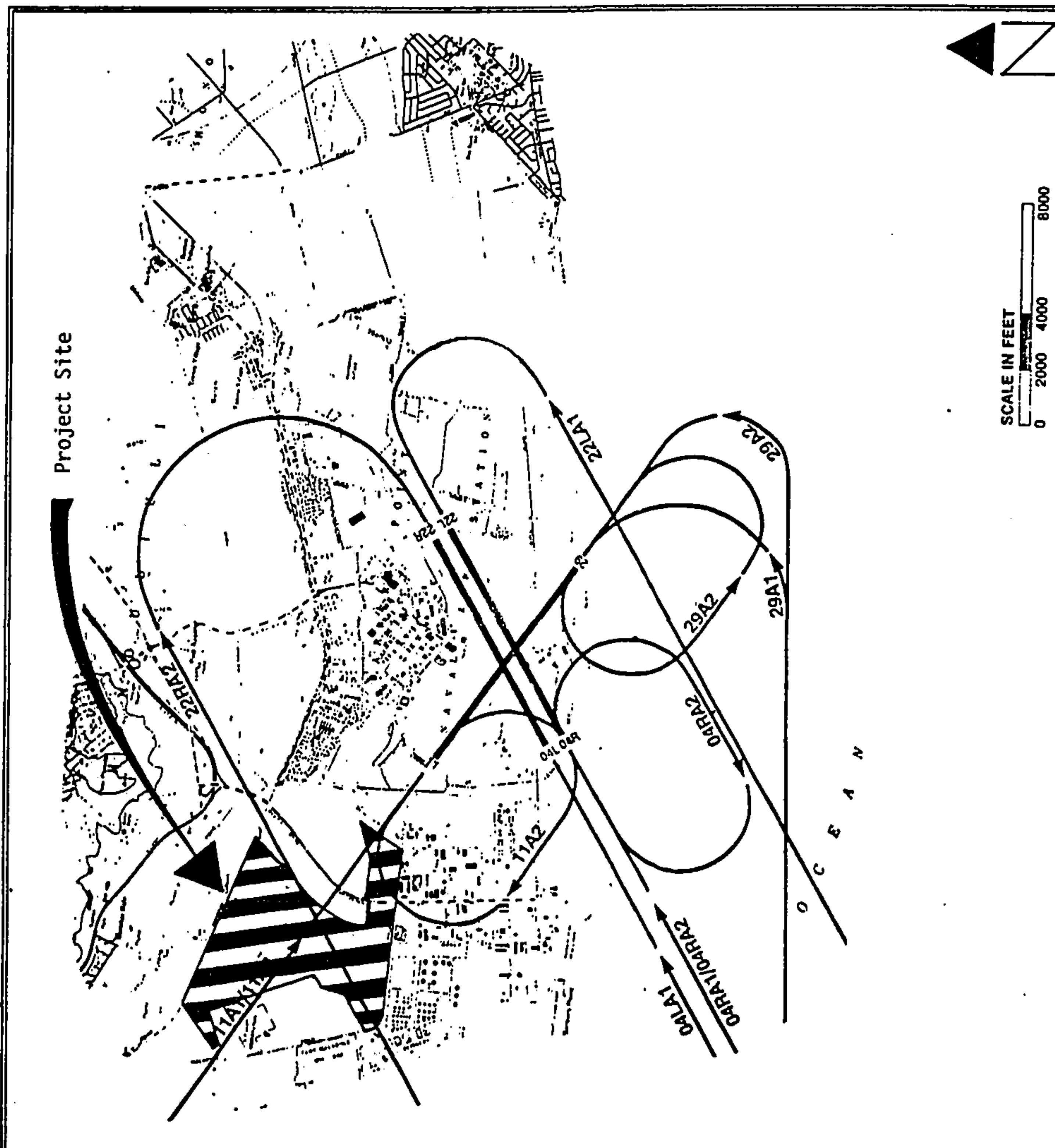

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FIGURE 10. NASBP FIXED WING ARRIVAL FLIGHT TRACKS

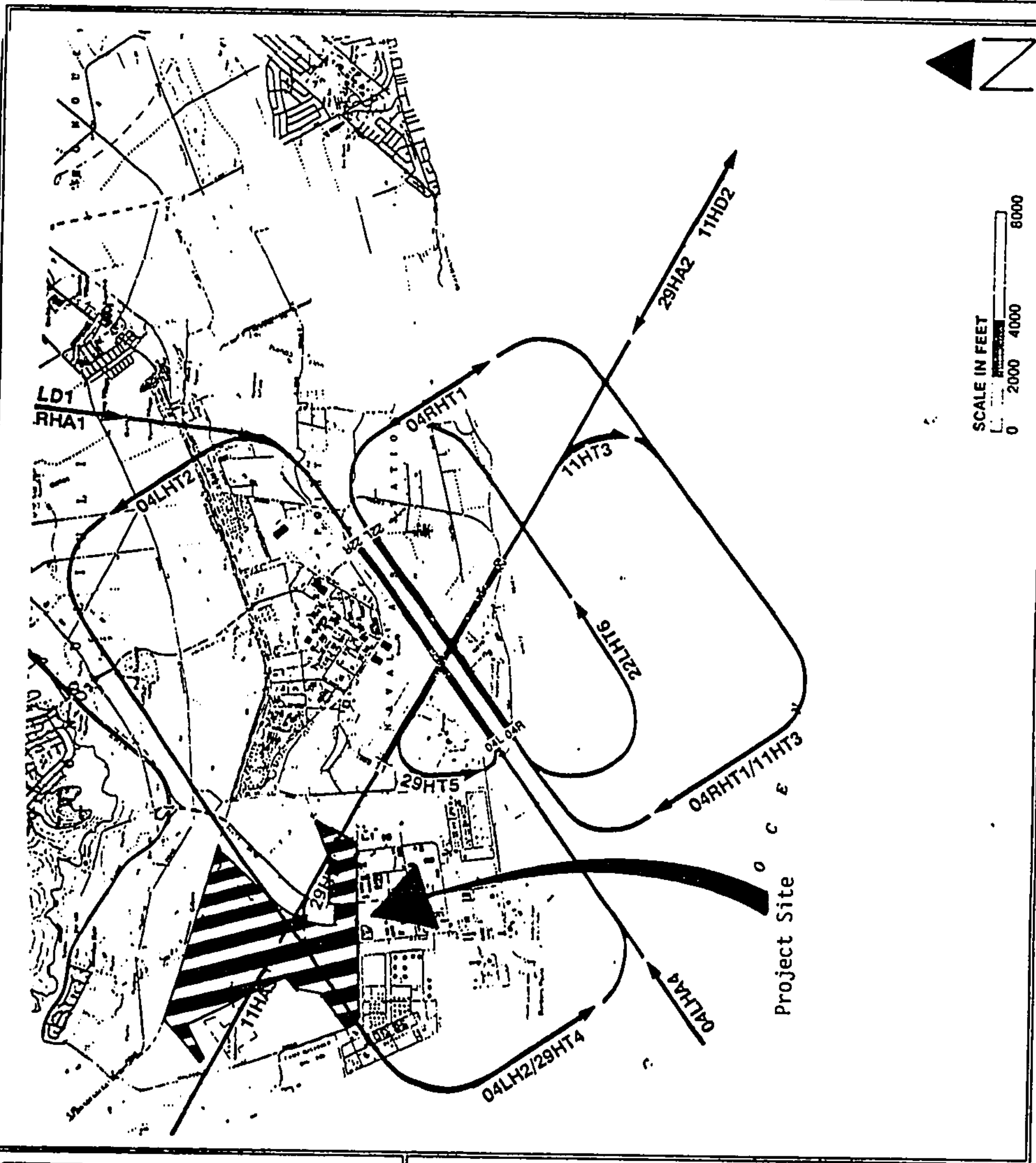

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FIGURE 11. NASBP ROTARY WING FLIGHT TRACKS

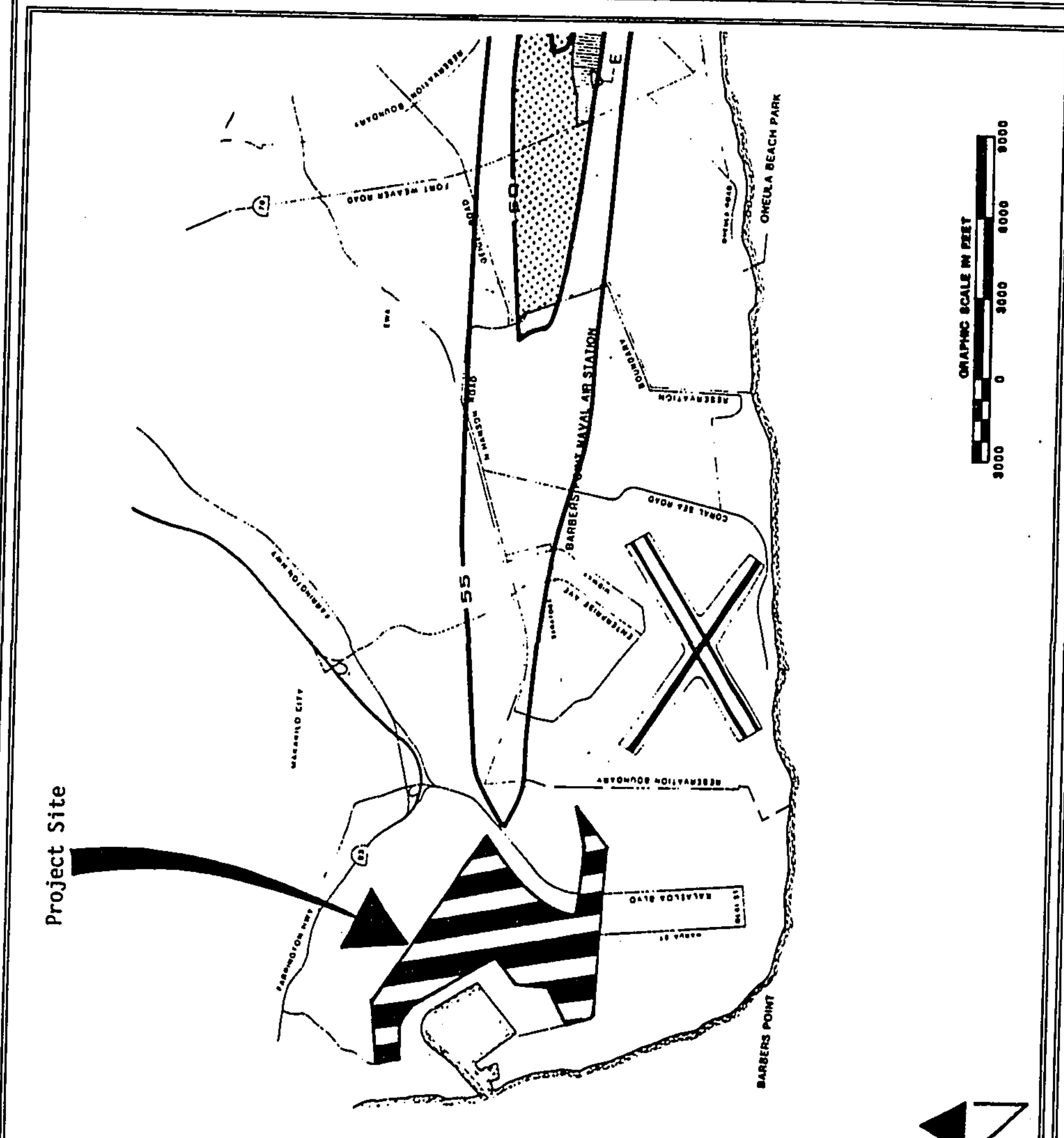

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FIGURE 12. HIA EXISTING (YEAR 1987) Ldn CONTOUR LINES

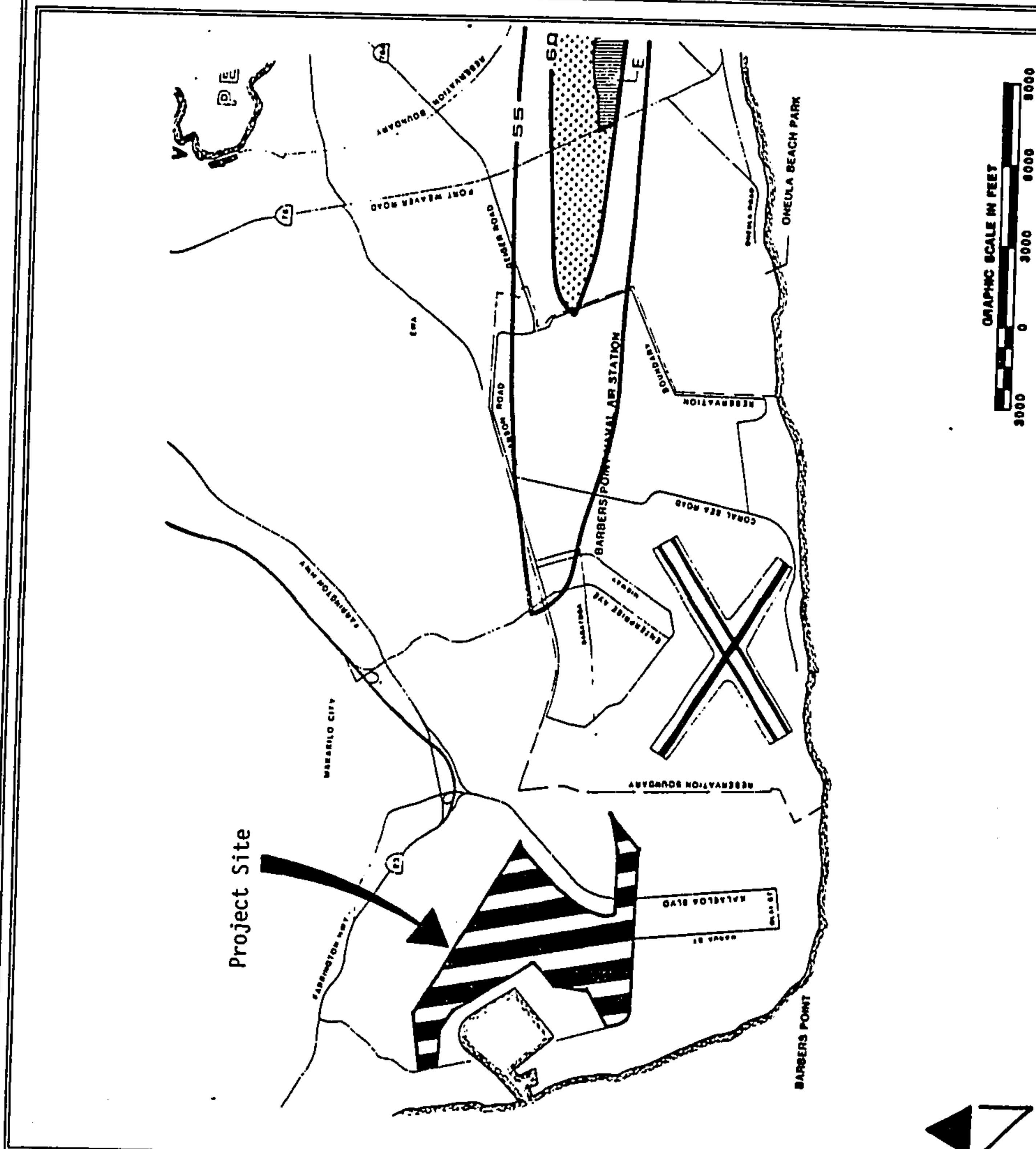

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FIGURE 13. HIA FUTURE
(YEAR 1992) Ldn
CONTOUR LINES

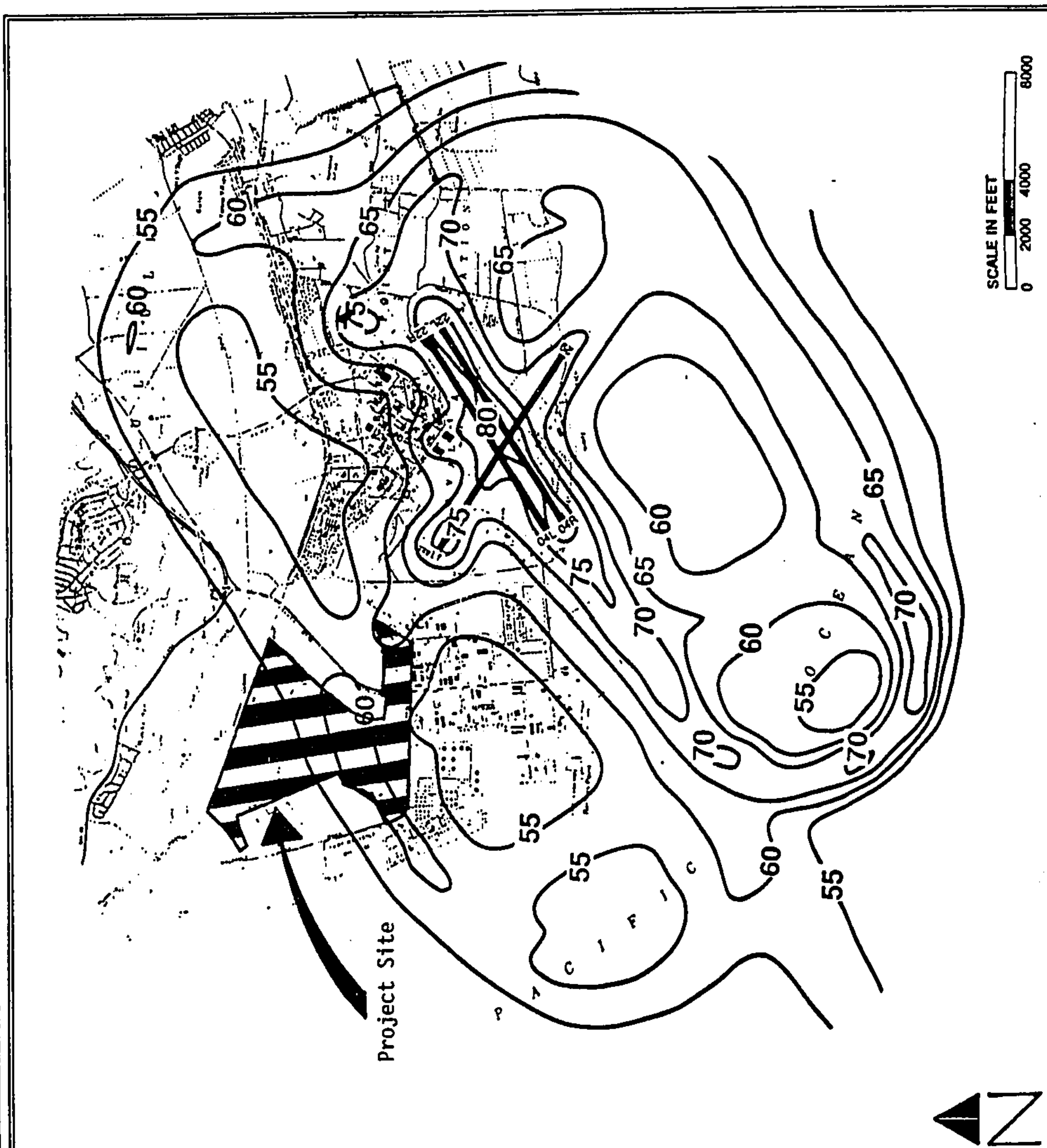

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FIGURE 14. NASBP MEAN YEAR
Ldn CONTOUR LINES

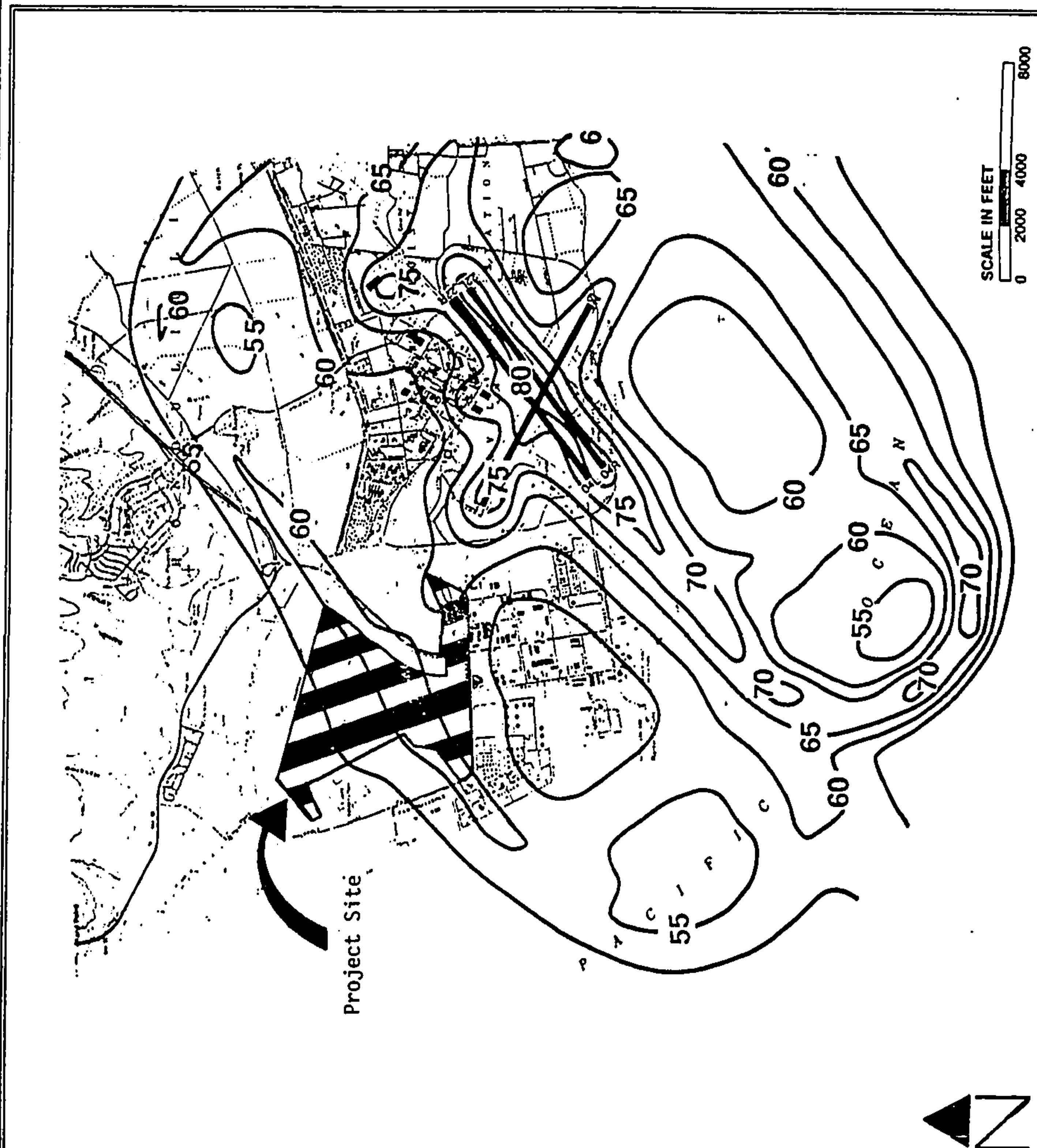

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FIGURE 15. COMBINED (HIA AND NASBP) Ldn CONTOUR LINES

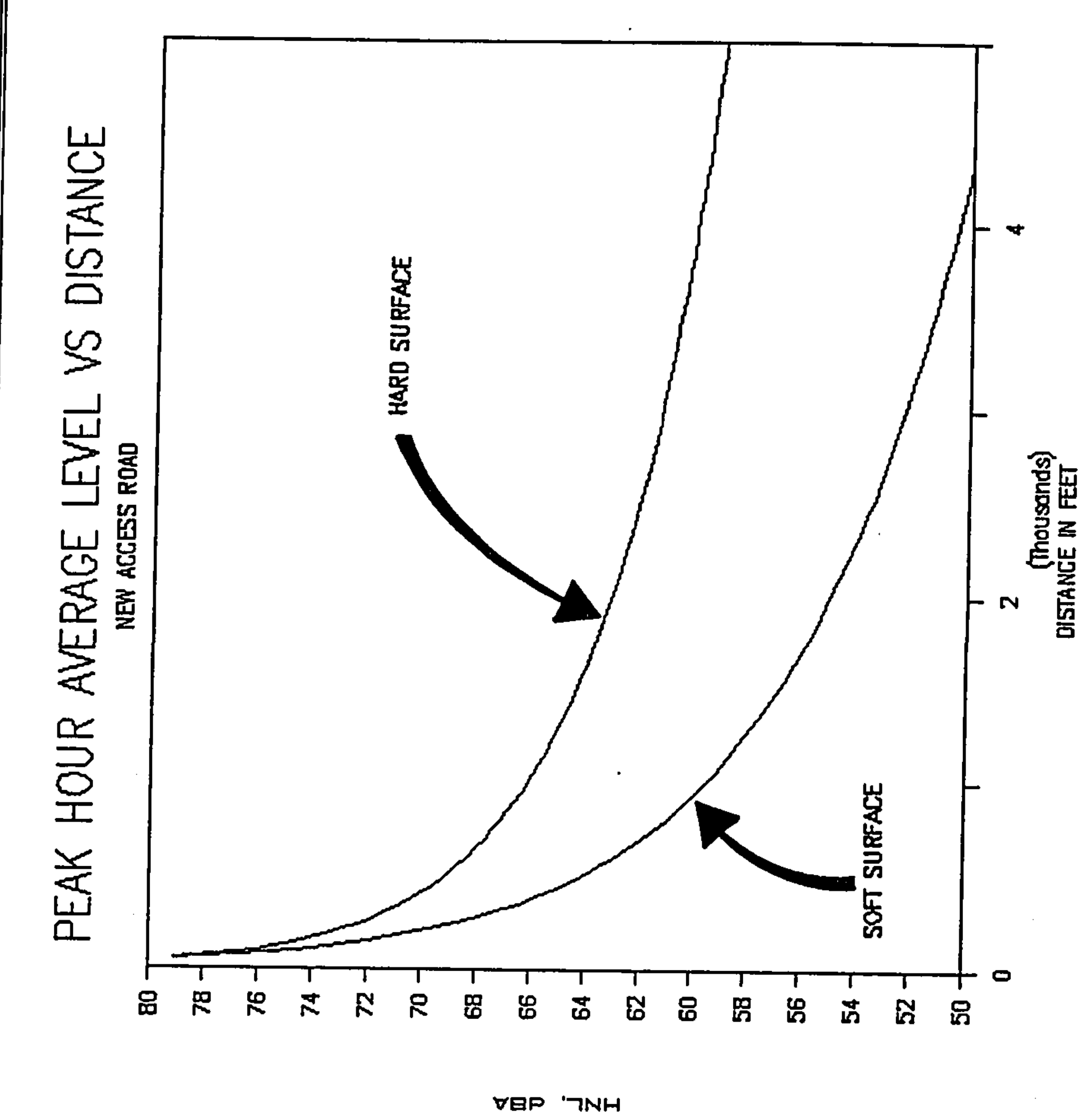

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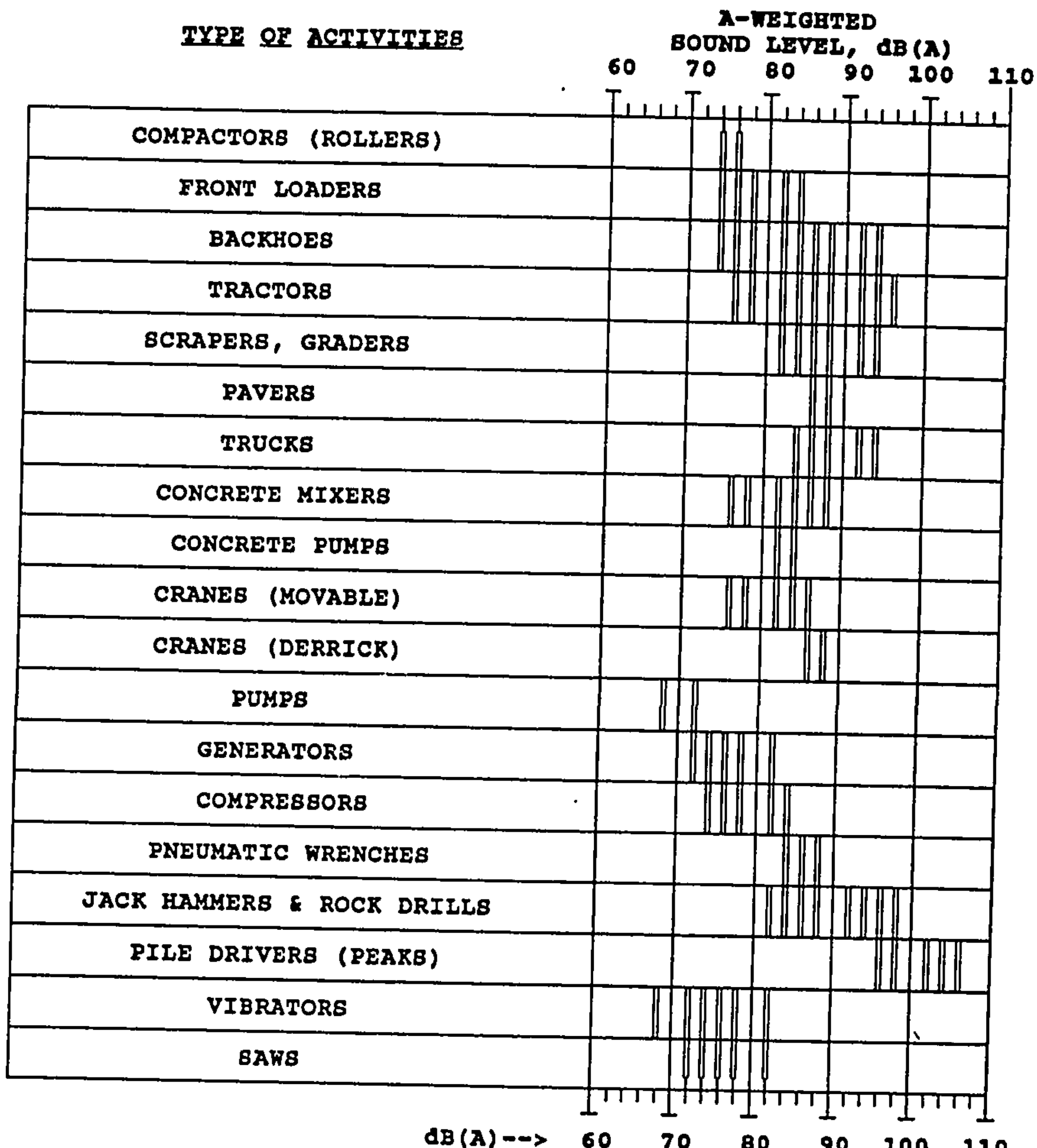
FIGURE 16. PEAK HOUR AVERAGE NOISE LEVELS VS DISTANCE, NEW ACCESS ROAD



CONSTRUCTION EQUIPMENT NOISE RANGES @ 50 FEET
NOTE: BASED ON LIMITED AVAILABLE DATA SAMPLES

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FIGURE 17. CONSTRUCTION EQUIPMENT NOISE RANGES @ 50'

APPENDIX I

DAY-NIGHT AVERAGE SOUND LEVEL

It is recognized that a given level of noise may be more or less tolerable, depending on the duration of exposure experienced by an individual. There are numerous measures of noise exposure which consider not only the A-weighted sound level variation of noise but also include the duration of the disturbance. The United States Environmental Protection Agency (EPA) has adopted a Federal Policy of noise control and acceptable levels of noise exposure. The measure of exposure used by the EPA is the day-night average noise level, Ldn. This measure is essentially an average of the A-weighted sound levels experienced for each 24-hour period. Noise levels occurring during late evening and early morning hours (10:00 pm to 7:00 am) are more annoying and, therefore, are increased by 10 dB(A) and averaged along with the daytime levels.

A comparative description of outdoor Ldn values is provided in Figure I-1.

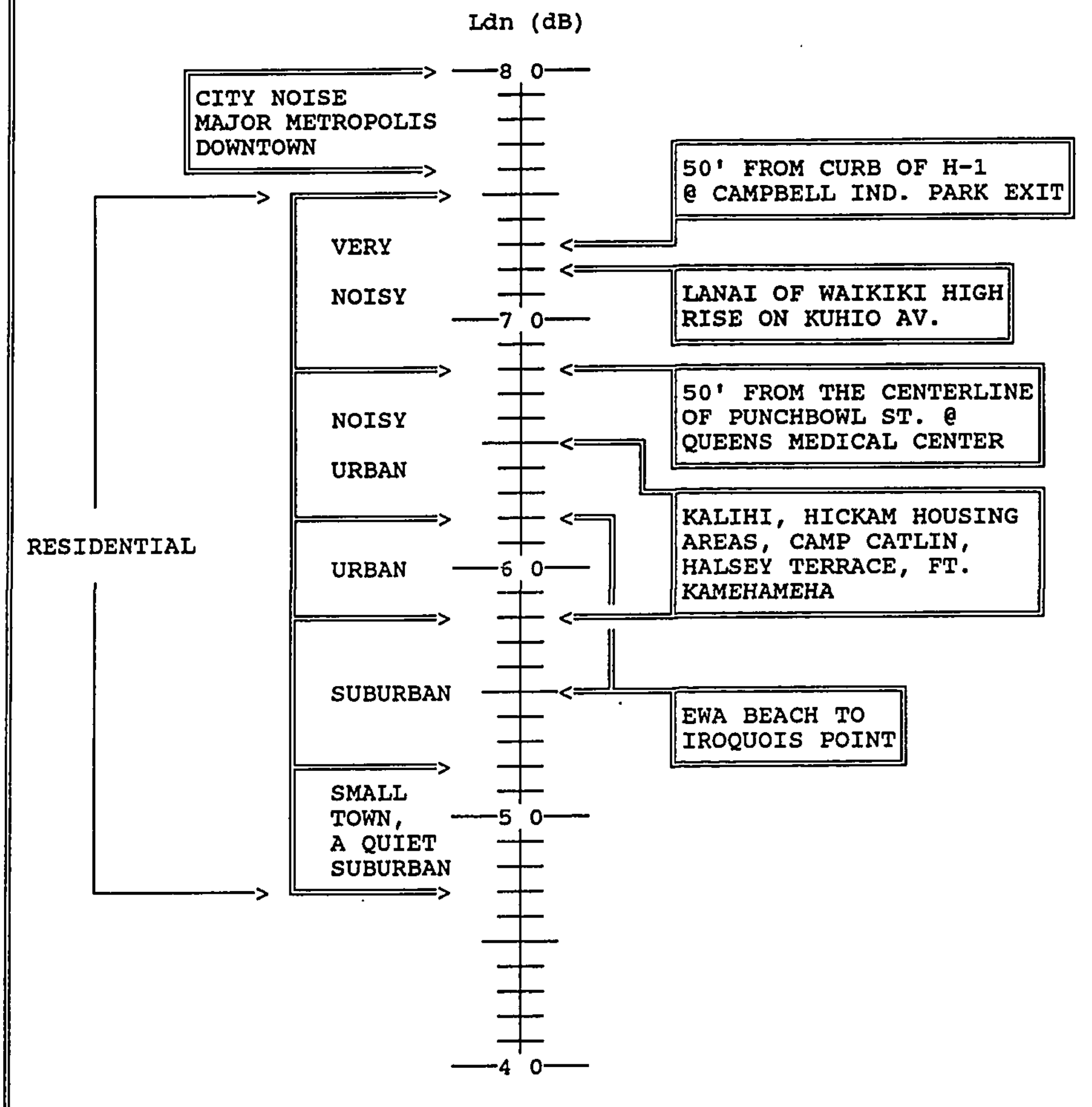

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FIGURE 1-1 TYPICAL Ldn LEVELS IN OUTDOOR LOCATIONS

APPENDIX II

A-WEIGHTED SOUND LEVEL

The human ear is more sensitive to sound with frequencies above 1000 cycles per second, or Hertz (Hz), than with frequencies below 125 Hz. Due to this type of frequency response, a weighting system, namely a A-weighting , was developed to approximate the sound response of the human ear. A-weighted sound level is a single number rating of a sound signal which de-emphasizes the low frequency portion of the spectrum of a signal, and is denoted either dB(A) or dBA. The A-weighted sound pressure levels of a few typical sources are listed in Figure II-1

The A-weighted 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 signal, several special noise indices have been developed and instrumentation are available to measure them. The following are two of commonly used noise indices:

* **Leq** -- The Equivalent A-weighted sound level (the energy averaged level)
  A single number rating which represents the fluctuating sound signal measured over a given time period as a constant level with the same amount of the total acoustic energy during that period (refer to Figure II-2). In this report, Leq assume a measurement period of one hour. This number is widely used to assess community noise annoyance and hearing damage potential.

* **Ln** -- The A-weighted exceedence level
  A single number rating which represents a A-weighted sound level that is exceeded for n% of total samples taken. For example, an L10 of 60 dB(A) for a traffic noise measurement for 20 minutes would mean that 10 percent of all the noise signals measured during the 20 minute period exceeded 60 dB(A). Note that 'n' can take any values (usually integers) between 1 and 99, where L1 and L99 represent the near maximum and the near minimum sound levels, respectively. This number is primarily used to assess community noise annoyance.

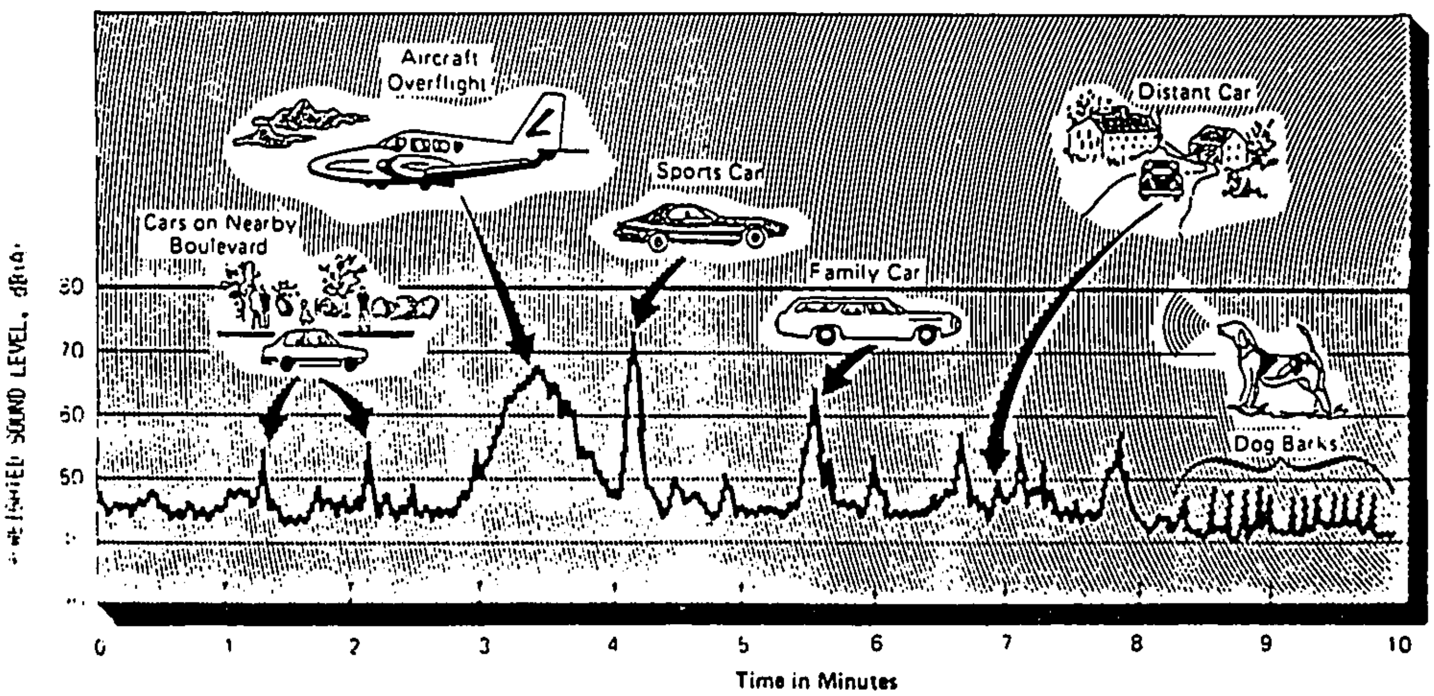

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FIGURE II-1 TYPICAL OUTDOOR A-WEIGHTED SOUND LEVELS MEASURED ON A QUIET SUBURBAN STREET

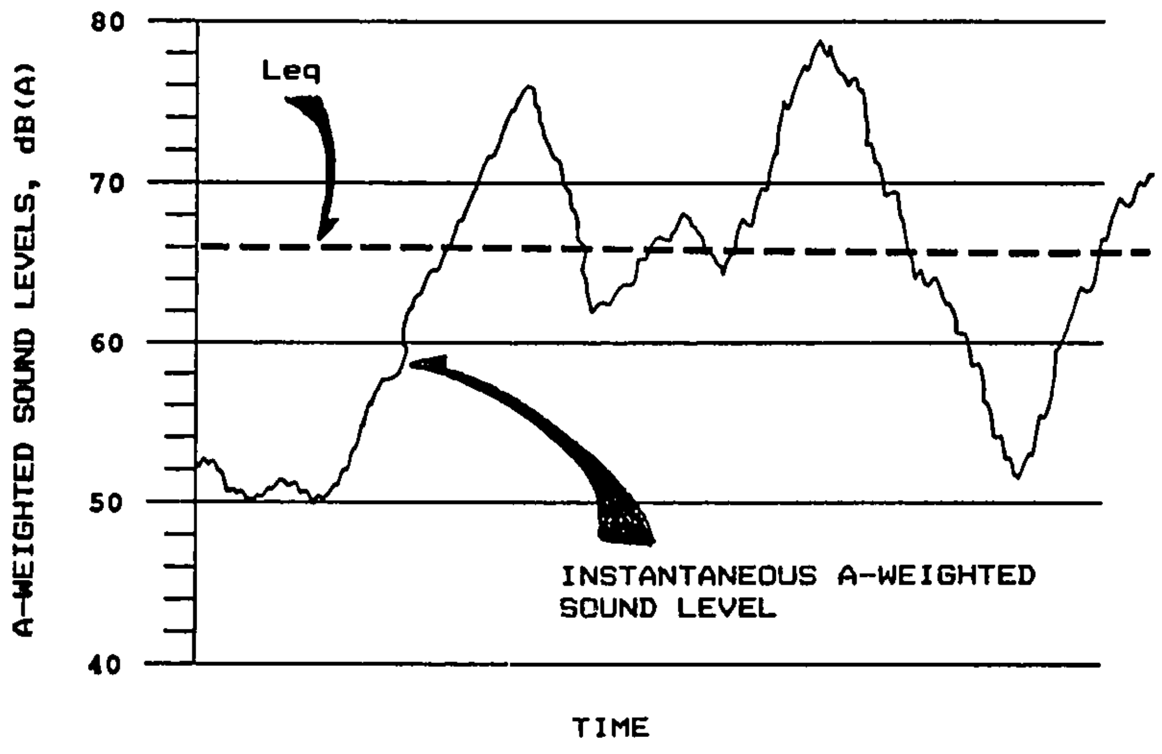

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FIGURE II-2 COMPARISON OF THE INSTANTANEOUS A-WEIGHTED SOUND LEVELS AND THE Leq

APPENDIX III

INSTRUMENTATION LISTING

AND

THE AIRCRAFT DATA

TABLE III-1

INSTRUMENTATION LISTING

1. Larson Davis Laboratory (LDL) Model 800B
   Precision Integrating Sound Level Meters, Type 1
   S/N 0486B0 600, 0385B0276

2. ACO 1/2" Condenser Microphone 7012, S/N 8872

3. LDL 1" Condenser Microphone, S/N 2575-1111

4. LDL Preamplifiers, S/N 826B0448, 826B0442

5. QUEST Calibrator, Model CA-22
   S/N J-8120014, 94 dB @ 1000 Hertz

TABLE III-2

LISTING OF THE MEASURED AND/OR OBSERVED AIRCRAFT EVENTS
IN CHRONOLOGICAL ORDER

EVENT NO.	DATE	TIME	MEASUREMENT POS. NO. *1	AIRCRAFT TYPE	FLIGHT PATTERN *2	Lmax dBA	SEL dBA
1	9-18-89	12:10	1	P-3	BP-04LT6	70.3	79.1
2	9-18-89	12:11	1	DC-10	HNL-18	<= AMBIENT	<= AMBIENT
3	9-18-89	12:13	1	DC-9	HNL-17	69.0	77.6
4	9-18-89	12:14	1	P-3	BP-04LT6	69.8	78.1
5	9-18-89	12:18	1	P-3	BP-04LT6	68.0	77.8
6	9-18-89	13:08	6	KC-135	BP-04LT6	82.0	90.6
7	9-18-89	13:23	1	KC-135	BP-04LT6	69.3	77.8
8	9-18-89	13:34	1	KC-135	BP-04LT6	75.3	82.2
9	9-18-89	13:34	1	DC-9	HNL-17	NOT MEASURED	NOT MEASURED
10	9-18-89	13:36	1	L-1011	HNL-18	68.0	77.4
11	9-18-89	13:38	1	KC-135	BP-04LT6	90.0	96.1
12	9-18-89	13:43	1	KC-135	BP-04LT6	75.8	83.0
13	9-18-89	13:49	1	DC-10	HNL-18	58.0	66.8
14	9-18-89	13:53	1	B-737	HNL-17	65.8	77.3
15	9-18-89	13:55	1	KC-135	BP-04LT6	71.0	78.5
16	9-18-89	13:57	1	DC-10	HNL-18	59.8	70.5
17	9-18-89	14:03	4	L-1011	HNL-18	63.5	74.1
18	9-18-89	15:09	4	DC-10	HNL-18	66.8	79.4
19	9-18-89	15:10	4	SH-2	BP-04LHT2	76.8	86.2
20	9-18-89	15:15	2	SH-2	BP-04LHT2	68.8	78.3
21	9-18-89	15:24	2	DC-10	HNL-18	69.5	81.3
22	9-18-89	15:30	2	DC-10	HNL-18	68.3	78.8
23	9-19-89	10:33	1	L-1011	HNL-18	73.8	84.8
24	9-19-89	10:35	1	B-747	HNL-17	71.5	82.9
25	9-19-89	10:38	1	DC-10	HNL-18	63.5	75.3
26	9-19-89	10:40	1	B-737	HNL-19	<= AMBIENT	<= AMBIENT
27	9-19-89	10:49	1	DC-10	HNL-18	66.3	76.8
28	9-19-89	10:52	1	DC-10	HNL-18	65.5	77.9
29	9-19-89	10:55	1	DC-8	HNL-19	<= AMBIENT	<= AMBIENT
30	9-19-89	10:57	1	DC-9	HNL-17	65.4	75.9
31	9-19-89	11:01	1	SH-2	BP-29HA2	83.0	91.0
32	9-19-89	11:03	1	DC-10	HNL-19	60.6	69.6
33	9-19-89	11:05	1	B-737	HNL-17	60.5	72.7
34	9-19-89	11:06	1	L-1011	HNL-18	60.0	72.4
35	9-19-89	11:09	1	DC-10	HNL-19	<= AMBIENT	<= AMBIENT
36	9-19-89	11:16	1	DC-10	HNL-19	<= AMBIENT	<= AMBIENT
37	9-19-89	11:18	1	KC-135	HNL-19	<= AMBIENT	<= AMBIENT
38	9-19-89	11:20	1	DC-10	HNL-19	<= AMBIENT	<= AMBIENT
39	9-19-89	11:22	1	2 F-15	HNL-17	70.3	79.8
40	9-19-89	11:23	1	B-747	HNL-18	63.8	75.3
41	9-19-89	11:24	1	L-1011	HNL-18	66.3	76.8
42	9-19-89	11:28	1	2 F-15	HNL-17	80.8	89.5
43	9-19-89	11:32	1	DC-9	HNL-17	62.8	72.0

*1 -- REFER TO FIGURE 3 OF THE TEXT FOR THE LOCATION OF THESE MEASUREMENT POSITIONS

*2 -- REFER TO FIGURES 6 TO 11 FOR THE DESCRIPTION OF THESE FLIGHT PATTERNS

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RESUME OF RONALD A. DARBY, P.E.

EDUCATION:	B.S. in Mechanical Engineering, Pennsylvania State University, 1954. M.S. in Engineering, 1967, and all course work for Doctor of Engineering at Catholic University, Washington, D.C., Graduate courses at University of Maryland and the University of Hawaii.
PROFESSIONAL ENGINEER:	State of Hawaii, PE 3002-E State of Maryland, PE 6482-ME
PROFESSIONAL AFFILIATION:	Member of Acoustical Society of America, National Society of Professional Engineers, Tau Beta Pi, and Pi Tau Sigma.
1970 TO PRESENT:	President of Darby & Associates* which specializes in acoustics and noise control engineering. Airport, community and industrial noise exposure measurements, evaluations, and studies have been performed in the Hawaiian Islands, Guam and the mainland U.S.A. Architectural and mechanical equipment noise control efforts have been made for new and existing building projects in the Pacific Basic, mainland U.S.A. and Japan.
1967 TO 1970:	Research Scientist, LTV Research Center, Hawaiian Division. Involved in all phases of deep ocean underwater acoustic measurement exercises: planning, data collection, data processing (analog and digital), analysis, and reporting. Typical results were long range sound transmission loss values, ambient noise levels and source levels. Developed unique method to measure radiated noise levels of submarines using aircraft. Served as a member of Tactical Analysis Group for Commander, Anti-submarine Warfare Forces, Pacific at Pearl Harbor.
1960 TO 1967:	Research Mechanical Engineer at the Marine Engineering Laboratory Annapolis,Maryland (Now NSRDC). Was technical secretary for the "Submarine Noise Measurement Panel", Committee of Undersea Warfare, National Academy of Science for one and a half years. Developed practical technique for predicting radiated noise from ship's machinery. Developed laboratory techniques and special transducers for measuring structural noise transmission from machines. Created technological forecasts and cost effectiveness studies on machinery noise. Devised practical experiments to evaluate machinery noise quieting devices, i.e., isolation mounts, flexible hoses, sound enclosures, etc.
1959 TO 1960:	Engineer at Westinghouse Electric Corp., Defense Center, Baltimore, Maryland. Team member in developing high frequency sonar transducers for Navy Applications.

* Formerly Ronald A. Darby & Associates and Darby-Ebisu & Associates, Inc.

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1957 TO 1959:	Research Engineer at Chesapeake Instrument Corp., in Shadyside, Maryland. Initiated program in study of dynamic mechanical properties of elastomers. Developed new products, i.e., hydrophones, accelerometers, special microphones, etc.
1956 TO 1957:	Engineer in Vitro Corporation in Silver Springs, Maryland. Involved in acoustic homing torpedo development.
1955 TO 1956:	Engineer at ERCO in Riverdale, Maryland. Did original development of novel techniques to simulate missile noise cone heating.
1954 TO 1955:	University of Maryland, College Park, Maryland. Instructor. Taught full time in C.E. Department: Undergraduate Strength of Materials, Statics and Dynamics and Elementary Surveying.
PATENTS, AWARDS, ETC:	Four patent grants; one patent pending; George Melville Award "for distinguished scientific and engineering achievement" at MEL in 1963; Severn Technical Society Award for Best Technical Paper at MEL in 1964.

MAJOR REPORTS AND PUBLICATIONS:

1. National Academy of Science Panel, "Measurement of Submarine Radiated Noise," NRC: CUW: 0331, Oct 1966 (Confidential).
2. R.A. Darby, "A Practical Method for Predicting Acoustic Radiation or Shock Excursions of Navy Machinery," Part 3, 34 Shock and Vibration Bulletin, The Shock and Vibration Information Center, USNRL, Dec. 1964.
3. H.A. Deferrari, R.A. Darby and F.A. Andrews, "Vibrational Displacement and Mode-Shapes Using a Laser Interferometer." J.A.S.A. Vol 42, No. 5, November 1967.
4. R.A. Darby, "Noise from Sugar Operations in Hawaii - A Study of the Extent and Effect on the Community," January 1971.
5. R.A. Darby, "A Study of Noise in the Kalihi-Palama Area and Practical Soundproofing of Housing," March 1971.
6. R.A. Darby, "Typical Noise Problems and Some Practical Solutions," Hawaiian Sugar Technicians Symposium, November 1972.
7. R.A. Darby, "Mechanical Impedance Measurements in Foundation Studies," Part 4, 33 Shock and Vibration Bulletin, The Shock and Vibration Information Center, USNRL, March 1964.
8. R.A. Darby, "The Quantitative Evaluation of Vibration Isolation Devices for Mounted Machinery Installations," MEL Report 82-287E. August 1963.
9. Film "Fundamental of Mechanical Impedance - Concepts Applicable to Ship Silencing," Navy Training Film MN9960.

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RESUMÉ OF JOHN C. SHEARER

EDUCATION:	B.E. (Hons) in Mechanical Engineering, University of Adelaide, Australia, 1970. M.Sc. in Engineering Acoustics, University of Southampton, U.K.,1975.
PROFESSIONAL AFFILIATIONS:	Member of the National Association of Acoustical Consultants. Member of the Australian Acoustical Society. Member of the Institution of Engineers, Australia.
1989 to Present:	Senior Consultant, Darby and Associates.
1988 to 1989:	Senior Consultant, Richard Heggie Associates Pty. Ltd., Sydney, Australia. Involved in preparing guidelines for residential development in areas affected by aircraft noise; environmental noise impact assessments for proposed hotels, commercial and industrial developments; architectural acoustics and mechanical noise control for high rise office buildings, hotels and television studios; engineering noise control, including design of specialized acoustic enclosures.
1985 to 1988:	Senior Consultant, Wilson, Ihrig & Associates, Inc., Oakland, California. Involved in assessing the noise and vibration impact of new rapid transit systems throughout the U.S. Also involved in assessing the community noise impact of helicopter operations; analysis of existing and projected noise levels at proposed residential developments potentially impacted by aircraft noise; prediction of the environmental noise impact of proposed motor sport raceways; analysis of building sound isolation requirements; design of acoustic enclosures for pumps, compressors, etc.; sound and impact isolation measurements in condominium apartments, and preparation of recommendations on means of upgrading performance to code requirements.
1977 to 1984:	Director, Shearer-Gardner Pty. Ltd., Adelaide, Australia. Involved in the design and

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conformance testing of fan silencers and high performance natural gas blowdown atteuators; design, letting of sub-contracts for and conformance testing of specialized acoustic enclosures; studies of existing ambient noise levels in areas potentially impacted by noise from new transportation systems, assessment of the environmental noise impacts of alternative transportation systems and design of noise control measures to minimize passby noise levels; design of modifications to improve acoustics in existing radio and television studios; design of new television studio facilities, letting of sub-contracts, supervision of installation and final conformance measurements.

1975 to 1977: Branch Manager, Vipac and Partners Pty. Ltd. Adelaide, Australia. General consulting in environmental and industrial noise control and architectural acoustics.

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RESUME OF MIKE SANG LEE

WORK EXPERIENCE

- **December 1988 - Present**
  Senior Acoustical Consultant
  Darby & Associates, Kailua, Hawaii

  Conducted noise studies for projects in the Hawaiian Islands in the following areas of acoustics: field noise measurements, impact assessment analysis and research, noise and vibration mitigation measures. The studies involved noise sources such as aircraft, traffic, machinery, musical performance, and construction activity.

- **October 1985 - November 1988**
  Senior, Associate Acoustical Engineer
  J.J. Van Houten & Associates, Anaheim, CA

  Performed noise studies in the following areas of acoustics: field noise and vibration measurements; impact assessment analysis; mitigation measures for noise sources such as aircraft, arterial, trains, mechanical equipment and industrial plants; noise tests for compliance with standards; noise element studies.

EDUCATION

University of Wisconsin-Madison, Madison, WI
January '83 - May '85
Degree: Master of Arts - may '85
Major: Mathematics with emphasis on Numerical Analysis

University of Hawaii at Manoa, Honolulu, HI
January '77 - December '82
Degree: Bachelor of Science
Major: Mathematics and Physics

PROFESSIONAL AFFILIATION

Associate member of Acoustical Society of America (ASA); March '87 - present

Affiliate member of Institute of Noise Control Engineering (INCE); Jan. '88 - pres.

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REPRESENTATIVE STUDIES

1. Noise Impact Evaluation for Proposed West Maui Marina, Launiupoko, Maui
2. Noise Impact Evaluation for Environmental Assessment, Waikoloa Beach Resort, Hawaii
3. Noise Impact Evaluation for Proposed Kahuku Golf Courses, Kahuku, Oahu
4. Waikiki Shell Improvement, Honolulu, Oahu
5. Waikiki Shell Litigation, Honolulu, Oahu
6. Kona Alii Condominium Equipment Noise, Kailua-Kona, Hawaii
7. Kamehameha School Hearing Screening Research, Oahu
8. State of Hawaii Helicopter System Plan Review
9. Rooftop A/C Unit for a Learning Center, Honolulu, Hawaii
10. Fire Alarm System, Ritz Carlton Hotel, Kona, Hawaii
11. Helicopter Noise Contour Calculation, Princeville, Kauai
12. Chaminade PRU Noise Impact Evaluation, Honolulu, Oahu
13. HECO 138 kV Transmission Line Construction Noise Study, Honolulu, Oahu
14. Sound Transmission Class Testing, Four Seasons Hotel, Wailea, Maui
15. Kohala Helistop Noise Contour Calculation, Kohala, Hawaii
16. Aircraft Noise Measurement and Impact Evaluation, Kauai Lagoon Golf Course
17. Diesel Generator, Outrigger Hotel, Honolulu, Oahu

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APPENDIX G

Visual Assessment

Michael S. Chu

APPENDIX G

VISUAL ASSESSMENT

(note: Figures identified in this assessment are contained within Volume I, Final EIS for Kapolei Business-Industrial Park, April 1990)

1. Purpose of Assessment

The purpose of this visual assessment is to evaluate the proposed land use amendment and to identify potential visual impacts which may effect existing scenic resources and other visual impacts within the area. This assessment takes into account existing policies and objectives regarding public views and their directives regarding the protection of scenic resources.

Detailed development site plans and building designs are not provided at this point in the planning process. This view assessment therefore assume building heights as established by the Ewa DP Special Provisions and design standards similar to those utilized at Campbell Industrial Park. While the general area is relative undeveloped at the present time, significant urbanization is scheduled for much of the region. This assessment therefore examines views of scenic/open space resources from existing vantage points, and attempts to provides certain anticipatory evaluation from yet to be developed locations. In such instances, a continuation of view assessment may be needed as the complexity of urbanization unfolds. Such assessments may be practical at the zoning and other advanced levels of plan review where greater design detail is produced.

2. Project Location & Description

The 552 acre amendment area is located at the western end (coral plain) of the Ewa Plain in the Ewa DP district. It lies immediately adjacent to the O.R. & L. right-of-way and extends makai to the northern boundary of the existing Campbell Industrial Park. The eastern edge of the amendment area abuts a large (397 ac.) but undeveloped industrial parcel. The western edge of the amendment area boarders the industrial and agricultural properties which flank the Deep Draft Harbor. Other significant urban nodes in the vicinity include the resort area of Ko Olina, the City of Kapolei and Barbers Point Naval Air Station. The juxtaposition of the amendment area relative to the surrounding land uses are illustrated on Figure 1.

Figures 1 and 2 demonstrate that the proposed conversion would substantially link the amendment area to surrounding urban land uses with a contiguous urban pattern. This linkage is further underscored by the proposed roadway circulation (see Traffic Analysis Report).

Urban activities and land uses adjacent and/or in close proximity to the amendment area include the following:

adjacent areas	*areas in close proximity*
Campbell Industrial Park	Makakilo community
Ko Olina	Barbers Point Naval Air Station
Deep Draft Harbor	City of Kapolei
Existing Industrial (397 ac.)	Villages of Kapolei
O.R. & L. right-of-way	

Figure 2 illustrates four specific land use designations proposed for the amendment area. These land uses and corresponding acreages are as follows:

land use designation	*acreage*
Commercial	19.20 ac.
Industrial (Maritime)	109.30 ac.
Industrial	419.99 ac.
Public Facility (HECO)	3.60 ac.
	552.09 ac.

The proposed commercial area (19.20 ac.) will occupy a narrow strip of land near the Ko Olina Small Boat Harbor. The purpose of this commercial acerage is to provide related commercial activities in close proximity to the PF, Park and Golf Couse land uses surrounding this recreational harbor facility.

The maritime industrial area (109.30 ac.) will boarder the back lands surrounding the Deep Draft Harbor and will serve as additional maritime industrial space.

A small portion of the amendment area (3.60 ac.) shall serve as public facilities (PF) to accomodate the existing HECO station located along the O.R. & L. right-of-way.

The majority of the amendment area (419.99 ac.) is proposed for general industrial activities similar to the allowables uses within the I-2 zoning district..

In addition to the land use amendments, approximately 2750 linear feet of a channelized drainage way is proposed to provide site drainage relief for the amendment area and other areas mauka of the site. The drainage channel shall be located along portions of the western boundary. This drainage channel shall be an extension of an existing channel. Existing drainage outfall is located approximately 3000 ft. south of the Deep Draft Harbor.

3. Applicable Policies & Land Use Controls

State and County policies regarding public views and scenic resources are as follows:

Hawaii State Plan, Chapter 226, HRS

The Hawaii State Plan, enacted by the Legislature of the State of Hawaii, identifies the goals, objectives, policies and priorities for the State of Hawaii. Section 226-12 of the plan addresses the State's objectives and policies regarding scenic resources.

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

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

(b) To achieve the scenic, natural beauty, and historic resource objective, it shall be the policy of this State to:

> (3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.
>
> (5) Encourage the design of developments and activities that complement the natural beauty of the islands.

Development Plans, Common Provisions

The DP Common Provisions provide general policies regarding the treatment of views and scenic resources. Under Section 312-1.4 the following statements are provided:

(1) Public Views

Public views include views along streets and highways, mauka-makai view corridors, panoramic and significant landmark views from public places, views of natural features, heritage resources, and other landmarks, and view corridors between significant landmarks.

Such public views shall be protected by appropriate building heights, setbacks, design and siting controls established in the CZC (sic LUO). These controls shall be determined by the particular needs of each view and applied to public streets and to both public and private structures.

The design and siting of all structures shall reflect the need to maintain and enhance available views of significant landmarks. No development shall be permitted that will block important public views.

Wherever possible, overhead utility wires and poles that significantly obstruct views shall be relocated or placed underground.

Ewa Development Plan, Special Provisions

The Special Provisions of the Ewa DP amplify the general policies stated in the Common Provisions . The Special Provisions provide specific urban design controls by way of open space, public views and height controls.

(1) Open Space

The visibility, preservation, enhancement and accessibility of open space areas as defined in Sections 32-1.4 of the development plan special provisions shall be given high priority in the design of adjacent and nearby developments in Ewa, and particularly along the shoreline at West Beach.

In the adjoining Barbers Point industrial area, adjoining urban uses shall be buffered by open spaces in order to minimize adverse impacts that may be associated with industrial development.

(2) Public Views

In order to promote pleasing and attractive living environments in existing and new neighborhoods, mauka and makai views, and views of central Honolulu shall be protected whenever possible.

(3) Height Controls

The general height limits of structures in Ewa shall be as follows:

Preservation	25 ft.
Agriculture	25 ft.
Residential	25 ft.
Low Density Apt.	30 ft.
Med. Density Apt.	
West Beach Special Area	150 ft.
all others	60 ft.
Commercial	
West Beach Special Area major shopping complex	150 ft.
all others	60 ft.
Industrial	60 ft.
Resort	150 ft.

In its area description, the Special Provisions state," On the makai part of the Barbers Point coral plain, the present industrial area may expand mauka. Compatible commercial uses may be developed along with the industrial uses."

4. Existing Conditions

The amendment area is situated in the Barbers Point coral plain, a relatively low lying sedimentary coastal region located at the southwestern portion of the greater Ewa Plain. The land area is currently designated as agriculture by the Ewa DP Land Use Map (see Figure 3). Anticipated public facilities improvements (see Figure 4) identified by the DP Public Facility Map include:

a) Additional right-of-way and new streets along Malakole Road
b) Transit corridor along the O.R. & L. right-of-way

Existing zoning consist of Ag. 1 and Ag. 2 zoning designations. The entire amendment area lies outside of the Special Management Area (SMA).

According to Federal Insurance Rate Maps (FIRM), the entire amendment area lies in flood zone D (areas in which flood hazards are undetermined).

Agricultural activities include sugar cane cultivation and a plant nursery which occupy limited portions of the site (approximately 100 ac.). Coral mining and the Hawaii Raceway Park are other visible activities (approximately 180 ac.) found within the amendment area.

Coral mining is characteristic of the soil quality/conditions of most of the site. The balance of the site is unutilized and vegetated with dry coastal scrub vegetation such as Kiawe, Hale Koa and other other natural vegetation (see Figure 7 for general activities within amendment areas).

The topographic elevation of the amendment area is approximately 70 ft. at its mauka boundary and approximately 15 ft. towards the makai area where it abuts the Campbell Industrial Park. The overall cross slope of the site from mauka to makai is less than 1%. There are no natural topographic or visual features of significance within the amendment area. The general topographic relief is illustrated on Figure 8.

As a low lying area, makai views can been seen from certain roadway areas and the upper residential communities at Makakilo. Such views are notated in the Oahu Urban Design Study (DLU, 1980). These views are broad and panoramic with the primary emphasis on the distant horizon, ocean and provides a general sense of open space to the region.

Key public areas (existing and future) where potential view impacts are assessed include the following:

area	*approx. elevation*
H-1 Freeway (interchange)	100 ft.
Puu Kapolei (park)	100+ ft.
Makakilo (Mauka Lani School and Playground)	700 ft.
Campbell Industrial Park	10 ft.
Ko Olina Small Boat Harbor	20 ft.
O.R. & L. Right-of-Way	60-70 ft.

H-1 Freeway (interchange)- Views from the interchange area is significant as it provides a direct frontal view overlooking the amendment area.

Puu Kapolei- Views from the future park site at Puu Kapolei may be significant as it is a significant high point and shall serve as a future public observation area (park) overlooking the region.

Makakilo- Distant makai views are significant attributes of the Makakilo residential community.

Ko Olina Small Boat Harbor- Views from the small boat harbor may be significant upon its completion as a quasi-public recreational facility.

O.R. & L. Right-of-Way- Views from the O.R. & L. right-of-way may be significant upon its utilization as a mass transit corridor.

5. Potential Visual Impacts & Mitigative Measures

Overall Short Term Visual Impacts

5.1 Disruption to the visual quality of the area can be expected during the clearing, grading and construction of the site. Disruption can be expected to occur over time as the site will be develops in phases. The Ewa region however shall be undergoing substantial transformation and construction will be wide spread over the entire area.

> Mitigative Measures- Standard measures to include dust control, temporary grassing, phasing of construction, etc. shall be employed to minimize both visual and environmental impacts.

Long Term Visual Impacts

5.2 The broad, panoramic makai views and sense of open space as seen from certain portions of the freeway may be adversely affected by the imposition of 60 ft. industrial buildings. Base on the present ground elevation, the industrial structures along the mauka portion of the amendment area (adjacent to the O.R. & L. right-of-way) may contribute more to the visual impact than structures of equal height located at the center or makai portions of the site.

> Mitigative Measures- The development of the Ko Olina resort area to include golf course uses fronting portions of the freeway will insure the continuation, in part, of open space and along the makai side of the freeway.
>
> Additional mitigative measures include the utilization of height controls aimed at:
> a) lower building heights at the mauka side of the amendment area;
> b) avoidance of industrial activities which require massive storage tanks or smoke stacks at the mauka side of the amendment area;
> c) substantial landscape setbacks and buffers along the mauka edge.
>
> Such measures would be consistent with the Special Provisions of the Ewa DP Special Provisions.

5.3 The penetration of of industrial storage tanks and smoke exhaust stacks into the horizon line may adversely affect the visual quality of makai views as seen from the freeway and other future public areas.

> Mitigative Measures- Subdivision design of the amendment area should provide a clustering of large lots to accommodate storage tanks and other large scale buildings in a central location. Location of such clustering should be determined based on the present industrial skyline configuration with preference towards consolidation of structural penetration into the horizon line.

5.4 The makai views from the Makakilo community be adversely affected by the structures, roof masses and possible glare of the proposed industrial expansion.

Mitigative Measures- Strict private covenants regarding roof design, roof material and color, and landscaping should be developed to reduce visual impact. Roof material and colors should favor muted tones and minimize glare. White or metallic colors/finishes should be avoided. Substantial landscape planting to include street trees and parking lot landscaping should be required to provide maximum vegetative cover.

Such measures would be consistent with the Special Provision objectives of the Ewa DP Special Provisions.

Examples of landscape and visual buffering may appropriately parallel the existing Campbell Industrial Park covenants which has successfully demonstrated aesthetic quality and enforcement towards its landscape covenants.

5.5 Aesthetic considerations for the ground level views from the proposed mass transit corridor (O.R. & L. right-of-way) may be precluded.

Mitigative Measure- Substantial building setbacks and landscape buffering should be established for areas fronting the O.R. & L. right-of-way. Special consideration should be placed on the frontage along the O.R. & L. right-of-way. A thematic development concept should be developed taking into account the Ko Olina, City of Kapolei and Kapolei Villages developments. Treatment along the amendment area frontage should correspond accordingly.

Such measures would be consistent with the policies of Chapter 226, HRS, Sec. 226-12.

****

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PROFESSIONAL SERVICES

Land Use Planning
Landscape Architecture
Urban Design

EDUCATION

B.S. California State Polytechnic University, Pomona, 1977
Landscape Architecture
University of Hawaii, Urban and Regional Planning.
Iolani School, 1967

PROFESSIONAL PRACTICE

Michael S. Chu, Land Architect, 1982 to present
Phillips Brandt Reddick, Hawaii 1978-82
EDAW Inc., 1977-78
Tongg Assoc. 1973-75

REGISTRATION

State of Hawaii, Board of Registration, Professional Landscape Architect
State of Hawaii, Board of Registration, Realtor Associate

PROFESSIONAL & COMMUNITY AFFILIATIONS

American Planning Association, Member
American Society of Landscape Architects, Member
American Institute of Architects, Professional Affiliate
Hawaii Architect Magazine
The American Land Resource Association, Charter Member
Honolulu Chamber of Commerce, Member
DLU Design Advisory Committee, Member
Honolulu Zoo Hui, Director

Background

Michael S. Chu, Land Architect is a professional consulting firm specializing in land use planning, landscape architecture and urban design. The firm was founded in 1982 and is located in downtown Honolulu.

The firm is often engaged by governmental agencies, private land owners, developers or other consultants to provide technical planning and/or design services. These services include land use analysis, site planning and landscape architectural design, environmental studies and permit processing.

As a sole propiertorship, the firm maintains a wide network of professional colleagues in related fields and often draws upon this network when undertaking multi-disciplinary projects. This flexibility has enabled the firm to successfully engage in larger and complex projects with a team of subconsultants specifically selected to meet the needs and work products of a particular project. In other instances, the firm participates as a subconsultant to others and is capable of contributing land use and site planning expertise, technical report writing, design graphics, and landscape architectural design services.

The services of the firm are particularly strengthened with its broad experience and familiarity with governmental objectives as they relate to land use planning and design. Most recently the firm was the prime consultant and author of the Coastal View Study for the City and County of Honolulu and the Statewide Planning for Private Marina Facilities for the State Department of Transportation, Harbors Division.

Since 1985 Michael S. Chu has served been a member of the DLU Design Advisory Committee and has served as a member of the DLU technical review committee for the BMX-4 zoning district of the Land Use Ordinance.

Prior to establishing the firm, Michael S. Chu was a planner and landscape architect with EDAW Inc., PBR Hawaii and Tongg Assoc. While at PBR he held the position of managing director of its Hawaii office and was project manager for several large multi-disciplinary projects to include the Oahu Urban Design and the Housing Location Study.

His professional experience includes planning and design work throughout Hawaii, as well as Guam, Tahiti and Japan.

List of Recent Projects

Waimea Main Street, Kauai
The firm performed planning and design services for the physical improvement and economic revitalization of Waimea Town. The project was the first to be sponsored under the Main Street Program and the Historic Hawaii Foundation. Performed for the West Kauai Professional and Businessmen Association and Spencer Mason Architects.

Old Koloa Town
The firm was responsible for planning and the development of a landscape architectural master plan for the renovation and revitalization of Koloa Town. Prepared for Koloa Town Associates and Spencer Mason Architects.

Russian Fort Elizabeth
The project consisted on preparing an overall master plan and phase I construction documents for the historic restoration of the Russian Fort Elizabeth at Waimea, Kauai. Performed for the State of Hawaii, Department of Land and Natural Resources.

Oahu Coastal View Study
This landmark study was completed in 1987 and consisted of a detailed inventory of coastal scenic resources on Oahu and the formulation of design guidelines applicable to the SMA and Coastal Zone Management program. Performed for the City and County of Honolulu, Department of Land Utilization.

Since the completion of the study, the firm was commissioned to conduct similar Coastal View Studies by the Hawaii County Planning Department (1988) and the Kauai County Planning Department (1989).

Kapolei Villages
Involvement in Kapolei Villages consisted of revising the 830 acre residential master plan and providing further design and design graphics to illustrate the overall development concept. Performed for the State of Hawaii, Housing and Finance Development Corp. and Towill Corp.

Architectural Compatibility Study, Oahu
This urban design project consisted of organizing and structuring a variety of independent projects into an overall and thematic development master plan for Hickam Air Force Base. Performed for the U.S. Air Force.

Servco Commercial Center
The services of the firm was utilized to prepare the owner's development requirements, preparation of a detailed development master plan and to process assorted governmental permits for Servco's newly acquired 14.5 acres of waterfront industrial land at Sand Island. Performed for Servco Pacific, Inc. and Aotani and Assoc.

Hotel Street Transit Mall
The firm participated in the planning and design of the Hotel Street Transit Mall by providing design guidance regarding historic features, street signage, bus shelters, light standards and sidewalks within the Chinatown historic district. Performed for the

Department of Transportation Services, City and County of Honolulu and Parsons Brinkerhoff, Quade and Douglas.

Kalakaua Center
The firm was retained to provide complete landscape architectural design and permit processing services for the renovation of the "Mitsukoshi building" located in the Waikiki Special District. Performed for Mutual of New York (MONY), Graham Murata and Russell, and the CJS Group Architects.

Hawaii State Library
The firm was the project landscape architect for the renovation of the Hawaii State Library locate within the Capital District on Honolulu. Performed for the Department of Accounting and General Services, State of Hawaii and Aotani and Assoc.

Chinatown Gateway
The firm participated as project landscape architect for the planning and design of the Chinatown Gateway Plaza, a mixed use project consisting of a highrise residential tower, lowrise commercial development and a major plaza and park flanking both sides of Hotel Street. Prepared for the City and County of Honolulu and Lacayo Architects.

EWA by Gentry, Soda Creek, Increment 2 & 3
The firm was retained to prepare the cluster development application for increments 2 and 3 of the EWA by Gentry development consisting of over 600 residential units and community support facilities. Services included the landscape design and the preparation of all material for the submittal and application of permits. Other services include participation in the rezoning application of the overall 700 acre development. Prepared for the Gentry Companies.

Pentagram Restaurant Projects
The firm provides exclusive landscape architectural services for all development and renovation of Burger King and El Pollo Loco restaurants in Hawaii and Guam. Work has included landscape development and/or renovation of over 12 restaurants since 1985. Performed for the Pentagram Corp.

Statewide Planning for Marina Facilities
The firm was retained as the prime consultant to provide a statewide study and recommendations for expediting the development of recreational marina facilities. Performed for the State of Hawaii, Department of Transportation, Harbors Division.

Honolulu Waterfront Master Plan
The firm served as the landscape architectural subconsultant (to R.M. Towill/ Helber Hastert Kimura, a joint venture) in preparing the overall redevelopment master plan for the 1500 acre Honolulu waterfront area. Performed for the State of Hawaii, Office of State Planning.

Kewalo Basin Park
The firm served as prime landscape architect for the park design at the triangle peninsula located at Kewalo Basin. The park development is the first increment of the "lei of green" concept envisioned by the Honolulu Waterfront Master Plan. Performed for the State of Hawaii, Hawaii Community Development Authority.

APPENDIX H

Air Quality Impact Reports, Kapolei Business-Industrial Park

Jim W. Morrow

APPENDIX H

AIR QUALITY IMPACT REPORT

KAPOLEI BUSINESS-INDUSTRIAL PARK

November 13, 1989

PREPARED FOR

William E. Wanket, Inc.

and

The Estate of James Campbell

PREPARED BY

J. W. Morrow
Environmental Management Consultant
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Kailua, Hawaii 96734

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1. INTRODUCTION

The Estate of James Campbell is proposing to develop the Kapolei Business-Industrial Park on 552 acres of land adjoining the existing Campbell Industrial Park in Ewa, Oahu (Figure 1). It will consist of 424 acres of industrial use, 109 acres of maritime industrial, and 19 acres of commercial use. The industrial use is anticipated to be similar to that at the existing park. Construction will commence in 1990 with completion and full occupancy expected by the year 2030.

The area is zoned agriculture and is currently being used for sugar cane cultivation, storage of coral dredge material from the Deep Draft Harbor development, a tree nursery, and a motor vehicle race track. While much of the surrounding Ewa Plain is still in sugar cane cultivation, this will gradually decline as urbanization proceeds in the area (Figure 2).

The purpose of this report is to assess the air quality impact of the proposed development. While the project will eventually include some stationary industrial sources of air pollution which will have to be evaluated on a case-by-case and cumulative impact basis, it can also be considered an "indirect source" of air pollution as defined in the federal Clean Air Act [1] since it will attract mobile sources of air pollution, i.e., motor vehicles. Since this traffic can be more readily projected than the exact industrial sources which will be sited later, much of the focus of this analysis is on traffic impact on air quality. Air quality impact was evaluated for existing (1989) and future (2030) conditions both with and without the proposed project

Since the project will effect and be affected by a variety of other direct and indirect, onsite and offsite, and short and long-term impacts, these too have been addressed in this report.

2. AIR QUALITY STANDARDS

A summary of State of Hawaii and national ambient air quality standards is presented in Table 1 [2,3]. Note that Hawaii's standards are not divided into primary and secondary standards as are the Federal standards.

Primary standards are intended to protect public health with an adequate margin of safety while secondary standards are intended to protect public welfare through the prevention of damage to soils, water, vegetation, man-made materials, animals, wildlife, visibility, climate, and economic values [4].

Some of Hawaii's standards are clearly more stringent than their Federal counterparts but, like their Federal counterparts, may be exceeded once per year. It should also be noted that in April, 1986, the Governor signed amendments to Chapter 59 (Ambient Air Quality Standards) making the State's standards for particulate matter and sulfur dioxide the same as national standards. In the case of particulate matter, however, this uniformity did not last long. On July 1, 1987, the EPA revised the Federal particulate standard to apply only to particles 10 microns or less in diameter (PM-10) [5], leaving the State once again with standards different than the Federal ones.

In the case of the automotive pollutants [carbon monoxide (CO), oxides of nitrogen (NOx), and ozone (O3)], there are only primary standards. Until 1983, there was also a hydrocarbons standard which was based on the precursor role hydrocarbons play in the formation of photochemical oxidants rather than any unique toxicological effect they had at ambient levels. The hydrocarbons standard was formally eliminated in January, 1983 [6].

The U.S. Environmental Protection Agency (EPA) is mandated by Congress to periodically review and re-evaluate the Federal standards in light of new research findings [7]. The last review resulted in the relaxation of the ozone standard from 160 to 235 micrograms/cubic meter (ug/m3) [8]. The carbon monoxide (CO), particulate matter, sulfur dioxide (SO2), and nitrogen dioxide (NO2) standards have been reviewed, but no new standards have been proposed [9].

Finally, the State of Hawaii also has fugitive dust regulations for particulate matter (PM) emanating from construction activities [10]. There simply can be no visible emissions from fugitive dust sources.

3. EXISTING AIR QUALITY

3.1 <u>General</u>. The State Department of Health maintains a network of air monitoring stations around the state to gather data on the following regulated pollutants:

- total suspended particulates (TSP)
- particulate matter <10 microns (PM-10)
- sulfur dioxide (SO2)
- carbon monoxide (CO)
- ozone (O3)
- lead (Pb)

In the case of TSP, PM-10, and SO2, measurements are made on a 24-hour basis to correspond with the averaging period specified in the 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. Note that the lead standard is a quarterly average.

The nearest Department of Health (DOH) air monitoring station to the project site, is presently located within 0.5 mile on the Chevron Refinery site south of Malakole Road. Data have been collected at this site and others in the Campbell Industrial Park area for many years. The DOH also monitors air quality at its downtown Honolulu building some 16 miles east of the project.

3.2 Department of Health Monitoring Sites. Recent data from the Barbers Point and Honolulu stations are summarized in Tables 2 - 5. The data indicate that total suspended particulate (TSP) and sulfur dioxide (SO2) standards are being met. In fact, much of the time sulfur dioxide concentrations are below the detectable limit of the measurement method being employed. Carbon monoxide (CO) levels are also below State standards most of the time with only occasional exceedances.

Photochemical oxidants are secondary pollutants formed in the atmosphere largely as a result of anthropogenic emissions of hydrocarbons and oxides of nitrogen. Since there are no ambient standards for hydrocarbons, there is no monitoring. In the case of NO2, the State ceased routine monitoring in 1976. As indicated by federal and state standards, ozone is monitored at Sand Island as a surrogate for all photochemical oxidants. Recent monitoring data from that station indicate that the state's 1-hour standard is being met over 99% of the time.

As noted above, the State also has been having particulate samples analyzed for lead content, and Table 5 summarizes ambient lead levels in recent years. Generally, airborne lead levels have declined as expected due to the federal program for gradual phaseout of leaded gasoline. Particulate lead accumulated over the years in roadside soils and plants, however, will remain indefinitely in the area and provide inhalation exposure whenever dust is re-entrained in the air as a result of scouring winds or mechanical disturbance due to vehicular motion.

3.3 Onsite Carbon Monoxide Sampling. In conjunction with this study, air sampling was conducted at the Kalaeloa Boulevard - Malakole Road intersection during September, 1989.

The sampling site was within 5 meters of the road edge and on the west side due to the winds prevailing at the time. A continuous carbon monoxide (CO) instrument was set up and operated during the a.m. and p.m. peak traffic hours based on the results of the traffic impact study [11]. An anemometer and vane were installed to record onsite surface winds. A simultaneous manual count of 2-way traffic along Kalaeloa Boulevard was also made. The variability of each of the parameters measured during the peak hours is clearly seen in Figures 2 - 5.

A summary of the average values is presented in Table 6. Onsite surface winds were generally northwesterly and almost parallel to Fort Weaver Road during the a.m. periods, but turned to northeasterly during the afternoon hours. Wind speeds were quite low during a.m. and p.m. periods ranging from < 0.5 - 1.5 meters per second (m/sec). Atmospheric stability was neutral in the morning and slightly to moderately unstable during the afternoon. Traffic counts were comparable to those reported by the traffic consultant. CO concentrations were comparable with the computer-predicted concentrations discussed in Section 6.

3.4 Toxic Air Pollutant Emissions. The U.S. Environmental Protection Agency (EPA) recently made available its 1987 Toxic Release Inventory [12]. Th data were reviewed and those air emissions from existing Campbell Industrial Park facilities were compiled into Table 7. It is evident that there are quite a number of chemicals with varying toxicities being released although their quantities are not nearly as great as the "criteria" pollutants, e.g., sulfur dioxide, carbon monoxide, etc., which are emitted in thousands of tons per year (Table 8).

Lacking any information on the specific time frame over which these emissions occur, it is virtually impossible to determine their impact on local air quality. Release of 120 tons of ammonia over a 24-hour period, for example, has a substantially greater effect on air quality than 120 tons released incrementally over a full year, i.e., 8,760 hours. Thus, while it is good to be aware of these emissions, their effects cannot be thoroughly evaluated.

4. CLIMATE & METEOROLOGY

4.1 Temperature & Rainfall. The National Climatic Data Center in its 1982 annual summary for Honolulu notes that:

> "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 temperature 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" [13].

Based on historical records from the National Weather Service at Honolulu International Airport and the U.S. Navy at Barbers Point Naval Air Station, rainfall in the project area averages about 20 inches per year [13,14]. In accordance with Thornwaite's scheme for climatic classification, the area is considered a semiarid steppe [15].

4.2 Surface Winds. Meteorological records were reviewed from the Honolulu International Airport and Hickam Air Force Base (AFB). It is quite evident that northeast tradewinds predominate during much of the year (Table 9). A closer examination of the data, however, indicates that low velocities (less than 10 mph) occur frequently and that the "normal" northeasterly tradewinds tend to breakdown 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 seen clearly in Figures 5 and 6.

Of particular interest from an air pollution standpoint were the stability wind roses prepared for the period January 1955 to December 1968 at Hickam Air Force Base [16]. These data indicated that stable conditions, i.e., Pasquill-Gifford stability categories E and F [17], occur about 28% of the time. It is under such conditions that the greatest potential for air pollutant buildup from groundlevel sources exists.

5. HIGHWAYS AND TRAFFIC

As noted previously the principal access road to the project site is Kalaeloa Boulevard which exists as a 4-lane divided highway from its intersection with the H-1 Freeway at the Palailai Interchange. Current speed limits are 35 mph from Palailai Interchange to the Malakole Road intersection, and 25 mph from Malakole southward. In actual practice, however, most vehicles are traveling at 40 - 50 mph along the northern stretch of Kalaeloa Boulevard due to the wide roadway and low level of traffic.

The traffic study provided by Pacific Planning & Engineering, Inc. [11] focused on existing and proposed future intersections along Kalaeloa Boulevard as well as a future second north-south access to the industrial park. Traffic counts made in conjunction with the air sampling conducted for this project were generally consistent with the traffic consultant's data. Photographs of the existing conditions along Kalaeloa Boulevard are presented in Figures 7 and 8.

The air quality impact analysis focused on the existing Malakole Road and the proposed Road "A" intersections with Kalaeloa Boulevard. In the first case, this would provide a comparison with the existing intersection conditions which could be measured as well as modeled. In the latter case, the Road "A" intersection appeared to have the highest level of traffic and would provide "worst case"conditions.

For future conditions, the assumptions of the traffic report that Kalaeloa Boulevard would be widened to six lanes and that a second north-south 4-lane roadway would be in use were also an integral part of this study.

6. MOBILE SOURCE IMPACT

6.1 Emission Factors. Automotive emission factors for carbon monoxide (CO) were generated for calendar years 1989 and 2020 using the Mobile Source Emissions Model (MOBILE-3) [18]. The MOBILE-3 model is currently limited to the year 2020; thus, emission rates for the actual design year 2030 could not be computed. However, until and if new motor vehicle emission standards are mandated, there would be very little difference between 2020 and 2030 emission rates. To localize emission factors as much as possible, the August, 1988 age distribution for the City & County of Honolulu [19] was input in lieu of the national statistics normally used.

6.2 Microscale Analysis. Analyses such as this generally involve estimation of concentrations of non-reactive pollutants. This is due to the complexity of modeling pollutants which undergo chemical reactions in the atmosphere and are subject to the effects of numerous physical and chemical factors which affect reaction rates and products. For projects involving motor vehicles as the principal air air pollution source, carbon monoxide is normally selected for modeling because it has a relatively long half-life in the atmosphere (about 1 month) [20], and it comprises the largest fraction of automotive emissions.

In this instance, a microscale screening analysis was performed for the Malakole Road and Road "A" intersections with Kalaeloa Boulevard. The updated version of an EPA guideline model CALINE-4 [21,22] was employed with an array of receptors spaced at distances of 10 - 40 meters from the road edge. Because of the growing level of urbanization and traffic in the area, a background CO concentration of 1.0 milligram per cubic meter (mg/m3) was assumed.

Worst case meteorological conditions were selected for the a.m. and p.m. peak traffic hours. Wind speeds of 0.5 (a.m.) and 1.0 (p.m.) meter per second, an acute wind/road angle, and stable (a.m.) and neutral (p.m.) stability (Pasquill-Gifford Classes "F" and "D", respectively) [16], were all selected to maximize concentration estimates in the vicinity of the intersections. Review of the traffic data and preliminary modeling indicated that southwesterly and southeasterly winds were most likely to produce the maximum CO concentrations near the intersections under study; thus, these wind directions were input for the modeling.

Maximum one-hour carbon monoxide (CO) concentrations were then computed for the peak traffic hours. The analyses were performed for existing conditions (1989) and future conditions (2030) both with and without the proposed project. The results are summarized in Figures 9 - 12.

7. OFF-SITE STATIONARY SOURCE IMPACT

7.1 Electrical Generation. The future buildout of the business/industrial area will necessitate the generation of additional electricity by power plants. Currently, most of Oahu's electrical energy is generated at Hawaiian Electric Company's (HECO) Kahe Generating Station located near Nanakuli on the leeward coast of Oahu. This is currently a six-unit, approximately 650-megawatt facility firing low-sulfur fuel oil. A seventh 150-megawatt unit was proposed by HECO [23], but more recently two outside companies have proposed building a new gas turbine and coal-fired power plant at Campbell Industrial Park and selling power to the utility [24].

The generation of this electrical power will result in emissions at the site of the power plant. In this case, those emissions may occur at the Kahe Generating Station or one or all of the three power plants which will be located directly south of the proposed park, i.e., the two aforementioned plants plus the City's HPOWER resource recovery facility. In the latter case, those emissions may at times impact the proposed industrial park site. Due to the lack of specific information on future industries and commercial operations in the park, a quantitative analysis of the park's contribution could not be conducted. A previous study for the proposed coal-fired plant, however, indicated that air quality standards would continue to be met despite the addition of that plant [25].

7.2 Solid Waste Disposal. The refuse generated by the business/industrial park will require disposal. Presently, about 80% of Oahu's refuse is being landfilled with the remaining 20% being burned at the Waipahu Incinerator [26]. In the future, most municipal refuse will be burned at the City's resource recovery facility (HPOWER), presently under construction at Campbell Industrial Park. Some fraction of the refuse generated at the proposed park may be disposed of at HPOWER as well. And again, the park may at times be impacted by emissions from HPOWER which is located directly south of it. This would occur most likely under midday onshore seabreezes or southerly Kona winds.

8. OTHER LONG-TERM IMPACTS

8.1 Agricultural Burning. Burning of sugar cane fields prior to harvest is a long-standing practice in Hawaii's sugar industry. Unfortunately, however, as urbanization closes in around agricultural operations, it is inevitable that complaints about air pollution will arise. Cane fires result in the emission of particulates, carbon monoxide, and trace amounts of other organics. This was most recently demonstrated in an EPA study of cane burning on Maui [27]. Concentrations of particulates can reach high levels within about one mile of the fires [28]. A complete quantitative characterization of cane smoke, however, has yet to be performed. Fortunately, fires are generally infrequent and only last about 20 - 30 minutes.

8.2 Campbell Industrial Park. The industrial sources at Campbell Industrial Park obviously affect air quality in the Ewa area. The maximum concentrations of total suspended particulates (TSP) and sulfur dioxide, however, are in compliance with existing federal and state air quality standards. Neither monitoring nor computer modeling show violations of the current standards. Historically, there has been a problem meeting the State's TSP standard, and even with adoption of the less stringent federal standards, this may continue to be a problem as levels in the past have on occasion even exceeded those standards. As noted in Section 2, the state and federal particulate standards are once again different and while recent monitoring data indicate that the federal PM-10 standard is being met, the state TSP standard continues to be threatened.

SO_2 standards are being gradually approached as new sources come in and existing sources expand. The impending completion of the aforementioned under-construction sources as well as those currently unidentified future sources in the existing and proposed industrial parks will all contribute additional increments of regulated and unregulated pollutants to the Ewa air. The responsible government agencies will have to watch the situation closely to insure that standards continue to be complied with.

9. CONSTRUCTION IMPACT

The principal source of short-term air quality impact will be construction activity. Construction vehicle activity will increase automotive pollutant concentrations along the principal access roads as well as in the vicinity of the project site itself. During off-peak hours, the additional construction vehicle traffic should not exceed road capacities although the presence of large trucks can reduce a roadway's capacity as well as lower average travel speeds thereby contributing to additional air pollution emissions.

The site preparation and earth moving will create particulate emissions as will building and on-site road construction. Construction vehicles movement on unpaved on-site roads will also generate particulate emissions. EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30%), and precipitation/evaporation (P/E) index of 50 [29].

Since a significant fraction of the onsite soils were silty clay loams, in all probability having silt content comparable to the 30% cited above, and the computed P/E Index for the area is 24 implying drier conditions than in the EPA case, it may be assumed that there is a potential for fugitive dust problems.

In addition to the onsite impacts attributable to construction activity, there will also be offsite impacts due to the operation of concrete batching plants needed for construction. Since it is also too early to identify specific facilities that will be providing the concrete, the discussion of air quality impacts is necessarily generic.

Design and operating features of a typical concrete batching plant were obtained for this analysis. This plant (Rex Transit Mix Batch Plant, Model LO GO 5) [30], is a portable unit capable of producing up to 100 cubic yards of concrete per hour.

Assuming 8 hours/day operation and published EPA emission factors [26] for both direct plant emissions and fugitive dust emissions, estimates of worst case ambient impact were derived using the PTPLU screening model [31]. Ninety percent control of particulate emissions from the plant itself and 60% control of fugitive dust emissions from the process were assumed. One-hour concentration estimates were adjusted to 8-hour averages using an EPA-recommended factor [32] and then to 24-hour averages based on a weighted averaging technique. The worst case concentration of total suspended particulates (TSP) was thus estimated to be 105 micrograms/cubic meter (ug/m3) due to the plant operation.

Since it is not known where exactly the plant(s) will be located and thus what the background concentration of TSP will be, it is somewhat difficult to predict cumulative concentrations for comparison with standards. However, if the batch plant's 105 ug/m3 were assumed to be all < 10 microns and were added to the second highest 24-hour PM-10 concentration (48 ug/m3) from the 1988 DOH Barbers Point data, the sum would exceed the federal 24-hour standard of 150 ug/m3.

10. DISCUSSION AND CONCLUSIONS

10.1 Microscale Analysis. The 1-hour "worst case" concentration estimates at the Kalaeloa Boulevard - Malakole Road intersection (Figures 9 and 10) indicate compliance with federal and state 1-hour CO standards under current traffic conditions but possible exceedance of the State standard in the future, with or without the proposed project. The highest concentration estimates occurred under a.m. traffic and weather conditions and in close proximity to the roadway (within 10 meters).

The general trend over the 1989 - 2030 period was towards increasing CO levels despite the effect of lower new vehicle emissions resulting from the federal motor vehicle emissions control program. The difference between the "with" and "without" project scenarios was mixed with some receptor locations showing higher concentrations while others were lower. The range was -25% to +27% with the "with project" scenario generally showing the higher CO levels during peak hours.

A similar situation was projected at the future Road "A" intersection with Kalaeloa Boulevard during the a.m. peak hour. The "with project" scenario had CO levels generally lower than without the project due to the diversion of some traffic to the future second north-south access road. The range of differences between "without" and "with" the project was -15% to +19%.

Compliance with the federal and state 8-hour standards can also be determined by applying an EPA-recommended "persistence" factor of 0.6 to the 1-hour maximum CO values [33]. When using this approach, any CO concentration greater than 8.4 mg/m3 would indicate exceedance of the State's 8-hour standard. Similarly, any 1-hour concentration over 15.7 mg/m3 would indicate exceedance of the federal 8-hour standard. In this case, the results indicate possible exceedances of the state, but not the federal, 8-hour standard at the same 1-hour "hotspots".

10.2 Other Long-Term Impacts. As noted in Section 8, there will be at times exposure to the smoke from agricultural field burning. Until urbanization entirely replaces sugar cane cultivation in the Ewa District, this will result in some human exposure and complaints about cane fire smoke. The State Department of Health and federal EPA have indicated that they are continuing efforts to better characterize the exposure and potential health effects [34]. Depending on the results of those efforts, the smoke exposure may be reduced or eliminated before cane cultivation ceases in Ewa.

10.3 Short-Term Impact. Since as noted in Section 9, 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%. The soonest possible landscaping of completed areas will also help. Use of dust screens may be necessary when excavation and other construction activities occur in close proximity to existing dwellings.

10.4 Conclusions. Based on the foregoing analysis, the following conclusions may be drawn:

- Traffic generated by the proposed project will contribute to reduced air quality along the major roadways serving the area. State and federal air quality standards will be met except possibly during the a.m. peak hours in close proximity to the main intersections with Kalaeloa Boulevard when the state standard may be exceeded.

- Future industrial sources on the site will contribute to local and regional air pollution but the magnitude of that contribution cannot be quantified until specific sources are identified.

- Electrical demand and solid waste disposal resulting from the project will contribute to increased emissions at the sites of the facilities which generate electricity and burn refuse.

- Project occupants may at times be affected by emissions from the surrounding environment, specifically:

  agricultural field burning which should decline as urbanization replaces agriculture in Ewa;

Campbell Industrial Park during southerly wind conditions;

- Construction activities will have a short-term impact on local air quality due to the additional construction vehicle activity and fugitive dust from construction activities.

10.5 Mitigation Measures. The types of measures that could help reduce the predicted traffic-related adverse impacts include:

- additional highway improvements to increase capacity
- development and use of a mass transit system
- increased bus service to the project area
- encouragement of car-pooling
- limited parking facilities to encourage use of public transportation
- implementation of an inspection/maintenance (I/M) program
- government growth restrictions in Ewa

While many of these measures would have to be initiated by government, the project developer can encourage such initiatives as well as implement those measures within his own capability.

Measures that will reduce offsite emissions at electrical power plants include:

- encourage use of solar water heating and heat pumps wherever possible in the proposed business/industrial park;
- encourage use of co-generation and other forms of waste heat recovery in those future industries which require their own boilers or heaters;
- encourage siting of energy efficient industries in the proposed park;

Measures to reduce offsite emissions resulting from solid waste combustion include:

- o encouragement of low waste generating businesses and industries;
- o encouragement of businesses and industries capable of recycling waste materials;
- o encouragement and provision of recycling facilities within the new park;

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T A B L E S

TABLE 1

SUMMARY OF STATE OF HAWAII AND FEDERAL
AMBIENT AIR QUALITY STANDARDS

POLLUTANT	SAMPLING PERIOD	FEDERAL STANDARDS PRIMARY	FEDERAL STANDARDS SECONDARY	STATE STANDARDS
1. Total Suspended Particulate Matter (TSP) (micrograms per cubic meter)	Annual Geometric Mean	--	--	60
	Maximum Average in Any 24 Hours	--	--	150
2. PM-10 (micrograms per cubic meter	Annual	50	50	--
	Maximum Average in Any 24 Hours	150	150	--
3. Sulfur Dioxide (SO2) (micrograms per cubic meter)	Annual Arithmetic Mean	80	--	80
	Maximum Average in Any 24 Hours	365	--	365
	Maximum Average in Any 3 Hours		1,300	1,300
4. Nitrogen Dioxide (NO2) (micrograms per cubic meter)	Annual Arithmetic Mean	100		70
5. Carbon Monoxide (CO) (milligrams per cubic meter)	Maximum Average in Any 8 Hours	10		5
	Maximum Average in Any 1 Hour	40		10
6. Ozone (micrograms per cubic meter	Maximum Average in Any 1 Hour	235		100
7. Lead (Pb) (micrograms per cubic meter)	Maximum Average in Any Calendar Quarter	1.5		1.5

TABLE 2

AIR MONITORING DATA
BARBERS POINT, OAHU
1974-88

	PARTICULATES*			SO_2			NO_2		
YEAR	RANGE	MEAN	>AQS	RANGE	MEAN	>AQS	RANGE	MEAN	>AQS
1974	23-132	47	1	<5-10	<5	0	<20-40	25	0
1975	13-137	52	1	<5-11	<5	0	< 5-25	11	0
1976	12-101	40	1	<5-7	<5	0	< 5-29	14	0
1977	25-134	54	1	<5-18	<5	0	------	--	-
1978	22-127	48	1	<5-40	<5	0	------	--	-
1979	23-223	76	10	<5-27	<5	0	------	--	-
1980	29-158	53	2	<5-10	<5	0	------	--	-
1981	26-188	51	2	<5-40	<5	0	------	--	-
1982	15- 63	41	0	<5-12	<5	0	------	--	-
1983	28-193	--	2	<5-95	--	1	------	--	-
1984	17-112	50	1	<5-<5	<5	0	------	--	-
1985*	24-138	57	3	<5-25	<5	0	------	--	-
1986*	7-66	26	0	<5-10	<5	0	------	--	-
1987*	10-40	22	0	<5-13	<5	0	------	--	-
1988*	10-48	24	0	<5-19	<5	0	------	--	-

NOTES:
1. Particulates = 1974-84, total suspended particulates (TSP) 1985-88, particulate matter <10 microns (PM-10)
2. SO2 = sulfur dioxide
3. NO2 = nitrogen dioxide
4. >AQS = number of violations of state air quality standard
5. All concentrations are in micrograms per cubic meter of air.
6. Sampling station was moved from Barbers Point Lighthouse to the Chevron Refinery site due to salt spray from the ocean on 17 March 1972.
7. The samplers were elevated to a rooftop on 7 August 1979.
8. Source: State Department of Health

TABLE 3

SUMMARY OF AEROMETRIC DATA COLLECTED
AT THE DEPARTMENT OF HEALTH BUILDING

1978 - 1987

TOTAL SUSPENDED PARTICULATES	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
(24-hr values, ug/m3)										
Period of sampling (mos.):	12	12	12	8	12	12	12	12	12	12
Number of samples:	60	8	61	35	55	56	60	59	57	53
Range of values:	14-53	22-62	23-103	23-75	11-42	14-58	11-48	10-48	11-61	14-59
Mean of values:	29	32	37	40	29	26	25	24	25	25
Number of times State AQS exceeded:	0	0	1	0	0	0	0	0	0	0
SULFUR DIOXIDE										
(24-hr values, ug/m3)										
Period of sampling (mos.):	12	12	12	8	12	12	12	12	12	12
Number of samples:	61	57	58	38	50	56	58	53	57	54
Range of values:	<5-44	<5-42	<5-60	<5-44	<5-38	<5-16	<5-<5	<5-<5	<5-6	<5-11
Mean of values:	18	22	18	19	11	<5	<5	<5	<5	<5
Number of times State AQS exceeded:	0	0	0	0	0	0	0	0	0	0
PHOTOCHEMICAL OXIDANTS										
(Daily 1-hr maxima, ug/m3)										
Period of sampling (mos.):	10	12	11	12	12	12	12	12	12	12
Number of samples:	284	337	295	314	335	348	296	341	348	342
Range of values:	10-84	10-80	10-84	10-104	0-151	0-123	0-104	8-198	10-88	4-84
Mean of values:	33	39	38	37	32	46	44	43	39	38
Number of times State AQS exceeded:	0	0	0	1	2	2	1	3	0	0

TABLE 4

SUMMARY OF AEROMETRIC DATA COLLECTED
AT THE DEPARTMENT OF HEALTH BUILDING

1971 - 1987

NITROGEN DIOXIDE	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980-87
(24-hr values)										
Period of sampling (mos.):	10	12	12	12	12	3	n.d.	n.d.	n.d.	n.d.
Number of samples:	83	113	99	90	91	22				
Range of values:	<20-159	<20-236	<20-95	<20-95	16-70	12-63				
Mean of values:	56	56	46	37	33	35				
Number of times State AQS exceeded:	1	2	0	0	0	0				

CARBON MONOXIDE	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
(Daily 1-hr maxima)										
Period of sampling (mos.):	12	8	n.d.	n.d.	n.d.	6	12	12	12	12
Number of samples:	365	208				169	318	342	348	345
Range of values:	0-20.7	0-17.3	Station moved to			0-8.6	0.6-10.9	0.0-10.4	0.2-13.5	0.3-11.1
Arithmetic mean of daily maximum values:	3.1	3.0		Kaimuki		2.4	2.4	1.5	2.2	1.7
Number of days State AQS exceeded:	19	10	10			0	1	1	3	1

TABLE 5

LEAD MONITORING DATA
HONOLULU, OAHU
1970-87

AVERAGE CONCENTRATION (micrograms/cubic meter)

YEAR	1st QUARTER	2nd QUARTER	3rd QUARTER	4th QUARTER
1970	0.78	0.81	0.65	0.92
1971	1.65	0.63	0.65	1.05
1972	--	0.75	0.65	0.48
1973	0.52	0.52	0.72	0.55
1974	0.84	0.61	0.70	0.92
1975	0.65	0.81	0.59	1.05
1976	0.91	0.65	0.99	1.00
1977	0.89	0.59	0.48	0.80
1978	--	--	--	0.72
1979	0.39	0.25	0.26	0.42
1980	0.41	0.23	0.21	0.20
1981	0.25	--	--	--
1982	0.21	0.16	0.09	0.21
1983	n/a	n/a	n/a	n/a
1984	0.3	0.2	0.2	0.3
1985	0.1	0.03	0.02	0.1
1986	0.1	0.0	0.0	0.0
1987	0.0	0.0	0.0	0.0

Source: State of Hawaii
Department of Health

TABLE 6

ONSITE CARBON MONOXIDE SAMPLING RESULTS
KALAELOA BOULEVARD AT MALAKOLE ROAD
SEPTEMBER, 1989

Date	Day of Week	Time	Distance	Side	CO mg/m3	Onsite Weather WD deg [s.d.]	Onsite Weather WS m/s
22 Sep 89	Fri	6:15 - 7:15 am	5 m	West	2.8	341 [12]	0.5
25 Sep 89	Mon	3:15 - 4:15 pm	5 m	West	4.9	25 [22]	1.2

TABLE 7

TOXIC EMISSIONS INVENTORY
CAMPBELL INDUSTRIAL PARK
EWA, OAHU
1987

CHEMICAL NAME	EMISSIONS (LB/YR)	FACILITY
1,1,1-Trichloroethane	75,240	Reynolds Metals Company
	500	Chevron U.S.A. Inc.
1,2,4-Trimethylbenzene	18,500	Chevron U.S.A. Inc.
	9,400	Hawaiian Independent Refinery
1,2-Dibromoethane	500	Chevron U.S.A. Inc.
1,2-Dichloroethane	500	Chevron U.S.A. Inc.
1,3-Butadiene	500	Chevron U.S.A. Inc.
1,3-Dichloropropylene	1,000	Chevron U.S.A. Inc.
Aluminum Oxide	150,250	Chevron U.S.A. Inc.
	360	Hawaiian Cement
Ammonia	242,900	Chevron U.S.A. Inc.
	3,100	Hawaiian Independent Refinery
Benzene	22,000	Hawaiian Independent Refinery
	18,100	Chevron U.S.A. Inc.
Chlorine	500	Chevron U.S.A. Inc.
Cyclohexane	24,000	Chevron U.S.A. Inc.
	8,900	Hawaiian Independent Refinery
Ethylbenzene	11,200	Chevron U.S.A. Inc.
	5,000	Hawaiian Independent Refinery
Ethylene	3,050	Chevron U.S.A. Inc.
Glycol Ethers	61,445	Reynolds Metals Company
Lead	500	Chevron U.S.A. Inc.
Methanol	500	Chevron U.S.A. Inc.
Methyl Tert-Butyl Ether	4,200	Hawaiian Independent Refinery
N-Butyl Alcohol	120,650	Reynolds Metals Company
Naphthalene	6,700	Chevron U.S.A. Inc.
	250	Hawaiian Independent Refinery
Propylene	33,750	Chevron U.S.A. Inc.
	250	Hawaiian Independent Refinery
Sulfuric Acid	14,250	Chevron U.S.A. Inc.
	250	Brewer Chemical Corporation
Toluene	40,000	Chevron U.S.A. Inc.
	57,000	Hawaiian Independent Refinery
Xylene (Mixed Isomers)	50,000	Hawaiian Independent Refinery
M-Xylene	34,000	Chevron U.S.A. Inc.
O-Xylene	20,800	Chevron U.S.A. Inc.
P-Xylene	8,800	Chevron U.S.A. Inc.

SOURCE: U.S. Environmental Protection Agency

TABLE 8

1980 EMISSIONS INVENTORY
CITY & COUNTY OF HONOLULU

SOURCE CATEGORY	EMISSIONS (Tons/Year)				
	PM	SOx	NOx	CO	HC
Steam Electric Power Plants	2092	36,736	12,455	1,065	184
Gas Utilities	14	0	199	0	0
Fuel Combustion in Agricultural Industry	1088	579	358	0	31
Refinery Industry	622	7,096	2,149	266	2,584
Petroleum Storage	0	0	0	0	1,261
Metallurgical Industries	28	96	40	0	0
Mineral Products Industry	6,884	1,883	597	0	31
Municipal Incineration	42	145	2,029	0	184
Motor Vehicles	1,413	1,014	17,270	239,198	22,853
Construction, Farm and Industrial Vehicles	184	193	2,507	3,729	338
Aircraft	382	145	1,751	5,594	1,476
Vessels	42	386	438	533	123
Agricultural Field Burning	1,399	0	0	15,982	1,692
TOTAL:	14,191	48,274	39,792	266,367	30,758

SOURCE: State Department of Health

TABLE 9

HONOLULU INTERNATIONAL AIRPORT
ANNUAL WIND ROSE

	Wind Speed (Kts)						
Direction	0 - 3	4 - 7	8 - 12	13 - 18	19 - 24	>24	TOTAL
N	0.0149	0.0261	0.0075	0.0020	0.0002	0.0000	0.0506
NNE	0.0114	0.0219	0.0106	0.0046	0.0005	0.0000	0.0490
NE	0.0114	0.0449	0.0829	0.0853	0.0204	0.0018	0.2466
ENE	0.0088	0.0637	0.1559	0.1209	0.0224	0.0014	0.3731
E	0.0039	0.0179	0.0329	0.0210	0.0023	0.0001	0.0782
ESE	0.0021	0.0056	0.0050	0.0015	0.0003	0.0001	0.0146
SE	0.0021	0.0059	0.0091	0.0049	0.0006	0.0002	0.0228
SSE	0.0023	0.0074	0.0123	0.0038	0.0008	0.0002	0.0268
S	0.0025	0.0104	0.0127	0.0033	0.0005	0.0003	0.0296
SSW	0.0011	0.0041	0.0053	0.0017	0.0003	0.0000	0.0125
SW	0.0007	0.0031	0.0058	0.0022	0.0003	0.0001	0.0122
WSW	0.0006	0.0017	0.0031	0.0022	0.0005	0.0001	0.0082
W	0.0019	0.0030	0.0021	0.0009	0.0002	0.0001	0.0082
WNW	0.0027	0.0051	0.0012	0.0003	0.0001	0.0000	0.0094
NW	0.0084	0.0153	0.0031	0.0008	0.0003	0.0000	0.0279
NNW	0.0087	0.0166	0.0041	0.0012	0.0002	0.0000	0.0308
TOTAL:	0.0835	0.2527	0.3534	0.2567	0.0496	0.0043	1.0002

FIGURES

FIGURE 1

PROJECT LOCATION

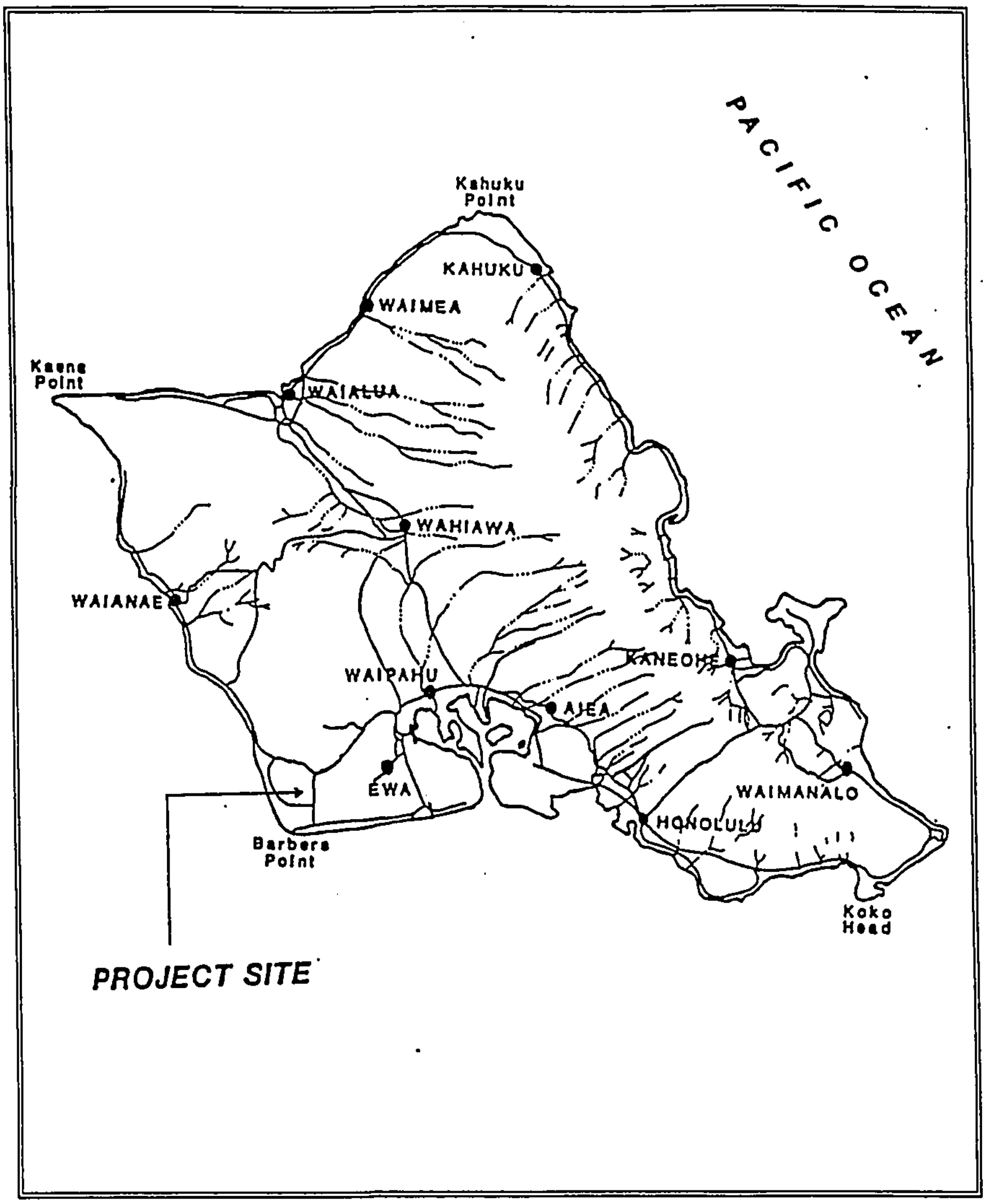
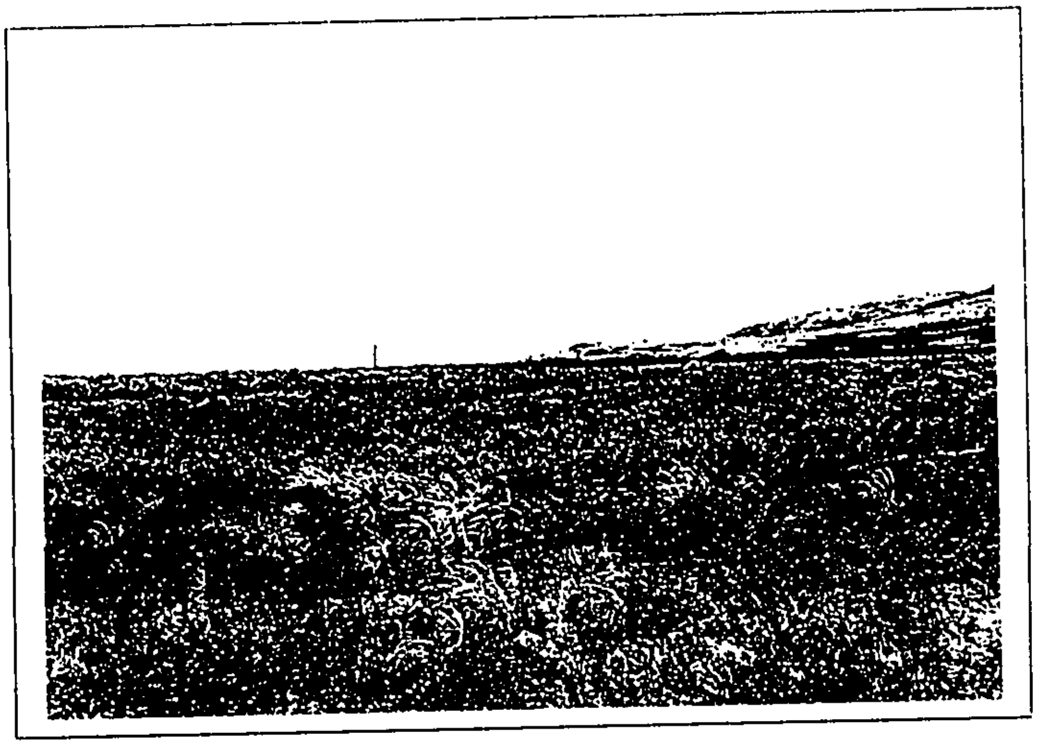
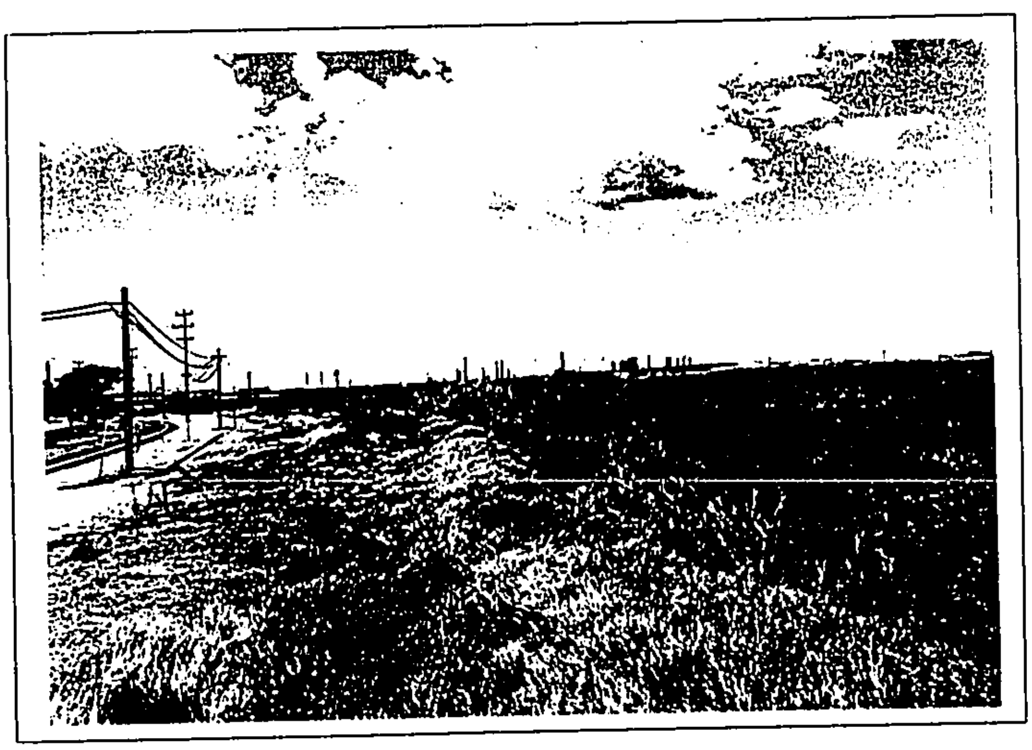


FIGURE 2

EXISTING SITE CONDITIONS

Facing West-Northwest toward Kahe Power Plant





Facing Southwest to Chevron Refinery

FIGURE 3

A.M. PEAK HOUR CONDITIONS
KALAELOA BOULEVARD AT MALAKOLE ROAD
SEPTEMBER 22, 1989

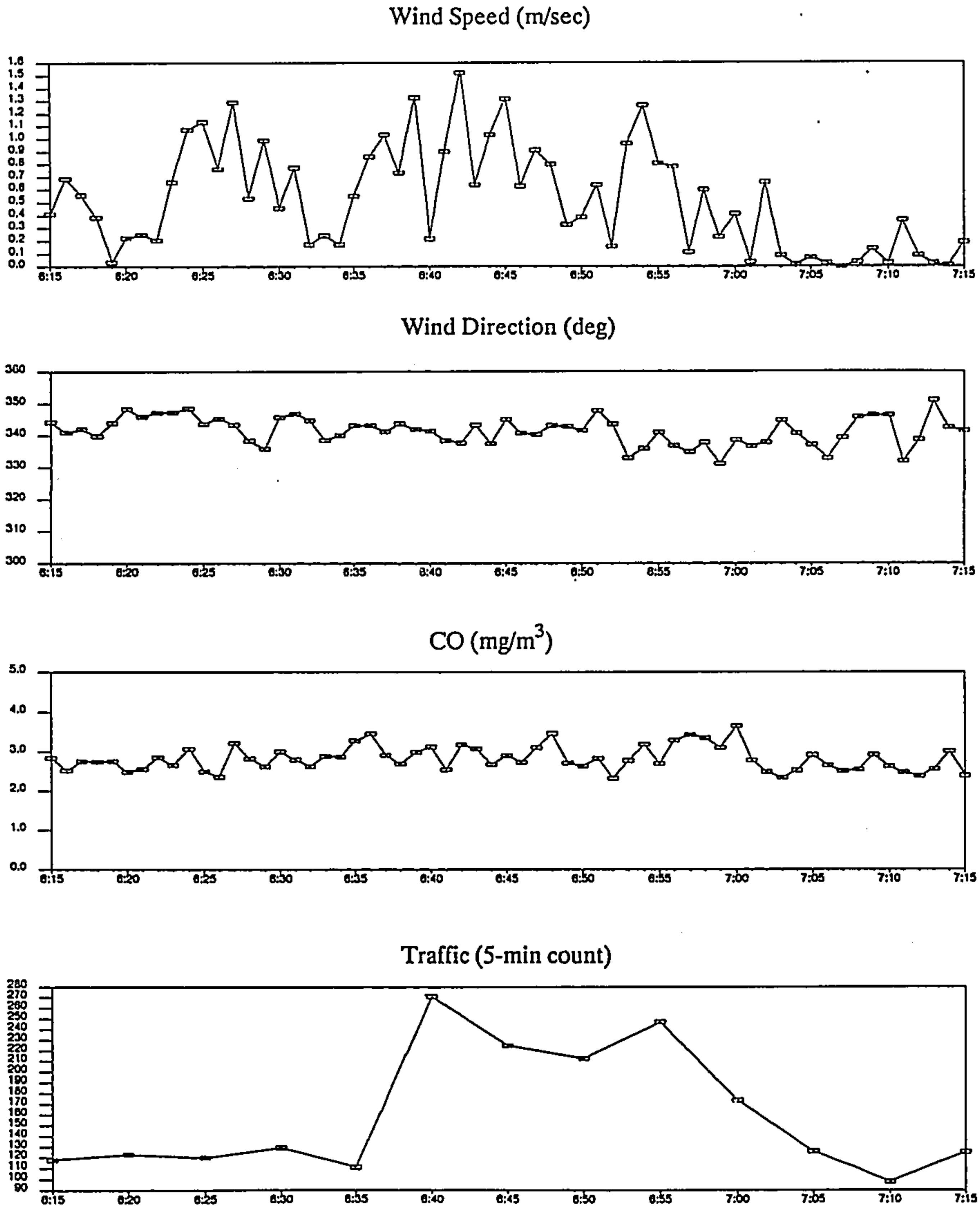


FIGURE 4

P.M. PEAK HOUR CONDITIONS
KALAELOA BOULEVARD AT MALAKOLE ROAD
SEPTEMBER 25, 1989

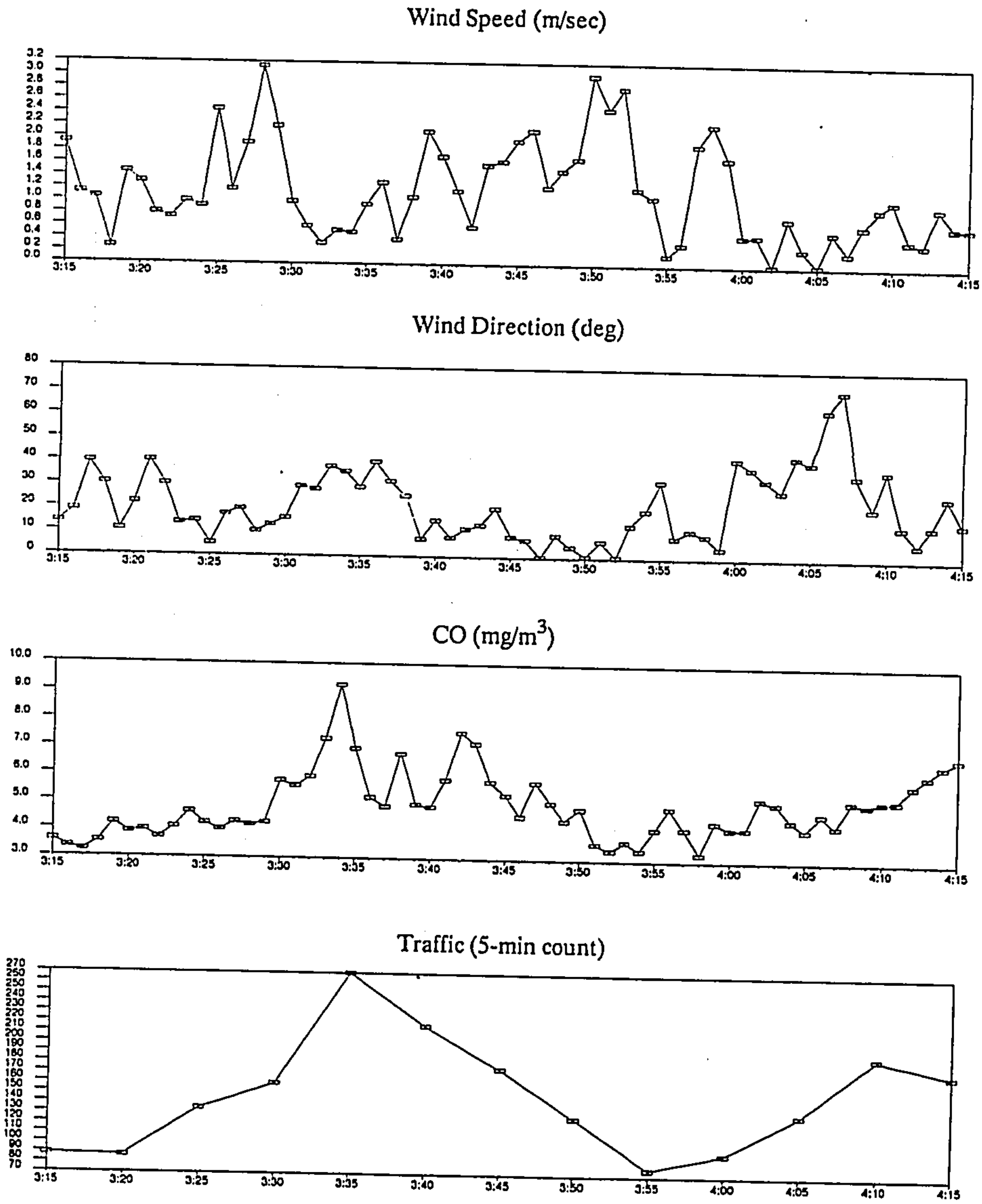
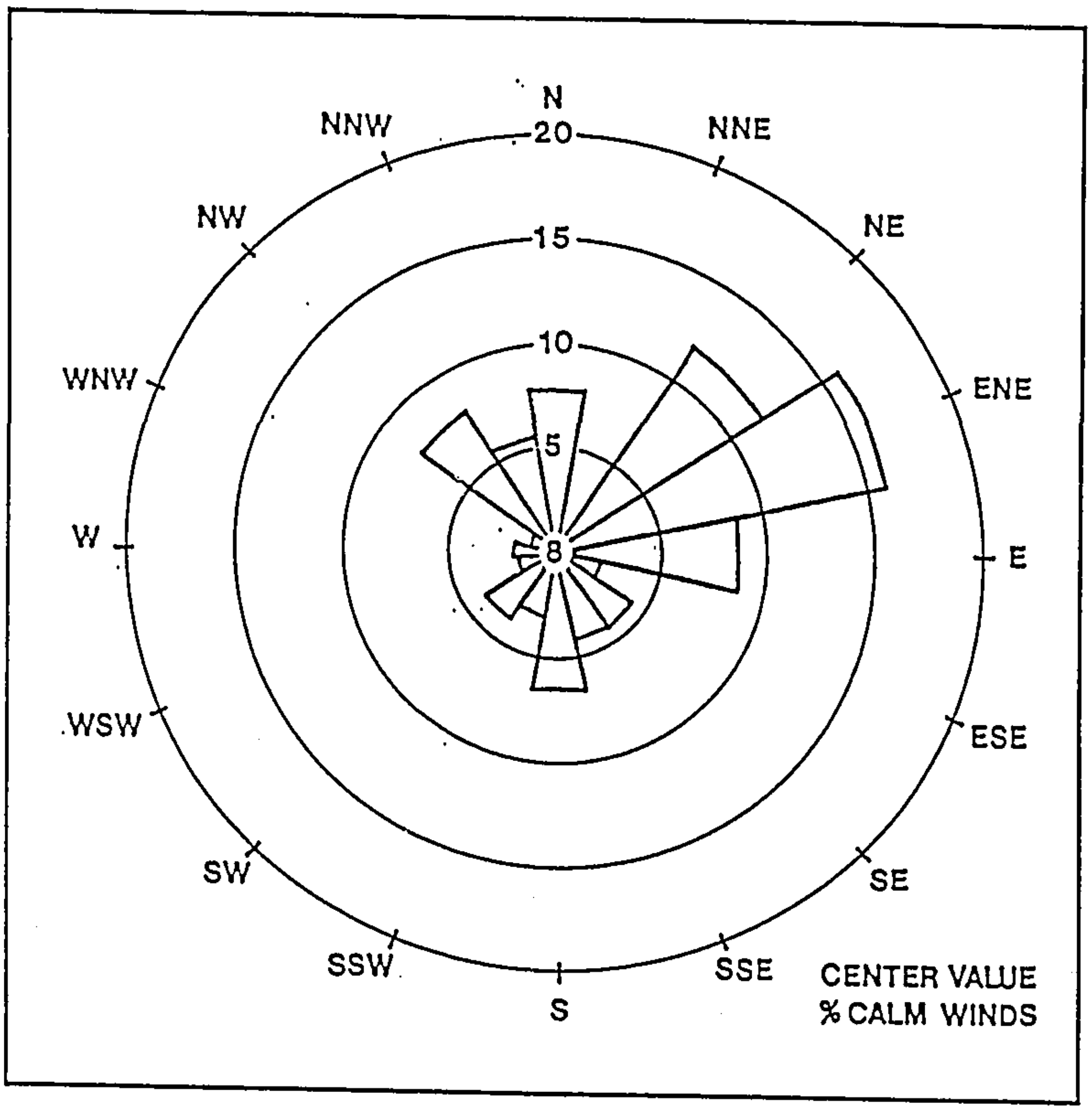


FIGURE 5

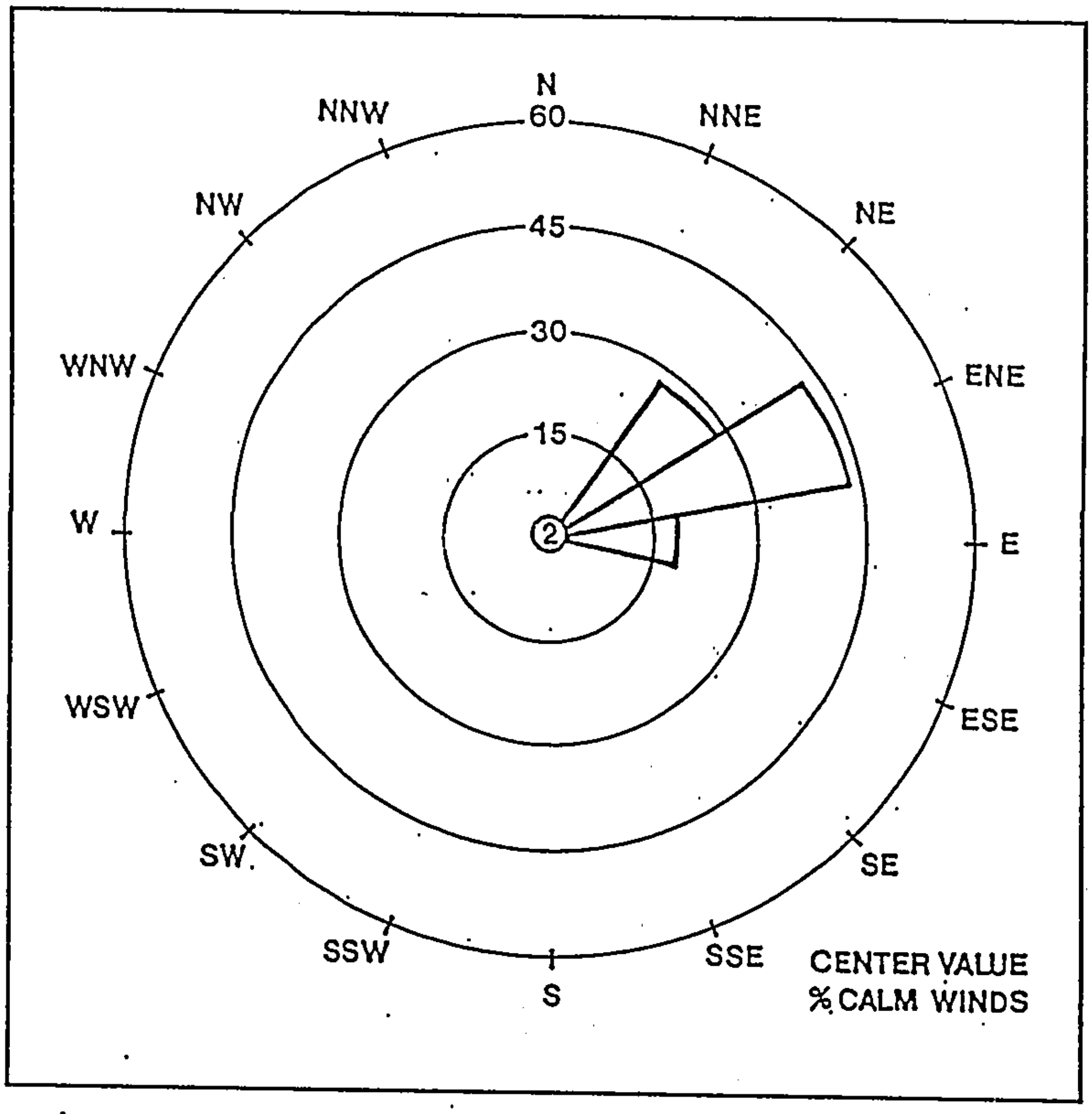
JANUARY WINDROSE
HONOLULU INTERNATIONAL AIRPORT



SOURCE: National Weather Service (1940-67)

FIGURE 6

AUGUST WINDROSE
HONOLULU INTERNATIONAL AIRPORT

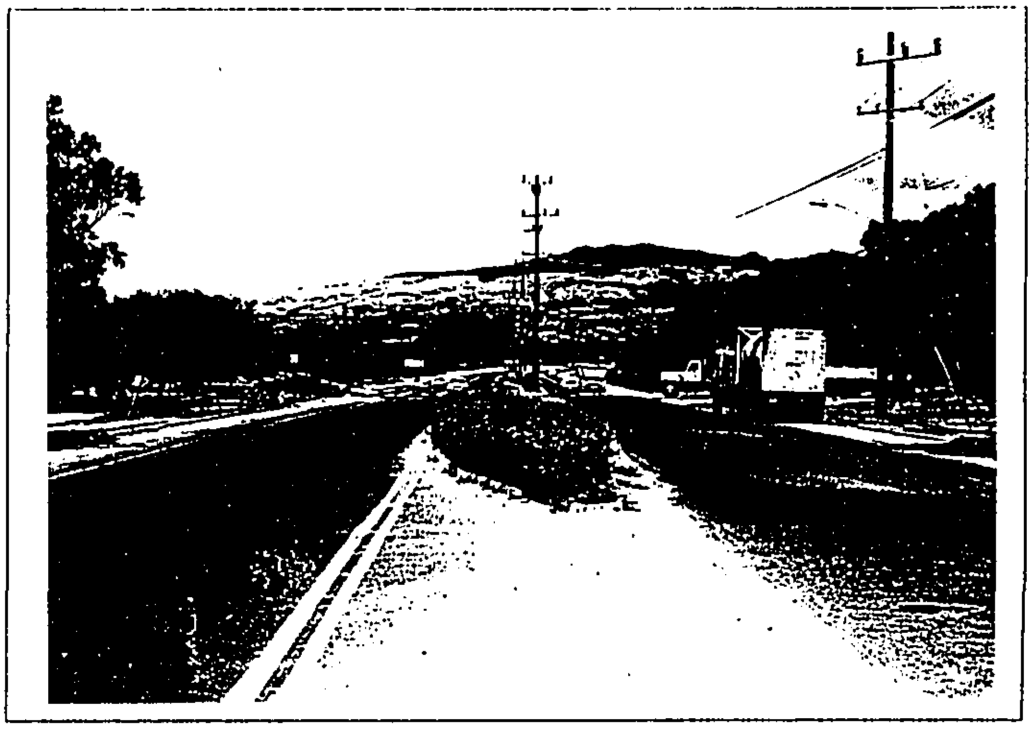


SOURCE: National Weather Service (1940-67)

FIGURE 7

KALAELOA BOULEVARD AT MALAKOLE ROAD

Kalaeloa Boulevard (facing North)

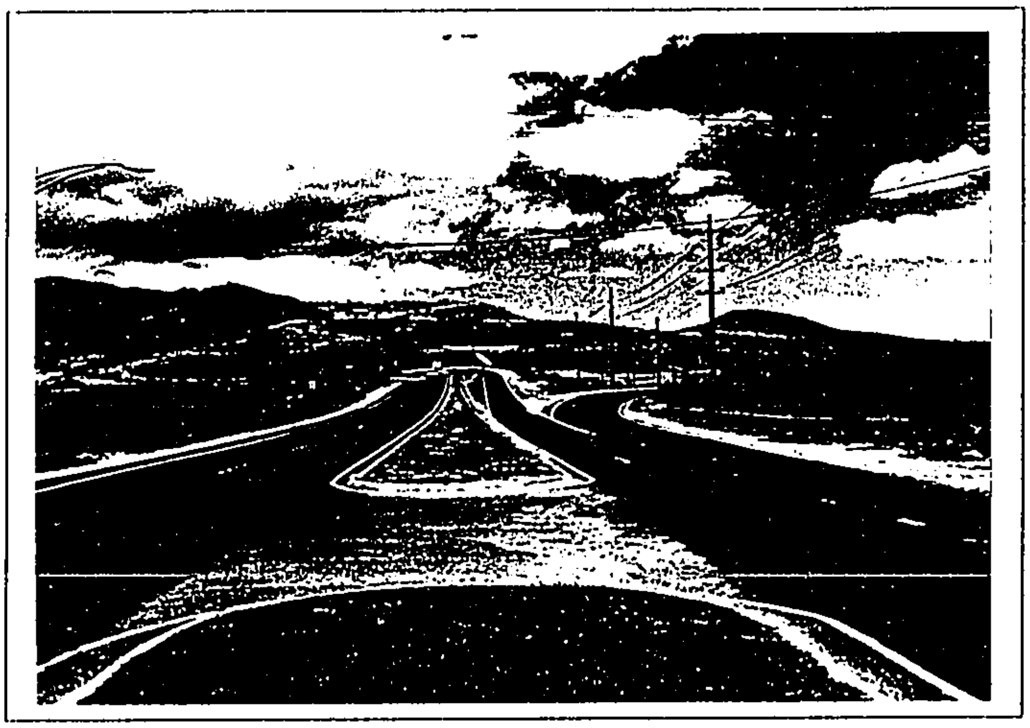


Malakole Road (facing West)

FIGURE 8

KALAELOA BOULEVARD NORTH OF PROJECT SITE

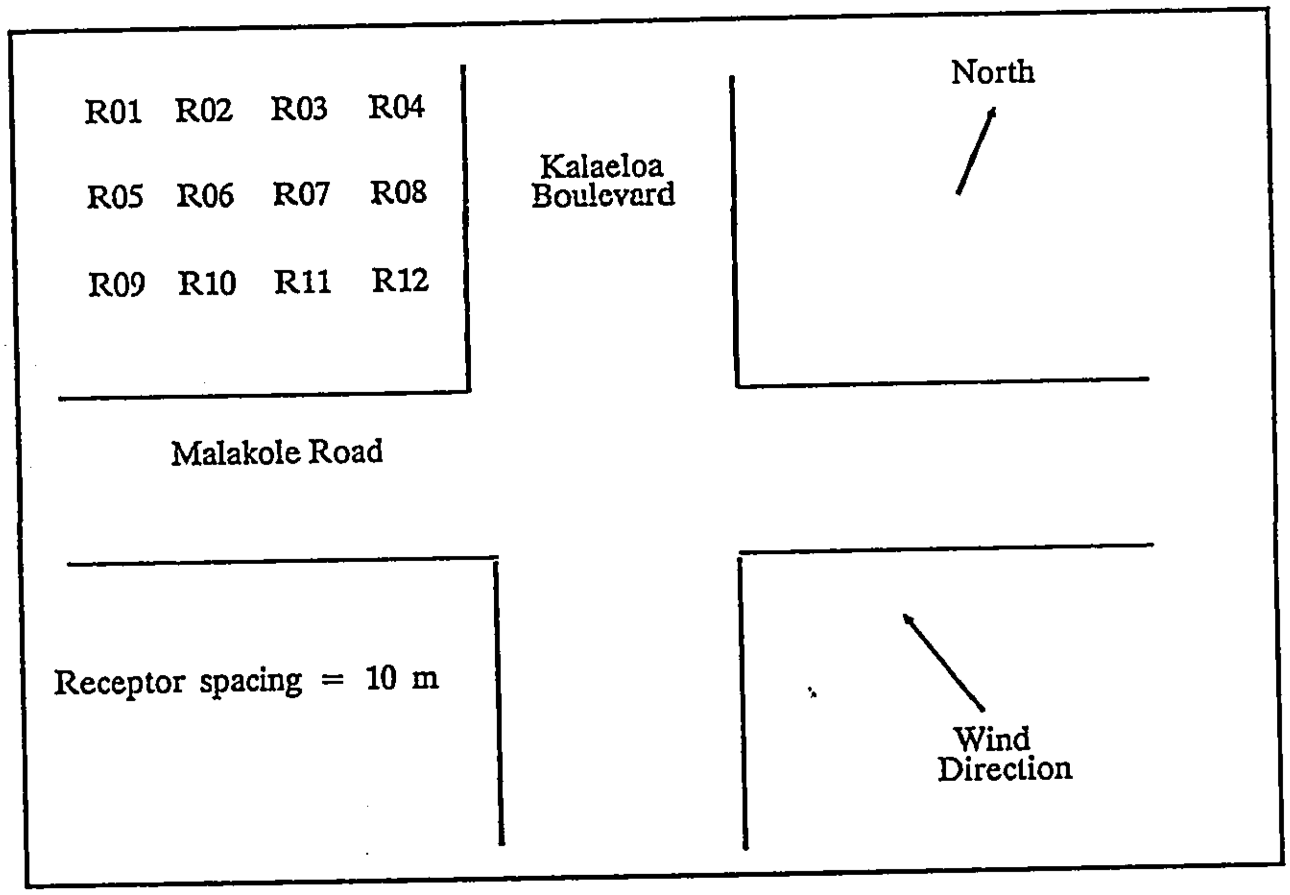
Kalaeloa Boulevard Vicinity of Proposed Road "A" (facing Northeast)



Palailai Interchange (facing North)

FIGURE 9

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Kalaeloa Boulevard at Malakole Road
A.M. Peak Hour
1989 - 2030

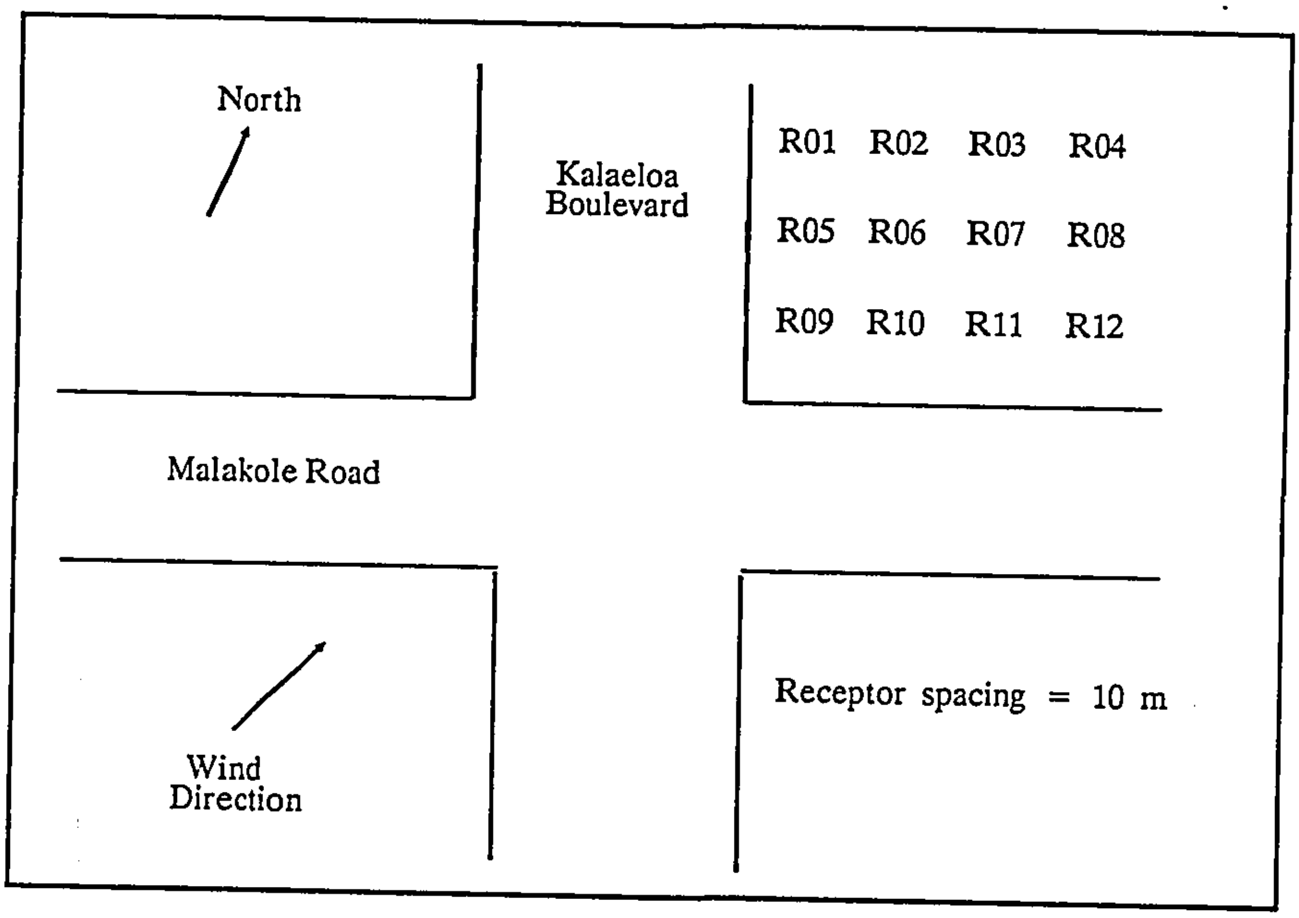


Concentration (mg/m^3)

Receptor	1989	2030 w/o proj	2030 w/proj
R01	2.7	3.8	4.2
R02	3.5	5.4	6.4
R03	4.9	8.3	10.1
R04	6.7	13.2	14.0
R05	2.5	3.0	3.0
R06	2.8	3.9	4.3
R07	3.9	6.2	7.3
R08	6.0	11.2	14.2
R09	2.7	2.6	2.2
R10	2.8	3.1	3.0
R11	3.2	4.4	4.8
R12	4.4	7.3	8.3

FIGURE 10

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Kalaeloa Boulevard at Malakole Road
P.M. Peak Hour
1989 - 2030

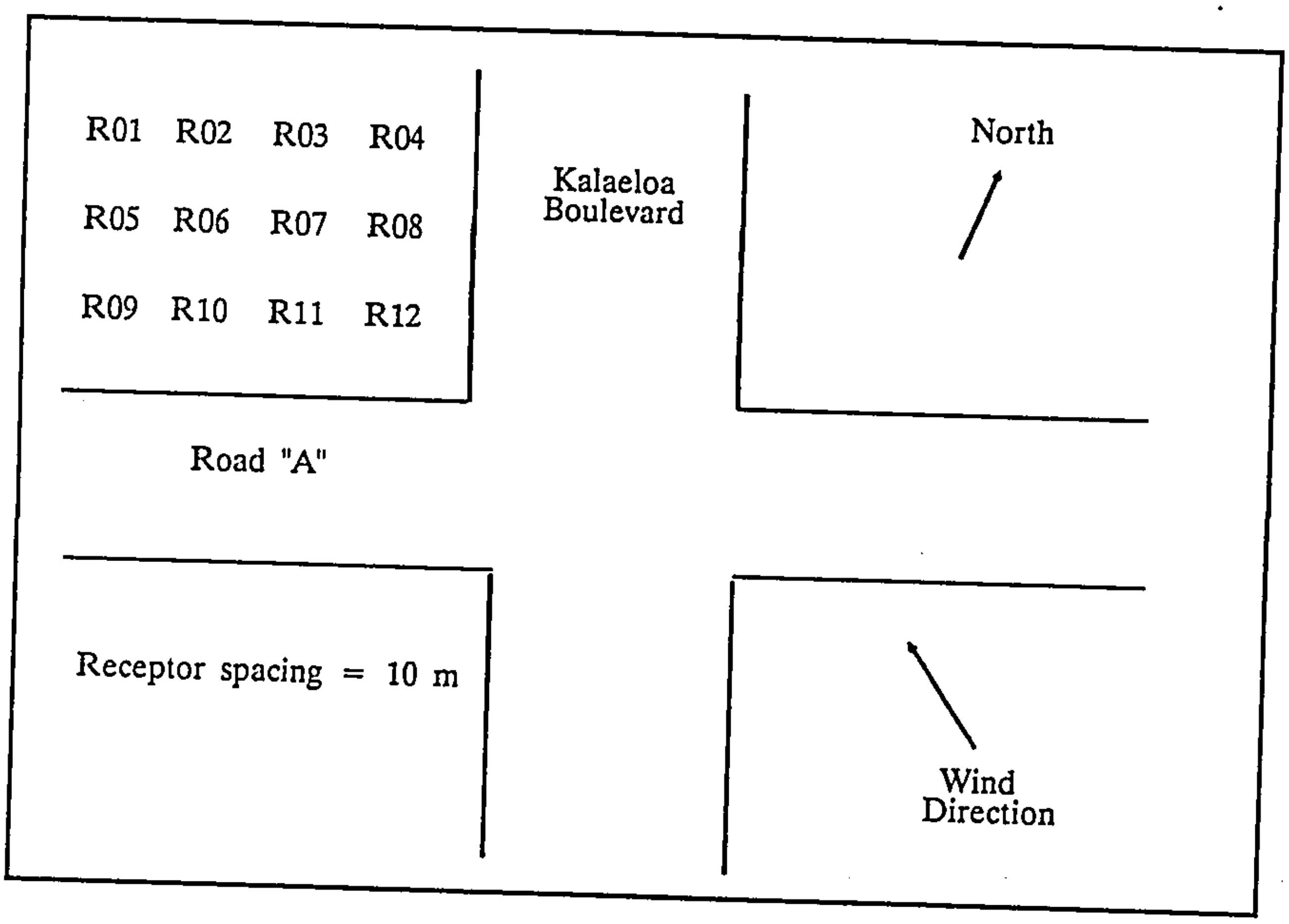


Concentration (mg/m^3)

Receptor	1989	2030 w/o proj	2030 w/proj
R01	3.8	5.0	3.8
R02	3.0	4.3	3.6
R03	2.6	3.9	3.5
R04	2.4	3.6	3.3
R05	3.6	5.5	4.7
R06	3.1	4.7	4.3
R07	2.7	4.1	3.9
R08	2.6	3.6	3.3
R09	3.6	5.7	5.8
R10	3.3	5.1	5.1
R11	3.1	4.4	4.0
R12	3.1	3.6	3.1

FIGURE 11

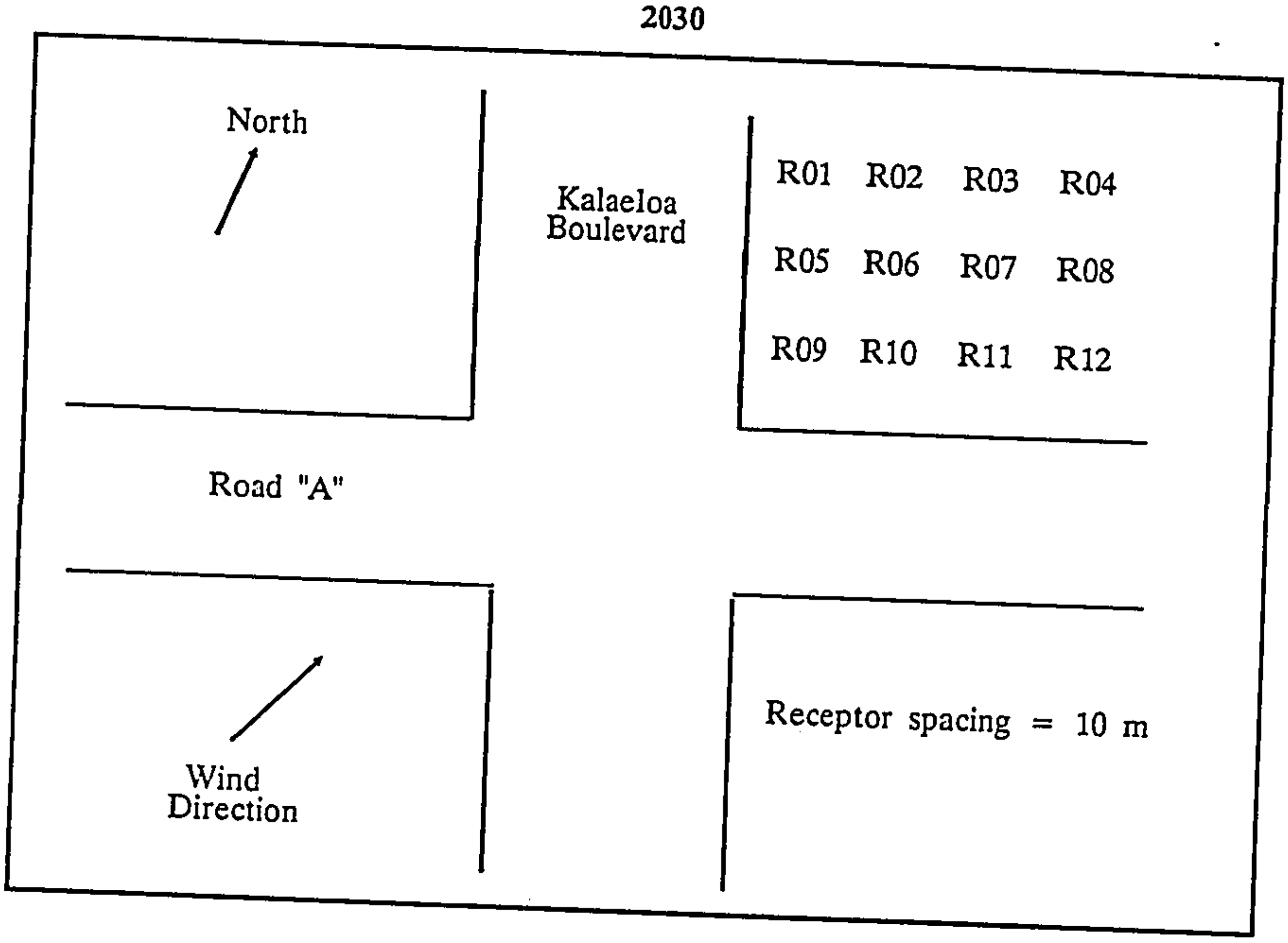
ESTIMATES OF MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS
Kalaeloa Boulevard at Proposed Road "A"
A.M. Peak Hour
2030



Receptor	Concentration (mg/m^3) w/o proj	w/proj
R01	4.3	4.2
R02	5.9	5.7
R03	8.4	8.3
R04	12.4	12.7
R05	3.4	3.3
R06	4.6	4.6
R07	6.8	6.7
R08	11.2	10.9
R09	2.8	2.7
R10	3.5	3.4
R11	5.1	5.4
R12	8.7	8.3

FIGURE 12

ESTIMATES OF MAXIMUM 1-HOUR
CARBON MONOXIDE CONCENTRATIONS
Kalaeloa Boulevard at Proposed Road "A"
P.M. Peak Hour
2030



	Concentration (mg/m^3)	
Receptor	w/o proj	w/proj
R01	4.3	5.0
R02	4.0	4.4
R03	3.9	4.1
R04	3.8	3.8
R05	4.8	5.7
R06	4.7	4.9
R07	4.4	4.3
R08	4.1	3.9
R09	6.5	6.4
R10	6.0	5.4
R11	5.1	4.4
R12	4.4	3.8

PROFESSIONAL QUALIFICATIONS

James W. Morrow, M.S.

Environmental Management Consultant

DATE OF BIRTH:	January 25, 1945	
EDUCATION:	B.S. (cum laude) Biochemistry June, 1966	University of New Hampshire Durham, New Hampshire
	M.S. Public Health August, 1973	University of Hawaii Honolulu, Hawaii
LANGUAGE TRAINING:	Vietnamese (3 years) - University of Hawaii Cambodian (2 years) - University of Hawaii Thai (2 years) - University of Hawaii German (1 year) - University of New Hampshire	
HONORS, SCHOLARSHIPS:	East-West Center Grantee, 1971-73 National Science Foundation Undergraduate Research Program, 1964-66 New York State Regents Scholarship, 1962	
MILITARY TRAINING:	ROTC Distinguished Military Graduate, 1966 US Army Chemical School Basic Officer's Course, 1967 Chemical Officer's Advanced Course, 1980 Radiological Safety Course, 1985 Command & General Staff College, 1986 (with honors)	
MILITARY ASSIGNMENTS:	Assistant Corps Chemical Officer (HQ IX Corps) Radiological Protection Officer (HQ IX Corps) Instructor, Nuclear-Biological-Chemical Defense Current Rank: Lieutenant Colonel	
PRESENT POSITION(S):	Environmental Management Consultant 1974 to present	
	Director, Environmental Health American Lung Association of Hawaii August, 1973 to present	
	Clinical Faculty (currently Associate Professor of Public Health) School of Public Health, University of Hawaii-Manoa 1978 to present	

AIR QUALITY CONSULTING SERVICES

PROJECT	YEAR(S)
Bayview Golf Course	1989
Pu'uhonua Subdivision	1989
Pualani Subdivision	1989
Kwajalein Environmental Assessment	1989
Kihei Hotel Project	1989
Honolulu Waterfront Development	1989
Ford Isle Causeway	1988
Pokahea Quarry Relocation	1988
Paluaea Lands Development (Maui)	1988
Waikoloa Resort Expansion	1988
Hawaii Film Studio (Fort Ruger)	1988
Airport Trade Center	1988
West Maui Marina	1988
Kinau Street Offramp	1988
Wahiawa Mixed Use Project	1988
Maui Wailea 670	1988
Honolulu Civic Center and City Hall Annex	1988
Maili Kai Property Affordable Housing	1988
Honolulu Rapid Transit System	1987
Kahului Airport Master Plan	1987
Keahole Airport Master Plan	1987
Kapolei Village	1987
West Loch Estates	1987
Hawaii Film Studio	1987
Honolulu International Airport Master Plan Update	1987
Ewa Town Center	1987
Hawaiian Riviera Resort	1987
AMFAC Entertainment Center	1987
Kwajalein Power Plant Renovation	1987
Kalakaua Sidewalks Widening Project	1986
Kaupulehu Resort	1986
Nitto Kogyo Golf Course	1986
Kipapa Cannery	1985
Hawaii High Technology Park	1985
Kuakini Medical Center Incinerator	1985
Pali Highway Carbon Monoxide Study	1985
Mauna Lani Resort	1985
Ka'u Agribusiness Power Plant	1985
Honolulu Resource Recovery Facility	1985

AIR QUALITY CONSULTING SERVICES (continued)

Ford Island Causeway	1984
North Kohala Residential/Resort	1984
Hapuna Beach Resort	1984
Waikoloa Hyatt Regency Hotel	1984
Hilton Hawaiian Village Renovation	1984
Queens Medical Center Incinerator	1983
Waipahu Incinerator Stack Testing	1983
Tripler Army Medical Center Steam Plant	1982
Honouliuli Wastewater Treatment Facility Sludge Incinerator and Backup Boiler	1982
Kalua Koi Residential/Resort	1982
Ala Moana Center Parking Structure Carbon Monoxide Study	1982
Honolulu Program of Waste Energy Recovery (HPOWER)	1980
Honolulu International Airport Master Plan Study	1980
Ewa Marina Community	1979
Mahukona Residential Resort	1979
Lalamilo Water Supply System	1979
Kailua-Kona Shopping Center & Industrial Park	1979
Mauna Kea Beach Hotel Power Plant	1978
Halekulani Hotel Expansion	1978
Mililani Town - Increment Five	1978
Tapa Tower - Hilton Hawaiian Village	1977
Kunia General Aviation Airport	1977
Dillingham Airfield	1977
Tripler Army Medical Center Modernization	1977
Oahu General Aviation Master Plan Study	1976
Aliamanu Military Housing Project	1974

CONTINUING EDUCATION

Course Title & Sponsoring Institution	Year
"Design & Current Status of Dry Scrubbing Systems" Air Pollution Control Association New York, New York	1987
Lethal Chemical Agent Decontamination Training US Army Chemical School Ft. McClellan, Alabama	1987
M8A1 Automatic Chemical Agent Alarm Certification Course Schofield Barracks, Hawaii	1986
Radiological Safety Course US Army Chemical School Ft. McClellan, Alabama	1984
"Principles & Practice of Air Pollution Control" (EPA Course No. 452) Honolulu, Hawaii	1982
"EPA Disperson Models" Air Pollution Control Association New Orleans, Louisiana	1982
"Dispersion Modeling of Complex Sources" Air Pollution Control Association Philadelphia, Pennsylvania	1981
"Control Equipment for Particulate Emissions "Industrial Ventilation Systems" "Airborne Radioactive Emissions" "Thermal Processing of Hazardous Organic Wastes" Air Pollution Control Association Montreal, Canada	1980
"Coastal Zone Meteorology and Air Quality Problems" Air Pollution Control Association Cincinatti, Ohio	1979
"Pesticide Protection for Health Personnel" EPA and University of Miami Medical School Honolulu, Hawaii	1977
"Principles of Industrial Toxicology" Wayne State University Detroit, Michigan	1977

RESEARCH

American Lung Association of Hawaii, 1973-74. Study of the unique short term air pollution episode occurring annually in Honolulu due to extreme use of fireworks at New Years.

University of Hawaii, School of Public Health, 1972-73. Study of the character, problems and solutions of wastewater treatment at a ready mix concrete plant.

University of New Hampshire, Department of Biochemistry, 1965-66. Study of cell wall constituents of selected Lactobacilli and means of separating and identifying those constituents.

University of New Hampshire, Department of Chemistry, 1964. Development of gas chromatographic method for separating and identifying polyamines from biological samples.

MEMBERSHIP IN HONORARY/PROFESSIONAL SOCIETIES

Air Pollution Control Association
American Public Health Association
National Association of Environmental Professionals
American Industrial Hygiene Association (Hawaii Section)
Hawaii Public Health Association
Alpha Chi Sigma (professional chemistry)
Sigma Xi
Phi Sigma (honorary biological sciences)
Phi Kappa Phi (academic honors)
Alpha Epsilon Delta (honorary pre-medical)
Alpha Zeta (honorary agricultural science)

PUBLICATIONS

Morrow, J. W., D. Thomas and H. Burkard. "H2S Monitoring in the Vicinity of Hawaii's First Geothermal Well," Paper No. 95-105B, Air Pollution Control Association Annual Meeting (1988)

Flachsbart, P. G. and J. W. Morrow. "Development of Hawaii's H2S Standards and Geothermal Regulations," Paper No. 87-104.5, Air Pollution Control Association Annual Meeting (1987)

Bach, W., A. Daniels, L. Dickinson, F. Hertlein, J. Morrow, S. Margolis, and V. Dinh. "Fireworks Pollution and Health," Intern. J. Environmental Studies, 7: 183-192 (1975)

Burbank, N. C. and J. W. Morrow. "Wastewater and Wastewater Treatment at a Ready Mix Concrete Plant, "Proceedings, 28th Annual Purdue Industrial Waste Conference (1973)

Ikawa, M., J. Morrow and S. Harney. "Paper Chromatographic System for the Identification of Glycerol in Bacterial Cell Walls," J. Bact., 92: 812-814 (1966)

APPENDIX I

Kapolei Business-Industrial Park, Social Impact Assessment

Earthplan

APPENDIX I

KAPOLEI BUSINESS–INDUSTRIAL PARK

SOCIAL IMPACT ASSESSMENT

PREPARED FOR
WILLIAM E. WANKET, INC.
BY
EARTHPLAN
November 1989

CONTENTS

TABLES AND FIGURES

SECTION 1: INTRODUCTION AND BACKGROUND

1 INTRODUCTION AND BACKGROUND

1.1 DESCRIPTION OF THIS REPORT

1.1.1 Purpose Of This Report

The Estate of James Campbell proposes to develop the Kapolei Business-Industrial Park in Ewa, Oahu. Part of the planned 920-acre business-industrial park, the project area encompasses 552.1 acres. The proposed project would essentially add uses similar to the existing James Campbell Industrial Park, plus a commercial area near Ko Olina and maritime industrial uses near the Barbers Point Deep Draft Harbor.

The project site is currently designated Agriculture on the Ewa Development Plan and zoned Ag-2, General Agriculture District. The Estate is currently requesting amendments to the Ewa Development Plan, and is preparing an Environmental Impact Statement as part of its application.

This social impact assessment was prepared in conjunction with the Environmental Impact Statement.

1.1.2 Preparers Of This Report

This report was prepared by Earthplan whose office is located at 81 South Hotel Street, Suite 211. *Berna Cabacungan*, principal of Earthplan, was the project manager, and principal interviewer, researcher and writer. Independent contractor *Michael P. Mays* assisted in research and analysis related to demographics and community issues, as well as in community interviews.

1.1.3 Report Organization

This report contains five major sections. The remaining portions of Section 1 presents the following discussions:

* Section 1.2 describes existing and surrounding uses and the proposed project.
* To help the reader understand the social impact assessment purpose and function, Section 1.3 describes social impact assessment in general and its application to Kapolei Business-Industrial Park.

Section 2 provides a profile of the existing community to establish the social context in which project impacts may occur. Information includes employment, population, housing and other social characteristics.

Section 3 explores the Study Area's future without the proposed project. This information extends the baseline data by identifying the possible future scenarios for the community independent of the proposed project. Public policies and major public and private developments are included in this analysis.

Section 4 identifies potential community issues and concerns on this project, based on historical trends to date and interviews conducted as part of this study.

Section 5 identifies potential social impacts of the Kapolei Business-Industrial Park. This section identifies the likely effects of the project on the nearby communities, in terms of the addition of a major employment center, compatibility with nearby uses, on-site considerations and impacts on public services and facilities.

1.2 PROJECT DESCRIPTION

1.2.1 Existing Uses

The project site is currently used for coral mining and agriculture, as well as motor racing, as follows:

* Coral mining operations on 267 acres are currently performed by Hawaiian Cement for the manufacture of cement and concrete products.

* Oahu Sugar Company is leasing 260 acres for sugar cane cultivation, and ten acres of this land is used for a small tree nursery.

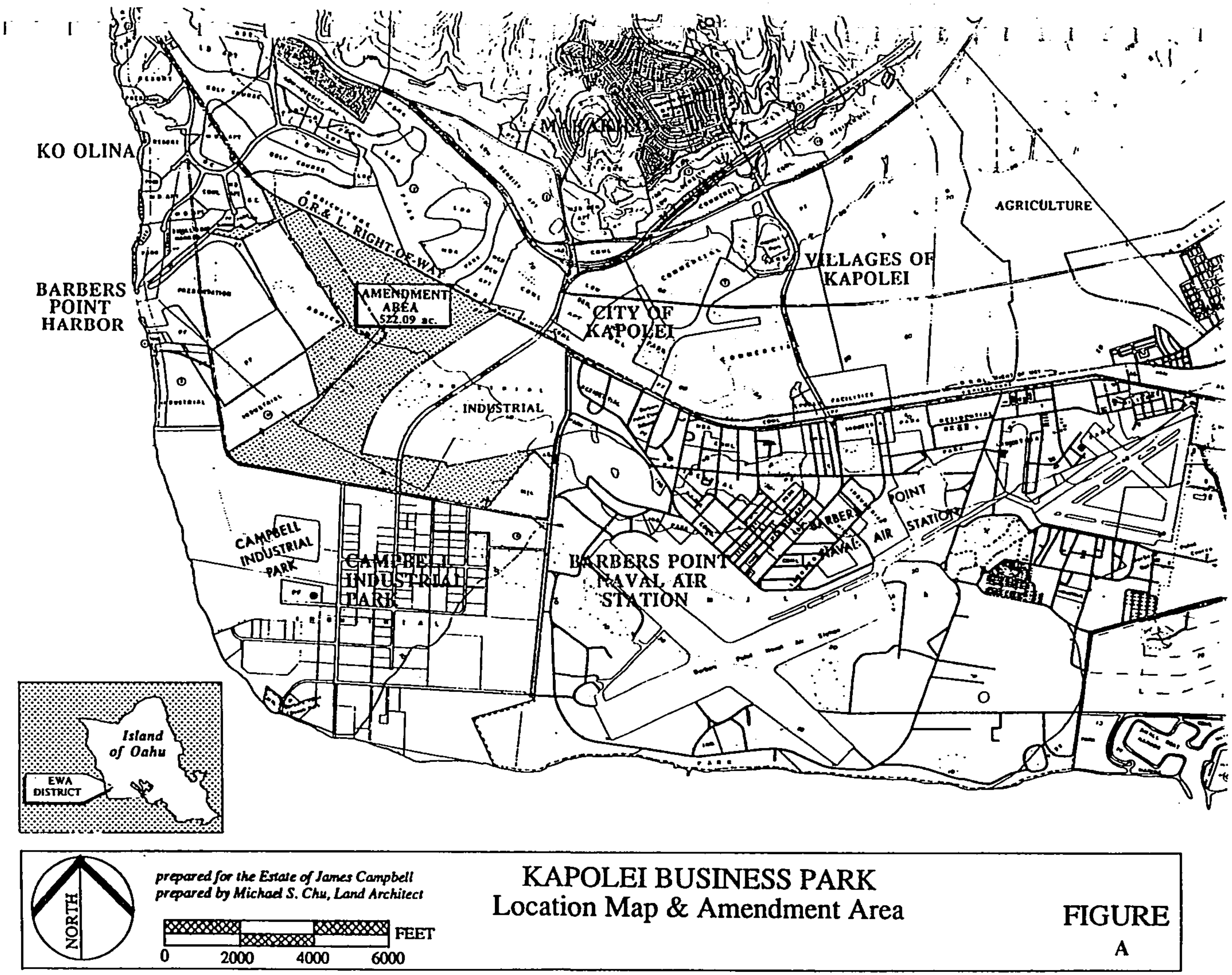
* Hawaii Raceway Park occupies 66 acres, as well as a portion of the adjacent parcel owned by the United States government. The City Council has established a temporary program through 1991 to allow racing at the park, and state and city officials are currently seeking another site for a permanent motor sports facility.

1.2.2 Surrounding Uses

Figure A illustrates the project's location. The existing 1,367-acre James Campbell Industrial Park is immediately south, or makai, of the project site. Currently, over 50 percent of this industrial park is owned by entities other than The Estate of James Campbell, and current negotiations may increase non-Estate landownership to 85 percent. Approximately 98 percent of the total park is in use or leased. Major employers include Hawaiian Independent Refinery, Chevron Oil, Hawaiian Cement, Reynolds of Hawaii and the Liberty House Distribution Center (personal communication with Susan Sublett, Assets Manager, The Estate of James Campbell, October 25, 1989).

Immediately west and north of the project site is the Ko Olina resort and residential community. Ko Olina is currently under construction. The Phase I 18-hole golf course is scheduled to begin operation in January 1990. In 1991, the initial residential and resort units will be ready for occupancy (personal communication with Gary Omori, Director of Government and Community Relations, October 26, 1989).

Also west of the project site is the Barbers Point Deep Draft Harbor, a new state-owned harbor. Being developed by the State Department of Transportation, Harbors Division, the harbor is partially complete.



prepared for the Estate of James Campbell
prepared by Michael S. Chu, Land Architect

KAPOLEI BUSINESS PARK
Location Map & Amendment Area

FIGURE
A

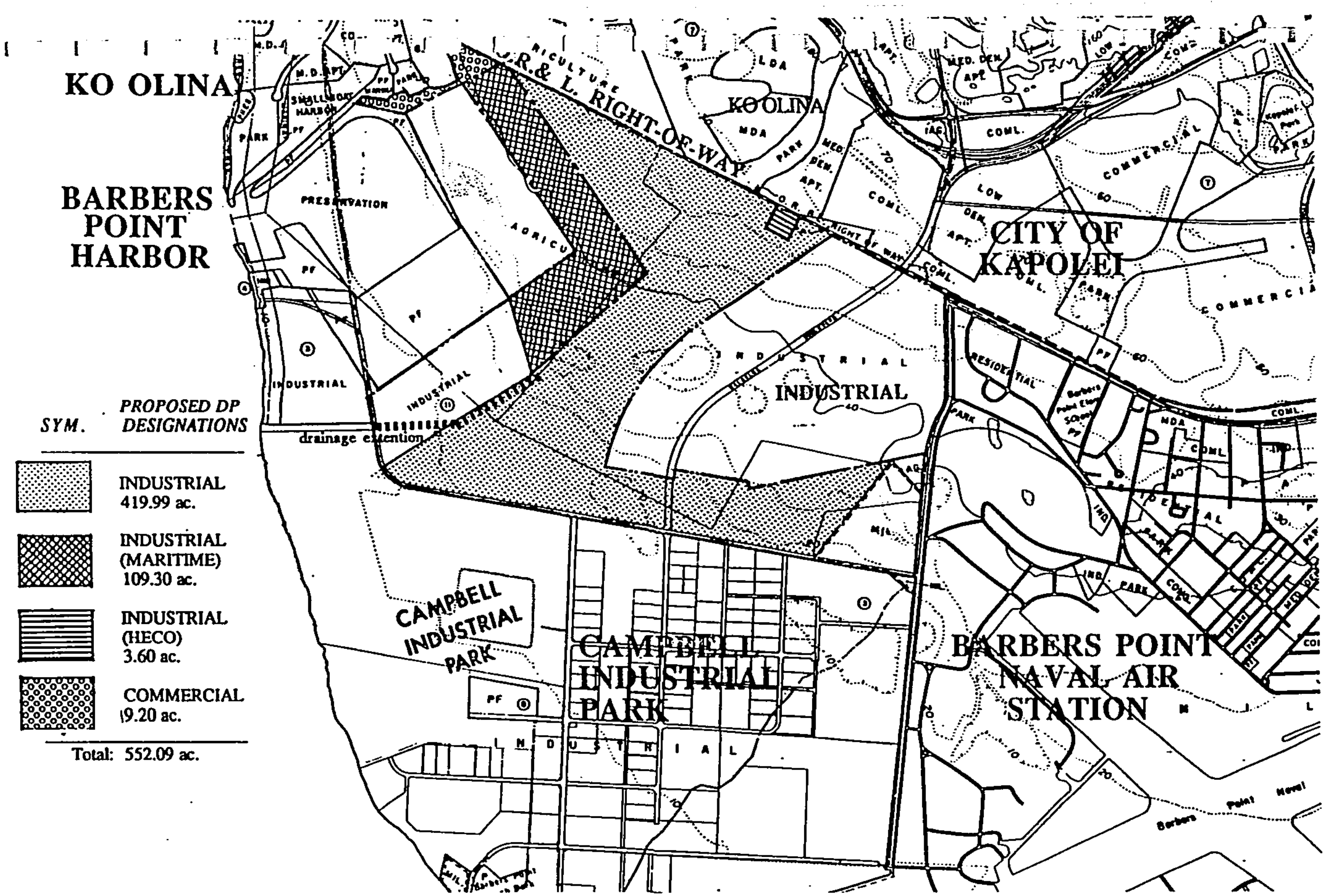
East of the project site is the Naval Air Station, Barbers Point (NASBP). General activities at the NASBP include fixed wing and helicopter arrivals, departures and patterns using all three runways. The NASBP also contains the residential community nearest the project site.

1.2.3 Project Components

The proposed Kapolei Business-Industrial Park encompasses 930 acres, and is envisioned as an industrial park similar to the James Campbell Industrial Park. Approximately 378 acres are already appropriately designated on the Ewa Development Plan. This leaves an amendment site of 552.1 acres, and as illustrated in Figure B, the proposed land uses for the site are as follows:

* **Intensive Industrial Uses.** Approximately 77 percent, or 423.59 acres, of the project site is proposed for intensive industrial uses. If the requested Industrial designation is approved, this portion of the site would need I-2, Intensive Industrial District, zoning. The following is a *partial* list of allowable uses under this zoning:

  - *processing of agricultural products and centralized bulk/collection/storage/distribution of such products;*
  - *automobile service stations, sales and rentals, and mechanized car washing;*
  - *bulk merchandise delivery;*
  - *commercial parking lots and garages;*
  - *day care facilities;*
  - *eating establishments, including drive-thru facilities;*
  - *medical and research laboratories;*
  - *most manufacturing, processing and packaging establishments;*
  - *publishing plants:*
  - *heavy equipment sales and rentals, including sale and service of agricultural machinery;*
  - *vocational, technical, industrial and trade schools;*
  - *some types of storage yards; and*
  - *wholesaling and distributions, including building or similar contracting and home improvement services, materials and equipment* (City and County of Honolulu Department of Land Utilization, Land Use Ordinance through Ord. No. 89-53).



prepared for the Estate of James Campbell
prepared by Michael S Chu, Land Architect

KAPOLEI BUSINESS PARK
Proposed Development Plan
Land Use Map

FIGURE B

* **Waterfront Industrial Uses.** One fifth of the project site, or 109.3 acres, is proposed for maritime industrial uses. Approximately 56 acres of this portion is intended for State use for the future expansion of the Barbers Point Harbor. If the requested Industrial designation is approved, this portion of the site would need I-3, Waterfront Industrial District, zoning. The following is a *partial* list of allowable uses under this zoning:

  - *eating establishments, including drive-thru facilities;*
  - *manufacturing, processing and packaging establishments;*
  - *marina accessories and maritime-related sales, construction, maintenance and repairing;*
  - *port facilities;*
  - *some types of storage yards;*
  - *truck terminals; and*
  - *warehousing; and*
  - *wholesale and retail establishments dealing primarily in bulk materials delivered by or to ship, or by ship and truck in combination.*

* **Commercial Uses.** Three percent, or 19.2 acres, of the project site is proposed for commercial uses. If the requested Commercial designation is approved, this portion of the site would need B-2, Community Business District, zoning. A wide variety of uses are permitted under this zoning and the following *partial* list is intended to illustrate the *diversity* of allowable uses:

  - *indoor amusement and recreation facilities;*
  - *art galleries and museums;*
  - *automobile service stations and sales and rentals;*
  - *bars, nightclubs, taverns, cabarets, and dance halls;*
  - *catering, drive thru and eating establishments;*
  - *office buildings and meeting facilities;*
  - *medical clinics and personal services; and*
  - *elementary, intermediate, high, business, language and vocational schools.*

1.3 SOCIAL IMPACT ASSESSMENTS AND ITS APPLICATION IN THIS PROJECT

Social impact assessment is a field of applied social science which has to do with the development and disclosure of social information relevant to (1) informing the decision-making process, and/or (2) developing management actions to deal with problematic social outcomes of a proposed project. It draws sometimes from social science, but other times from organizational development, political analysis, or simple journalism.

Commonly identified uses of social impact assessments include (1) understanding the ability of a community or group to adapt to changing conditions; (2) defining the problems or clarifying the issues involved in a proposed change; (3) illuminating the meaning and importance of anticipated change, and (4) identifying mitigation opportunities or requirements.

The emphasis of this process varies, based on the particular land use characteristics of a project, the extent of development in nearby areas and the requirements of the different permit processes.

This report serves as the mechanism to identify potential social impacts which should be considered in the request for amendments to the Ewa Development Plan.

In the overall social impact assessment *process*, however, this report can be useful in further and ongoing community dialogue between The Estate of James Campbell and the affected parties. The ongoing nature of this process can lead to an informed community and project team, possible project modifications, and, ideally, consensus on proposed actions.

SECTION 2: PROFILE OF THE EXISTING COMMUNITY

2 PROFILE OF THE EXISTING COMMUNITY

This section provides information on the "existing community" to establish a baseline of information, upon which potential social impacts can be identified and examined.

Section 2.1 defines the study area used in this report. In Section 2.2, this study area is described in terms of in-area employment, population and housing trends and certain socio-economic characteristics. Ewa to Honokai Hale, Makakilo and NASBP, the communities nearest to the proposed project, are described further in Section 2.3.

2.1 STUDY AREA DESCRIPTION

The project site is located in the Ewa region, or Development Plan area. From north to south, the Ewa region extends from the lower slopes of the Waianae mountain range to the coastline. From west to east, Ewa extends from Kahe Point to the West Loch of Pearl Harbor.

Historically, three major forces have shaped the existing Ewa community. These include national defense needs, the growth of large-scale sugar cultivation and the growth of suburban community. The result of these influences is a region with pockets of military and residential communities separated by vast agricultural fields.

The Study Area for this report is the Ewa Development Plan area and the following describes the different areas and uses in this region:

* The **James Campbell Industrial Park** is immediately south of the project site. Approximately 1,360 acres are currently in use. Major park tenants include two oil refineries, a concrete manufacturing plant, a cattle feed lot operation, large building material supply yards, and a motor vehicle raceway park.

* **Barbers Point Harbor** is a new state-owned harbor located on the west of the project site. Being developed by the State Department of Transportation, Harbors Division, the harbor is partially complete.

* Located in the south-central area of Ewa, the **Naval Air Station Barbers Point (NASBP)** covers 3,672 acres and abuts the eastern boundary of the project site. The station's mission is to support aviation activities and units of the Navy. Aircraft operations are conducted on a 24-hour basis and consist primarily of fixed-winged propeller aircraft with most flights conducted during the daylight hours. The station has three major runways (U. S. Navy, 1985). The NASBP contains the residential community nearest the project site.

* Located on the lower slopes of the Waianae Range and northeast of the project site, **Makakilo** is a 23-year old residential community offering mid-priced, single family and multi-family housing, and support public and commercial facilities.

* **Honokai Hale and Nanakai Gardens** are two contiguous and older residential communities located in the western portion of Ewa, and northwest of the project site.

* **Ewa Villages** is in the east central portion of Ewa and located east of the project site. This community comprises the Varona, Tenney, Renton and Fernandez plantation villages.

* **Honouliuli** is in the northeastern portion of Ewa and is east of the project site. This community includes a mixture of residential uses, few support commercial establishments, and small-scale agricultural operations.

* **Ewa Beach** is in the southeastern section of the Ewa region, and is southeast of the project site. This is an older residential community, with a small commercial center along Fort Weaver Road.

* The **Iroquois Point Puuloa Military Family Housing (IPP Military Family Housing)** is located at the southeastern portion of the Ewa region. This community houses Navy personnel, as well as Army and Marine personnel.

* Oahu's largest sugar producer, **Oahu Sugar Company** (OSCO) cultivates approximately 8,000 acres in the Ewa region. Nearly all of the Ewa land under cultivation are leased from the Estate of James Campbell with a lease expiration date of 1995.

For the purposes of describing Ewa, the two sources of information include 1980 census information and estimates provided by Traffic Assessment Zones as available at the City Department of General Planning, Planning Information Branch. The following indicates the delineation of communities and areas, based on these sources:

Traffic Assessment Zone 142, hereby referred to as *Ewa to Honokai Hale*, includes the project site, Ewa Villages, Honokai Hale / Nanakai Gardens, Honouliuli and the James Campbell Industrial Park. This zone is conterminous with Census Tract 86.02.

TAZ 140 includes Makakilo and is a portion of Census Tract 86.01. This Census Tract also includes Kunia.

TAZ 139 is the *Naval Air Station, Barbers Point*, or *NASBP*, and covers the same area as Census Tract 85.

TAZ 138 includes the portion of Ewa Beach west of Fort Weaver Road, hereby referred to as *West Ewa Beach*, and is conterminous with Census Tract 84.

TAZ 137 is referred to as *East Ewa Beach*, and covers the communities to the east of Fort Weaver Road, and includes the IPP Military Family Housing, and a portion of Ewa Beach. TAZ 137 covers the same area as Census Tract 83.

2.2 OVERVIEW OF EWA

2.2.1 Employment Profile

Tables 1 and 2 present estimates of employment in 1985. Table 1 indicates the number of jobs by *how these are allocated by sub-areas*. Highlights of this table are as follows:

1. In 1985, Ewa contained 10,628 jobs, none of which were hotel-related.
2. Over half of these jobs, or 52 percent, were located at the NASBP. As expected, this area accounted for virtually all of the area's military jobs.
3. West Ewa Beach contained 17 percent of Ewa's total jobs and two-thirds of the Ewa's finance, insurance and real estate jobs. Ewa Beach also contained almost half of Ewa's transport, communications and utilities jobs.
4. The area from Ewa Villages to Honokai Hale contained one-fifth of Ewa's total jobs. Almost half of Ewa's industrial jobs are in this area.
5. Makakilo and east Ewa Beach/Iroquois Point Puuloa Military Family Housing, all residential communities, collectively contained only ten percent of Ewa's total jobs.

Table 2 shows the *breakdown of employment by types of jobs*. Over half of Ewa's jobs were military, and 17 percent were service. These were followed by government and industrial jobs, each of which accounted for 11 percent of the total. Retail jobs accounted for only 13 percent of the total Ewa jobs, followed by government employment at nine percent.

2.2.2 Population And Housing Trends

In the first half of the 1980s, the City and County of Honolulu's resident population grew 5 percent, from 762,564 in 1980 to 801,096 persons in 1985. Housing characteristics are characterized as follows:

* Housing units increased by 7.12 percent, from 254,785 to 272,936 units, during this five-year period.
* This disproportionate growth between housing and population correlates to the decrease in household size. The islandwide household size decreased from 3.20 persons in 1980 to 3.14 persons in 1985.

Table 1

STUDY AREA EMPLOYMENT
NUMBER AND BREAKDOWN BY STUDY AREA

1985

	STUDY AREA					
	Total Ewa D. P. Area	NASBP	Ewa to Honokai Hale	Makakilo	West Ewa Beach	East Ewa Beach & Iroquois Pt.
Military	4,339	4146	0	0	0	193
% By Sub-area	100%	96%	0%	0%	0%	4%
Government	1,185	516	496	17	38	118
% By Sub-area	100%	44%	42%	1%	3%	10%
Transport, Communications, Utilities	196	18	62	19	97	0
% By Sub-area	100%	9%	32%	10%	49%	0%
Industrial	1,149	38	525	60	526	0
% By Sub-area	100%	3%	46%	5%	46%	0%
Finance, Insurance, Real Estate	221	33	14	27	147	0
% By Sub-area	100%	15%	6%	12%	67%	0%
Service	1,760	274	310	17	632	527
%By Sub-area	100%	16%	18%	1%	36%	30%
Retail	1,375	485	496	47	289	58
% By Sub-area	100%	35%	36%	3%	21%	4%
Construction	493	32	222	73	144	22
% By Sub-area	100%	6%	45%	15%	29%	4%
Agriculture	403	44	268	32	59	0
% By Sub-area	100%	11%	67%	8%	15%	0%
Total	10,628	5,554	2,171	219	1,788	896
% By Sub-area	100%	52%	20%	2%	17%	8%

NASBP or Naval Air Station, Barbers Point is in Traffic Assessment Zone 139.
Ewa to Honokai Hale is in Traffic Assessment Zone 142.
Makakilo is in Traffic Assessment Zone 140.
West Ewa Beach is in Traffic Assessment Zone 138.
East Ewa Beach and the Iroquois Point Puuloa Military Family Housing are in Traffic Assessment Zone 137.

Source: City and County of Honolulu Department of General Planning, Planning Information Branch. Traffic Assessment Zones. October 1987. Calculations performed by Earthplan.

Table 2

STUDY AREA EMPLOYMENT
NUMBER AND BREAKDOWN BY JOB TYPE

1985

	STUDY AREA					
	Total Ewa D. P. Area	NASBP	Ewa to Honokai Hale	Makakilo	West Ewa Beach	East Ewa Beach & Iroquois Pt.
Military	41%	75%	0%	0%	0%	22%
Government	11%	9%	23%	8%	2%	13%
Transport, Communications, Utilities	2%	0%	3%	9%	5%	0%
Industrial	11%	1%	24%	27%	29%	0%
Finance, Insurance, Real Estate	2%	1%	1%	12%	8%	0%
Service	17%	5%	14%	8%	35%	59%
Retail	13%	9%	23%	21%	16%	6%
Construction	5%	1%	10%	33%	8%	2%
Agriculture	4%	1%	12%	15%	3%	0%
Total	100%	100%	100%	100%	100%	100%

NASBP or Naval Air Station, Barbers Point is in Traffic Assessment Zone 139.
Ewa to Honokai Hale is in Traffic Assessment Zone 142.
Makakilo is in Traffic Assessment Zone 140.
West Ewa Beach is in Traffic Assessment Zone 138.
East Ewa Beach and the Iroquois Point Puuloa Military Family Housing are in Traffic Assessment Zone 137.

Source: City and County of Honolulu Department of General Planning, Planning Information Branch. Traffic Assessment Zones. October 1987. Calculations performed by Earthplan.

* Approximately 55 percent of the islandwide housing stock, or 128,643 units, were single-family residences in 1980. With the increase in multi-family units, the share of single family residences decreased slightly to 53 percent in 1985, indicating an increase in multi-family residential units. In 1985, Oahu had 135,101 single family units and 118,559 multi-family units *(Single family + multi-family = total housing units).*

* Oahu's 9,324 "adjusted visitor units" (modification of Hawaii Visitor Bureau's report of housing units used for visitor accommodations) accounted for only 3.6 percent of the total housing stock in 1980 *(Adjusted visitor + dwelling units = total housing units).* This share decreased to 2.2 percent, as the total adjusted visitor units decreased to 5,965 units (City and County of Honolulu Department of General Planning, Traffic Assessment Zones, October 1987).

Ewa's population growth during this 1980-1985 period was proportionally much lower. As indicated on Table 3, the Ewa population grew by three percent over this five-year period, from 35,695 in 1980 to 36,590. The areas which experienced some growth was the Ewa to Honokai Hale area and Makakilo. The population of Ewa to Honokai Hale increased by 507 persons, for an eleven percent increase from 4,674 in 1980 to 5,181 in 1985. The Makakilo population increased by eight percent, from 8,000 persons in 1980 to 8,628 persons in 1985. Other areas experienced only nominal growth, or a slight decrease.

The housing stock in the study area experienced a corresponding low increase. Between 1980 and 1985, Ewa's housing units increased four percent, from 9,168 to 9,530 units. The following summarizes housing trends in the Ewa area:

* Single-family units increased 4.4 percent, from 5,485 to 5,724. As suggested by the population growth trends cited above, most of this increase was found in Makakilo with 171 new units and in Ewa to Honokai Hale with 65 new units.

* Multi-family housing units increased by a larger proportion of ten percent. This increase in multi-family units is attributable to a 90-unit increase in Ewa to Honokai Hale and a 42-unit increase in Makakilo.

Historically, the average household size in Ewa is larger than the islandwide household size. Compared to the islandwide household size of 3.14 persons in 1985, Ewa had an average of 3.98 persons per household.

TABLE 3

POPULATION AND HOUSING TRENDS

	EwaD. P. Area			NASBP			Ewa to Honokai Hale			Makakilo			West Ewa Beach			East Ewa Beach and Iroquois		
	1980	1985	Percent Change	1980	1985	Percent Change	1980	1985	Percent Change	1980	1985	Percent Change	1980	1985	Percent Change	1980	1985	Percent Change
POPULATION	35,695	36,590	3%	2,942	2,913	-1%	4,674	5,181	11%	7,999	8,628	8%	7,643	7,596	-1%	12,437	12,272	-1%
% of total Study Area	--	--	--	8%	8%	--	13%	14%	--	22%	24%	--	96%	21%	--	35%	34%	--
HOUSING UNITS																		
Total Housing Units [1]	9,168	9,530	3.9%	854	854	0%	1,098	1,253	14.1%	2,263	2,476	9.4%	2,055	2,049	-0%	2,898	2,898	0%
Single Family Units	3,527	5,724	62.3%	0	0	0%	1086	1151	6.0%	1,446	1,617	11.8%	1958	1960	0%	995	996	.1%
Multi-family Units	1,246	1,457	16.9%	0	0	0%	12	102	750.0%	817	859	5.14%	77	79	3%	417	417	.0%
OCCUPIED DWELLINGS	8,809	9,191	4.3%	771	771	.0%	1,072	1,225	14.3%	2,143	2,350	9.7%	1,960	1,984	1%	2863	2861	-.1%
HOUSEHOLD SIZE	4.05	3.98	-1.8%	3.01	2.81	-6.6%	4.34	3.85	-11.3%	3.72	3.36	-9.7%	3.89	3.64	-6%	4.29	4.11	-4.2%

NASBP or Naval Air Station, Barbers Point is in Traffic Assessment Zone 139.
Ewa to Honokai Hale is in Traffic Assessment Zone 142.
Makakilo is in Traffic Assessment Zone 140.
West Ewa Beach is in Traffic Assessment Zone 138.
East Ewa Beach and the Iroquois Point Puuloa Military Family Housing are in Traffic Assessment Zone 137.

Source: City and County of Honolulu Department of General Planning, Planning Information Branch. Traffic Assessment Zones. October 1987. Calculations performed by Earthplan.

1. The housing units for Ewa Beach include 20 units used for visitors in 1980 and 10 units in 1985. The housing units in Barbers Point Naval Air Station and Iroquois Point include barracks. Barracks are not considered single or multi-family dwellings in this information.

2.2.3 Other Population Characteristics

Table 4 presents social and economic characteristics of Oahu, the entire Ewa Development Plan area, and each sub-area. Based on 1980 census information, the following are highlights of this comparison:

Age. As a whole Ewa is slightly younger than the rest of the island. In 1980, the median age on Oahu was 28 years of age, as compared to Ewa's 25.6 years of age. There were major differences between the different communities. The oldest community was the Ewa to Honokai Hale area, whose median age was 33.1 years of age. By comparison, and as expected, the military bases contained much younger populations with median ages of 22.1 in Naval Air Station Barbers Point and 21.3 in the East Ewa Beach/IPP Military Family Housing.

Ethnicity. Compared to the islandwide population, Ewa has significantly higher proportions of Caucasians and Filipinos, and a moderately higher proportion of Hawaiians. On the other hand, there were proportionally fewer Japanese and Chinese people. The Naval Air Station Barbers Point and East Ewa Beach/IPP Military Family Housing had large segments of Caucasians, who accounted for almost three-quarters of the former installation. High proportions of Filipinos were found in Ewa to Honokai Hale (53.7 percent), Ewa Beach (20.8 percent), Makakilo (19.9 percent) and East Ewa Beach/IPP Military Family Housing (24.8 percent).

Place of Birth. Ewa had proportionally (1) fewer people born in Hawaii, (2) more people born in other parts of the United States, and (3) slightly less foreign-born residents. The differences between the communities are notable. Ewa Beach, Ewa and Honokai Hale all had significantly higher proportions of people born in Hawaii than the Oahu-wide population. The Naval Air Station Barbers Point and East Ewa Beach/IPP Military Family Housing had relatively higher percentages of people born in other parts of the United States. One-third of the Ewa to Honokai Hale area population was born in another country.

Education. In 1980, Ewa residents were slightly less educated than the islandwide community. Compared to the 21.7 percent of Oahu residents completing a four-year college, Ewa has only 12.4 percent. Among the different communities, the percentage of people who completed a four-year college ranged from seven percent in the Ewa to Honokai Hale area to 18.4 percent in Makakilo.

Mean Family Income. As a whole, Ewa's mean family income in 1980 of $21,000 was lower than Oahu's $27,318. The mean family income ranged from $10,377 in Naval Air Station Barbers Point to $26,059 in Makakilo.

Table 4

Social and Economic Characteristics

Oahu, Ewa and Sub-Areas, 1980

	Oahu	Ewa D. P. Area	BPNAS	Ewa to Honokai Hale	Makakilo	West Ewa Beach	East Ewa B. & Iroquois Pt.
Resident Population							
1970	629,176	24,087	3,187	4,114	4,226	7,801	4,759
1980	762,565	36,234	2,942	4,653	8,559	7,643	12,437
percent change	21.2%	50.4%	-7.7%	13.1%	102.5%	-2.0%	161.3%
Median Age	28.0	25.6	22.1	33.1	25.9	24.8	21.3
Ethnicity							
Caucasian	33.1%	44.5%	73.9%	11.0%	44.1%	37.5%	47.4%
Japanese	24.9%	8.8%	1.5%	19.1%	10.6%	11.8%	5.1%
Chinese	6.9%	2.0%	.2%	1.0%	2.9%	2.4%	1.1%
Filipino	12.6%	24.4%	11.5%	53.7%	19.9%	20.8%	24.8%
Hawaiian	10.5%	12.4%	1.1%	8.3%	12.6%	14.2%	12.4%
Other	11.8%	7.5%	11.8%	6.8%	9.9%	13.3%	9.6%
Place of Birth							
Born in Hawaii	55.1%	49.5%	8.6%	62.8%	53.5%	61.4%	44.1%
Other U.S. Born	30.1%	36.0%	78.5%	4.1%	37.2%	26.8%	42.7%
Foreign Born	14.8%	14.5%	12.9%	33.1%	9.3%	11.8%	13.2%
Education (selected persons 25+ years)							
8 years or less	14.4%	14.3%	4.0%	39.1%	8.4%	14.3%	9.2%
Completed high school	35.5%	43.0%	54.8%	26.9%	46.1%	43.9%	45.8%
College	21.7%	12.4%	8.7%	6.9%	18.4%	9.1%	13.2%
Potential Labor Force	574,903	23,862	2,193	3,296	5,878	5,325	7,260
In Labor Force							
Civilian	59.1%	49.5%	12.5%	56.3%	56.4%	58.8%	41.5%
Military	11.5%	27.0%	63.2%	2.2%	12.9%	6.2%	25.0%
Mean Family Income	$27,318	$21,000	$10,377	$21,465	$26,059	$22,789	$18,015
Families Below Poverty Level	7.5%	7.2%	10.5%	7.2%	3.1%	8.5%	7.4%
Housing Vacancy Rate	8.2%	3.4%	5.2%	2.4%	9.9%	1.2%	2.3%
Persons Per Household	3.31	3.96	3.81	4.07	3.66	3.77	4.37
Owner-Occupied Units	49.9%	50.2%	.0%	26.6%	70.5%	60.0%	42.9%

Notes:

NASBP or Naval Air Station Barbers Point is in Census Tract 85
Ewa to Honokai Hale is in Census Tract 86.02.
Makakilo is in Census Tract 86.01; this census tract also includes Kunia.
West Ewa Beach is in Census Tract 84.
East Ewa Beach and Iroquois Point Puuloa Navy Housing is in Census Tract 83.

Source: Earthplan, 1985 and U.S Bureau of the Census, 1983.

2.3 PROFILE OF NEARBY COMMUNITIES

The communities nearest the project site are NASBP, Honokai Hale / Nanakai Gardens, and Makakilo. Because of the proximity and potential for interaction with the Kapolei Business-Industrial Park, these communities are further described. Note that Honokai Hale / Nanakai Gardens area is included with Ewa Villages in the census district and traffic assessment zones; thus, the Ewa-to-Honokai Hale area includes these communities in this discussion.

Population and Housing. In 1985, the NASBP housed approximately 2,900 people and, based on the 1989 Kapolei Master Plan, about 2,000 persons resided in Honokai Hale / Nanakai Gardens (Helber, Hastert and Kimura, Planners, 1989). An estimated 8,628 persons lived in Makakilo. Hence, approximately 13,500 people lived near the project site.

The only community which experienced any growth in the first half of this decade was Makakilo, which gained 507 persons and 213 new residential units.

Employment. Of the three areas, the NASBP contained the largest number of jobs and accounted for 52 percent of Ewa's total jobs. NASBP contained over 5,500 jobs in 1985, and three-fourths of these were military. The Ewa-to-Honokai Hale area contained one-fifth of Ewa's total jobs and the major categories were government (23 percent), industrial (24 percent) and retail (23 percent). Because of its strong residential character, Makakilo accounted for only two percent of Ewa's total jobs, and the largest categories were construction (33 percent) and industrial (27 percent).

Social and Economic Characteristics. Compared to the Ewa regional median age of 25.6 years, NASBP was the youngest community with a median age of 22.1 years. With a median age of 33.1 years, Ewa-to-Honokai Hale was the oldest community in Ewa. The median age of Makakilo was similar to the regional median..

Of all of these communities, Makakilo tended to resemble the regional ethnic breakdown and had similarly large proportions of Caucasians and Filipinos. The other communities have significant differences. Compared to the islandwide (33.1 percent) and regional (44.5 percent) proportions of Caucasians, 73.9 percent of NASBP residents were Caucasian. The Ewa-to-Honokai Hale area had the lowest proportion of eleven percent. On the other hand, Filipinos accounted for 53.7 percent of Ewa-to-Honokai Hale's population, as compared to Oahu's 12.6 percent and the regional 24.4 percent.

Only 8.6 percent of NASBP residents were born in Hawaii, as compared to 49.5 percent of the regional population; over three-quarters of NASBP residents were born in other parts of the United States. Makakilo and Ewa-to-Honokai Hale, on the other hand, had higher proportions of Hawaii-born residents with 53.5 and 62.8 percent, respectively. Compared to the islandwide residents, all of these communities had proportionally fewer people completing a four-year college, although Makakilo's share was higher than the regional average.

SECTION 3: POLICIES AND PROPOSALS WHICH WILL AFFECT THE COMMUNITY'S FUTURE

3 POLICIES AND PROPOSALS WHICH WILL AFFECT THE COMMUNITY'S FUTURE

The three major forces which have shaped the existing Ewa community are national defense needs, the growth of large-scale sugar cultivation and the growth of suburban community. Public policies add a fourth major force in shaping Ewa. Government efforts are directing large-scale residential growth to this area, and construction is already underway for new planned communities. Kapolei Business-Industrial Park is being proposed as part of this community in transition.

This section examines public policies and proposed changes to understand what is anticipated to occur in Ewa independent of the proposed project. Section 3.1 describes public policies for Ewa, and identifies proposed amendments to the Ewa Development Plan. Section 3.2 provides an overview of the projects which will help shape the secondary urban center. In Section 3.3, a description of a likely scenario *without* Kapolei Business-Industrial Park is provided.

3.1 DIRECTION OUTLINED IN GENERAL AND DEVELOPMENT PLAN POLICIES

The City and County of Honolulu General Plan encourages the development within the secondary urban center at Kapolei and the Ewa and Central Oahu urban-fringe areas to relieve developmental pressures in the remaining urban-fringe and rural areas and to meet housing needs not readily provided in the primary urban center.

Consistent with this policy is the General Plan's residential population distribution for the year 2010. As shown in Table 5, Ewa is targeted to accommodate 12 to 13.3 percent of the total islandwide population. These proportions translate to a range of 119,940 to 132,934 persons in Ewa.

In 1985, the Ewa population accounted for 4.5 percent of the total islandwide population. The 2010 target population means that Ewa's population is anticipated to increase three to 3.5 times over the 1985 population.

The project site lies in the secondary urban center. In terms of physical development and urban design, the Kapolei area is to be the nucleus of this secondary urban center. Funds from the City and County's capital improvement program are to be allocated for public projects that are needed to facilitate the development of the secondary urban center.

The following are proposed amendments to the Ewa Development Plan, as presented in the 1989 Annual Amendment Review package:

> **89/E-1: Kapolei City.** The Estate of James Campbell is proposing to re-allocate land in this 879-acre project site to (1) reduce residential land; (2) eliminate land for medium-density apartment, (3) increase the amount of land for low-density apartment and (4) reduce the amount of land for commercial uses.

Table 5

Population Projections by
Development Plan Area, 2010

	General Plan Distribution of Residential Population [1]	2010 Population Range Based on Series M-K Projections [2]
Primary Urban Center	45.1% - 49.8%	450,775 - 497,751
Ewa	12.0% - 13.3%	119,940 - 132,934
Central Oahu	14.9% - 16.5%	148,926 - 164,918
East Honolulu	5.3% - 5.8%	52,974 - 57,971
Koolaupoko	11.0% - 12.2%	109,945 - 121,939
Koolauloa	1.3% - 1.4%	12,994 - 13,993
North Shore	1.6% - 1.8%	15,992 - 17,991
Waianae	3.8% - 4.2%	37,981 - 41,979
Total Oahu	95.0% - 105.0%	949,525 - 1,049,475

1. City Council, Resolution Relating to Amending the General Plan of the City and County of Honolulu, No. 88-404, CD-1, FD-1.

2. Table 18 of the The State of Hawaii Data Book: 1988 (State Department of Business and Economic Development, 1988) provides a population projection of 999,500 persons for the City and County of Honolulu in 2010.

> **89/E-3: Kapolei Village I.** The Honolulu City Council and the State of Hawaii is requesting that 71 acres be re-designated from its current commercial, public and quasi-public, and agriculture designations to residential. This change would permit 520 single-family units and reflect the first phase of the State Housing Finance and Development Corporation housing proposal.

In addition, the City's Chief Planning Officer proposes to amend the Special Provisions for the Ewa Development Plan area to (1) change the agricultural density to a maximum of one unit per acre, rather than the current one unit per two acres; and (2) to revise and update development priorities. In the latter proposed amendment, the Chief Planning Officer proposes to replace specific developments, such as Ewa Villages and Ewa Marina, with projects, such as affordable housing and secondary employment centers (City and County of Honolulu Department of General Planning, July 1, 1989).

3.2 MAJOR DEVELOPMENT PROPOSALS IN THE STUDY AREA

As the major landowner in Ewa, the Estate of James Campbell has taken the lead in preparing the master plan for this region. The first Ewa Master Plan was prepared in 1955 and revised in the early 1960s. In a 1974 update of this plan, the concept of a self-contained city began to evolve. The planning firm of Helber, Hastert & Kimura, Planners prepared an update of this plan in 1984 and identified a major "City Center" located between Makakilo, Campbell Industrial Park and NASBP.

In 1986, the Honolulu City Council subsequently amended the Ewa Development Plan to adopt the Estate's Master Plan land use pattern in the "City Center" area. After the Estate commissioned a detailed implementation plan for the 890-acre City Center, then re-named Kapolei, the State Land Use Commission granted incremental approval of a 135-acres "First Increment" in mid-1988 (Helber, Hastert & Kimura, Planners, 1989).

The most recent master plan for this region was prepared in May 1989. Note that, as with all long-range plans, the plan represents a process which is in constant flux in that it anticipates and reacts to economic, social, environmental and political forces. The following summarizes the development projects anticipated for the Ewa region, beginning with the projects closest to the Kapolei Business-Industrial Park. Except where indicated, this information was extracted from the most recent Kapolei Master Plan (Helber, Hastert and Kimura, Planners, 1989).

> **Kapolei Town Center, the City of Kapolei, and the Kapolei Shopping Center.** Located north and northeast of the project site and encompassing approximately 879 acres, the Kapolei Town Center is the major nucleus of the long range Kapolei Master Plan. The 570-acre City of Kapolei, or Kapolei Town Center Core, is a triangular shaped parcel located at the heart of this larger project area. The development concept for the City is (1) to provide an urban nucleus in and around which secondary land uses can be located and (2) to provide a self-contained economic center which will accommodate the employment needs of Oahu's growing population.

The overall development program calls for about two million square feet of office space on approximately 100 acres of land; one million square feet of commercial space on 113 acres of land; and 860,000 square feet of public facilities. The latter includes 333,000 square feet of light industrial uses on 23 acres, 173 acres of park and 127 acres of open space/circulation. Approximately 3,040 residential units are also proposed in the overall development program(Helber, Hastert & Kimura, Planners, 1988).

The overall project is expected to be implemented in three phases.

- Phase 1 is the implementation of the 30-acre Kapolei Shopping Center. This complex will begin construction this year.
- Phase 2 is the first increment of a petition to the Land Use Commission. It includes 135 acres, 67 of which would be for commercial and office uses. Approximately 39.5 acres would be used for circulation and open space; 19.5 acres, for public facility; and 9.5 acres for light industrial uses (Helber, Hastert & Kimura, Planners, 1988). The State Land Use Commission has reclassified these lands to the Urban district, and City Development Plan refinements are being processed.
- Phase 3 is the remaining proposed uses and will be developed in response to market demands.

Ko Olina. Encompassing 1,000 acres, Ko Olina is a resort/residential community being developed by the West Beach Estates in two phases. First phase development program includes 5,200 residential units and 4,000 visitor units. Currently under construction are (1) a 500-slip marina, (2) an 18-hole golf course, (3) four newly-created sandy beaches, (4) a Hawaiian cultural center, (5) two shopping centers and (6) restaurants.

Recent plans for Phase 2 call for two 18-hole golf courses, commercial development at the east end of the site and relocation and expansion of the Kamokila Neighborhood Park (Wilson Okamoto and Associates, Inc., 1989). This proposal has been withdrawn from the 1989 Annual Review of the Ewa Development Plan.

Makakilo Expansion. Expansion plans include adding 2,200 residential units over the next ten years. Also, a golf course is planned for the slopes of Puu Makakilo. The developer, Finance Realty, is marketing a number of different home-styles in various areas of the development and is currently constructing a bridge to Palailai. Construction on residential units on Palailai is expected to commence this year.

Makaiwa Hills. Encompassing 1,800 acres, this area is located west of Makakilo and mauka of Honokai Hale and Farrington Highway. Long term development plans call for 3,000 to 3,500 residential units and an 18-hole golf course. Planning for this area is preliminary, however, and no development approvals are being sought at this time.

Kapolei Villages. To be developed by the State of Hawaii Housing Finance and Development Corporation, this residential community is located northeast of the project site. The development concept emphasizes a major residential component of 5,000 units with a 60/40 percent balance between affordable and market units. Other components of this 830-acre project site are intended to serve the residential population and include recreation, parks and open space on 22 percent of the entire site, civic uses on two percent, schools on six percent, and commercial uses on one percent (R. M. Towill Corporation, February 1988). This project received Urban designation from the State Land Use Commission, and the first increment, Kumu Iki, is under construction. The lottery for making units available to prospective buyers will be held in mid-November 1989.

Kapolei Knolls. The Lusk Company proposes to develop 79.5 acres located north of Kapolei Villages into a residential community. The plan calls for 500 single-family residential units and a park (Environmental Communications, Inc., 1988). With Development Plan approvals already secured, the project is in the process of requesting State Land Use, zoning and subdivision approvals.

Ewa Gentry. This approximately 1,000-acre planned community includes 7,500 residential units, a golf course and community facilities, such as schools, parks and greenways. The project area has been granted Urban designation, and 531 acres have received necessary Development Plan approvals for a total of 5,300 residential units. Soda Creek, the first project in the overall community, contains 413 units and is completed. The second project, 352-unit Palm Villa, is under construction (personal communication with Tosh Hosoda, Chief Planner, The Gentry Companies, October 16, 1989).

Ewa Villages. Plans for this area include infilling, and the possible development of commercial uses to serve village and adjacent communities. Short and medium-term goals include rehabilitating existing homes, upgrading infrastructure, and eventually selling the residential units to the area's residents.

West Loch. West Loch is being developed by the City and County of Honolulu Department of Housing and Community Development in two phases. The first phase, which is currently under construction, includes 600 residential units, a golf course, and shoreline park. The second phase involves the development of approximately 900 residential units, a neighborhood park, elementary school, park-and-ride and day care facilities, and a commercial area. Implementation for the 1,007-unit second phase is anticipated to begin in August 1991 (personal communication with Strather Ing, City and County of Honolulu Department of Housing and community Development, October 16, 1989).

Seibu/Myers Golf Course. Seibu Hawaii, Inc. is developing a 27-hole golf course on 270 acres north of Ewa Beach. A privately-owned facility, this golf course will be available for public play. Accessory uses include a clubhouse facility with a golf pro shop, a snack bar, limited locker facilities, and a driving range. All land use and zoning approvals have been obtained, and the developer is currently seeking grading permits (personal communication with Fred Rodriguez, president, Environmental Communications, Inc., October 6, 1989).

Ewa Marina. HASEKO (Hawaii), Inc. proposes to develop 1,100 acres into a recreation-oriented community with 4,850 residential units, 1,600 boat slips to be accommodated in marina basins and waterway systems, golf courses, and a variety of commercial centers and visitor accommodations related to the residential and recreational activities. Phase 1 includes the marina and residential components. Major land use approvals have been secured and HASEKO (Hawaii), Inc. is currently seeking Federal, State and City permits for the marina configuration, location and construction. Planning and design for the first housing increment are also in process, with construction of the affordable housing anticipated for 1990. Phase 2 is in the planning stage.

3.3 LIKELY SCENARIO WITHOUT THE KAPOLEI BUSINESS-INDUSTRIAL PARK

As indicated in Sections 3.1 and 3.2, the Ewa Development Plan area is targeted for major growth and numerous projects are paving the way to achieve the objectives for a secondary urban center. Without the Kapolei Business-Industrial Park, the following scenario is likely to occur:

1. **Significant increase in residential population.**

   Between 74,139 and 111,376 people are estimated to be living in the Ewa Development Plan area in the year 2010, as illustrated in Table 6. These figures are estimated for the existing communities of Ewa Beach, the IPP Military Family Housing (which is not part of the Ewa planning area of The Estate of James Campbell), the NASBP, Honokai Hale/Nanakai Gardens, Makakilo and Ewa Villages. Significant residential growth is expected in West Loch, Makakilo, Ewa Gentry, Ko Olina, Ewa Marina Phase 1 and Kapolei Villages and Knolls.

   This population increase implies that the current proposals for residential growth could accommodate a population two to three times that of the current Ewa population.

   The target population for Ewa is between 119,940 to 132,934 persons; hence the proposed projects are within the General Plan residential distribution policies.

2. **Significant increase in employment.**

   Market study projections indicate that job opportunities within the planning region are projected to increase about 600 percent over a twenty year period (Leventhal, 1986).

Table 6

Population Projection for the
Ewa Development Plan Area, 2010

Community/Project	1985	2010 Mid Range	2010 High Range
Ewa Beach [1]	13,800	13,800	13,800
IPP Military Family Housing [1]	6,000	6,000	6,000
NASBP [3]	2,924	2,924	2,924
Honokai Hale/Nanakai Gardens [3]	1,989	1,989	1,989
Makakilo [3]	8,628	15,704	15,714
Ewa Gentry [4]	3,000	7,853	25,006
West Loch [6]	0	4,320	4,725
Ko Olina [3]	0	4,946	12,640
Ewa Marina Phase 1 [3]	0	5,994	12,993
Kapolei Villages [3]	0	8,909	13,685
Kapolei Knolls [5]	0	1,700	1,900
TOTAL POPULATION	36,341	74,139	111,376

1. It is estimated that, in 1985, approximately 13,800 people lived in west and east Ewa Beach. This estimate is based on subtracting the 1,489 housing units in IPP Military Family Housing to derive the 1,409 housing units in east Ewa Beach. When combined with the 2,049 housing units in west Ewa Beach, a total of 3,453 housing units can be assumed for all of Ewa Beach. A household size of 4 persons was also assumed. It is assumed that no significant residential development will occur in this area since essentially all of the residential land in this community has been developed.

2. Estimate based on 1,489 housing units in 1985 and a household size of four persons. It is assumed that no significant residential development will occur in this area unless programmed by the military.

3. Source: Kenneth Leventhal and Company, Projections of Future Employment, Population and Land Use for the Ewa Town Center, January 1986, Table 5.

4. Ibid. Note that these calculations include the Ewa Villages.

5. Source: Environmental Communications, Inc., March 1988.

6. Source: City and County of Honolulu Department of Housing and Community Development, 1987.

3. **Establishment of city-related mixed uses and secondary urban center in "western" Ewa.**

   Kapolei City, Ko Olina and the James Campbell Industrial Park, all situated in the western half of the Ewa Development Plan area, are major employment generators -- which essentially create the city-like environment in the "secondary urban center," as defined by the City and County of Honolulu General Plan. The nearby residential communities include the Kapolei Villages, Makakilo, Honokai Hale/Nanakai Gardens and Makaiwa Hills.

4. **Intensification of residential uses in eastern Ewa.**

   The City and County of Honolulu General Plan designates the eastern half of Ewa, generally the area along Fort Weaver Road, as Ewa's urban-fringe and this area is intended primarily for residences. All other uses are to be established to serve the nearby residents.

5. **Retention of military uses.**

   The NASBP and the IPP Military Family Housing will likely continue their operations.

SECTION 4: COMMUNITY ISSUES ON KAPOLEI BUSINESS–INDUSTRIAL PARK

4 COMMUNITY ISSUES ON KAPOLEI BUSINESS-INDUSTRIAL PARK

This section explores potential community issues and concerns on Kapolei Business-Industrial Park. Section 3.1 discusses issues and concerns independent of the proposed project. Section 3.2 identifies preliminary community issues on Kapolei Business-Industrial Park.

Three sources of information were used in this analysis:

1. **Neighborhood Board minutes.**

   The Neighborhood Board system is a formal mechanism for citizen input to public entities regarding islandwide City policies, specific community problems and other matters, and proposed changes. The types of issues addressed by a Neighborhood Board and subsequent actions often reflect values and concerns of the constituent population.

   To understand the values, concerns and issues of Ewa residents, this study examined the minutes of the Ewa Neighborhood Board No. 23 over a two-year period, from July 1987 to July 1989. Section 4.1.1 discusses issues addressed by this Board.

2. **Community Advisory Committee on the Secondary Urban Center.** The Estate of James Campbell assembled this group comprising representatives of Ewa community organizations. This group provides community input into the Estate's planning process.

   In 1987, a series of community workshops were held to define community issues and needs for community services and facilities. The findings and recommendations were presented in Ewa Secondary Urban Center: Workshops on Community Facility Needs and Solutions (Phillips Brandt Reddick and Associates (Hawaii), Inc., 1987). Section 4.1.2 summarizes this group's recommendations.

3. **Community Interviews.** Earthplan conducted interviews with community residents and organization leaders in the course of this study. These interviews were held to supplement information from printed sources of material regarding community needs and values, and, more importantly, to identify community issues and concerns relative to Kapolei Business-Industrial Park. No attempt was made to assess the extent or "quantity" of project support or opposition.

   The selection of individuals was based on the following *cross-section* of potential interests:

   - Leaders of regional Ewa organizations, including the Neighborhood Board, business, community and neighborhood organizations;

- Residents in nearby communities who are active in their community activities; and
- Organizations related to James Campbell Industrial Park.

Twenty-two people were interviewed during this study and the list is presented in Table 7.

In general, interviewers asked people to provide input as individuals. In some cases, the interviewer asked the informants to further explain their organization's position, in addition to their own personal viewpoint. Informants were not asked to "take a position," nor were they asked to predict their organization's position if one were not yet taken.

Each person was informed that input would be summarized in the Social Impact Assessment and that individual conversations would remain confidential. The basic source of project information was the Proposal for: Development Plan Amendment/Environmental Assessment, Kapolei Business-Industrial Park (Wanket, 1989).

4.1 ISSUES AND CONCERNS INDEPENDENT OF THE PROJECT

4.1.1 Neighborhood Board Issues

The Ewa Neighborhood Board No. 23 dealt with two types of community issues:

1. **Problems typically associated with stable, active and predominantly residential communities.**

   These included:

   - *controlling and minimizing crime,*
   - *improving the quality and facilities in the public education system,*
   - *improving roadway infrastructure and circulation,*
   - *monitoring and improving recreational facilities, and*
   - *improving the delivery of ambulance, police and fire protection services.*

   The Ewa Neighborhood Board appeared to be very active in and aware of community affairs. As a whole, the Board maintained an ongoing working relationship with the Ewa Beach, Makakilo and Honokai Hale Community Associations. In fact, many of the Board members were active participants in these neighborhood groups.

   This Neighborhood Board also worked closely with public officials in advocating community improvements.

Table 7

List of People Interviewed

(Note: Those interviewed provided their comments as individuals and not as representatives of their organizations. Organizational affiliations are provided only to indicate some of the networks and interests of those interviewed.)

NAME	ORGANIZATION/AFFILIATION
Roger Au	Staff Civil Engineer, NASBP
Betty Barbett	Recent member, Ewa Neighborhood Board No. 23 Member, Community Advisory Committee on the Secondary Urban Center
Dick Beamer	Member, Ewa Neighborhood Board No. 23 and Chair, Transportion Committee President, Ewa Beach Community Association Member, Community Advisory Committee on the Secondary Urban Center
Harry Benson	Recent member, Ewa Neighborhood Board No. 23
Lawrence Cohen	Member, Ewa Neighborhood Board No. 23 President, Palehua Towers Apartment Owners Association
Barbara Conrardy	Public Affairs Officer, NASBP
Mike Crozier	Senator, 23rd Senatorial District, Hawaii State Legislature Vice President, Makakilo Community Association Member, Community Advisory Committee on the Secondary Urban Center
John DeSoto	Representative, District IX, Honolulu City Council
Cynthia Foo	President, Ewa Beach Merchants Association Member, Ewa Beach Community Association
Dave Gilbert	Member, Ewa Neighborhood Board No. 23
Myra Immings	Staff Civil Engineer, NASBP
Emogene Martin	Recent Chair, Ewa Neighborhood Board No. 23 and Chair, Parks and Recreation Committee Member, Board of Directors, Friends for Ewa Member, Community Advisory Committee on the Secondary Urban Center

John Meatoga	Member, Ewa Neighborhood Board No. 23
Gary Omori	Director of Government and Community Relations, West Beach Estates/Ko Olina
Penny Pagliaro	President, Friends for Ewa
Commander Carl Pierson	Executive Officer, NASBP Resident, NASBP
John Respicio	Member, Ewa Neighborhood Board No. 23
Ed Robinson	Past President (1984-1987), Campbell Industrial Park Owners and Tenants Association (currently inactive)
Lieutenant Commander Andy Scontras	Air Operations Officer, NASBP Resident, NASBP
Leroy Segawa	Vice President, Hawaiian Cement at James Campbell Industrial Park
Dick Stephen-Hazard	President, Harbors Users Group
Lieutenant Commander Mike Thompson	Air Traffic Control, NASBP Resident, NASBP
Roy Wickramartna	President, Makakilo Community Association Member, Community Advisory Committee on the Secondary Urban Center

2. **Potential effects of proposed developments.** This Neighborhood Board is somewhat unique among the other neighborhood boards in that Ewa is a community in constant transition. New communities and development proposals were discussed at virtually every meeting during this two-year period. Construction activities on previously vacant or agricultural land are evidence that the existing physical, social and economic environments will evolve into the secondary urban center. Hence, the awareness of and expectations for change exist among the Neighborhood Board members.

   Generally, this Neighborhood Board tended to support these developments, providing that (1) the proposal is consistent with the Kapolei Master Plan of The Estate of James Campbell and (2) the proposal addresses the necessary infrastructure and public service requirements.

Major issues and concerns are as follows:

Education -- The Ewa Neighborhood Board monitored the public schools and requested improvements from the State Department of Education as appropriate. Of specific concern was (1) the need for more classrooms at the Ewa Beach, Iroquois Point and other elementary schools, and (2) the increase in crime and vandalism, particularly at Campbell High School.

Police protection -- Neighborhood Board members continued to encourage the establishment of a (1) a new police beat (for additional personnel) and (2) a new police station somewhere in Ewa. This desire was often related to the need to prevent youth-related crime. In a related matter, the Board supported a drug and alcohol abuse program in the public schools. Further, the Board fully supported an ad hoc committee on violence and vandalism in schools.

Roadway safety and circulation improvements -- The Board encouraged police surveillance of Farrington Highway in front of Honokai Hale/Nanakai Gardens; there has been a high incidence of automobile accidents along this stretch. Board members have also requested the signalizing of major intersections along Fort Weaver Road, such as the entrances to the Ewa Gentry and West Loch communities. Further, the Board requested that the timetable for the north-south road from Fort Weaver Road to Ewa Marina be revised on the Ewa Development Plan Public Facilities from the six-years-and-beyond time frame to within-six years.

Ambulance service -- The Board requested increase ambulance service for the Ewa region, especially in light of the expected increase in residents.

Recreational facilities -- Improvements at the Ewa Beach and Makakilo Recreational Centers were requested, as was a new skateboard facility. These facility improvements essentially were viewed as a way to provide a gathering place for young people, and, ideally, help deter youth-related crime.

Of note is the Oneula, or Hau Bush, Beach Park. Board members felt that the area needed increased police supervision because of vandalism, auto theft and loitering.

Development proposals -- Within this two-year period, the Board supported or had no objections to the following projects:

- Urban designation of 130 acres in Kapolei;
- The 27-hole Golf Course by The Myers Company;
- Kapolei Knolls;
- Ewa Gentry;
- 64-acre expansion of the James Campbell Industrial Park;
- Puuloa Golf Course;
- City's proposal to remove the vehicle shredder facility from the Ewa Development Plan Public Facilities Map;
- Kapolei Town Center (with request to see overall plan);
- Rezoning of 96 acres in Kapolei City to B-2;
- Ko Olina Phase 2 (with stipulations regarding Kamokila Park relocation);
- Preservation designation for Midden Beach; and
- The entire package in the Ewa Development Plan 1989 Annual Review.

4.1.2 The Secondary Urban Center Community Advisory Committee

In 1987, the Community Advisory Committee on the Secondary Urban Center held a series of community workshops to define community issues and needs for community services and facilities. The workshops focussed discussions in:

* *governmental services*, including programs and facilities for transportation, police and fire protection, medical and emergency rescue, civil defense and governmental offices;
* *education*, including programs and facilities for child care, preschool, and secondary, higher and continuing education; and

* *recreation/culture/art*.

The following summarizes the recommendations of these efforts, as reported in Ewa Secondary Urban Center: Workshops on Community Facility Needs and Solutions (Phillips Brandt Reddick and Associates (Hawaii), Inc., 1987):

1. **Governmental Services.**

   Police protection: supported fully-operational police station in the Ewa (Kapolei) Town Center

   Health care facilities: recommended siting of emergency ambulance service to be reassessed in terms of future needs, and that this service be located near the proposed Ewa (Kapolei) Town Center

   Public transportation services: supported transit line extending to Ko Olina, recommended more evaluation of viable water transportation and recommended shuttle service linking main shopping areas and transit terminals

   Secondary City Hall/auxiliary State offices: supported the location of a civic center in the Ewa (Kapolei) Town Center; recommended a secondary City Hall providing a full range of services and auxiliary state offices

   Civil defense services: recommended that a civil defense communication center be located in the Ewa (Kapolei) Town Center to include emergency rescue services and a helipad

2. **Education.**

   - recommended setting aside relatively level and "expandable" sites for all schools; move West Oahu College to the second city; locate high technology and adult education programs at the James Campbell Industrial Park; provide adequate space for resource teachers and the arts; schools should be within walking and biking distance from residences; provide water sports at West Beach (Ko Olina) marina; set aside sites for day care centers; provide adult education programs in high schools and colleges; provide sites for private schools; develop aquaculture facility at the Barbers Point Harbor

3. **Recreation/culture/art.**

   - provide active recreation and cultural facilities at the planned Kapolei Regional Park; delete the proposed Makakilo District park; transfer Ewa Beach and Ewa proposed park funds to the Kapolei Regional Park; locate a central library and museum adjacent to the Kapolei Regional Park; develop a public golf course in Ewa

Where appropriate, these recommendations have been incorporated in plans for the Kapolei Town Center (Helber, Hastert & Kimura, Planners, 1988).

4.2 COMMUNITY ISSUES ON KAPOLEI BUSINESS-INDUSTRIAL PARK

The issues identified in this section are *preliminary* in that they indicate what is important to the community at a specific point in time (October and November 1989). Changes in attitude and issues may occur in time, given possible project modifications and other events or influences in the community.

The following summarizes issues and concerns raised by those interviewed:

1. **Consistent support for overall Kapolei development.**

   All of those interviewed expressed strong support for the development of the Ewa region into the secondary urban center. They favored the regional development because of its potential to improve the quality of life in the area through increased employment opportunities, more diversity in residents, and improved infrastructure.

   A few had strong concerns about the effects of growth in the area on the existing communities. Although they still believed that the overall effects will be positive, they nevertheless felt that the Kapolei development will result in the loss of rural communities. They also feared that the elderly would be unable to handle the increased taxes resulting from increased property values.

2. **General support for Kapolei Business-Industrial Park.**

   All of those interviewed were aware of the proposed expansion of James Campbell Industrial Park, though most did not know specific project components or site boundaries. Those interviewed favored the Kapolei Business-Industrial Park for the following reasons:

   - *Part of the overall Kapolei long-range plan* -- Consistent with the position of the Ewa Neighborhood Board, those interviewed supported Kapolei development efforts. The proposed project has been presented to the community as part of these long-range efforts, and, hence, interviewees accepted the project.

   - *Creation of jobs* -- Those interviewed felt that the project would help current Ewa residents by providing increased job opportunities near their homes. This would essentially reduce commuting time and help reduce eastbound traffic.

   - *Diversification of jobs* -- Some felt that Hawaii's jobs are too service-oriented and that more industrial jobs would diversify the available employment in the area.

- *Additional commercial opportunities* -- Many felt that the proposed commercial component would benefit the community by (1) providing a buffer between the business-industrial park and Ko Olina, and (2) providing more shopping and office areas.

- *Increased maritime opportunities* -- Those interviewed felt that the proposed maritime industrial component would help improve the efficiency of transporting and storing shipped goods.

3. Environmental impacts and public safety.

The most frequently-expressed concerns were related to potential environmental effects of industrial uses. Residents of nearby communities cited examples of industrial impacts, such as dust from the quarry, smoke and fumes from some plants at the James Campbell Industrial Park, and noise from the raceway park. They did not want these effects continued or increased by the proposed project, and urged compliance with Environmental Protection Agency regulations. Some also strongly discouraged any waivers from these regulations.

Many were also concerned about the types of activities which will be permitted at the Kapolei Business-Industrial Park. Specific undesired uses included oil refinery and storage, as well as fireworks and plastic explosives.

4. Visual impacts.

A few felt that industrial facilities, such as smoke stacks and factories, are typically unattractive. They were concerned that the project would add to the industrial landscape and would eventually result in a visual blight.

Some of those interviewed were optimistic that economics would preclude siting unattractive facilities near the more people-oriented areas of Ko Olina and Kapolei. They expected that the Estate would discourage incompatible uses to maintain the marketability of resort and residential properties.

5. Adequacy of infrastructure and public services.

Many felt that public officials need to ensure that the proposed project can be adequately serviced by existing and improved infrastructure. They were particularly concerned about (1) the roadways; (2) the sewerage system; and (3) water availability. Those interviewed wanted to make sure that adequate police and fire protection will be available. Further, they stressed the importance of an efficient evacuation system for major industrial accidents.

6. **Desired facilities in Kapolei Business-Industrial Park.**

Those who participated in the 1987 workshops of the Community Advisory Committee on the Secondary Urban Center reiterated the recommendation for high technology and adult educational facilities at the Kapolei Business-Industrial Park. They also expressed a desire to see fishing-oriented facilities, such as a cannery and an ice plant, in the maritime industrial area.

7. **Displacement.**

One person strongly objected to displacement of the Hawaii Raceway Park because this facility is Oahu's only site for motor racing. This person feared that, with the displacement of this facility, motor racers will use roadways for racing, thus threatening public safety. Further, this person wanted no plans for industrial development at this site until an alternative site was found for the Hawaii Raceway Park.

Note that the City Council recently adopted a resolution instructing the Chief Planning Officer to review a proposal to designate the 66-acre Hawaii Raceway Park site as a publicly-funded park on the Ewa Development Plan Public Facilities Map. The Chief Planning Officer is to transmit in a timely manner the required reports, findings and recommendations to the Council for its consideration (Honolulu City Council, Resolution No. 89-309, approved July 26, 1989).

Further note that others interviewed either wanted to see the racing facility moved because of noise impacts on the nearby communities, or did not have any comment on this item.

SECTION 5: POTENTIAL SOCIAL IMPACTS OF KAPOLEI BUSINESS–INDUSTRIAL PARK

5 POTENTIAL SOCIAL IMPACTS OF THE KAPOLEI BUSINESS-INDUSTRIAL PARK

This section identifies potential social impacts related to the Kapolei Business-Industrial Park. Section 5.1 describes the project's effects of creating a major employment center in the Kapolei region. Section 5.2 looks at the project's compatibility with residential, resort and commercial, and military activities. Section 5.3 raises on-site considerations and Section 5.4 discusses impacts on public facilities and services, including police and fire protection, education and day care, and medical and emergency facilities.

5.1 ADDITION OF A MAJOR EMPLOYMENT CENTER

5.1.1 Probable Non-project Changes

Section 3 presents the General Plan target population range of 119,940 to 132,934 persons in 2010. The current development proposals indicate that between 74,139 and 111,376 people could be living in the Ewa Development Plan area in the year 2010. Current proposals for residential growth could therefore accommodate a population two to three times that of the current Ewa population.

In the vicinity of the project site, the City of Kapolei is intended to be the nucleus of the secondary urban center. The Kapolei Shopping Center, the first phase of that development program, is anticipated to begin construction this year.

The existing community will therefore have been undergoing a gradual adaptation to this major influx of new people by the time Kapolei Business-Industrial Park begins implementation. Some of the changes which may have begun to occur when the project is implemented are as follows:

1. **Population and cultural diversification.**

   When compared to the islandwide community, the existing Ewa community tends to be slightly younger, and contain significantly higher proportions of Caucasians and Filipinos. Ewa had proportionally (1) fewer people born in Hawaii, (2) more people born in other parts of the United States, and (3) slightly less foreign-born residents. Residents of Ewa tended to be less educated than the islandwide community, and the mean family income was lower.

   When the project begins implementation, the residential profile of the Ewa area will have begun to gradually reflect more of a cross-section of the islandwide community. Residents of Makakilo will already have experienced a diversity of new residents from the Makakilo expansion area and Kumu Iki of Kapolei Village will have begun housing new residents. Though many of these developments will offer affordable housing, many of the new residents will be part of the market housing segment and will therefore have incomes above the current median income level for the Ewa area.

With these changes will come cultural diversity. Adaptation will begin with competition for jobs at the new commercial and resort facilities, shared use of new shopping centers, altered make-up of schools and community organizations and shared new recreation areas.

2. **Disruption of the slow-paced lifestyle.**

The initial impact of impending change is a change in the current slow-paced lifestyle which characterizes the residential communities of the Ewa region. The existing communities may experience difficulty in adjusting to the changes which are likely to develop. Some of these changes include (1) the potential increase in crime; (2) disturbance of community cohesion due to economic disparities; (3) crowding at recreational and commercial facilities; (4) increased traffic; and (5) transitional effects of new schools.

3. **Competition for public facilities and services.**

Concurrent with the influx of new residents will be competition for public facilities, such as parks, and increased usage of public services, including police and fire protection. To mitigate the strain on public facilities and services, public officials are planning major improvements in the City of Kapolei and its environs.

4. **Shift in employment patterns and increased job competition.**

As the Kapolei Business-Industrial Park is developed, the Ewa region will be experiencing an increased diversity in types of employment. Many current Ewa residents who are working outside Ewa will have jobs closer to home. Many unemployed and currently employed people working in other parts of Oahu will seek jobs in the City of Kapolei, nearby clubhouses at golf courses, day care centers, schools and new resort hotels.

Ewa's new residents will also be competing for the same jobs. This period of adjustment to a new lifestyle will be difficult for many Hawaii-born residents who need jobs but lack training. A potential for further confounding the frustrations of old residents will be working under new management from a different cultural group.

5. **Introduction of visitor industry to the Ewa region.**

   Ewa residents will have begun to adapt to having a resort community at Ko Olina in their region. Many residents will visit the restaurants and shops and some will be employees at these facilities.

5.1.2 Potential Effects of Kapolei Business-Industrial Park

Although the project will not directly increase the residential population, it will contribute to the influx of new people by being a major employment center.

The Kapolei Business-Industrial Park and James Campbell Industrial Park would employ an additional 9,700 people by 2035, as follows:

- The entire 921-acre Kapolei Business-Industrial Park will provide an estimated 8,872 full-time jobs at full build-out in 2025.

- Approximately 5,646 of these jobs would be located in the 552-acre Development Plan amendment area.

- In addition to its current 3,000 employees, the James Campbell Industrial Park is estimated to employ 500 more people by 2015, at which time the Park is anticipated to be fully occupied.

- The commercial area is expected to create 678 jobs (Zapotocky, 1989).

The following are the potential effects of the project's employment-generating aspect:

1. **Islandwide identity.**

   The lack of available industrial land is a major islandwide problem. As pressures to intensify land uses in urban Honolulu increase, industrial uses are being replaced by more compatible and land-efficient uses, such as residents and commercial activities. The proposed project will help meet the demand for industrial land by increasing the islandwide supply of industrial land. The proposed project will therefore likely have an islandwide identity, rather than being solely a regional asset.

2. **Increase in job diversity.**

   As indicated in Section 2.2.1, military activities currently account for a major proportion of Ewa jobs. Section 3 presents that, with the development of the City of Kapolei, the types of Ewa jobs will diversify as shopping centers, government agencies, professional office buildings and public facilities are developed. The proposed project will further add to this diversity by adding a substantial number of intensive and maritime industrial employment-generating activities.

3. **Increase in in-migration of non-Ewa employees.**

Inasmuch as the regional population is expected to experience major growth and diversification, it is likely that non-Ewa residents will also be employed at the Kapolei Business-Industrial Park. The proposed project will provide employment opportunities which will be available to all residents, as well as relocation alternatives for existing non-Ewa industrial uses. Hence, the project will cause the in-migration of many non-Ewa employees. The extent of this in-migration will depend on (1) the types of available on-site jobs; (2) the available qualified labor supply in the Ewa region; and (3) the number of businesses relocating from other areas.

4. **Consistency with growth policies.**

The City and County of Honolulu General Plan encourages the development within Kapolei to relieve developmental pressures in the remaining urban-fringe and rural areas and to meet housing needs not readily provided in the primary urban center. A major consideration in public policy is to *redirect* traffic currently flowing into Honolulu proper by providing alternative employment centers outside of the existing urban core. The proposed project will be consistent with these policies.

5.2 COMPATIBILITY WITH NEARBY USES

5.2.1 Residential Uses

NASBP contains the residential community nearest to the project site. Coral Rose Gardens/Manor, which contains 524 units and houses enlisted Navy personnel and their families, is located immediately east of the project site. Adjacent to this complex is the Officer Housing area and further east is the "Makai Housing" for officers and enlisted personnel (personal communication with Barbara Conrardy, Public Affairs Officer, NASBP, October 31, 1989). In 1985, approximately 2,900 people lived at the NASBP (City and County of Honolulu Department of General Planning, Planning Information Branch, October 1987).

Honokai Hale and Nanakai Gardens are situated to the northwest of the project site and, in 1985, approximately 2,000 people lived in these contiguous communities (Helber, Hastert and Kimura, 1989). Makakilo, located northwest of the project site, contained approximately 8,600 people in 1985 (City and County of Honolulu Department of General Planning, Planning Information Branch, October 1987).

In terms of planned developments, residents at the Kapolei Villages and at the City of Kapolei will also be living near this business-industrial park. It is also assumed that the low and medium-density apartments proposed in Ko Olina

Phase 2 will eventually be built, unless the developer proposes another alternative, in light of the recent withdrawal by the developer to replace these uses with golf courses and commercial uses.

As discussed in Section 5.2.1, pockets of industrial uses are being replaced by more compatible and land-efficient uses, such as residential and commercial activities, as pressures to intensify land uses in urban Honolulu increase.

The need for industrial land will continue to increase, and long-range policies are attempting to create a total urban environment in Ewa. Compatibility between the industrial activities and nearby residents will therefore require ongoing monitoring to ensure an economically viable and socially peaceful co-existence in the community. The following are possible incompatibility problems which may arise and will require consideration in the implementation of the Kapolei Business-Industrial Park:

1. **Sharing Of Transportation Facilities.**

   Major regional roadway networks, including the H-1 Freeway and Kalaeloa Boulevard, will be increasingly shared by residents of nearby NASBP, Honokai Hale, Nanakai Gardens, and Makakilo. In the future, residents of nearby City of Kapolei will also be sharing these roadways. Large vehicles transporting goods and materials from the proposed project to other parts of the island will increase as a result of the project, and private operators and public officials will need to assess overall traffic patterns to minimize traffic congestion and to ensure public safety.

2. **Air, Wind and Noise.**

   Typical considerations in industrial-residential compatibility include the disturbances and inconveniences resulting from nearby industrial activities. Ultimately, measures regulated by the Environmental Protection Agency (EPA) will minimize these occurrences.

   Noise, particularly in the evenings, has historically motivated resident complaints in other areas which abut industrial uses. In the case of the existing James Campbell Industrial Park, residents of nearby communities have complained about noise generated by motor racing at the Hawaii Raceway Park, as well as aircraft operations of the NASBP. Both the Estate of James Campbell and the NASBP have initiated mitigating measures in consideration of nearby residents. The proposed project would not include these specific uses; in fact, it will eventually displace the motor racing.

   Discomfort and other problems resulting from air emissions, such as offensive odors to breathing impairment, may also elicit resident complaints.

3. Public Safety.

As the urban environment of Kapolei evolves, the people-oriented activities will intensify. Public safety facilities and services, including civil defense, are to be incorporated in the government-related facilities planned for Kapolei. Because of the proximity of Kapolei to the proposed project, Federal, State and City agencies will undoubtedly be assessing potentially dangerous and hazardous industrial activities to ensure that the nearby communities will be protected.

5.2.2 Resort and Commercial Uses

The project site abuts the Ko Olina resort/residential community on its northern and western boundaries. Currently under construction are (1) a 500-slip marina, (2) an 18-hole golf course, (3) four newly-created sandy beaches, (4) a Hawaiian cultural center, (5) two shopping centers and (6) restaurants. Plans are also underway to develop seven world class hotels within this 1,000-acre project site. The first 18-hole golf course is expected to be operational in January 1990, and, in 1991, some of the residential and hotel units should be ready for occupancy (personal communication with Gary Omori, Director of Government and Community Relations, October 26, 1989).

Industrial-resort compatibility has essentially the same considerations as those pertaining to residential uses, such as the sharing of transportation facilities; air, wind and noise problems; and public safety.

In addition, the proximity of resort uses to intensive industrial activities would raise another compatibility consideration. Tourists visit Hawaii for its climate, environmental beauty and inviting ocean. Ko Olina hopes to capitalize on these assets and provide an alternative to Waikiki and rural resort areas. Although the on-site facilities, including the newly-created beaches, will create a pleasing and attractive ambience, the surrounding environment will be equally important in creating a total experience.

The orientation of Ko Olina, relative to the adjacent maritime activities at Barbers Point, and the existing James Campbell Industrial Park will therefore be important considerations in siting of visitor facilities.

The Kapolei Business-Industrial Park will add to the current industrial "landscape" of the area, and as implementation of both projects occur, coordination will be needed to ensure visual compatibility.

Note that James Campbell Industrial Park recognizes the aesthetic and economic needs to maintain an attractive area. For the past 17 years, the Park has issued annual Landscape Awards for overall design and landscaping (Honolulu Advertiser, 1988), and this continued practice at Kapolei Business-Industrial Park would encourage ongoing beautification efforts.

5.2.3 Military Uses

The Naval Air Station, Barbers Point (NASBP) is located immediately east of the project site. The station's mission is to support aviation activities and units of the Navy. General activities include fixed wing and helicopter arrivals, departures and patterns using all three of its runways.

In 1986, the Estate filed two lawsuits seeking $160 million in damages related to the findings and recommendations of the 1984 NASBP Air Installations Compatible Use Zones (AICUZ) study. The Estate contended that the study intentionally and improperly overstated noise impacts of aviation activities at the base, and that this study "significantly impacted and blighted at least 1,793 acres of estate land adjacent to Barbers Point Naval Air Station (Christensen, 1986).

A settlement was reached in 1989. The Navy agreed to modify its flight operations at Barbers Point and to redo the AICUZ study (Yamaguchi, 1989).

Based on the 1989 AICUZ study, the settlement agreement included a Compatible Land Use Map (CLUM) designated five areas within the Accident Potential Zones I and II, and specified allowable and non-permitted uses within each area. Further, within certain areas, physical structures could not intrude into the "inner horizontal surface" and "conical surface.". The parties agreed on certain AICUZ methodology, and acknowledged general provisions on NASBP standard operating procedures. The Navy also agreed to purchase protected flight paths over the Estate's land for $6.5 million.

Further, the agreement states that the Commanding Officer of NASBP is to call "*a meeting of interested parties. . . for the purposes of requesting input . . . regarding noise monitoring activities, addressing appropriate issues as liaison, and, reviewing and obtaining comments from each of them upon proposed adjustments and modifications to the CLUM and NASBP Standard Operating Procedures. . .*" (Appendix C, Harris Miller Miller and Hanson, Inc., July 1989).

The Kapolei Business-Industrial Park is not in any of the five designated areas and falls generally within 55 to 60 Day-Night Average Sound Level (Ldn). In the "Suggested Land Use Compatibility," the uses permitted under the proposed B-2, I-2 and I-3 zoning are generally considered compatible within this noise range (Figure ES-6, Harris Miller Miller and Hanson, Inc., July 1989).

Uses which are compatible, but which may require special consideration would generally not be found in a typical business-industrial park. These uses include single- and multi-family residents, hospitals and nursing homes, educational and government services, and certain cultural and recreational activities (Table 1, Appendix C, Harris Miller Miller and Hanson, Inc., July 1989).

The proposed project is therefore anticipated to be compatible with the NASBP aviation activities, and this compatibility can be monitored in the ongoing dialogue process outlined in the recent settlement agreement.

5.3 ON-SITE CONSIDERATIONS

Impacts related to on-site tenants and their employees will become more of a focal point as the project reaches implementation and construction stages. This section outlines socially-related elements which should be considered in project implementation:

1. **Lease Rent.**

   In 1985, news articles reported a dispute between the Estate and tenants of the James Campbell Industrial Park over the increase in lease rents (Smith, 1985; Sylvester, 1985). The tenants organized into the Campbell Industrial Park Owners and Tenants. This group represented about 90 percent of lessees and owners whose leases were renegotiated between 1983 and 1987. When these negotiations were completed, the group became inactive (personal communication with Ed Robinson, past president, Campbell Industrial Park Owners and Tenants, November 1, 1989).

   The Estate intends to lease parcels in the Kapolei Business-Industrial Park (personal communication with Susan Sublett, Assets Manager, The Estate of James Campbell, October 25, 1989). The Estate would need to maintain an ongoing dialogue with lessees to avoid previous lease rent problems.

   Such dialogue has already been initiated by future users of the Barbers Point Deep Draft Harbor. A Harbors Users Group was organized to represent future facility users and the current membership of 50 comprises primarily entities from James Campbell Industrial Park. This group hopes to provide a unified voice in working with harbor officials (personal communication with Dick Stephen-Hazard, President, Harbor Users Group, November 1, 1989).

2. **Safety Measures for On-Site Employees.**

   Public regulation will mandate certain standards to ensure employee safety. Further, Navy officials (based on meeting held on October 31, 1989) suggested that structural measures may be needed to protect industrial employees from noise pollution, particularly if structures are built right up to the maximum envelope permitted by the settlement agreement reached in January 1989.

5.4 IMPACTS ON PUBLIC SERVICES AND FACILITIES

5.4.1 Police Protection

Ewa's Crime Statistics

In 1987, there were a total of 372,022 reported offenses on the island of Oahu. Thirteen percent were Part 1 offenses, which partially includes murder, forcible rape, robbery, and auto theft. Twenty one percent of the total reported offenses were Part 2 offenses, which partially include arson, fraud, vandalism, substance abuse and stolen goods. The bulk of these reported offenses, almost two-thirds, were vehicular accidents and miscellaneous reports.

As part of District III, Ewa is included in Beats 325 (Makakilo and Honokai Hale), 326 (Ewa Villages, Honouliuli and NASBP) and 327 (the project site, Ewa Beach and IPP Military Family Housing). With 71,745 reported offenses in 1987, District III accounted for 19.2 percent of the total islandwide reported offenses. The breakdown of the District III's reported offenses was similar to the islandwide proportions.

Overall, Beats 325, 326 and 327 accounted for 13.1 percent of the total District III reported offenses. These beats had a smaller proportion of the more violent Part 1 reported offenses, with 11.4 percent of the total reported offenses. These beats also had a larger proportion of Part 2 offenses with 24.6 percent of the total (Honolulu Police Department, 1988).

Existing and Proposed Police Facilities

District III, which extends from Red Hill to Kaena Point and Kipapa Ridge, is handled by the Pearl City Police Station.

Currently, three shifts of two police officers are dispatched to each beat in a 24-hour period. Police officials have recently added another beat -- 326a -- which will cover the western side of Fort Weaver Road. Funds for staffing this new beat have already been released and the beat will be operational before July 1990. Long-term plans include adding a new full-service station in Kapolei, with the establishment of Ewa as a new district (personal communication with Lieutenant Melvin Chastain, Administrative Lieutenant for District III, Pearl City Police Station, October 20, 1989).

Given the long term goal of upgrading police facilities in Kapolei, the proposed project is anticipated to be adequately served by existing and proposed facilities.

5.4.2 Fire Protection

The nearest fire station is located in Makakilo, which has a single engine company with five firefighters working in a 24-hour period. Backup for the general vicinity is provided primarily by the Waipahu Fire Station, and secondarily by facilities in Ewa Beach and Nanakuli.

The Fire Department is currently planning a number of improvements to accommodate the increasing population. These are as follows:

* the relocation of the Ewa Beach Fire Station to a location north of the shopping center along Fort Weaver Road;
* a new engine company at Tenney Village to be constructed in a six-year time frame;
* a Kapolei engine-and-ladder company;

* a Ko Olina engine-and-ladder company; and

* a fire station in the Kapolei Business-Industrial Park, near the southeastern boundary of the amendment area (based on information provided by Captain Gordon Mahiko, Administrative Services, Honolulu Fire Department, November 2, 1989, and the Ewa Development Plan Public Facilities Map).

The engine companies will have five firefighters working in a 24-hour period; the engine-and-ladder companies, eleven firefighters. These improvements and new facilities are in preliminary stages at this time.

The existing and proposed fire protection facilities are anticipated to be adequate to serve the Kapolei Business-Industrial Park (personal communication with Captain Gordon Mahiko, Administrative Services, Honolulu Fire Department, November 2, 1989).

5.4.3 Education And Child Care

The proposed project will not house permanent residents and is therefore not expected to impact the educational facilities in the area.

The project may require child care services because of the number of on-site jobs generated by the proposed uses. The extent of this requirement depends on, first, the availability of other child care facilities which can serve employees of the proposed project and, second, the actual employee requirements and preferences expressed when the facility is in operation. Both factors are hereby discussed.

1. **Availability of Ewa Child Care Facilities.**

   Currently three sites have been committed for child care facilities:

   * West Loch has a 5.3 acre site for a park-and-ride facility with a 30,000 square foot child care center. This is scheduled for implementation in Phase 2.

   * Royal Kunia in Central Oahu has similar provisions included in its master plan.

   * Ko Olina has one acre for child care and other public facilities.

   In addition, three potential child care centers are being explored in Kapolei. One site is located in the City of Kapolei, with the other two in Kapolei Villages. The size of these facilities ranges from 20,000 to 25,000 square feet.

   The ownership and operation of these committed and proposed child care facilities is currently being evaluated by the City and County of Honolulu. Three general options are available: (1) the City could build and operate such a facility; (2) the City could build the facility and contract an operator; (3) the City could acquire the land and issue a long-term lease for a private entity to build and operate the facility (personal communication with Wayne Protheroe, Executive Assistant, City and County of Honolulu Office of Human Resources, October 19, 1989).

2. **Indicators of Actual Employee-Based Child Care Needs.**

Currently, there is no rule of thumb in projecting child care needs and requirements for specific development proposals have been determined on a case-by-case basis.

Based on historic trends, child care providers have a general expectation that ten percent of the eligible on-site employee population will choose employer-sponsored child care services. The eligible employees are those between the ages of 18 and 35.

This low proportion of potential users is due to (1) the availability of family or relative child care services (used by half of the need group) and (2) the high cost of existing services.

At the time of this writing, employer-sponsored child care programs are initiated primarily by the health and medical care profession. The various forms of employer-sponsored child care include:

* *major subsidy of on-site care* -- The Castle Medical Center charges $1.82 per hour of child care, a rate which is significantly low, and subsidizes the remaining costs;

* *pre-tax contribution* -- PRI assists its qualified employees by contributing pre-tax funds;

* *direct voucher* -- McDonald's in Kona provides a direct voucher of $1.25 an hour to employees who demonstrate their use of qualified child care facilities (personal communication with Barbara Morgan, Business Liaison, PATCH, October 12, 1989).

5.4.4 Medical And Emergency Services

Three hospitals are within reasonable travelling distance of the project site. The nearest is the St. Francis Hospital-West is located in the eastern portion of the Ewa Plains. The Kaiser Foundation Health Plan has a relatively new central hospital in Moanalua, and the Pali Momi Medical Center is located near the Pearl Ridge Shopping Center. In addition, the area contains numerous medical clinics and doctors' offices.

As Kapolei City progresses, additional medical facilities will be required to serve the increased population. The proposed project is expected to be adequately served by the existing and additional medical facilities.

Emergency services are provided by City ambulances located in Aiea. Further, the Waipahu Fire Station contains an ambulance unit which serves Pearl City, Waipahu, Ewa Beach, Makakilo and parts of Waianae. Also eight-hour service is provided to the Makakilo Fire Station by the Waipahu unit. Twenty-four hour ambulance service at the Makakilo Fire Station is currently in the planning stage. The extent of emergency services required will depend on the types of activities at the Kapolei Business-Industrial Park, the degree of risk, and the number of employees (personal communication with Donna Maiava, Chief of Emergency Medical Service Systems Branch, State Department of Health, August 31, 1989).

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APPENDIX J

Proposed Kapolei Business-Industrial Park: Impact on Agriculture

Decision Analysts Hawaii, Inc.

APPENDIX J

KAPOLEI BUSINESS-INDUSTRIAL PARK: Impact on Agriculture

PREPARED FOR:

The Estate of James Campbell

PREPARED BY:

Decision Analysts Hawaii, Inc.

November 1989

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TABLES

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EXECUTIVE SUMMARY

The development of Kapolei Business-Industrial Park would result in the urbanization of approximately 552 acres of land owned by The Estate of James Campbell (Campbell Estate), of which about 145 acres are in sugarcane that is being cultivated by Oahu Sugar Company, Ltd. (OSCo), and 10 acres are used for a tree farm operated by Campbell Estate. The impact of this conversion on OSCo operations and on diversified agriculture is summarized in this report.

Impact on OSCo

Assuming that U.S. sugar prices will continue to be high enough to justify continued sugar operations in Hawaii, an important question is whether Kapolei Business-Industrial Park—combined with other planned and proposed projects—would eventually cause the closing of OSCo, by reducing sugarcane acreage sufficiently to reduce economies of scale, and/or by contributing to a scattered and therefore inefficient plantation rather than a more compact and efficient one.

Assuming further that all proposed projects will be approved, and that it would take about 20 years to realize the full development of all projects, OSCo would retain about 11,490 acres under cultivation in the mid-1990s when its leases expire. If the average yield for the plantation were to reach a very optimistic 17.9 tons per acre by the end of 1995 (which is not expected), then this would be sufficient land to maintain the historic level of production of 90,000 to 95,000 tons of raw sugar per year.

More realistically, if an average yield of 17.9 tons per acre is not achieved, or if the resulting form of the plantation proves to be inefficient for OSCo to run the plantation at its historic level of production, or if urbanization proceeds much more rapidly than projected, then a conversion from a two- to a one-mill operation would allow a smaller but still efficient operation. For this case, land requirements would be about 10,350 acres, assuming a more realistic yield of 14.5 tons per acre and production of about 67,500 tons per year. This would provide a buffer of 1,140 acres from which to assemble an efficient plantation; this figure is based on 11,490 acres remaining after projected urbanization (assuming approval of all planned and proposed projects), minus the estimated 10,350 acres required for a one-mill operation. If yields reach higher levels, then the buffer increases accordingly. It is uncertain whether or not attrition would be sufficient to accommodate the reduction in employment associated with a conversion to a one-mill operation.

In terms of the form of the plantation, the development of Kapolei Business-Industrial Park would conform to the preferred sequence for contracting the plantation, which is from the periphery of the plantation inward; lands at the site of the proposed development are a long trucking distance from the mill, soils are inferior to those of inland fields, and yields are generally lower than average. Also, Campbell Estate has coordinated and will continue to coordinate its developments so as to avoid unnecessary disruption of OSCo operations.

In summary, Kapolei Business-Industrial Park, in combination with other approved and proposed projects, is not expected to threaten the economic viability of OSCo before its leases expire in the mid-1990s. However, managing the survival of a shrinking plantation is expected to become increasingly difficult.

In the longer term, the site for the proposed development eventually will become isolated from the rest of the plantation as a result of the Villages of Kapolei and the City of Kapolei, both of which are in their initial stages of development. Consequently, if the project area were to remain with OSCo, it would become a "remnant" property of the plantation, and the fields would be fallowed.

In addition, the future of OSCo is uncertain given the outlook for flat or declining sugar prices, and costs which generally increase with inflation. Furthermore, economic incentives may not favor renewal of the major leases. However, assuming continued operations, then at full development of all the planned and proposed projects (assuming approval of all projects), the amount of land under cultivation by OSCo would decline by nearly 5,800 acres, from 13,487 acres to about 7,700 acres. This loss of acreage would likely require a switch to a one-mill operation in an effort to maintain economic viability. Furthermore, the average yield would have to reach an optimistic 19.5 tons per acre or more. Given currently available information, it is uncertain whether the form of the plantation—whether or not Kapolei Business-Industrial Park is developed—would allow viable operations.

Impact on Existing Diversified Agriculture Operation

The development of Kapolei Business-Industrial Park would eliminate the 10-acre tree farm which is currently operating in the area. However, production would be assumed by other nurseries in Hawaii.

Impact on the Growth of Diversified Agriculture

The development of Kapolei Business-Industrial Park on 145 acres of of sugarcane land and the 10-acre tree farm, would eliminate the possibility of using these lands for diversified agriculture. However, it is extremely doubtful that the project would adversely affect the growth of diversified agriculture in Hawaii. There are four reasons for this assessment: (1) an extensive amount of prime-agricultural land and water has been freed from sugar and pineapple production because of past plantation closings and reductions in operations, with most of this land and water remaining available for diversified agriculture activities; (2) a very real possibility exists that additional land and water will be freed from sugar production given that a number of plantations are not profitable; (3) most of the sugar operations would make their lands available for profitable replacement crops to the extent that such crops are available; and (4) compared to the available supply, a very small amount of land and water is required to grow proven and promising crops to achieve a realistic level of food and animal-feed self-sufficiency, and to increase exports.

The increasing availability of prime agricultural land in Hawaii is part of very long-term and accelerating trends occurring throughout most developed and developing market economies. Productivity and yields have been increasing faster than population growth. This situation requires that labor, land, and other resources be gradually withdrawn from agriculture in order to maintain balanced markets and to increase farm income for those who remain.

Consistency with State and County Plans

Since the development of Kapolei Business-Industrial Park is not expected to adversely affect the economic viability of OSCo before the major leases expire in the mid-1990s, conforms to the preferred sequence for contracting the plantation, would not adversely affect the economic viability of OSCo in the longer term since the property will become an isolated remnant of the plantation as a result of other development projects, and would not limit the growth of diversified agriculture since ample agricultural lands are available elsewhere, the proposed project is consistent with the major thrust of the agricultural portion of the *Hawaii State Plan, the State Agriculture Functional Plan,* and the *General Plan of the City and County of Honolulu.* This thrust in all three plans calls for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture (see Table 6). To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured. Nevertheless, for about 15 percent of the project area, the development of the Kapolei Business-Industrial Park would be potentially inconsistent with the lower-level State agricultural guidelines which call for Agricultural Lands of Importance to be protected from development.

Furthermore, Kapolei Business-Industrial Park would conform with State and County plans and policies in that it would provide public benefits in terms of employment and reduced commuting.

PROPOSED KAPOLEI BUSINESS-INDUSTRIAL PARK: IMPACT ON AGRICULTURE

The proposed Kapolei Business-Industrial Park would result in the urbanization of approximately 552 acres of land, of which about 145 acres are in sugarcane that is being cultivated by Oahu Sugar Company, Ltd. (OSCo), and 10 acres are used for a tree farm operated by The Estate of James Campbell (Campbell Estate). The impact of this conversion on OSCo operations and on diversified agriculture is summarized in this report.

SOIL QUALITY

The affected acreage consists primarily of three soil types:

CR	Coral outcrop.
EmA	Ewa silty clay loam, moderately shallow, 0 to 2 percent slopes.
MnC	Mamala stony silty clay loam, 0 to 12 percent slopes.

For each soil type, Table 1 shows the approximate acreage, possible agricultural uses, and two soil ratings (explained below). The predominate soil type, CR (coral outcrop), comprises 86 percent of the project area and is poorly suited for agriculture, although cane is being grown on a portion of the coral outcrop which has been covered with topsoil. Suitable agricultural activities associated with the remaining acreage include sugarcane, truck crops, and pasture.

The soils within the petition area have been rated in terms of four classification systems commonly used in Hawaii: (1) Land Capability Grouping, (2) Agricultural Lands of Importance to the State of Hawaii, (3) Overall Productivity Rating, and (4) Proposed Land Evaluation and Site Assessment. These classification systems are discussed below.

(1) *Land Capability Grouping by the United States Department of Agriculture Soil Conservation Service (SCS).*

This classification system rates soils according to eight levels, ranging from the highest classification level, I, to the lowest level, VIII. Assuming that the land is irrigated, these ratings are shown in Table 1. As mentioned above, soil type CR, coral outcrop, covers over 86 percent of the project area, and has a land capability rating of VIIIs, which indicates that the soil has severe problems which make it generally unsuited for agriculture. Soil type MnC, which covers about 13 percent of the project area, has a land capability rating of IIIs, which indicates that the soils have severe limitations that reduce the options on plants, require special conservation practices, or both. Soil type EmA which covers about 1 percent of the proposed project area—has a land capability rating of IIs, which indicates that the soils have moderate limitations that reduce the choice of plants that can be grown successfully, or indicates that moderate conservation practices are required. The subclassification "s" indicates that the limitation is due to stoniness, unfavorable texture, shallowness, or low water-holding capacity.

Table 1.— **PROPOSED KAPOLEI BUSINESS-INDUSTRIAL PARK: SOIL TYPES, ACREAGE, AGRICULTURAL USES, AND SCS AND LESA RATINGS**

Soil Type	Acreage	Agricultural Uses	SCS Rating[1]	LESA Rating
CR	472	None	VIIIs	12
MnC	73	Sugarcane, Truck Crops, Pasture	IIIs	66
EmA	7	Sugarcane, Truck Crops, Pasture	IIs	74

1. Assuming that the soils are irrigated, except for CR which is coral outcrop.

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

(2) *Agricultural Lands of Importance in the State of Hawaii (ALISH), by the SCS, University of Hawaii (UH) College of Tropical Agriculture and Human Resources, and the State of Hawaii, Department of Agriculture.*

This system classifies lands into three categories: (a) "Prime" agricultural land which is land that is best-suited for the production of crops because of its ability to sustain high yields with relatively little input and with the least damage to the environment; (b) "Unique" agricultural land which is non-prime agricultural land that is currently used for the production of specific high-value crops; and (c) "Other" agricultural land which is non-prime and non-unique agricultural land that is of importance to the production of crops. Most of the soils in the proposed development are poor and, correspondingly, most of the area is **not rated** in the ALISH classification system. However, the area that has been planted in sugarcane has soils that are rated as **Other**.

(3) *Overall Productivity Rating, by the UH Land Study Bureau (LSB).*

This classification rates soils according to five levels, with "A" representing the class of highest productivity and "E" the lowest. About 14 percent of the petition area has soils rated **B**, 21 percent are rated **C**, while the remaining 65 percent is rated **E**.

(4) *Proposed Land Evaluation and Site Assessment (LESA) System, by the State of Hawaii Land Evaluation and Site Assessment Commission*

Based on soil quality, locational attributes, improvements, nearby activities, and land-use plans, the proposed LESA classification system would designate a sufficient amount of the better agricultural lands to meet projected agricultural goals. If the LESA classification approach were applied to the proposed site, about 14 percent of the designated lands would be termed "important agricultural lands" (IAL), which would include all lands having a LESA rating of 66 or higher, out of a possible total of 100. The ratings for each soil type are shown in Table 1. However, the designations could be changed based on a change in nearby activities and a change in County land-use plans. Also, the designation could be changed if an overriding public benefit were demonstrated.

These soil-rating systems suggest that about 15 percent of the project site is comprised of good soils.

IMPACT ON OSCo[1]

Background Information

Production

Oahu Sugar Company, Inc. (OSCo), a subsidiary of Amfac/JMB Hawaii (Amfac), first milled sugar in 1899, and is now the fourth largest sugar operation in the State. In 1987, it produced 94,414 tons of raw sugar (nearly 10 percent of the State's total sugar production) and 18,917 tons of molasses. In addition, it sold 17.0 million kWh of electric power to Hawaiian Electric Co.

Land Area

In late 1988, OSCo cultivated 13,487 acres of sugarcane lands which covered portions of Central Oahu on each side of Kunia Road above Pearl Harbor, and portions of the Ewa Plain to the west of Pearl Harbor. The Ewa lands were taken over from Ewa Plantation in 1970. Another 4,910 acres of OSCo lands were in production in 1982, the bulk of which now lie fallow, while a few hundred acres have been urbanized. These lands are primarily mauka lands which incurred high pumping costs; and lands close to the ocean where soils tend to be inferior, yields low, and hauling costs high because of the distance to the mill.

Land Ownership

As mentioned above, nearly all of the land which OSCo cultivates is leased. Until recently, the principal landowners were the Campbell and Robinson Estates, whose leases to OSCo expire in 1995 and 1996, respectively; and the U.S. Navy whose lease to OSCo expires in 1995. The Campbell Estate lands include most of the Ewa Plain and Central Oahu lands above the H-1 Freeway and west of Kunia Road. The Robinson Estate lands are in Central Oahu above the H-1 Freeway and between Kunia Road and Waikele Stream. Navy lands include Waipio Peninsula, and a portion of the eastern portion of the Ewa Plain.

To a major extent, control of OSCo lands recently has passed or is in the process of being passed from the two major estates to developers. The lands affected include: (1) practically all of the Campbell Estate lands in Ewa, except for lands which Campbell Estate plans for commercial development and expansion of Campbell Industrial Park, and a few fields near Ewa Beach; and (2) over half of the Robinson Estate lands. The only lands still under the control of a major estate and leased to OSCo include: (1) some of the Campbell Estate lands in Ewa which Campbell Estate has retained for its own development, plus a few fields near Ewa Beach; (2) Campbell Estate lands in Central Oahu; and (3) some of the northern fields on Robinson Estate lands.

1. Unless otherwise noted, the material in this section is from OSCo.

The new landowners include about a half-dozen private companies, plus the State of Hawaii and the City & County of Honolulu. The major new owner of OSCo leased lands, and the one which will play a dominate role in determining the fate of OSCo, is now the State of Hawaii, which is in the process of negotiating the purchase from Campbell Estate of an additional 3,100 acres of land in the central portion of the Ewa Plain, with the intention of "banking" it for eventual housing developments.

Water Usage

OSCo, one of the major water users on Oahu, pumped up to 112 million gallons per day (mgd) of groundwater in 1987, some of which was potable and some brackish. OSCo also diverts 25 to 30 mgd from the Windward side via Waiahole Ditch in normal-rainfall years. Per-acre usage by OSCo can exceed 9,000 gallons per day. In comparison, domestic water provided by the Honolulu Board of Water Supply for Oahu averages only 141 mgd, and per-acre usage for single-family homes (at 5 units per acre) averages about 2,130 gallons per day.

Employment

Field, mill, and management employment at OSCo in late 1988 was 460 workers. Indirect employment dependent upon OSCo is estimated to be 520 jobs.[2]

Yields

Because of favorable growing conditions, good farming practices, and drip irrigation, sugar yields at OSCo are very high: 14.06 tons per acre in 1987, versus a Statewide average of 12.32 tons per acre.[3] In fact, OSCo holds the world record sugar yield at 21.63 tons per acre set in April 1985.[4] The 1987 average yield was about 24 percent higher than the 1979 yield of 11.3 tons per acre.

Profitability

Even with high yields and very efficient operations, OSCo has been only marginally profitable in recent years—the principal problem being low sugar prices and high lease rents. The marginal profitability is measured before accounting for any new capital investment that may be required to replace equipment.

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2. Multiplier of 1.13, based on the State Economic Model.
3. HSPA, *Hawaiian Sugar Manual, 1988.*
4. HSPA, "Hawaii Sugar News," June 26, 1985.

OSCo Plans

In 1982, Amfac developed a Master Agricultural Plan which included a "Survival Plan" for OSCo. This plan, which has been fully implemented, was developed in response to OSCo's operating loss in 1981 of nearly $10 million, and an outlook for low sugar prices. In recognition of the fact that the sugar plantation was already in place with substantial improvements, but suitable replacement crops were yet to be identified, the Plan amounted to a holding action to gain time to either restore the profitability of the plantation, or find as many replacement crops as possible before OSCo could be forced by outside economic factors to cease operations. Key components of the plan were:

- continue to improve the economic efficiency of OSCo by increasing sugar yields and reducing production costs (both of which have been improved substantially since 1981);
- urbanize Waikele (the only OSCo land owned by Amfac) in order to derive revenues to help support and justify continued sugar operations; and
- experiment with a variety of crops (papaya, sweet corn, potatoes, forage and feed crops, coffee, etc.) in order to find profitable replacement crops for sugar.

An important component of OSCo's cost-reduction efforts has been its continued decline in the labor force; between 1985 and 1988, employment decreased by about 140 jobs, or about 23 percent. The decrease in employment is accomplished by attrition—that is, employees who retire or leave OSCo for other voluntary reasons generally are not replaced.

Of interest, nearly all sugarcane operators throughout the world are pursuing a similar strategy of trying to improve efficiency by increasing yields and reducing production costs, while searching for alternative crops[5].

Among the options being considered by OSCo in response to the loss of land to urbanization is to reduce processing capacity by operating a single mill rather than two mills in parallel, as is currently the case. With a single mill, OSCo could be expected to reduce production from its historic level of 90,000 to 95,000 tons per year to 60,000 to 75,000 tons; a corresponding decrease would occur in the OSCo acreage requirements. Such a conversion would require new investment in the plantation; however, given a lower volume of production as a result of losing land to urbanization, the average cost per ton of sugar is expected to be lower with one mill running at full capacity than would be the case with two mills running below capacity. However, when compared to the average cost per ton under the existing two-mill operation running at full capacity, the single mill is expected to result in a marginally higher cost of production. In terms of labor savings, a conversion to a single-mill operation would save about six jobs.

5. James B. Brown, *The International Sugar Industry, Developments and Prospects.*

Of significance, Amfac's Kekaha Sugar Company, Inc.—which experiences climatic conditions similar to those of OSCo and has a similar yield potential—historically has been one of the most efficient sugar operations in the State. Yet this plantation cultivated just 8,375 acres in 1987, and produced only about 56,620 tons of sugar.

Outlook For OSCo

The continued survival of OSCo will depend on a number of factors. One of the most important of these will be continued Federal price supports for sugar that are sufficiently high to justify continued operations, and continued—if not greater—success in reducing production costs to a level that will allow profitability. OSCo's success in increasing its yields and/or downsizing the plantation to compensate for lands lost to urbanization will also be important. The agricultural quality of the lands which remain, and the form of the plantation will also be a concern. In general, the preferred contraction in the plantation is from the periphery inward because this would result in a compact plantation and high-quality lands: a more compact plantation reduces trucking and other costs, while higher-quality lands contribute to higher yields. After the major leases expire in the mid-1990s, continued sugar operations also will depend on OSCo's success in negotiating favorable lease terms. These issues are discussed below for two time periods: 1995 when the major leases become due, and the longer term of about two decades.

Outlook to 1995

<u>Short-Term Outlook for Sugar Prices</u>

The survival of OSCo will depend greatly on the price of sugar. In the world market, the average price of sugar is expected to remain well below the production costs for all countries, because most sugar is traded in controlled and/or subsidized markets, while surplus sugar is dumped onto the world market for sale at a loss. Dramatic price increases have occurred, however, following a 6- to 9-year cycle, with prices increasing when world production falls short of consumption. However, a number of fundamental developments have taken place in sugar and in related industries in the past two decades which appear to have altered the pattern of sugar prices, thereby reducing peak prices and extending the periods of low prices. These changes include: the decline or stagnation of sugar consumption in some developed countries; market inroads made by the liquid sweetener high-fructose corn syrup (HFCS); the availability of substantial sugar reserves in the form of sugarcane now devoted to ethanol production; major gains in sugarbeet production in several European countries which were traditionally cane sugar importers; the appearance of the European Economic Community (ECC) as a major exporter of refined sugar; and, in the world market, major importers are no longer the developed countries, but rather the developing countries which have far less purchasing power and less ability to drive sugar prices to high levels during shortfalls.[6]

In the United States, Federal legislation protects sugar from the low world prices by imposing import quotas, tariffs, and import fees. However, U.S. sugar prices are managed so that they remain fairly low in order to prevent an acceleration in the growth of competing sweeteners, and to maintain public support for the program. Under the U.S. Food Security Act, which runs to late 1990, the target price for sugar is 18 cents per pound, with no adjustments for inflation.

The competing sweetener of major concern has been HFCS. It is as sweet, or sweeter, than regular sugar, costs less to produce, sells for less, is more profitable, is very similar to liquid sugar, can be substituted readily in many applications, and is easier and cheaper to handle. It has experienced a rapid growth in sales at the expense of regular sugar sales. However, HFCS has captured nearly all of the liquid-sweetener market so that its continued growth will depend on the market acceptance of Crystar, the crystalline version of HFCS. In addition, the new low-calorie sweetener aspartame, sold under the brand name "Equal," is capturing market share and putting additional downward pressure on U.S. sugar prices.

Regarding the short-term outlook for sugar legislation, it should be noted that, because of the advent of HFCS, many corn states (HFCS is produced from corn) have joined the sugar and sweetener coalition, making it larger and stronger than in the past. The considered expectation among sugar experts and lobbyists is that sugar will continue to be included in the U.S. Food Security Act, but that the price-support level will remain unchanged with no adjustment for inflation. Even though this is expected, there is a risk that efforts by sugar users and consumer groups to exclude sugar from the U.S. Food Security Act, or to significantly reduce the support price, will be successful.

Another and more serious threat to U.S. sugar price supports is the negotiations on the General Agreement on Tariffs and Trade (GATT). A GATT panel has found that the U.S. limits on sugar imports violate international trade rules. In order to comply with GATT, the U.S. sugar program may require a major restructuring, allowing a higher volume of imports, and probably resulting in lower U.S. sugar prices. Furthermore, any GATT Agreement would be subject to an accept-or-reject decision by the U.S. Senate, without opportunity for modification. If accepted, GATT would supersede U.S. sugar legislation, with the 1991/1992 crop being the first one affected.

If U.S. sugar prices drop, OSCo would have to decrease its production costs accordingly.

6. Ibid.

Urbanization Pressures on OSCo

The gradual growth westward of urban Honolulu has consumed a large amount of former sugarcane land, as evidenced by the fact that the eastern boundary of OSCo lands has moved westward by 9 miles from Moanalua Valley to the area beyond Waikele Stream. Since the 1960s, four ridges west of Halawa have been urbanized. Even with this level of urbanization, sufficient acreage was cultivated by OSCo to maintain economies of scale because of new plantings in the foothills of the Waianae mountains and on former pasture lands. The westward urbanization pressures of Honolulu continue, but plantings of new lands to compensate for lost fields are no longer feasible.

The economic forces which create urbanization pressures on OSCo are very strong:

- Financial returns from urban land uses far exceed those from agricultural uses.
- OSCo is near the new or growing employment centers of Ko Olina Resort, Barbers Point Harbor, Campbell Industrial Park, City of Kapolei, and downtown Honolulu.
- Because of OSCo's proximity to the H-1 Freeway, its lands are within reasonable travel distance of these new and growing employment centers.
- Water supplies would become available for other uses if it were freed from sugar production.
- OSCo land is near the Honouliuli waste-treatment facility.
- Construction costs would be low in comparison to areas that require extensive grading or removal of existing structures.

In contrast, redevelopment of downtown Honolulu suffers from the high expense and displacement problems required to remove existing structures, the cost and inconvenience of redeveloping inadequate infrastructure, less desirable high-rise housing compared to single-family homes, and occasional strong community opposition. Hawaii Kai suffers from a lack of employment growth centers, relatively little land available for further single-family housing, commuter traffic problems, and community opposition to further development. Similarly, the Windward side suffers from a lack of growing employment centers, commuter traffic problems, and community opposition to further development.

In view of these factors, the City & County of Honolulu has designated the Ewa area as a "Secondary Urban Center" which will be developed to accommodate a major portion of Honolulu's future growth. Developments approved and proposed for the Ewa/Central-Oahu area which would affect OSCo acreage are shown in Table 2.

In this listing of major developments, it should be noted that the landowner for the proposed Kunia Golf Course lacks land withdrawal rights before the lease expires in 1996.

Acreage Reduction to 1995

Assuming approval of Kapolei Business-Industrial Park, along with development of all of the other planned and proposed projects listed in Table 2 (some of which may fail to receive the necessary approvals in the near future), and assuming a 20-year average development period for the housing, commercial, and resort projects, then the loss of sugarcane acreage by the end of 1995 when the major lease with Campbell Estate expires would be under 2,000 acres. Remaining acreage under cultivation by OSCo would fall from 13,487 acres to about 11,490 acres, assuming no replanting of currently fallowed land.

Assuming further that U.S. sugar prices will continue to be high enough to justify continued sugar operations in Hawaii, an important question is whether the contraction of the plantation to 11,490 acres would cause the closing of OSCo by reducing sugarcane acreage sufficiently to reduce economies of scale, and/or by contributing to a scattered and therefore inefficient plantation rather than a more compact and efficient one.

Table 2. **PLANNED AND PROPOSED DEVELOPMENTS AFFECTING OSCo ACREAGE: 1989**

Project	**Sugarcane Acreage**
Kapolei Business-Industrial Park	145
Ewa Marina, Phase I (partially approved)	410
Ewa Marina, Phase II	367
Royal Kunia, Phases I (partially approved)	548
Royal Kunia, Phases II	838
Ewa Gentry (partially approved)	891
Villages of Kapolei, State of Hawaii (approved)	775
City of Kapolei, Campbell Estate (partially approved)	693
Ko Olina Resort (approved)	281
Golf Course (J. Myers)	270
West Loch Estates, City and County of Honolulu (approved)	195
Kunia Golf Course	190
Kapolei Knolls (partially approved)	55
Eventual Remnant Property	94
Total	**5,750**

Source: Applications and discussions with Oahu Sugar Co., Ltd.

Acreage Requirement

As indicated in Table 3, OSCo's requirements for land will depend on its success in increasing its yields, and on whether or not the plantation is downsized to a one-mill operation. Average sugar yields fluctuate from year to year but, over the long term, yields have increased gradually. For example, yields increased from 11.3 tons per acre in 1979, to 14.06 tons in 1987, or an increase of 24.4 percent over 8 years. The increase resulted from the conversion to drip irrigation, fallowing low-yield fields, the introduction of improved varieties of the sugarcane plant, and other improvements. Under ideal conditions, OSCo achieved the world-record yield of 21.63 tons per acre from one of its Kunia fields. For the future, increasing yields are expected to occur as a result of contracting operations to higher-quality fields, introducing im-

Table 3. OSCo ACREAGE REQUIREMENTS FOR ONE AND TWO MILLS, BY YIELD LEVEL[1]

Yield (tons of raw sugar per harvested acre)		**One Mill**[2] (67,500 tons of raw sugar per year)	**Two Mills**[3] (92,500 tons of raw sugar per year)
11.3[3]	(1979 average yield)	13,274 acres	18,191 acres
14.06	(1987 average yield)	10,669	14,620
14.5		10,345	14,176
15.0		10,000	13,704
15.5		9,677	13,262
16.0		9,375	12,847
16.5		9,091	12,458
17.0		8,824	12,092
17.5		8,571	11,746
18.0		8,333	11,420
18.5		8,108	11,111
19.0		7,895	10,819
21.63	(record yield)	6,935	9,503

1. It is assumed that 10 percent of the acreage is set aside for seed cane, and that one-half of the remaining acreage is harvested annually.
2. The estimated output from a one-mill operation would be from 60,000 to 75,000 tons of raw sugar per year.
3. Historic production from the two-mill operation is from 90,000 to 95,000 tons of raw sugar per year.

proved varieties of cane, improving farming practices, adding chemical ripeners, introducing more efficient harvesters, etc.

Returning to the 11,490 acres of sugarcane lands that are projected to remain after urbanization to 1995 (which assumes that all planned and proposed projects are approved), and assuming that the average yield reaches a very optimistic 17.9 tons per acre by the year 1995 (which is not expected), then sufficient land would remain to operate a two-mill operation at the historic level of 90,000 to 95,000 tons per year (see Table 3).

More realistically, if an average yield of 17.9 tons per acre is not achieved, or if the resulting form of the plantation proves to be inefficient for OSCo to run a two-mill operation, or if urbanization proceeds much more rapidly than projected, then (under the assumption that all proposed projects are approved) switching from a two- to a one-mill operation would allow a smaller but still efficient operation, with land requirements reduced by about 25 percent or more. For a one-mill operation, about 10,000 to 10,350 acres would be required, assuming a more realistic yield of 14.5 to 15 tons per acre for the remaining acreage (see Table 3). A yield of 14.5 tons per acre would provide a buffer of 1,140 acres from which to assemble an efficient plantation; the figure of 1,140 acres is based on 11,490 acres remaining after projected urbanization (assuming approval of *all planned* and proposed projects), minus the estimated 10,350 acres needed for a one-mill operation assuming yields of 14.5 tons per acre. If yields are higher, the buffer increases accordingly.

With regard to the form of the plantation, the development of Kapolei Business-Industrial Park would conform to the preferred sequence for contracting the plantation, which is from the periphery of the plantation inward; lands at the site of the proposed development are a long trucking distance to the mill, soils are inferior to those of inland fields, and yields are generally lower than average. Also, Campbell Estate has coordinated, and will continue to coordinate, its developments with OSCo so as to avoid unnecessary disruption of OSCo operations.

Summary Outlook to 1995

In summary, by the mid-1990s, when the major leases expire, Kapolei Business-Industrial Park, in combination with the various other planned and proposed projects, is not expected to cause OSCo to lose its economic viability. However, if all or nearly all proposed projects are approved, and if urbanization proceeds rapidly, or if the sequence of urbanization results in a scattered plantation that is inefficient for running a two-mill operation, then a conversion from a two- to a one-mill operation would allow a smaller but still efficient operation. It must be recognized, however, that managing the survival of a shrinking plantation is expected to become increasingly difficult.

Long-Term Outlook

After the major leases expire in 1995 and 1996, the future of OSCo becomes increasingly uncertain, as discussed below.

Long-Term Outlook for Sugar Prices

Regarding sugar prices, the major long-term concern is that a number of new sweeteners are being introduced for which the target market is that portion of the sweetener market still being held by cane and beet sugar. New sweeteners include Crystar (crystalline HFCS), high-temperature aspartame, super aspartame, sunette, sucralose, alitame, talin, and stevioside. Some of the sweeteners have recently won approval for human consumption in the United States, and others are in the process of obtaining approvals. If at least one of these new sweeteners achieves significant market success, then the downward pressure on sugar prices will increase.

Lease Renewals

The continued survival of OSCo also will depend upon renewal of its major leases which are scheduled to expire in 1995 and 1996, including leases with Campbell Estate, Robinson Estate, the State of Hawaii, the U.S. Navy, and major developers. It is uncertain whether the major leases will be renewed with terms acceptable to all parties, particularly since a significant reduction in rents may be required in order to allow OSCo to achieve profitable operations. In turn, this may allow one or both of the pineapple companies on Oahu to outbid OSCo for a major portion of the Kunia lands now farmed by OSCo. Also, Navy regulations require that their lands be leased according to competitive bids, which raises the possibility that some of the Navy land may be converted to diversified agriculture. Finally, major developers may be unwilling to commit their lands to continued sugar operations.

The uncertainty regarding the renewal of its leases is affecting OSCo's long-term investment in the operation.

Long-Term Urbanization

Assuming U.S. sugar prices that are sufficiently high to justify continued sugar operations, and assuming all of the major leases are renewed, then the gradual and cumulative loss of sugarcane acreage to urbanization becomes an issue. Assuming, further, that all planned and proposed projects are approved and fully developed within two decades, then the amount of land under cultivation by OSCo would decline by nearly 5,800 acres, from 13,487 acres to about 7,700 acres. This loss of acreage would be likely to require a switch to a one-mill operation in an effort to maintain economic viability. Furthermore, yields would have to reach an optimistic 19.5 tons per acre. Given currently available information, it is uncertain whether the form of the plantation—because of developments other than Kapolei Business-Industrial Park—would allow viable operations.

Impact of Nearby Developments

Eventually, the site for the proposed development will become isolated from the rest of the plantation as a result of the Villages of Kapolei and the City of Kapolei, both of which are in their initial stages of development. Consequently, if the subject area were to remain with OSCo, it would become a "remnant" property of the plantation, and the fields would be fallowed.

Summary Long-Term Outlook

In summary, the long-term future of OSCo becomes increasingly uncertain because of the potential for declining sugar prices, the possibility that major leases will not be renewed, and the potential impacts of urban pressures on the plantation. However, because other developments will eventually isolate the petition area from the plantation, the affected fields would be removed from sugar production independently of Kapolei Business-Industrial Park.

Economic Impact of Reducing OSCo Operations

Assuming that a two-mill operation remains economically viable, OSCo would lose little revenue so long as yields increase sufficiently for production to remain near its historic level. Also, the reduction in employment associated with the projected reduction in acreage is not expected to require any layoffs of sugar workers since OSCo has made a practice of reducing employment through attrition.

For a one-mill operation, production would decline by about 25,000 tons of raw sugar per year, or 27 percent of current production. Based on 1987 prices ($332.47 per ton for sugar, and $39.56 per ton for molasses, with one-fifth of a ton of molasses produced for each ton of sugar), lost revenues would amount to about $8.5 million per year. However, because less sugar would be grown and milled, production costs would also decline. It is uncertain whether or not attrition would be sufficient to accommodate a reduction in employment associated with a switch to a one-mill operation.

IMPACT ON EXISTING DIVERSIFIED AGRICULTURE ACTIVITIES

The only diversified agriculture activity on the property is a 10-acre tree farm containing approximately 4,000 trees. This nursery, which is operated by Campbell Estate, would eventually be closed when the land is needed for the Kapolei Business-Industrial Park. However, it is anticipated that other nurseries in Hawaii would increase their production as needed to satisfy the local demand for trees.

IMPACT ON THE GROWTH OF DIVERSIFIED AGRICULTURE

The development of Kapolei Business-Industrial Park constitutes a commitment of a small amount of prime agricultural land to a non-agricultural use. For the purposes of this discussion, prime agricultural land is loosely defined to mean any high-quality agricultural land capable of providing high yields for a variety of crops. Based on soil quality, about 15 percent of the project area would be considered prime agricultural land. This commitment raises the question of whether Kapolei Business-Industrial Park would affect adversely the growth of diversified agriculture—either immediately or over the long term. Before addressing this question, *potential* crops, and the *demand* for and the supply of prime agricultural land for diversified agriculture are clarified below.

Potential Diversified-Agriculture Crops

Given the relatively sunny conditions, soils, and other agronomical conditions in Ewa, crops and agricultural activities suited for Ewa include: avocados, Chinese bananas, snap beans, bittermelon, sweet corn, cucumbers, daikon, long eggplant, round eggplant, semi-head lettuce, limes, dry onions, green onions, Chinese peas, sweet peppers, potatoes, sweet potatoes, pumpkins, radishes, Italian squash, oriental squash, tomatoes, watermelon, seed crops, forage crops, flowers, potted foliage, and livestock. Given the high land rents which prevail in the area, it is uncertain which of these crops would be profitable, assuming the Hawaii market exceeds that which is already supplied by producers elsewhere in the State.

Demand for Prime Agricultural Land[7]

From an islandwide or Statewide perspective, the proposed development would involve too little prime agricultural land to affect the growth of diversified agriculture. The highest projections known to the consultant for the growth of diversified agriculture are those prepared by the Land Evaluation and Site Assessment (LESA) Commission. These projections—which are shown in Tables 4 and 5 for the State and Oahu, respectively—were prepared in 1985. The projections represent an attempt to quantify the amount of agricultural land that will be required to (1) accommodate resident-plus-visitor population growth, (2) increase food and animal-feed self-sufficiency, and (3) increase crop exports.

7. For the purposes of this discussion, prime agricultural land is loosely defined to mean any high-quality agricultural land that is capable of providing high yields for a variety of crops.

Table 4.— LESA AGRICULTURAL ACREAGE REQUIREMENTS, STATE OF HAWAII: 1983 AND 1995

Crop or Activity	1983	1995	Increase
Crops and Activities which Generally Do Not Require Prime Agricultural Lands			
Beef/cattle [1,2]	765,450	365,090	--
Livestock:			
Dairy	1,000	1,182	182
Eggs/Poultry	281	515	234
Swine	600	1,050	450
Subtotal for Livestock	1,881	2,747	866
Unique Crops:			
Aquaculture	500	4,500	4,000
Coffee	2,000	5,700	3,700
Flowers/Nursery	1,786	3,040	1,254
Papaya	2,120	11,850	9,730
Taro/Watercress	400	527	127
Subtotal for Unique Crops	6,806	25,617	18,811
Macadamia Nuts	15,800	27,000	11,200
Crops and Activities which Generally Do Require Prime Agricultural Lands			
Plantation:			
Sugarcane [2,3]	194,300	177,700	-16,600
Pineapple	36,000	36,049	49
Subtotal for Plantation	230,300	213,749	-16,551
Other:			
Guava	965	1,400	435
Seed Corn	730	1,060	330
Bananas	1,100	2,200	1,100
Feed/Forage [2,4]	8,705	12,495	3,790
Fruits	635	1,156	521
Vegetables/Melons [5]	4,340	7,022	2,682
Subtotal for Other Crops	16,475	25,333	8,858
Contingency [6]	--	29,500	29,500
TOTAL	1,036,712	689,036	--
TOTAL, Excluding Beef/Cattle	271,262	323,946	52,684

Table 4.— LESA AGRICULTURAL ACREAGE REQUIREMENTS, STATE OF HAWAII: 1983 AND 1995 (continued)

1. Includes marginal grazing and pasture lands. The 1983 figure includes arid zones and other areas having low carrying capacity, while the 1995 figure does not.
2. Often includes land in a holding operation awaiting discovery of profitable uses.
3. The decline in acreage primarily reflects the loss of Puna Sugar Co.
4. Includes some pastureland and 8,000 acres of guinea grass on Molokai.
5. Overstated in that the acreage figures are for harvested acres, rather than for the amount of land required (i.e., the acreage requirements for a crop harvested twice a year should be halved).
6. Based on 10% of all acreage other than that for beef/cattle. This contingency amounts to double counting in that the LESA projections are already high. Also, the contingency figure allows for an additional 17,770 acres for expansion of sugarcane, even though the sugar industry is expected to decline, not expand.

Table 5.— LESA AGRICULTURAL ACREAGE REQUIREMENTS, CITY AND COUNTY OF HONOLULU: 1983 AND 1995

Crop or Activity	1983	1995	Increase
Crops and Activities which Generally Do Not Require Prime Agricultural Lands			
Beef/cattle [1,2]	18,200	10,090	--
Livestock:			
Dairy	340	40	62
Eggs/Poultry	250	390	140
Swine	144	200	56
Subtotal for Livestock	734	992	258
Unique Crops:			
Aquaculture	300	2,400	2,100
Flowers/Nursery	495	850	355
Papaya	70	170	100
Taro/Watercress	60	85	25
Subtotal for Unique Crops	925	3,505	2,580
Crops and Activities which Generally Do Require Prime Agricultural Lands			
Plantation:			
Sugarcane [2]	27,200	25,300	-1,900
Pineapple	11,829	11,800	-29
Subtotal for Plantation	39,029	37,100	-1,929
Other:			
Guava	--	242	242
Seed Corn	125	180	55
Bananas	540	836	296
Feed/Forage [2,3]	1,741	2,912	1,171
Fruits	90	200	110
Vegetables/Melons [4]	1,155	1,595	440
Subtotal for Other Crops	3,651	5,965	2,314
Contingency [5]	--	4,756	4,756
TOTAL	62,539	62,408	--
TOTAL, Excluding Beef/Cattle	44,339	52,318	7,979

Table 5.— LESA AGRICULTURAL ACREAGE REQUIREMENTS,
CITY AND COUNTY OF HONOLULU: 1983 AND 1995
(continued)

1. Includes marginal grazing and pasture lands. The 1983 figure includes arid zones and other areas having low carrying capacity, while the 1995 figure does not.
2. Often includes land in a holding operation awaiting discovery of profitable uses.
3. Includes some pasture.
4. Overstated in that the acreage figures are for harvested acres, rather than for the amount of land required (i.e., the acreage requirements for a crop harvested twice a year should be halved).
5. Based on 10% of all acreage other than that for beef/cattle. This contingency amounts to double counting in that the LESA projections are already high. Also, the contingency figure allows for an additional 17,770 acres for expansion of sugarcane, even though the sugar industry is expected to decline, not expand.

As indicated, the LESA Commission projected that an estimated 52,684 additional acres of land would be required Statewide to accommodate the increase in production form 1983 to 1995. The corresponding figure for Oahu is 7,979 acres. The crops and acreage requirements are categorized according to those which generally do not require prime agricultural land (although some crops may be grown profitably on prime agricultural land), those which generally do require prime agricultural land, plus a contingency of 10 percent for all acreage used for purposes other than beef and cattle production.

The relevant figures from Tables 4 and 5 are not the total figures, but rather the increase in the amount of *prime* agricultural land that is projected to be required to accommodate diversified agriculture: the increase is 8,858 acres for the State, and 2,314 for Oahu. These increased requirements for prime agricultural land are surprisingly small. Nevertheless, the projected land requirements, as small as they are, are high in that diversified agriculture is growing more slowly than the LESA Commission projections. A more realistic estimate of the amount of *prime* agricultural land that will be required to accommodate the Statewide growth of diversified agriculture over the next decade to the year 2000 is probably far less than 2,000 acres.[8] Furthermore, land is being freed from plantation agriculture faster than it can be absorbed by other crops (see discussion below).

If diversified agriculture is to require a large amount of prime agricultural land, then additional crops will have to be grown for the export market rather than for the small Hawaii market. However, the extreme difficulty of developing large export markets should be noted. For over a century, numerous and extensive crop searches and experiments have been conducted by many people and organizations, and have led to surprisingly few major long-term successes in Hawaii, thereby confirming the extreme difficulty of identifying new export crops and developing them into new and profitable industries. Furthermore, the difficulty in developing export markets is increasing because of increasing competition from other sugarcane-growing areas. Periodic low sugar prices have led nearly all sugarcane operators throughout the world to search for profitable replacement crops, particularly those crops which can increase the level of earnings from exports. Thus far, few successes have materialized.

Supply of Prime Agricultural Land

Regarding the supply of land in Hawaii, an enormous and growing supply of prime agricultural land is available for alternative uses. Since 1968, about 90,000 acres of Hawaii's prime agricultural land have been freed from sugar and pineapple production: about 62,700 acres of land freed from sugar production (about 15,200 acres on Oahu and 47,500 on the Neighbor Islands), and about 27,300 acres freed from pineapple production (about 6,600 acres

8. Plasch, Bruce S., Peter Garrod, et. al., *An Economic Development Strategy and Implementation Program for Molokai.*

on Oahu and 20,700 on the Neighbor Islands).[9-11] In addition, Hamakua Sugar Co., Inc. has announced that it will sell up to 9,000 acres of land on the Big Island in order to reduce its debt, and Ka'u Agribusiness Co., Inc. has announced that it will contract operations by 4,200 acres.

Some of the land which has freed from sugar and pineapple production has been or will be converted to urban, diversified agriculture, and aquaculture uses. After making allowances for these conversions, uncommitted acreage which remains available to diversified agriculture and aquaculture amounts to many tens of thousands of acres, with a large portion of this on Oahu. Much of this land is fallow, in pasture, or in some other low-value land-holding operation.

The Statewide supply of prime agricultural land probably will increase given the very real possibility of future sugar plantation closings. A number of Hawaii's sugar plantations are unprofitable but remain in operation today only because they are committed to lease and/or energy contracts which make closing prohibitively expensive. However, these contracts eventually will end.

Furthermore, a portion of the sugarcane land is in a holding pattern awaiting the discovery of profitable replacement activities; this land forms part of the supply of prime agricultural land available to profitable diversified agriculture crops.

Many of the lands 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 lands 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 that are particularly well-suited for growing papaya. The supply of unique lands is quite large and is distinct from the supply of prime agricultural lands.

Availability of Land to Small-Scale Farmers

Even though considerable agricultural land exists in the State, small agricultural parcels are seldom available to small-scale farmers under long-term leases because land-use regulations and the political environment make it unprofitable and too risky to the landowner to lease

9. Hawaiian Sugar Planters' Association, *Hawaiian Sugar Manual 1988.*
10. Hawaii Agricultural Statistics Service, *Statistics of Hawaiian Agriculture 1987.*
11. Robert C. Schmitt, *Historical Statistics of Hawaii.*

out small farm parcels. Agricultural use constitutes a low-value use of the land and, correspondingly, farmers pay relatively low lease rents. At the same time, in order to rent land to small-scale farmers, landowners are required to subdivide the property. Applicable County subdivision regulations (designed for rural estates) require expensive electrical power, paved rather than gravel roads, and buried rather than surface water lines. Thus the combination of low rents and expensive subdivision requirements makes it unprofitable for the landowner to subdivide land into parcels for small farms. For example, rather than developing the State agricultural park in Kahuku, it would have been—as surprising as it may seem—less expensive for the State to give each farmer in the park $100,000.[12]

In addition, there is the risk that when the leases expire, small-scale farmers will turn to the Legislature in an attempt to prevent landowners from raising lease rents, or to prevent landowners from evicting them in favor of a higher and more profitable use of the landowner's land—this often occurs in long-term leases for land on which small-scale farmers have built homes (e.g., Waihole-Waikane, Kona, Waianae, Kalama Valley). Such an economic environment favors leases to large-scale operators (including cooperatives consisting of many small-scale farmers), short-term and illegal leases of unsubdivided land, subdivision of the land into rural estates for sale to buyers who can afford the costs of the subdivision requirements, or leaving the land fallow.

In summary, the shortage of small parcels of land for farmers is a serious problem. Nevertheless, a vast supply of prime agricultural land does exist and is available for those profitable diversified agriculture activities that are large in scale, or for which the subdivision requirements are somehow circumvented.

Outlook for Diversified Agriculture

Based on the above assessment, ample prime agricultural land will be available to easily accommodate the Statewide requirements of diversified agriculture. This conclusion derives from the following: (1) a vast amount of prime agricultural land and water is available Statewide, having been freed from sugar and pineapple production in recent years; (2) it is very possible that additional sugarcane acreage and water will be freed, given the existence of unprofitable sugar operations; (3) some, if not most, of the sugar operations would 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. In other words,

12. This is based on 220 usable acres divided into 24 lots, a land cost to the State of $50 per acre per year; improvement costs of $3.4 million for developing the farm plots (electric power, roads, etc.); rents received from farmers of $300 per acre per year; an 8-percent discount rate based on State bonds; and a 30-year term for the bond and the lease. Improvements are not to County standards.

the limiting factor is not the *land supply*, but rather the *market demand* for those crops that can be *grown profitably* in Hawaii and, for small farms, *expensive subdivision requirements*. The proposed Kapolei Business-Industrial Park involves too little land to affect this conclusion, and would therefore not affect adversely the Statewide growth of diversified agriculture.

Consistency with Overseas Long-Term Trends

The increased availability of prime agricultural land in Hawaii compared to that of prior decades results from some very long-term and accelerating trends that are occurring throughout the United States, Europe, and many developed and developing market economies.[13] For example, U.S. farmers are paid by the government not to farm their land. This has resulted in 30 million acres of agricultural land lying fallow in 1984.[14] In Europe, quotas are used to limit production. The principal agricultural problem has been overproduction, which has occurred as a result of the tremendous success of increasing yields, coupled with a slowing of the population growth rate. Because yields increase faster than population growth, resources must be freed gradually from agriculture in order to maintain balanced markets, and to increase income to the farmers who remain. Otherwise agricultural products glut the market; this is followed by low prices, a decline in farmers' income, and bankruptcies.

Furthermore, the export market has not been able to absorb the excess production, partly due to the agricultural successes achieved in many developing counties. For example, India once suffered from severe food problems. With the introduction of modern agriculture, however, its farm industry has been transformed, making India self-sufficient and even an exporter of many foods it once had to import. Similar gains have been achieved throughout Asia and Central and South America.

Of significance to Hawaii, sugar is clearly part of this trend which, over the long term, shows supply increasing more quickly than demand. In fact, some of the newer sweeteners have the theoretical potential of causing the release of all the land in the world that is now planted in sugarcane and sugarbeets.

The major agricultural problem facing the United States and many other economies, therefore, is how to make the reduction in production an orderly one so as to minimize social problems. This is a problem that arises from the tremendous successes in agriculture production, and contrasts sharply with, and invalidates, the 200-year old prediction of Thomas Malthus that population will increase faster than the food supply.

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13. Dvoskin, Dan, "Excess Capacity and Resource Allocation in Agriculture, 1940-1985," *Agricultural Outlook*, U.S. Department of Agriculture, Economic Research Service, October 1986.
14. Norman E. Borlaug and Christopher R. Dowswell, "World Revolution in Agriculture."

CONSISTENCY WITH STATE AND COUNTY PLANS

Since the development of Kapolei Business-Industrial Park is not expected to adversely affect the economic viability of OSCo before the major leases expire in the mid-1990s, conforms to the preferred sequence for contracting the plantation, would not adversely affect the economic viability of OSCo in the longer term since the property will become an isolated remnant of the plantation as a result of other development projects, and would not limit the growth of diversified agriculture since ample agricultural lands are available elsewhere, the proposed project is consistent with the major thrust of the agricultural portion of the *Hawaii State Plan, the State Agriculture Functional Plan,* and the *General Plan of the City and County of Honolulu.* This thrust in all three plans calls for preserving the economic viability of plantation agriculture and promoting the growth of diversified agriculture (see Table 6). To accomplish this, an adequate supply of agriculturally suitable lands and water must be assured. Nevertheless, for about 15 percent of the project area, the development of the Kapolei Business-Industrial Park would be potentially inconsistent with the lower-level State agricultural guidelines which call for Agricultural Lands of Importance to be protected from development.

Furthermore, Kapolei Business-Industrial Park would conform with State and County plans and policies in that it would provide public benefits in terms of employment and reduced commuting.

Table 6.-- SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS

HAWAII STATE PLAN (Chapter 226, Hawaii Revised Statutes, as amended):

Section 226-7 Objectives and policies for the economy--agriculture.

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

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

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

(b) To achieve the agricultural objectives, it shall be the policy of the State to:

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

Section 226-103 Economic priority guidelines.

(c) Priority guidelines to promote the continued viability of the sugar and pineapple industries:

(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.

(d) Priority guidelines to promote the growth and development of diversified agriculture and aquaculture:

(1) Identify, conserve, and protect agricultural and aquacultural lands of importance and initiate affirmative and comprehensive programs to promote economically productive agricultural and aquacultural uses of such lands.

Section 226-104 Population growth and land resources priority guidelines.

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

(2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

Table 6.-- **SELECTED STATE AND COUNTY OBJECTIVES, POLICIES, AND GUIDELINES RELATED TO AGRICULTURAL LANDS**
(continued)

STATE AGRICULTURAL FUNCTIONAL PLAN (June 1985)
(Functional plans are guidelines for implementing the State Plan, and are not adopted by the State Legislature.)

B. Objective: Achievement of Productive Agricultural Use of Lands Most Suitable and Needed for Agriculture.

(5) Policy: Provide greater protection to agricultural lands in accordance with the Hawaii State Constitution.

(c) Implementing Action: Identify important agricultural lands to promote diversified agriculture, increased agricultural self-sufficiency, and assure the availability of agriculturally suitable lands.

(d) Implementing Action: Until standards and criteria to conserve and protect important agricultural lands are enacted by the Legislature, important agricultural lands should be classified in the State Agricultural District and zoned for agricultural use, except where, by the preponderance of the evidence presented, injustice or inequity will result or overriding public interest exists to provide such lands for other objectives of the Hawaii State plan.

CITY AND COUNTY OF HONOLULU
GENERAL PLAN, Objectives and Policies (Resolution No. 87-211)

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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EDUCATION	Ph.D. 1971: Stanford University, Engineering-Economic Systems M.S. 1966: Stanford University, Engineering-Economic Systems B.S. 1965: University of California, Santa Barbara, Electrical Engineering, unofficial liberal arts minor.
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APPENDIX K

Proposed Kapolei Business-Industrial Park: Impact on State And County Finances

Decision Analysts Hawaii, Inc.

APPENDIX K

PROPOSED KAPOLEI BUSINESS-INDUSTRIAL PARK:

IMPACT ON STATE AND COUNTY FINANCES

PROPOSED KAPOLEI BUSINESS-INDUSTRIAL PARK:

IMPACT ON STATE AND COUNTY FINANCES

PREPARED FOR:

The Estate of James Campbell

PREPARED BY:

Decision Analysts Hawaii, Inc.

December 1989

Contents

Tables

Executive Summary

The Kapolei Business-Industrial Park, which is proposed by The Estate of James Campbell (Campbell Estate), would offer a variety of light-industrial, maritime industrial, and commercial activities.

After the project is approved, the County would net approximately $1.5 million in "rollback" tax revenues which would be triggered when the land—which has previously been assessed and taxed at its agricultural value—is developed. Upon full development of the project, the County would net over $3.9 million per year in tax revenues. This compares with less than $60,000 currently being paid in County property taxes.

The State would net about $16.4 million from taxes on construction expenditures and, at full development, would net over $7.6 million per year from taxes on operations. Currently, State revenues derived from activities on the property are very low since the level of economic activity is relatively low, the sugar produced on the property is exempt from excise taxes, and trees from the nursery operation are not sold commercially and therefore are not subject to excise tax.

Proposed Kapolei Business-Industrial Park: Impact on State and County Finances

Introduction

The Estate of James Campbell (Campbell Estate) has proposed to develop the Kapolei Business-Industrial Park on about 552 acres of land near Barbers Point Harbor and the existing Campbell Industrial Park. About 533 acres would be used for industrial activities, and 19 acres for commercial activities. The industrial land would support light industrial activities and maritime industrial activities associated with Barbers Point Harbor.

The impact of this project on State of Hawaii and City & County of Honolulu tax revenues and expenditures is summarized in Table 1 and discussed below. Dollar amounts are expressed in terms of 1989 purchasing power.

Current Economic Activity and Tax Revenues

About 145 acres of the project site are currently in sugarcane that is cultivated by Oahu Sugar Company, Ltd., 10 acres are used for a tree nursery operated by Campbell Estate, and a portion of the property is used by Hawaii Raceway Park. Most of the remaining property consists of a coral stockpile created by the dredging of Barbers Point Harbor.

Table 1.— KAPOLEI BUSINESS-INDUSTRIAL PARK: IMPACT ON STATE AND COUNTY FINANCES
[In 1989 dollars.]

Item		Amount	
LAND AREA			
Industrial		532.88	acres
Commercial		19.20	acres
Total Land Area		552.08	acres
FLOOR AREA (mid values)			
Industrial		5,450,342	sq. ft.
Commercial		292,723	sq. ft.
Total Employment		5,743,065	sq. ft.
DURATION OF CONSTRUCTION		35	years
OPERATING EMPLOYMENT			
Industrial		5,070	jobs
Commercial		576	jobs
Total Employment		5,646	jobs
INCREASED PROPERTY TAX BASE			
Industrial (S70 per sq. ft.)	S	381.5	million
Commercial (S100 per sq. ft.)		29.3	million
Total Assessed Property Value	S	410.8	million
RENTS			
Industrial Space (S0.75 per sq. ft. per month)	S	49.1	million per year
Commercial Space (S1 per sq. ft. per month)		3.5	million per year
Total Rents	S	52.6	million per year
SALES			
Wholesale (S125 per sq. ft. of industrial space)	S	681.3	million per year
Retail (S175 per sq. ft. of commercial space)		51.2	million per year
Total Sales	S	732.5	million per year
COUNTY TAX REVENUES			
Rollback Taxes (prior to development)	S	1.5	million
Property Taxes, Full Development (S9.45 per S1,000 of assessed value)	S	3.9	million per year
STATE EXCISE TAX REVENUES			
Construction Activity	S	16.4	million
Full Operations			
Wholesale Transactions (0.5%)	S	3.4	million per year
Retail Sales and Rents (4%)		4.2	million per year
Total Excise Tax Revenues	S	7.6	million per year

Compared to the proposed Kapolei Business-Industrial Park, these operations represent a very low level of economic activity. For example, the 145 acres in sugarcane support only five field and mill jobs. Correspondingly, the tax revenues derived from the existing activities on the property are very small compared to that which would be generated by the proposed activity. In 1989, County property tax revenues were less than $60,000. State tax revenues are also low because the level of economic activity is low, sugar sales are exempt from excise taxes, and trees grown by the nursery operations are used on Campbell Estate's own property rather than being sold commercially and therefore are not subject to excise tax.

PROJECTED ECONOMIC ACTIVITY

It is anticipated that it will take about 35 years for the proposed Kapolei Business-Industrial Park to reach full development, after which an estimated 4.67 to 6.23 million square feet of industrial floor space and 251,000 to 335,000 square feet of commercial floor space will have been built.[1] For the calculations which follow, mid-values of 5.45 million square feet and 294,000 square feet of industrial and commercial floor space, respectively, are assumed.

Also at full development, employment is expected to reach about 5,650 jobs, including 5,070 industrial jobs and 580 commercial jobs.[1] The total assessed property value is estimated at $410.8 million, assuming values of $70 per square foot for industrial space, and $100 per square foot for commercial space.

Rents would total an estimated $52.6 million per year, assuming 75 cents per square foot per month for industrial space, and $1 per square foot per month for commercial space.

Total sales generated on the property would be about $732.5 million per year, based on wholesale activity at $125 per square foot per year for industrial space, and $175 per square foot per year for commercial space.

CORRECTION

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

Compared to the proposed Kapolei Business-Industrial Park, these operations represent a very low level of economic activity. For example, the 145 acres in sugarcane support only five field and mill jobs. Correspondingly, the tax revenues derived from the existing activities on the property are very small compared to that which would be generated by the proposed activity. In 1989, County property tax revenues were less than $60,000. State tax revenues are also low because the level of economic activity is low, sugar sales are exempt from excise taxes, and trees grown by the nursery operations are used on Campbell Estate's own property rather than being sold commercially and therefore are not subject to excise tax.

PROJECTED ECONOMIC ACTIVITY

It is anticipated that it will take about 35 years for the proposed Kapolei Business-Industrial Park to reach full development, after which an estimated 4.67 to 6.23 million square feet of industrial floor space and 251,000 to 335,000 square feet of commercial floor space will have been built.[1] For the calculations which follow, mid-values of 5.45 million square feet and 294,000 square feet of industrial and commercial floor space, respectively, are assumed.

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Total sales generated on the property would be about $732.5 million per year, based on wholesale activity at $125 per square foot per year for industrial space, and $175 per square foot per year for commercial space.

COUNTY REVENUES AND EXPENDITURES

Projected Revenues

When land is developed which has previously been assessed and taxed at its agricultural value, the action triggers "rollback" taxes which recover 10 years of back taxes based on the difference between taxes computed on the market assessment and the agricultural assessment, plus a penalty of 10 percent. Development of the project site would trigger the rollback tax, which has been estimated at $1.5 million.[2]

Upon full development, property tax revenues would be about $3.9 million per year, based on the current tax rate of $9.45 per $1,000 assessed value for industrial and commercial property.[3]

Additional revenues to the County would be derived from miscellaneous taxes and user fees. In addition, revenues would be derived from County taxes paid by employees of the various industrial and commercial companies at Kapolei Business-Industrial Park. However, these tax revenues would be largely offset by corresponding government expenditures on facilities and services provided to these employees.

Projected Expenditures

No significant County expenditures are anticipated for new infrastructure development or facilities to support the proposed project, since these items would be paid by the developer, operator, and/or users. In particular, Campbell Estate is committed to paying its fair share of County road, water, and sewer improvements.

Projected Net Increase in Revenues

Based on the above, the County would net approximately $1.5 million in rollback taxes after the proposed project is approved. Upon full development, the County would net about $3.9 per year in revenues.

STATE REVENUES AND EXPENDITURES

Projected Revenues

Construction

The State would derive an estimated $16.4 million in general excise taxes on construction expenditures for projected industrial and commercial development, or an average of about $500,000 per year over the 35-year construction period. This estimate is based on 4 percent of the property value, and excludes wholesale taxes on building supplies.

Operations

Once the Kapolei Business-Industrial Park is fully developed, State excise taxes would be approximately $7.6 million per year. This is based on the wholesale tax rate of 0.5 percent on sales from industrial activities, and a tax rate of 4 percent on sales from commercial activities and rents. Additional revenues to the State would derive from corporate income taxes, taxes paid by suppliers, and miscellaneous taxes and user fees.

Further State revenues would be derived from income taxes paid by employees of the various industrial and commercial companies within the Kapolei Business Industrial Park, plus excise taxes on their expenditures. However, these taxes would be largely offset by corresponding government expenditures on facilities and services provided to support these employees.

Projected Expenditures

No significant State expenditures are anticipated for new infrastructure development or facilities to support the proposed project, since these items would be paid by the developer, operator, and/or users. In particular, Campbell Estate is committed to paying its fair share of State road improvements.

Projected Net Increase in Revenues

Based on the above analysis, the State would net about $16.4 million from taxes on construction expenditures and, at full development, would net over $7.6 million per year from taxes on operations.

COMBINED NET REVENUES TO THE STATE AND COUNTY.

In summary, the County would net approximately $1.5 million in roll-back taxes after the project is approved, and the State would net about $16.4 million from taxes on construction expenditures. Upon full development, the State and County would net over $11.5 million per year from taxes on operations. This compares with less than $60,000 currently being paid for County property taxes. State taxes are similarly low since the level of economic activity on the property is relatively low, sugar is exempt from excise taxes, and trees from the nursery operation are not sold commercially.

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[1] Information provided by John Zapotocky, consultant.

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APPENDIX L

Traffic Impact Assessment Report for Kapolei Business-Industrial Park

Pacific Planning And Engineering, Inc.

APPENDIX L

TRAFFIC IMPACT ASSESSMENT REPORT

for

KAPOLEI BUSINESS-INDUSTRIAL PARK

Ewa, Hawaii

November 1989

Prepared for:

The Estate of James Campbell

Prepared by:

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EXECUTIVE SUMMARY

Introduction

Pacific Planning & Engineering, Inc. (PPE) was engaged to undertake a study to identify and assess future traffic impacts on Kalaeloa Boulevard resulting from the Estate of James Campbell's proposed Kapolei Business-Industrial Park. The study will focus on the proposed intersections along Kalaeloa Boulevard within the project site. This report presents the findings and recommendations of the traffic study.

Impacts to other facilities, such as the Palailai Interchange, due to the project will be addressed in the Ewa Region Highway Transportation Master Plan. The Master Plan is being developed to identify roadway system improvements necessary to accommodate forecasted future traffic and allocate the cost of the improvements to the developers in the region. The Estate of James Campbell, which is proposing the Kapolei Business-Industrial Park, is committed to participate in the Transportation Master Plan to determine "fair share" costs for improving the regional highway system.

Project Description

The Kapolei Business-Industrial Park will be located between Farrington Highway / H-1 Freeway to the north, Campbell Industrial Park to the south, Barbers Point Harbor to the west and Barbers Point Naval Air Station to the east. The Business Park will be built on approximately 552 acres of land that is currently zoned for agricultural use and is planned to be rezoned to industrial and commercial use.

The proposed development will consist of 424 acres for industrial use, 109 acres for maritime industrial and 19 acres for commercial use. The industrial activities within the area are expected to be similar to those presently occurring in Campbell Industrial Park, while the maritime industrial area will be used to support the activities of the Barbers Point harbor. The expected market for the development will be primarily industrial land users. Construction for the proposed project is expected to begin in 1990 with completion of construction and full occupancy expected by the year 2030. Kapolei Business Park will have two roadway accesses, the existing Kalaeloa Boulevard and a proposed second access road that will either connect to the future Kapolei Parkway or Kalaeloa Boulevard north of the project site.

Existing Conditions

The surrounding areas are primarily sugar cane fields with the project site presently being used for sugar cane production, a coral stockpile, a tree nursery and for Hawaii Raceway Park. Barbers Point Naval Air Station (BPNAS) is a military airfield with approximately 1,500 people working and 2900 people living on base. James Campbell Industrial Park (JCIP) is presently used for a variety of industrial activity with about 3,000 people employed there. Barbers Point Harbor employs about 270 people, and is owned by the State of Hawaii and run by the Department of Transportation, Harbors Division. Makakilo City (2,500 units) and Honokai Hale/Nanakai Gardens (500 units) are residential communities located north of the project site.

Presently, Kalaeloa Boulevard is a divided highway with two lanes in each direction providing the only roadway access into the existing Campbell Industrial Park and Barbers Point Harbor from the H-1 Freeway at the Palailai Interchange. Malakole Road is the main access to the harbor running in an east-west direction and intersects Kalaeloa Boulevard at a stop-controlled cross intersection.

Future Conditions

Barbers Point Harbor is currently under development to expand the existing maritime industrial site to accommodate the island's long-term waterborne commerce needs. The development is taking place on 260 acres of land that is zoned I-3 and expected to employ about 1270 people by the year 2005.

Campbell Industrial Park is projected to have 500 additional jobs by the year 2010. Additional land above Campbell Industrial Park has also been zoned for development. A total of 315 acres zoned I-2 is expected to employ about 3380 people, while another 64 acres zoned I-3 is expected to employ about 220 people by the year 2030.

The Barbers Point Harbor, Campbell Industrial Park, and currently zoned areas are future developments that will contribute traffic along Kalaeloa Boulevard.

There are also other land developments planned in the future for the Ewa Region resulting from the State and County government's decision to designate the area as the "Second Urban Center." Some of the developments include residential units such as Kapolei City and Kapolei Village, resort developments such as the Ko'Olina Resort, and business districts.

Traffic Impact Analysis

Presently, drivers on Malakole Road experience very long delays (LOS E or F) attempting to cross or turn left onto Kalaeloa Boulevard during the morning and afternoon peak hours.

By the year 2030, even without the Business Park, the results of the analysis indicate that Kalaeloa Boulevard will not have the capacity to accommodate the forecasted traffic due to the increase volume of ambient traffic. Improvements such as widening Kalaeloa Boulevard and/or providing a second access will be necessary.

The level of service for drivers will worsen to LOS F for vehicles attempting to cross or turn left onto Kalaeloa Boulevard from minor streets. LOS F is an indication that signalization will be necessary.

With the project generated traffic in the year 2030, Kalaeloa Boulevard will require additional laneage capacity to accommodate the forecasted traffic even with the project's proposed second access due to the project traffic and increase in ambient traffic. Drivers from Minor Streets will experience very long to extreme delays attempting crossing movements or left-turns onto Kalaeloa Boulevard and the second access road during the morning and afternoon peak hours.

Conclusion and Recommendations

The proposed Kapolei Business-Industrial Park will have a major impact on Kalaeloa Boulevard in the year 2030 when the Park is expected to be fully developed.

The results of our analysis indicate that with or without the project, by the year 2030, Kalaeloa Boulevard will not have the capacity to accommodate the increase in traffic. Drivers from minor streets will experience very long or extreme delays (LOS F) crossing or making left-turns onto Kalaeloa Boulevard and the second access road during the peak hours if the intersections are not signalized.

To mitigate the impacts of the proposed project on Kalaeloa Boulevard, the following phased improvements are recommended:

1. Signalize the study intersections along Kalaeloa Boulevard when future traffic volumes meet signal warrants. All of the study intersections will probably require signalization before the year 2010.
2. By year 2010, Kalaeloa Boulevard will need to be widened to a six lane divided highway between Malakole Road and the Palailai Interchange.
3. Provide a two-lane second access road to and from the industrial park. The second access road will probably be needed by the year 2010. Ultimately this second access road will need to be expanded to four lanes between Malakole Road and the second access road entrance into the project site before the year 2030. Signalize intersections of the second access road with Malakole Road, Road D, Road C, Road B, and Road A when future traffic volumes meet signal warrants.

Further improvements will be necessary to accommodate the traffic beyond the study area. These improvements will be identified in the Ewa Region Highway Transportation Master Plan. The Estate of James Campbell, which is proposing the Kapolei Business Park, is committed to participate in the Transportation Master Plan to determine "fair share" costs of improving the regional highway system.

PROJECT DESCRIPTION

The Estate of James Campbell is proposing the development of the Kapolei Business-Industrial Park. The project site will be located between Farrington Highway and H-1 Freeway to the north, Campbell Industrial Park to the south, Barbers Point Harbor to the west and Barbers Point Naval Air Station to the east. Figure 1 shows the project location and the roadway network in the vicinity.

The project area includes 552 acres of the land and consist of the following land uses:

Land Use		Acres	Jobs
Industrial		424	4690
Maritime Industrial		109	380
Commercial		19	580
	Total	552	5650

Figure 2 shows the site plan of the proposed development's expansion. The industrial activities in the 424 acre portion are expected to be similar to those presently occurring in the Campbell Industrial Park. The maritime industrial area will be used to support the activities of the deep draft harbor. This project is expected to create 5,650 new jobs. The expected market for the development is industrial land users. Construction for the project will begin in 1990 with completion and full occupancy expected by the year 2030.

Presently, the only vehicular access to the proposed project is from Kalaeloa Boulevard which connects to the H-1 Freeway at the Palailai Interchange. A second access road into the project site is intended to connect with the future Kapolei Parkway. An alternative alignment is to Kalaeloa Boulevard located north of the project site. The proposed connection with Kapolei Parkway is preferred, however, this will be dependent upon discussions with other parties having development options in the area. The second access road's connection with Kapolei Parkway was analyzed for this traffic study.

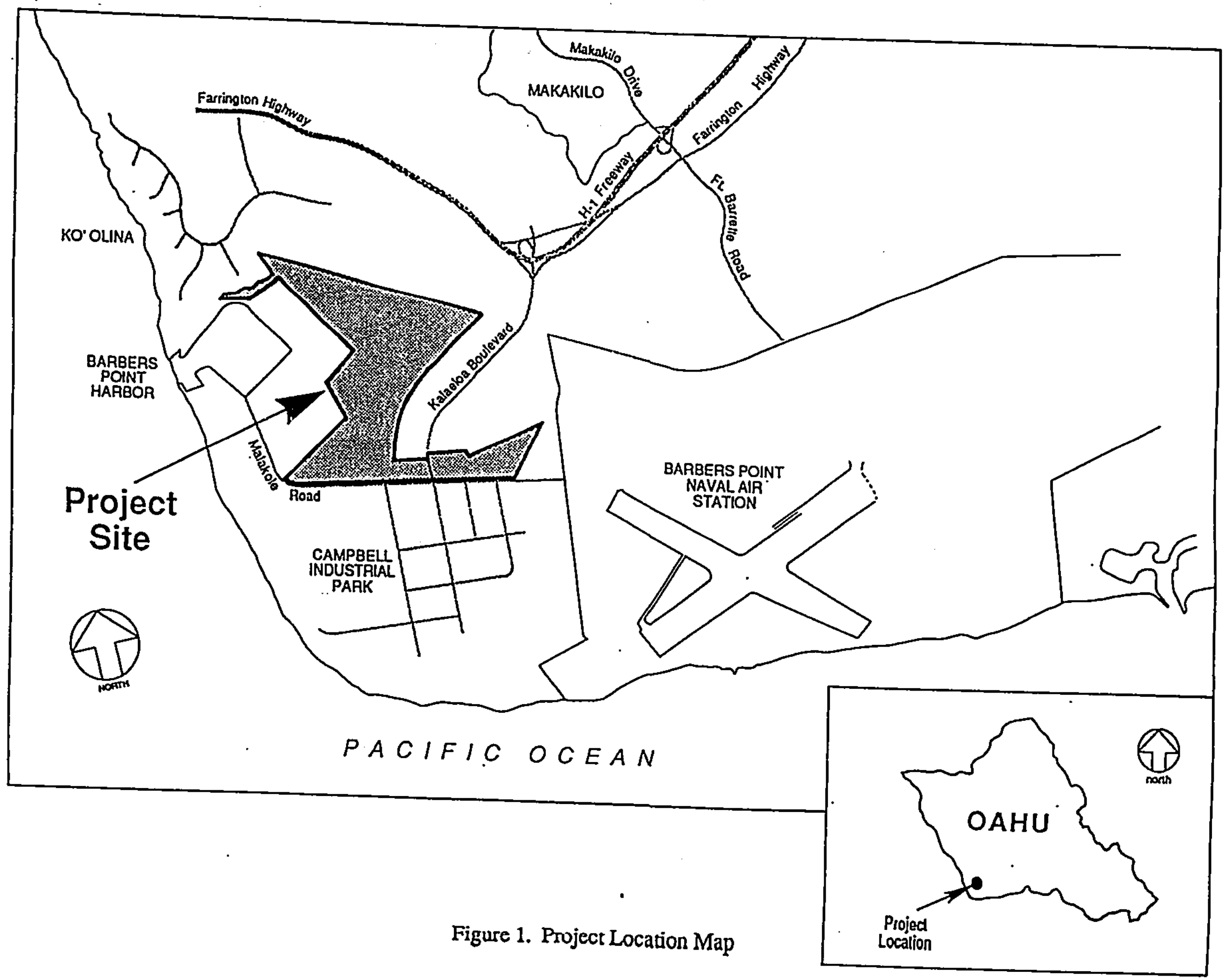

Figure 1. Project Location Map

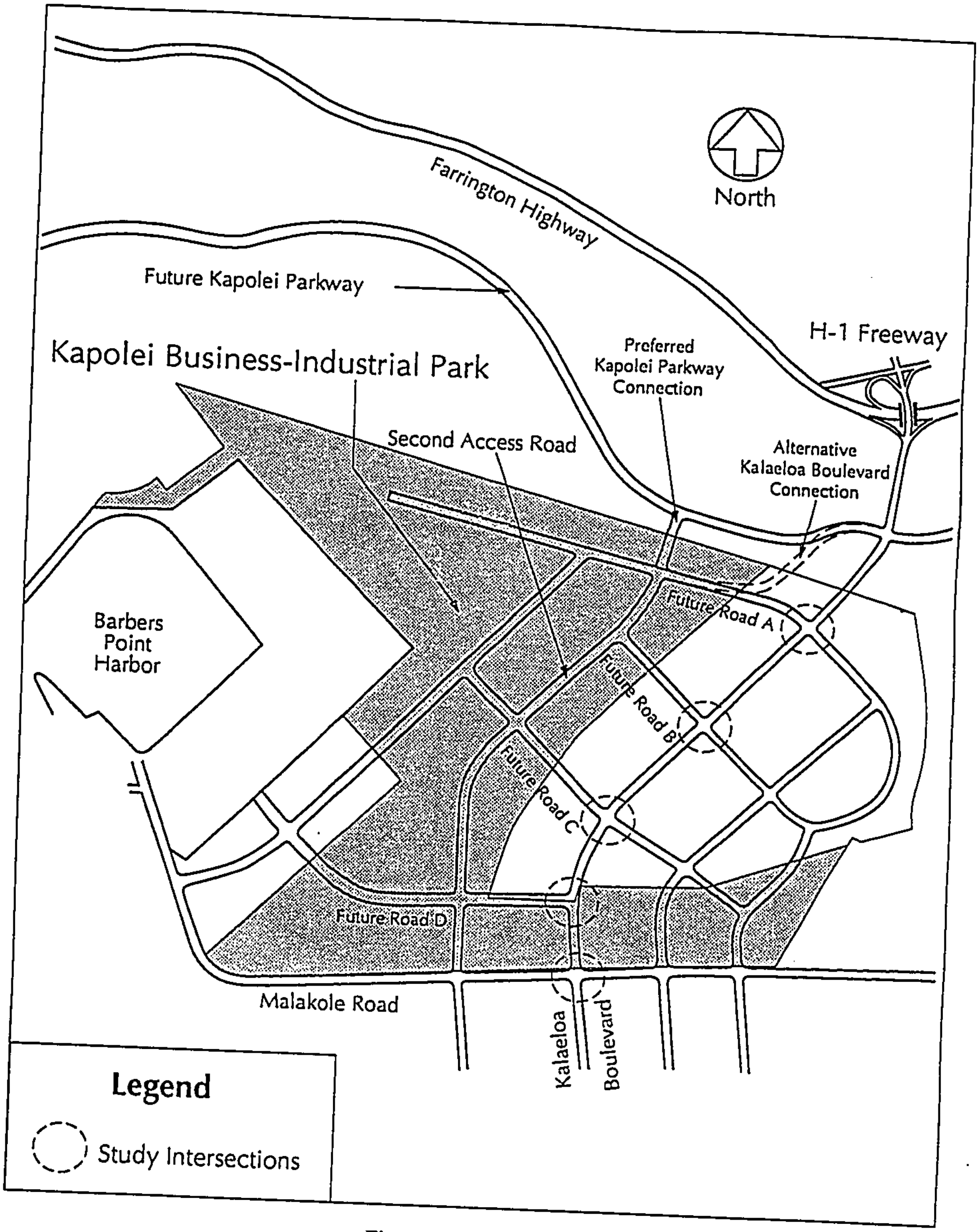

Figure 2. Project Site Plan

AREA CONDITIONS

Existing Land Uses

The project site is presently being used for sugar cane production, a coral stockpile, a tree nursery and for the Hawaii Raceway Park. Much of the land in the surrounding area is also presently being used for sugar cane production. However, with the planned developments for the area, land for agricultural use will one day comprise only a minor portion of land use.

Barbers Point Naval Air Station is southeast of the project site. It is a military airfield with accommodations for personnel living on base. Many civilians also work within the base with approximately 1,500 people working within the base and 2,900 people living there. There are two entrances to the base. Fort Barrette Road functions as the main entrance to the base and it connects to Farrington Highway and the Makakilo Interchange of the H-1 Freeway. Gieger Road functions as a secondary entrance and connects to Fort Weaver Road which leads to the Kunia Interchange of the H-1 Freeway.

James Campbell Industrial Park is located south of the project site. It is presently used for a variety of industrial activity including the production of gasoline, baseyards for construction companies, construction material suppliers, and various other uses. The entire park presently employs about 3,000 people. Kalaeloa Boulevard is the only road serving the industrial park and connects to the H-1 Freeway at the Palailai Interchange.

The Barbers Point Harbor is located west of the project site. The harbor is owned by the State of Hawaii and run by the Department of Transportation, Harbors Division. Presently, there are about 270 people employed at the Harbor. The main access to the harbor is through Malakole Road which connects to Kalaeloa Boulevard.

The residential communities of Makakilo City and Honokai Hale/Nanakai Gardens are located to the north of the project site. Makakilo City is a 2,500 unit residential development on the slopes of the Waianae Mountain Range. The only roadway access to Makakilo City is Makakilo Drive. Honokai Hale/Nanakai Gardens is a 500 unit residential development located along Farrington Highway, adjacent to the Ko'Olina resort.

Future Land Uses

The Ewa Region has been designated by the State and County governments as the "Second Urban Center". There are many future land developments planned for the Ewa area including a business district, residential developments, and resort developments. Some of the major developments are listed below.

The Estate of James Campbell is planning for the development of Kapolei City near Puu Kapolei, a natural hill-like geological feature. The City will be complete with governmental offices and provide an attractive setting for businesses. It will be located between the Palailai and Makakilo Interchanges.

Campbell Industrial Park is projected to have 500 additional jobs by the year 2010. Additonal land above Campbell Industrial Park has also been zoned for development. A total of 315 acres zoned I-2 is expected to employ about 3,380 people, while another 64 acres zoned I-3 is expected to employ about 220 people by the year 2030.

The Barbers Point Harbor is currently under development to expand the existing maritime industrial site to accommodate the island's long-term waterborne commerce needs. The development is taking place on 260 acres of land that is zoned I-3 and expected to employ about 1,270 people by the year 2005.

CORRECTION

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SEE FRAME(S) IMMEDIATELY FOLLOWING

AREA CONDITIONS

Existing Land Uses

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The Barbers Point Harbor is currently under development to expand the existing maritime industrial site to accommodate the island's long-term waterborne commerce needs. The development is taking place on 260 acres of land that is zoned I-3 and expected to employ about 1,270 people by the year 2005.

The Ko'Olina Resort began construction at its resort complex in 1987, and is projected to be completed by the year 2000. The resort includes hotel facilities, residential units, commercial area and golf courses.

The State Housing Finance and Development Corporation is also starting construction of the Kapolei Village residential community which will consist of about 4,870 units of residential housing.

Existing Roadway Facilities

Kalaeloa Boulevard runs through the project site in a north-south direction. It connects the Palailai Interchange located to the north with Malakole Road to the south. North of its intersection with Malakole Road, Kalaeloa Boulevard is a four-lane roadway with a raised grassed median and 4-foot paved shoulders. Left and right-turn pockets are provided for southbound traffic at the intersection. South of the intersection, the pavement narrows to two lanes with a median between the lanes for approximately 200 feet. The lanes are generally 12 feet in width. The posted speed limit is 35 mph north of the Malakole Road intersection and 25 mph to the south as the roadway narrows.

Kalaeloa Boulevard is a State maintained roadway that meets Farrington Highway and the H-1 Freeway at the Palailai Interchange north of the project site. Kalaeloa Boulevard is the only roadway access to the James Campbell Industrial Park (JCIP) and the Barbers Point Harbor.

Malakole Road, the main access to Barbers Point Harbor, runs in an east-west direction. It is a two-lane roadway that intersects Kalaeloa Boulevard at a stop-controlled cross intersection.

The lanes east of Kalaeloa Boulevard are 18-feet in width, while to the west the lanes are 32-feet in width. For both approaches to the intersection, a single lane is used for right-turn, through and left-turn movements. The posted speed limit is 25 mph and parking is not allowed on either side of the road. Approximately 100 feet from the harbor the paved road becomes a gravel road.

Farrington Highway is a state maintained highway that connects Waipahu in the east to Waianae in the west. It intersects with the H-1 Freeway and Kalaeloa Boulevard at the Palailai Interchange. West of the Palailai Interchange, it is a two lane highway with a grassed median and east of the interchange, it narrows to a two-way roadway with a 20 foot pavement width. The posted speed limit is 35 mph.

The H-1 Freeway runs in an east-west direction. It is a 6-lane divided highway that connects the Honolulu area with the Ewa region. The highway has shoulders wide enough for vehicles to make emergency stops adjacent the mauka and makai lanes and on both sides of the divider. The posted speed limit is 55 mph with a minimum speed of 45 mph.

Future Roadway Facilities

Presently, there are no major roadway improvements planned by the State Dept. of Transportation in the Ewa area. The Ewa Region Highway Transportation Master Plan is being developed to identify roadway system improvements necessary to accommodate forecasted future traffic and allocate the cost for improvements to the developers in the region.

Traffic Conditions

A review of 1988 State Department of Transportation (DOT) traffic count data for the intersection of Kalaeloa Boulevard and Malakole Road indicate that the peak hours along Kalaeloa Boulevard occur between 6:00 and 8:00 in the morning and 3:00-5:00 in the afternoon.

Manual traffic counts were taken for the intersection of Kalaeloa Boulevard and Malakole Road on August 17, 1989. The present counts were used as baseline condition upon which future estimated traffic volumes were added. Figures 3 and 4 shows the present volumes and movements of traffic at the study intersection.

The recorded traffic count data is shown in Appendix B. Manual counts were taken of passenger cars, trucks, buses, bicycles, motorcycles and pedestrians by turning movements and approaches. During the field counts, the weather conditions were clear and the pavement was dry.

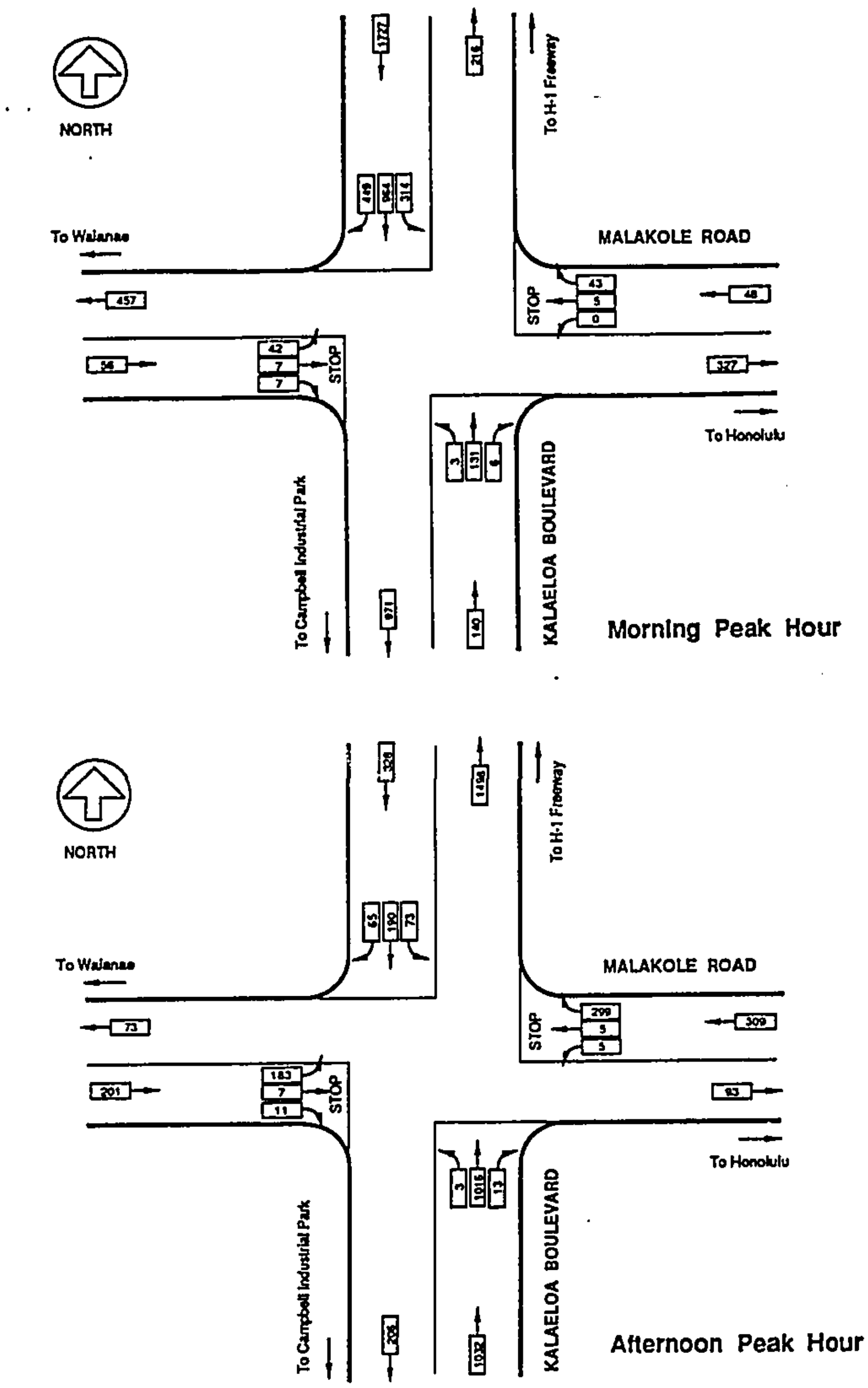


Figure 3. Existing Morning and Afternoon Peak Hour Traffic
Kalaeloa Boulevard and Malakole Road

PROJECTED TRAFFIC CONDITIONS

Future traffic forecasts without and with the project were estimated for the year 2030. Traffic generated by major future developments were used to forecast traffic without the project. The additional traffic volumes from ambient growth and the proposed project were added to the present traffic counts to arrive at the 2030 forecast volumes.

Future Ambient Traffic

Ambient traffic is the traffic which would occur if the proposed project were not built. Since Kalaeloa Boulevard does not provide access to areas beyond the industrial park and harbor, ambient traffic was forecasted based only on the additional traffic generated by proposed developments in the area. The proposed developments in the area include areas zoned for industrial uses around Barbers Point Harbor and areas zoned for industrial use above the James Campbell Industrial Park.

The three-step procedure of trip generation, distribution and assignment was used to forecast future ambient traffic.

Trip Generation calculates the number of trips that would be generated during the morning and afternoon peak hours by the proposed project. The number of trips were calculated from the ITE Trip Generation Report (Fourth Edition, 1987) for the future additional jobs expected in the Harbor and areas already zoned for industrial use. Table 1 shows the ITE trip generation rates and number of trips generated by the proposed land uses during the morning and afternoon peak hours. The trip generation data for Industrial Parks for the morning and afternoon peak generation periods was used to generated the traffic for the ambient traffic.

Table 1. Trip Generation -- ITE Standard Rates

Land Use	New Jobs	ITE Rate (Trips/Job) Morning Enter	Morning Exit	Afternoon Enter	Afternoon Exit	Number of Trips Morning Enter	Morning Exit	Afternoon Enter	Afternoon Exit
I-2 Industrial Amended	3380	0.33	0.06	0.10	0.30	1115	203	338	1014
I-3 Industrial Amended	220	0.33	0.06	0.10	0.30	73	13	22	66
I-3 Barbers Point Harbor	1010	0.33	0.06	0.10	0.30	333	61	101	303
JCIP Industrial	500	0.33	0.06	0.10	0.30	165	30	50	150
Total Number of Trips						1686	307	511	1533

Trip distribution and traffic assignment allocate the generated trips to the different directions of travel and specific turning movements on the roadway. Since there is presently only one access to the industrial park, all trips were assigned to Kalaeloa Boulevard.

Project Generated Traffic

The three-step procedure of trip generation, distribution and assignment was used to forecast future peak hour traffic from the proposed project.

Trip Generation calculates the number of trips which would be generated during the afternoon peak hour by the proposed project. The number of trips were calculated from the ITE Trip Generation Report (Fourth Edition, 1987) for the future additional jobs expected in the project. Table 2 shows the ITE standard trip generation rates and number of trips generated by the proposed land uses during the morning and afternoon peak hours. The trip generation data for Industrial Parks for the morning and afternoon peak generation periods were used to generate the ambient traffic.

Table 2. Trip Generation -- ITE Standard Rates

Land Use	New Jobs	ITE Rate (Trips/Job) Morning Enter	Morning Exit	Afternoon Enter	Afternoon Exit	Number of Trips Morning Enter	Morning Exit	Afternoon Enter	Afternoon Exit
I-2 Industrial	4690	0.33	0.06	0.10	0.30	1548	281	469	1407
I-3 Industrial	380	0.33	0.06	0.10	0.30	125	23	38	114
Commercial	580	0.49	0.08	0.08	0.38	284	46	46	220
Total Number of Trips						1957	350	553	1741

Trip distribution and traffic assignment allocate the generated trips to different directions of travel and specific turning movements on the roadway. The project generated traffic entering and exiting the project site were assigned to Kalaeloa Boulevard and the second access road. The non-project related, or ambient traffic, was reassigned since the project provides an additional access in and out of the area.

Total Traffic

Figures 4 thru 7 show the resulting turning movement volumes for the conditions *without* and *with* the proposed project. The ambient traffic volumes in Figures 4 and 5 were added to the project generated volumes to obtain the total forecast volumes shown in Figures 6 and 7.

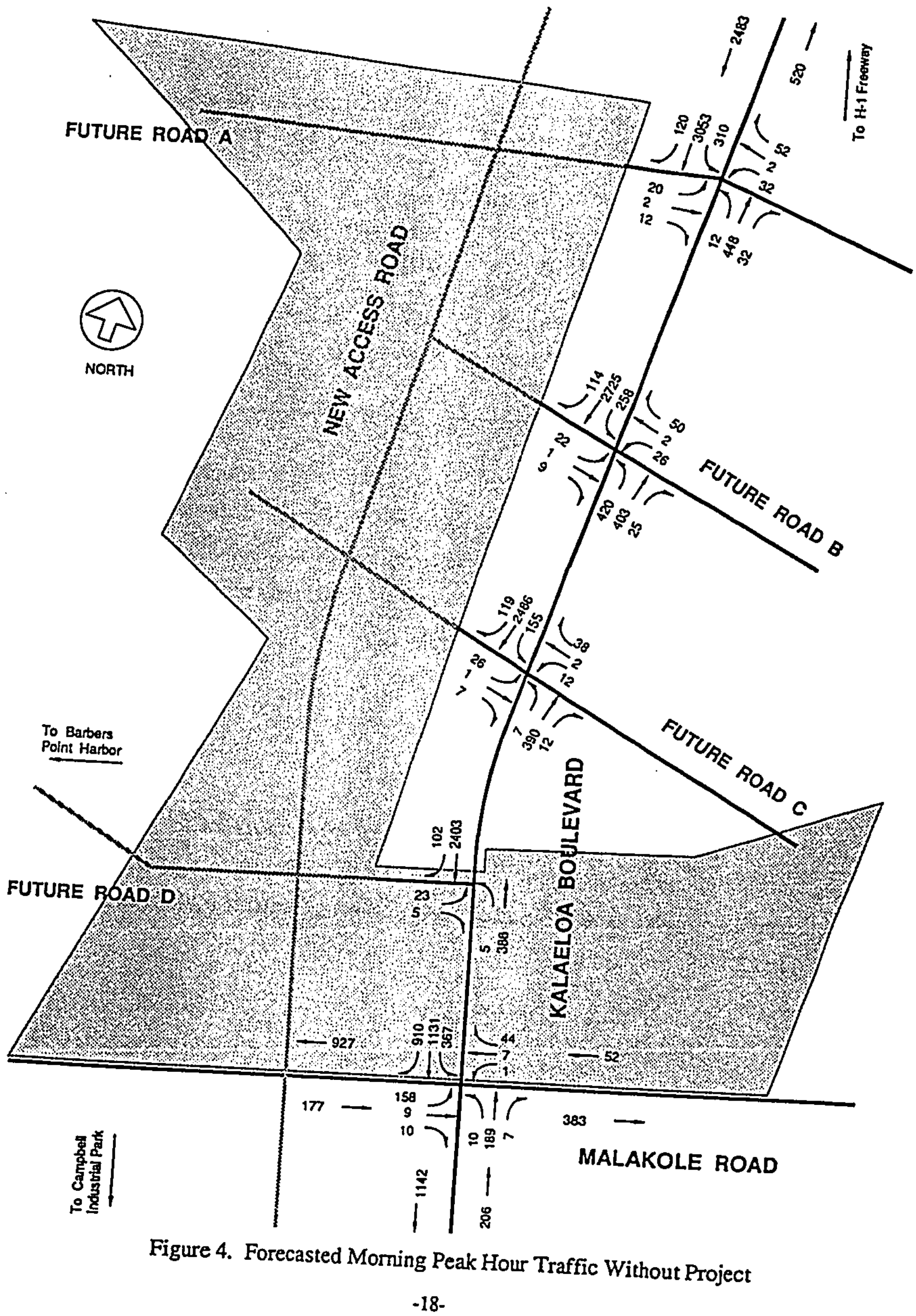


Figure 4. Forecasted Morning Peak Hour Traffic Without Project

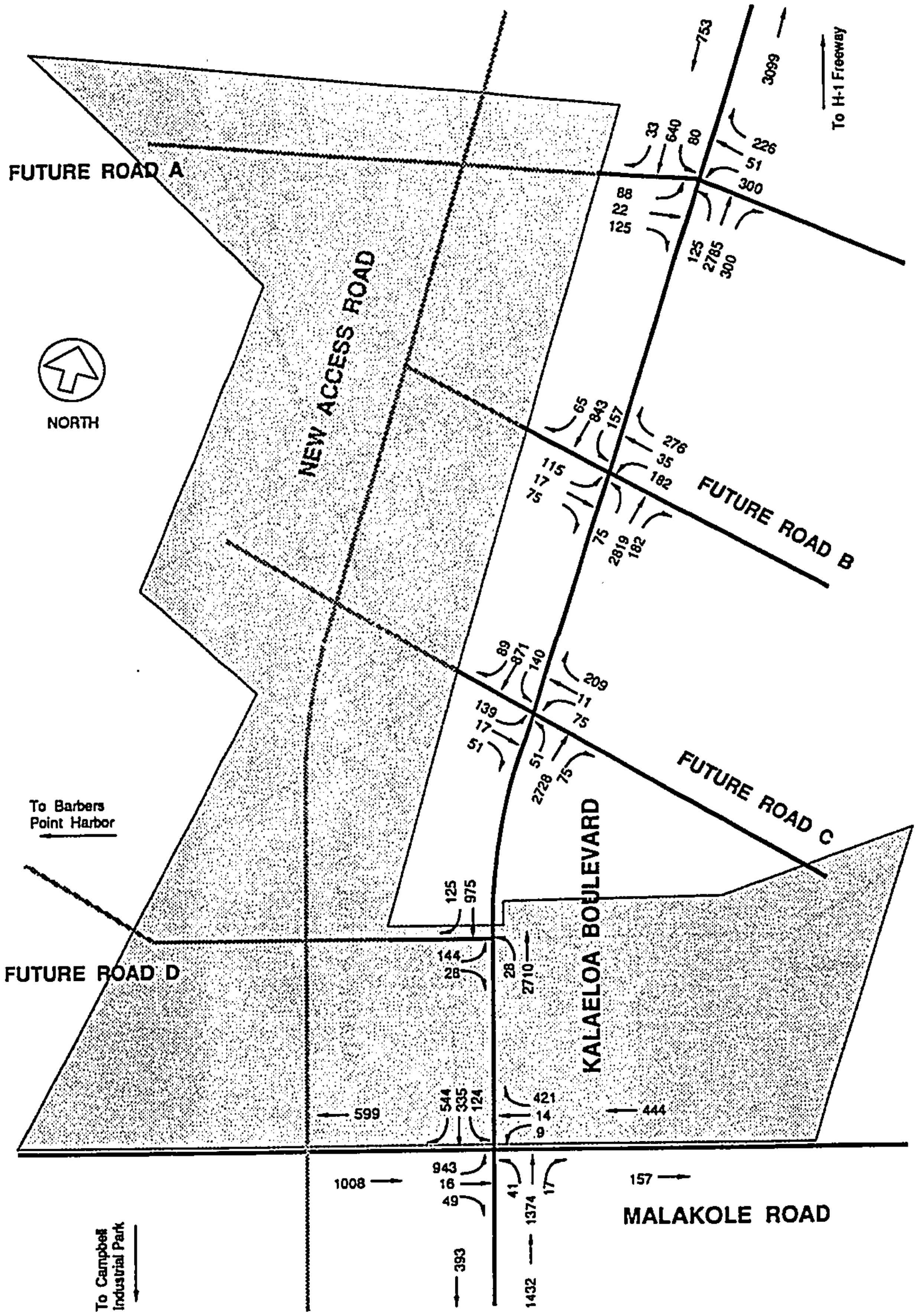


Figure 5. Forecasted Afternoon Peak Hour Traffic Without Project

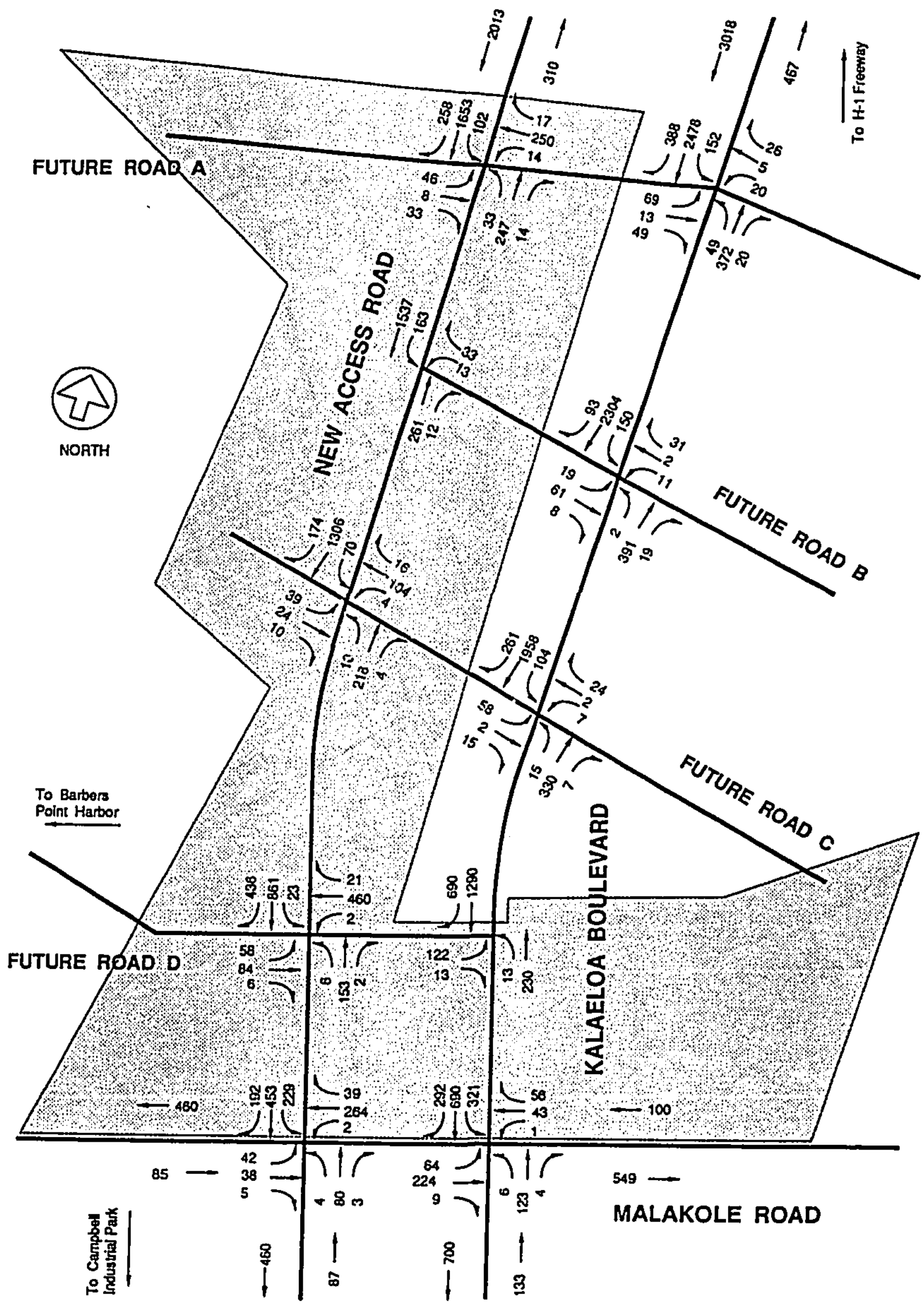


Figure 6. Forecasted Morning Peak Hour Traffic With Project

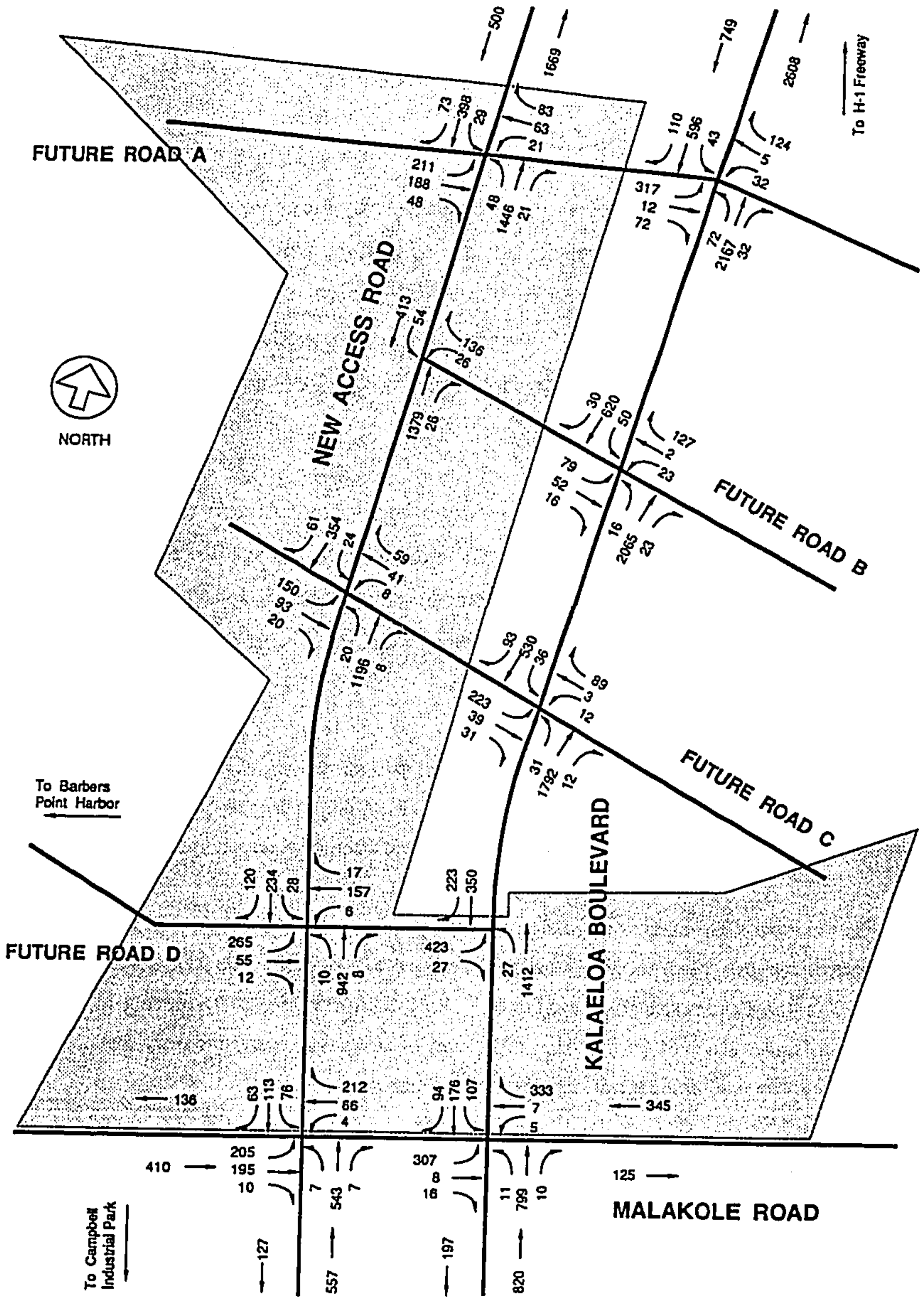


Figure 7. Forecasted Afternoon Peak Hour Traffic With Project

TRAFFIC IMPACT ANALYSIS

Impacts from the proposed project were measured by the change in level of service (LOS) for specific turning movements with and without the project. The existing traffic volumes in Figure 3, the ambient traffic volumes in Figures 4 and 5, and the total forecast traffic volumes in Figures 6 and 7 were analyzed. The methodology for analyzing unsignalized intersections in the TRB Highway Capacity Manual, Special Report 209 (1986) was used.

The methodology yields levels of service ranging from A to F (summarized in Appendix A) and should not be confused with the level of service for signalized intersections. The LOS for the traffic movements at an intersection is classified into six categories ranging from little or no delay (LOS A) to extreme delays (LOS F). The results of the analysis are summarized on Table 3.

The results of the analysis indicate that motorists on Malakole Road presently experience very long to extreme delays (LOS E or F) in attempting to cross or make left-turns onto Kalaeloa Boulevard during the morning and afternoon peak hours.

By the Year 2030 even without Kapolei Business Park, the LOS for traffic attempting to cross or make a left-turn onto Kalaeloa Boulevard will worsen. The LOS for left-turns onto Kalaeloa Boulevard will be LOS F. The LOS for vehicles attempting to cross Kalaeloa Boulevard will be LOS F. This level-of-service is predominantly due to the increased volume of ambient traffic on Kalaeloa Boulevard.

With Kapolei Business Park, which includes the addition of a second access, the results of the analysis also indicates that the left-turn and crossing movements will continue to operate with very long to extreme delays (LOS E or F).

Table 3. Level-of-Service Analysis

Unsignalized Intersections

Intersection		1989 AM	1989 PM	2030 w/o Project AM	2030 w/o Project PM	2030 w/ Project AM	2030 w/ Project PM
Kalaeloa & Road A		AM	PM	AM	PM	AM	PM
Road A							
Eastbound	LT	N/A	N/A	F	F	F	F
	TH	N/A	N/A	F	F	F	F
	RT	N/A	N/A	C	F	F	A
Westbound	LT	N/A	N/A	F	F	F	F
	TH	N/A	N/A	F	D	F	F
	RT	N/A	N/A	E	E	A	F
Kalaeloa							
Northbound	LT	N/A	N/A	F	C	F	A
Southbound	LT	N/A	N/A	B	E	A	F
Kalaeloa & Road B		AM	PM	AM	PM	AM	PM
Road B							
Eastbound	LT	N/A	N/A	F	F	F	F
	TH	N/A	N/A	F	F	F	F
	RT	N/A	N/A	C	F	F	A
Westbound	LT	N/A	N/A	F	F	F	F
	TH	N/A	N/A	F	D	F	F
	RT	N/A	N/A	E	E	A	F
Kalaeloa							
Northbound	LT	N/A	N/A	F	C	F	A
Southbound	LT	N/A	N/A	B	E	A	F

Table 3. Level-of-Service Analysis (Cont.)

Unsignalized Intersections

Intersection		1989		2030 w/o Project		2030 w/ Project	
Kalaeloa & Road C		AM	PM	AM	PM	AM	PM
Road C							
Eastbound	LT	N/A	N/A	F	F	F	F
	TH	N/A	N/A	F	F	F	F
	RT	N/A	N/A	F	F	F	A
Westbound	LT	N/A	N/A	F	F	F	F
	TH	N/A	N/A	F	D	F	F
	RT	N/A	N/A	E	E	A	F
Kalaeloa							
Northbound	LT	N/A	N/A	F	C	F	A
Southbound	LT	N/A	N/A	B	E	A	F
Kalaeloa & Road D		AM	PM	AM	PM	AM	PM
Road D							
Eastbound	LT	N/A	N/A	F	F	F	F
	RT	N/A	N/A	E	C	D	A
Kalaeloa							
Northbound	LT	N/A	N/A	F	D	F	A

Table 3. Level-of-Service Analysis (Cont.)

Unsignalized Intersections

Intersection		1989		2030 w/o Project		2030 w/ Project	
Kalaeloa & Malakole		AM	PM	AM	PM	AM	PM
Malakole							
Eastbound	LT	E	F	F	F	F	F
	TH	E	D	F	F	E	D
	RT	C	A	C	F	C	D
Westbound	LT	E	E	F	F	F	E
	TH	E	D	F	D	F	D
	RT	A	E	E	E	B	D
Kalaeloa							
Northbound	LT	C	A	F	C	C	A
Southbound	LT	A	C	B	E	A	C

Signalization of Study Intersections

Due to the expected delays for the minor streets, the study intersections were analyzed as signalized intersections. The Planning Analysis technique from the HCM was used to determine if the intersections are operating below capacity of signalized intersections.

Planning analysis uses an intersection's critical volume to determine whether an intersection will be over, near, or under capacity. The critical volume measures intersection capacity using the volume of conflicting traffic movements. A critical volume of less than 1200 vehicles indicates that an intersection is under capacity, between 1200 and 1400 vehicles indicates near capacity, and greater than 1400 vehicles indicates over capacity.

Table 4 shows the results of the Planning Analysis of the study intersections for forecasted traffic without the project traffic in the year 2030. The results indicate that even if Kalaeloa Boulevard is widened to a six lane highway the study intersections would still operate near or over capacity.

Tables 5 and 6 show the results of the planning analysis for Kalaeloa Boulevard with the project generated traffic including the addition of a second access to the industrial park in the year 2030. Table 7 shows the results of the planning analysis for the second access road to the industrial park with the project generated traffic in the year 2030. The results indicate that if Kalaeloa Boulevard is widened to 6 lanes and a second 4 lane access road is provided, all the study intersections would operate under capacity.

Table 4. Planning Analysis for Signalized Intersections

Kalaeloa Boulevard Without Project in 2030

Morning Peak Hour

	4 Lane Kalaeloa		6 Lane Kalaeloa	
Intersection	Critical Vol.	Capacity Level	Critical Vol.	Capacity Level
Kalaeloa & Road A	1633	Over	1104	Under
Kalaeloa & Road B	1456	Over	982	Under
Kalaeloa & Road C	1338	Near	915	Under
Kalaeloa & Road D	1274	Near	863	Under
Kalaeloa & Malakole	1196	Under	855	Under

Afternoon Peak Hour

	4 Lane Kalaeloa		6 Lane Kalaeloa	
Intersection	Critical Vol.	Capacity Level	Critical Vol.	Capacity Level
Kalaeloa & Road A	1989	Over	1555	Over
Kalaeloa & Road B	1932	Over	1431	Over
Kalaeloa & Road C	1692	Over	1224	Near
Kalaeloa & Road D	1499	Over	1047	Under
Kalaeloa & Malakole	1787	Over	1545	Over

Table 5. Planning Analysis for Signalized Intersections (Cont.)
With 4 Lane Kalaeloa Boulevard and Second Access
2030 With Project

	Morning Peak Hour		Afternoon Peak Hour	
Intersection	Critical Vol.	Capacity Level	Critical Vol.	Capacity Level
Kalaeloa & Road A	1556	Over	1465	Over
Kalaeloa & Road B	1281	Near	1185	Under
Kalaeloa & Road C	1184	Under	1164	Under
Kalaeloa & Road D	1125	Under	1129	Under
Kalaeloa & Malakole	731	Under	826	Under

Table 6. Planning Analysis for Signalized Intersections
With 6 Lane Kalaeloa Boulevard and Second Access
2030 With Project

	Morning Peak Hour		Afternoon Peak Hour	
Intersection	Critical Vol.	Capacity Level	Critical Vol.	Capacity Level
Kalaeloa & Road A	987	Under	1098	Under
Kalaeloa & Road B	881	Under	837	Under
Kalaeloa & Road C	1054	Under	863	Under
Kalaeloa & Road D	780	Under	894	Under
Kalaeloa & Malakole	619	Under	691	Under

Table 7. Planning Analysis for Signalized Intersections (Cont.)

4 Lane Second Access Road

2030 With Project

	Morning Peak Hour		Afternoon Peak Hour	
Intersection	Critical Vol.	Capacity Level	Critical Vol.	Capacity Level
Second Access & Road A	1156	Under	1037	Under
Second Access & Road B	782	Under	783	Under
Second Access & Road C	893	Under	817	Under
Second Access & Road D	955	Under	925	Under
Second Access & Malakole	633	Under	622	Under

CONCLUSIONS AND RECOMMENDATIONS

The proposed Kapolei Business-Industrial Park will have a major impact on Kalaeloa Boulevard in the year 2030 when the Park is expected to be fully developed.

Even without the Business Park, Kalaeloa Boulevard will not have the capacity to accommodate the forecasted traffic in the year 2030 due to the increase volume of ambient traffic. To provide additional roadway capacity, improvements such as widening Kalaeloa Boulevard and/or providing a second access into the area will be necessary.

With the project generated traffic in the year 2030, additional roadway capacity will be required for Kalaeloa Boulevard to accommodate the forecasted traffic. Even with sufficient capacity, drivers from minor streets will experience very long delays crossing or entering Kalaeloa Boulevard if the intersections are not signalized. If unsignalized, traffic attempting to turn left onto and cross Kalaeloa Boulevard will encounter level-of-service (LOS) F, meaning extreme delays during the peak hours. If signalized, the study intersections would operate under capacity, assuming Kalaeloa Boulevard is widened to a six lane divided highway and a second four lane access road is provided.

To mitigate the impacts of the proposed project on Kalaeloa Boulevard, the following phased improvements are recommended:

1. Signalize the study intersections along Kalaeloa Boulevard when future traffic volumes meet signal warrants. All of the study intersections will probably require signalization before the year 2010.
2. By year 2010, Kalaeloa Boulevard will need to be widened to a six lane divided highway between Malakole Road and the Palailai Interchange. Recommended roadway improvements for Kalaeloa Boulevard is shown on figure 8.

3. Provide a two lane second access road to and from the industrial park. The second access road will probably be needed by the year 2010. Ultimately this second access road will need to be expanded to four lanes between Malakole Road and the second access road entrance into the project site before the year 2030. Signalize intersections of the second access road with Malakole Road, Road D, Road C, Road B, and Road A when future traffic volumes meet signal warrants.

Further improvements will be necessary to accommodate the traffic beyond the study area. These improvements will be identified in the Ewa Region Highway Transportation Master Plan. The Estate of James Campbell, which is proposing the Kapolei Business Park, is committed to participate in the Transportation Master Plan to determine "fair share" costs of improving the regional highway system.

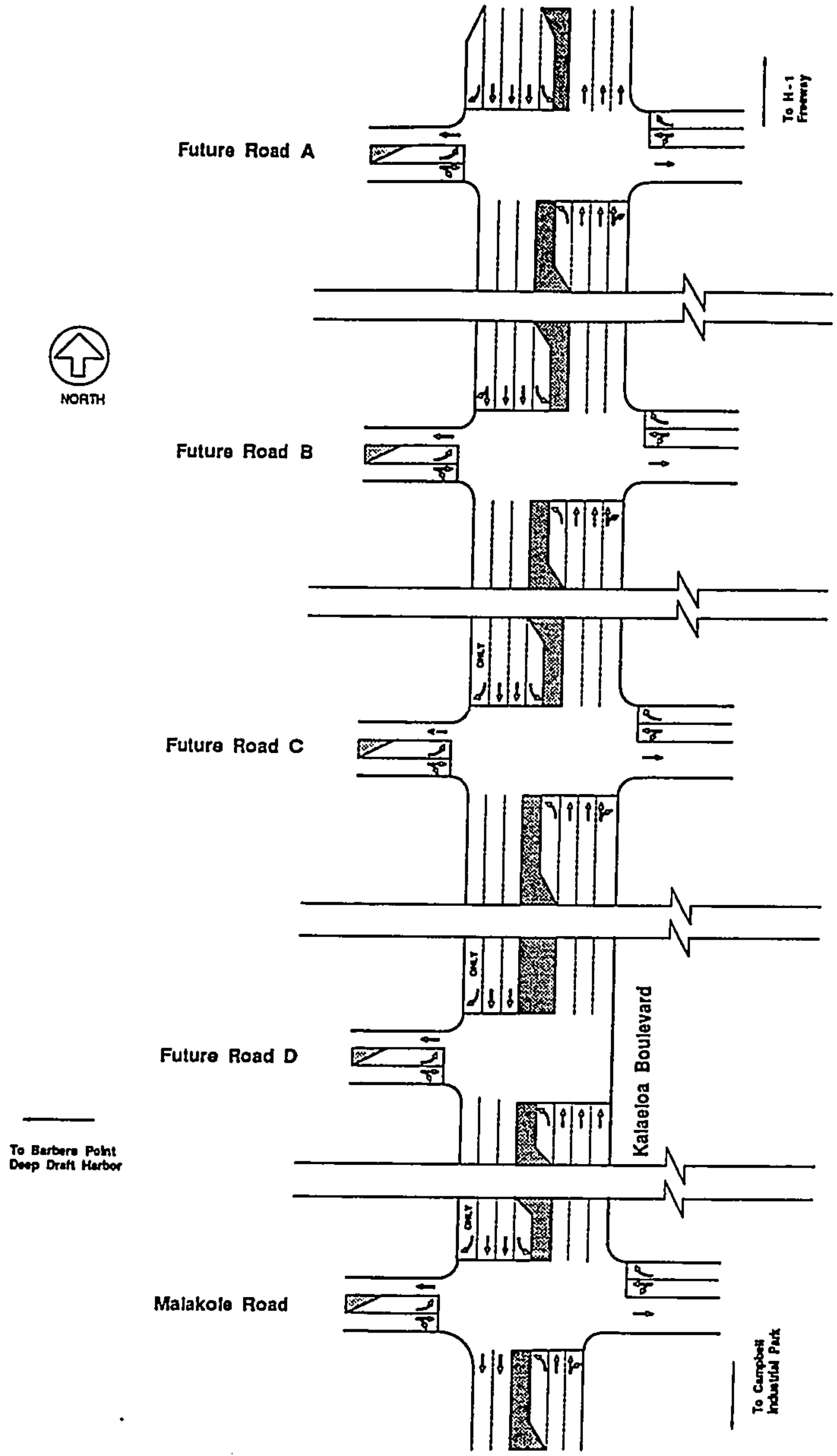


Figure 8. Recommended Roadway Improvements for Kalaeloa Boulevard

APPENDIX A

Definition of Level-of-Service For

Signalized Intersections

APPENDIX A

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

Level of service for signalized intersections is defined in terms of *delay*. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period.

Level-of Service A describes operations with very low delay, i.e., less than 5.0 sec per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

Level-of-Service B describes operations with delay in the range of 5.1 to 15.0 sec per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-Service C describes operations with delay in the range of 15.1 to 25.0 sec per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Level-of-Service D describes operations with delay in the range of 25.1 to 40.0 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or a high *v/c* ratios (volume of cars to capacity of intersection). Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level-of-Service E describes operations with delay in the range of 40.1 to 60.0 sec per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle length, and high *v/c* ratios. Individual cycle failures are frequent occurrences.

Level-of-Service F describes operations with delay in excess of 60.0 sec per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

REFERENCE: Highway Capacity Manual (Special Report 209, 1985)

APPENDIX B

MANUAL TRAFFIC COUNT DATA

APPENDIX B

MANUAL TRAFFIC COUNT DATA
Date: August 31, 1989

Location: Kalaeloa Boulevard & Malakole Road

	Kalaeloa Boulevard						Malakole Road					
	Northbound			Southbound			Eastbound			Westbound		
Time (am)	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
6:15-6:30	1	24	0	57	198	106	9	0	1	0	0	12
6:30-6:45	2	25	0	77	316	144	10	2	3	0	1	2
6:45-7:00	0	42	3	123	320	130	8	2	1	0	1	18
7:00-7:15	0	40	3	57	130	69	15	3	2	0	3	11
7:15-7:30	0	40	2	89	103	55	11	1	5	0	2	25
7:30-7:45	2	34	3	88	72	40	22	3	3	2	1	26
Peak Hour	**6:15-7:15**											
Totals	**3**	**131**	**6**	**314**	**964**	**449**	**42**	**7**	**7**	**0**	**5**	**43**

Location: Kalaeloa Boulevard & Malakole Road

	Kalaeloa Boulevard						Malakole Road					
	Northbound			Southbound			Eastbound			Westbound		
Time (am)	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
3:15-3:30	2	217	6	25	62	20	37	5	4	3	2	49
3:30-3:45	0	423	4	12	47	19	52	0	6	1	1	82
3:45-4:00	1	131	1	22	46	11	40	1	0	1	2	52
4:00-4:15	0	245	2	14	35	15	54	1	1	0	0	116
4:15-4:30	2	122	3	10	25	14	45	0	4	1	0	39
4:30-4:45	0	114	0	15	20	11	39	0	0	0	0	52
Peak Hour	**3:15-4:15**											
Totals	**3**	**1016**	**13**	**73**	**190**	**65**	**183**	**7**	**11**	**5**	**5**	**299**

PACIFIC PLANNING & ENGINEERING, INC.

COMPANY QUALIFICATIONS

JULY 1989

We provide planning and consultancy services to:

- Public Works Agencies
- Housing Agencies
- Transportation Departments
- Private Development Groups
- Major Facility Owners (Golf Courses, Major Resorts)
- Airports
- Airline Interests

We work closely with our clients to gain an understanding and appreciation of their needs beyond the bound report or design sheet. Our sensitivity to client needs arises from our experience in managing large public works departments. Our awareness of the pressures and nuances of management decision-making enables us to provide perspectives beyond the norm. Our understanding and working knowledge of agencies in planning and governance enable us to serve beyond the technical area.

Management Services

- Management Information Assistance
  - Rapid, Highly Focused Evaluations
  - Financial Analysis
  - Feasibility Studies
  - Organizational Assessments
- Planning and Design Team Management
- Construction Management
- Lease Negotiations
- Property Management Evaluations

Planning and Engineering Consultancy

- Assistance with Government Requirements
- Alternatives Analysis
- Traffic Impact Studies
- Traffic Engineering and Roadway Design
- Ground Transportation System Evaluations
- Facilities Planning

Personnel

The Principals of PPE, Inc. are Dr. Jonathan Shimada and Mr. Howard Abe. They have decades of experience and training in management and technical fields.

In managing the Hawaii Airports System for seven years, Dr. Jonathan Shimada has experience in:

-airport system management
-transportation planning consultancy
-traffic engineering and safety
-airport finance and budgeting
-lease and property management
-airline and retail concession operations
-ground transportation
-program planning and evaluation
-engineering administration
-media and public relations
-management and technical Workshops
-contract negotiations

He has a wide range of experience by having managed a large public works agency with a $120 million annual operating budget and over 800 employees. He has dealt with print and television reporters, small and large airport operators, State Legislature and County Governments, major retail businesses, protocol personnel, airlines, small businesses, ground transportation operators, special interest groups, and attorneys. This provides a strong and effective base for assisting those needing people and solutions who can deal effectively with technical problems, government agencies, and private enterprise. Dr. Shimada is well-known and respected in the world-wide system of airports, and particularly in the Pacific Basin.

Mr. Howard Abe's professional experience has been notable in its ever increasing management responsibilities. His management experiences, technical knowledge and field experience over three decades provide a strong and practical base. He is widely respected by the agencies he has served, and most significantly by government, media, private and community groups with whom he has worked. His awards and recognition are even more noteworthy when one considers they were given in the public service field of highways. He has received awards and recognition from such respected and diverse groups as:

-Maui Chamber of Commerce
-State Government
-Maui County
-Newspaper editors
-State legislators, mayors, and private citizens

His past achievements in his work represent abilities and knowledge which he will bring to bear in the most demanding and difficult planning/engineering situations.

PPE, Inc.--CLIENTS

Department of Housing and Community Development, City and County of Honolulu
Castle & Cooke
Queens' Development Corporation
Airport Operators Council International
The Estate of James Campbell
Hawaii Finance and Development Corporation, State of Hawaii
Princeville Development Corporation
Aloha Airlines
Japan Travel Bureau International
Department of Business and Economic Development, State of Hawaii
Department of Accounting and General Services, State of Hawaii
Signal Puako Corporation
R. M. Towill, Inc.
DHM, Inc.
Engineering Concepts, Inc.
Transcontinental Development Company
Department of Transportation
Aloha Tower Development Corporation

SAMPLING OF PROJECTS BY PPE, INC.

West Loch Estates
Kapolei Town Center
Signal Puako
Maui Palisades
Honoapiilani Apartments
UH Hilo Expansion
Queens' Medical Center
Waikiki Landmark
Lanai Airport Planning
Lanai Highway Planning
Princeville Airport
Waikiki Convention Center
Honolulu Waterfront Development Project
Lanai City Traffic Circulation
Waikoloa Expansion Project
State Filming Facility
Lihue/Puhi District Project
Ewa Regional Long-Range Transportation Plan
Aloha Stadium Master Plan Update
Honolulu International Airport Intra-Airport Transportation System

APPENDIX M

Kapolei Business-Industrial Park, Market Assessment

John Zapotocky

APPENDIX M

THE ESTATE OF JAMES CAMPBELL

KAPOLEI BUSINESS–INDUSTRIAL PARK

MARKET ASSESSMENT

Prepared by:

John Zapotocky, Consultant
Gail Atwater, Consultant

OCTOBER 1989

TABLE OF CONTENTS

Executive Summary

The Estate of James Campbell is requesting an amendment to the Ewa Development Plan which would change the designation of 552.32 acres of land now designated for agriculture to 533.12 acres designated Industrial and 19.2 acres designated commercial.

There are five major reasons for requesting the change in designation at this time:

1. All of the other major land use changes called for in the Ewa Master Plan for lands owned by the Estate of James Campbell have been completed and physical implementation of the actual development is well underway at the three residential communities of West Loch Estates, Ewa Gentry and The Kapolei Villages. Development of infrastructure for the Ko Olina Resort has been underway for two years. In October 1989, a major hotel project was announced for Ko Olina. Announcement of other major hotel and condominium projects are expected in the near future. The Kapolei Shopping Center, the first major commercial development in Kapolei has experienced an exceptionally strong reception from commercial tenants with over 95% of the space committed prior to ground breaking. Thus the emergence of the Ewa area as the dominant growth area for the county during the next twenty years in accordance with city and state planning policies in now assured.

2. The James Campbell Industrial Park is 97% leased with essentially all of the remaining acreage committed for development.

3. During the past two years there has been a shortage of industrial space on the Island of Oahu with vacancy rates for industrial space currently estimated at less than two percent (2%) vs. an ideal vacancy rate at between 5% and 10%.

4. Over time Hawaii's economy has been continuously evolving from the 1950's when its was based primarily on agriculture and military expenditures through the 1970's when tourism emerged as the dominant industry until today when tourism is clearly the dominant economic activity in the state's economy. This transition as well as the nationwide change from an industrial based to service based economy has resulted in a change in the types of demand for industrial land. At the same time there is an increasing recognition on the part of government planners and industrial land developers of the need to maintain an adequate supply of industrial land for all types of industrial land uses. This is especially critical as primary urban center

land values increase due to alternative uses putting pressure on existing industrial land users within the Honolulu to Pearl City corridor to find alternate locations.

5. The Series M-K Economic Projections adopted officially by the Department of Business and Economic Development in November 1988, while indicating a relative decline in traditional industrial jobs vis a vis total jobs, project continuous absolute growth. Non-hotel service jobs another potential component of industrial land demand continue to grow in both absolute and relative terms.

To meet approval requirements for this Environmental Impact Statement, The Estate of James Campbell has authorized the consultants to proceed with this Market Assessment. The purposes of this report are to:

- Examine the major economic issues and assumptions underlying this proposal;
- Analyze the demand for the proposed redesignated land;
- Analyze demand versus projected supply of land;
- Discuss creative land use alternatives for development of Kapolei Business-Industrial Park acreage; and,
- Project the rate of future absorption of Industrial (I-2 and I-3) and Commercial parcels.

The Kapolei Business-Industrial Park is being proposed by the Estate of James Campbell at this time to respond to the needs and opportunities described above in a comprehensive rather than piecemeal manner.

The proposed Kapolei Business-Industrial Park responds to the above challenges in a number of ways:

1. It accommodates future industrial growth by providing additional acreage for demand generated by growth in jobs, displacement of existing businesses and providing an adequate vacancy factor.

2. It accommodates the need to provide land for critical harbor functions as well as the overall spectrum of industrial development.

3. It provides long range opportunities for the location of both heavy and light industrial uses.

4. It proposes a land use pattern within the park which maximizes compatibility of existing and planned industrial uses within the Kapolei Business Industrial Park and the surrounding harbor, military, commercial, residential and resort land uses.

More specifically the report demonstrates that island wide there is a need for 1,194 acres of I-2 land on Oahu and 672 acres in Ewa by 2010 composed of the following:

	ACRES	
	OAHU	EWA
1. Due to job growth	543	271
2. Due to relocation	222	122
3. Need for vacant	429	279
Total	1,194	672

The report estimates a mid range demand for I-3 land at 277 acres in Ewa by the year 2010 and The report identifies potential demand for I-3 land from six sources. However, the total amount of I-3 proposed for the Barbers Point Harbor, including the 109.5 acres of the proposed request would result in approximately 75% of the total I-3 area surrounding the existing Honolulu Harbor, Oahu's only major commercial port. The fact that the state owns, controls or has expressed interest in 60% of this land for primary harbor functions argues strongly that additional harbor I-3 lands should be made available. The I-3 use proposed in this application would be for 109.53 acres of I-3 of which the State has already expressed an interest in 56.5 acres. Thus the net expansion of private I-3 acreage would be 53.03 acres.

Demand for I-3 lands has been estimated by the consultant to range between 97 acres and 427 acres. Medium and high acreage projections will depend on the implementation of the proposed Honolulu Harbor Redevelopment master plan and the success of the state's planned acquisition of the Kapalama Military Reservation lands for Honolulu Harbor's expansion. For purposes of this report absorption of I-3 acreage within the Kapolei Business-Industrial Park is estimated at approximately 57 acres through 2010.

The proposed addition of I-3 land would result in I-3 boundaries which would be consistent with providing a concentration of I-3 lands surrounding the Barbers Point Harbor.

Demand for the proposed 19.2 acre commercial designation will come from two primary sources. The approximately 13,000 persons who will ultimately work within the JCIP and Proposed Kapolei Business-Industrial Park and the commercial support activity for the harbor and the park tenants are the primary source of demand. The location of the proposed commercial land between the Barbers Point Harbor and the Ko Olina Marina suggest the site will have excellent visual amenities which will enhance its value in attracting commercial tenants such as restaurants and other shops in a theme commercial center. New commercial development would attract patrons from the Ewa community in general as well as the Ko Olina Resort Community which is adjacent. The consultants have estimated 15 acres will be absorbed prior to 2010 with the remaining 4.2 acres available for expansion at a later date.

Based on the above estimates of demand the consultants have estimated the absorption of acreage within the proposed Kapolei Business-Industrial Park. In addition, employment and building square footage was estimated based on the acreage absorptions.

Estimates thru 2010 indicate that 420 acres of industrial land (363 acres of (I-2) and 57 acres of (I-3) would be absorbed within the proposed Kapolei Business-Industrial Park. NOTE: The proposed park would consist of 911 acres of industrial land including 379 acres of industrial land already approved for development. In addition, 15 acres of commercial land would be absorbed.

Through 2010 approximately 4,751 jobs would be created at the park, while ultimately 9,748 jobs would be created. This would be in addition to the estimated 3,000 persons already working at the James Campbell Industrial Park.

Building square footage estimates provided in a low and high range indicted 2.1 million to 2.9 million square feet through 2010 respectively. And 4.9 million to 6.5 million square feet upon completion of development.

There is a demonstrated need for additional industrial land in the Ewa development plan area thru the year 2010. The proposed development plan amendment consisting of 533 acres of industrial land and 19 acres of support commercial will insure the availability of adequate industrial land for Oahu's vital industrial sector. Land for new businesses generated by the projected rapid population growth in the Ewa area as well as land for existing industrial businesses which will be relocated from the Primary Urban Center. Land is also being set aside to meet the projected needs of the Barbers Point Harbor, Oahu's only alternative commercial harbor. The Kapolei Business-Industrial Park proposal anticipates and responds to long-term needs for an adequate supply of industrial land of various types as well as changing use patterns. In addition, it proposes to do so in a manner consistent with responsible planning with care taken to insure the most compatible relationships of uses within the Kapolei Business-Industrial Park and with surrounding land uses.

KAPOLEI BUSINESS–INDUSTRIAL PARK

MARKET ASSESSMENT

I. INTRODUCTION

The long-envisioned Ewa Master Plan for development of west Oahu is now in the preliminary implementation stage.

- Kapolei Village, Ewa Gentry and West Loch Estates developments are under construction.
- The development of the deep draft harbor infrastructure by the State of Hawaii is proceeding at Barbers Point.
- The upscale hotel and condominium complex at West Beach (Ko Olina) is under development near the harbor's mouth at Barbers Point.
- An unprecedented demand for commercial space has been indicated by the 95% pre-lease of the proposed Kapolei Shopping Center.

The Estate of James Campbell is requesting this *Development Plan* Amendment to complete the master planning for industrial development in Ewa. This Market Assessment will illustrate how the proposed Kapolei Business-Industrial Park, added to the existing James Campbell Industrial Park, will provide the necessary infrastructure for the economic growth anticipated with a tripling of Ewa population between 1990 and 2010. It will also show the pivotal role to be played by Ewa in meeting Oahu's future needs for industrial land.

A. Allocation Procedure

Keeping in mind this role to be played by Ewa in meeting future Industrial land needs, the rationale presented in this Market Assessment focuses on the projecting total-Oahu demand for land until 2010, then allocating a portion of that total to Ewa, based on various factors. In this way, those reviewing this document can readily see the relative importance of this Ewa Industrial master planning effort to meeting future Oahu land needs.

B. Purpose of the Market Assessment

To meet approval requirements for this Environmental Impact Statement, The Estate of James Campbell has authorized the consultants to proceed with this Market Assessment. The purposes of this report are to:

- Examine the major economic issues and assumptions underlying this proposal;
- Analyze the demand for the proposed redesignated land;
- Analyze demand versus projected supply of land;
- Discuss creative land use alternatives for development of Kapolei Business-Industrial Park acreage; and,
- Project the rate of future absorption of Industrial (I-2 and I-3) and Commercial parcels.

The following sections provide background information and the rationale behind the proposed redesignation.

II. PROJECT DESCRIPTION

Acreage for Redesignation - The Estate of James Campbell is requesting an amendment to the City and County of Honolulu's Ewa Development Plan. The primary impetus of this request is to ensure the Industrial land needs not only of Ewa but of Oahu as a whole will be met.

The project name is Kapolei Business-Industrial Park. Following is a summary of acreage proposed for redesignation from Agricultural to Industrial and Commercial. Appropriate citations from the *Land Use Ordinance* of October 22, 1986 (as amended) describe the ultimate proposed uses:

A. Industrial

<u>I-2 (Industrial) - 423.59 acres</u>

Purpose of I-2: ". . . to set aside areas for the full range of industrial uses necessary to support the City. It is intended for areas with necessary supporting public infrastructure, near major transportation systems and with other locational characteristics necessary to support industrial centers . . ." (page 5-72)

<u>I-3 (Waterfront Industrial) - 109.53 acres</u>

Purpose of I-3: " . . . to set apart and protect areas considered vital to the performance of port functions and to their efficient operation. It is the intent to permit a full range of facilities necessary for successful and efficient performance of port functions." (page 5-72).

B. Commercial

Commercial - 19.20 acres

Purpose of Commercial (B-2): ". . . to set aside areas for commercial and business activity to meet and support the economic growth of the City . . . [and] to provide areas for community-wide business establishments, serving several neighborhoods and offering a wide range of uses . . ." (page 5-50)

Purpose of the Redesignation - Good planning indicates the need to complete the master scheme for industrial development of Ewa over the next twenty years. Through its Department of General Planning, the City and County of Honolulu has recognized the potential for industrial land being squeezed out to higher uses throughout the island. The future dictates that a place be preserved on the island for standard Industrial and Waterfront Industrial uses should the need arise. Under the present *Development Plan*, this provision is not ensured.

Ewa, with a large concentration of industrial land on the island, holds a pivotal position in planning for the future industrial land needs on Oahu. The industrial complex envisioned in Ewa by the Estate of James Campbell would have three major characteristics: diversity, a "gradation" of uses, and flexibility.

- **Diversity** - Both Industrial (I-2) and Waterfront Industrial (I-3) uses will be accommodated. Heavy and light industry will both have a place, with enough acreage to allow flexibility in land use.

- **"Gradation" Of Uses** - In the existing James Campbell Industrial Park, heavy industrial uses (e.g. Hawaiian Independent Refinery, H-Power plant, etc.) are located near the ocean and harbor. Further mauka, the character of the park becomes oriented toward manufacturing and lighter industrial use.

  The character of Kapolei Business-Industrial Park, as indicated by its name, is envisioned to extend the trend toward light and service-oriented industry in the direction of the planned commercial and residential areas in Kapolei. Toward the Barbers Point Harbor area, provision would be made for heavy industrial land use.

- **Flexibility** - No matter how carefully future needs are planned, situations require change. The City and County of Honolulu must be in a position to provide a wide range of choices to be able to make the best possible land use decisions. With this *Development Plan* Amendment, the City would be in a position to provide this needed flexibility in future years.

III. HISTORICAL DEMAND FOR INDUSTRIAL (I-2) LAND ON OAHU

This section includes discussion of:

- Public policy regarding Industrial land use in Oahu;
- Historical use of Industrial land on Oahu; and
- The effect of the growing service economy on Oahu.

A. Public Policy

The long-term policy of both the City and County of Honolulu and the State of Hawaii is to develop west Oahu. The purpose of this policy is to redirect the pressure for growth away from the Primary Urban Center; thereby creating a second city on the island.

The following conclusion was reached in the Department of General Planning's 1983 research report titled *Industrial Land Use Needs on Oahu*:

> "The Halawa to Pearl City, Waipio, and Barbers Point areas are viewed as suitable locations for most industrial, wholesaling and service commercial activities which have been traditionally located in the Kalihi Kai to Kakaako area." (page 8)

This report also recognized the trend in commercial real estate that has accelerated over time - that smaller Oahu industrial and commercial firms are being squeezed out of their Primary Urban Center (PUC) locations and forced to seek alternate sites.

B. Historical Use of Industrial Lands

As Honolulu developed, industrial activity was concentrated in the Primary Urban Center (PUC). As population and economic activity began to shift westward, demand continued to be strong for PUC industrial real estate. However, as land values rose, industrial companies, particularly heavy industry, created demand for suitable locations outside the PUC.

James Campbell Industrial Park (JCIP) was opened in 1959 to help meet this demand for industrial land. The development of JCIP occurred according to the following pattern:

1959-1969

Large land absorption by heavy industrial users unable to expand elsewhere.

Relocation from Honolulu of other firms needing more industrial land at affordable prices.

New and expanding firms resulting from high rates of economic growth prior to 1980.

1969-1979

Absorption of I-2 lands primarily from the latter two groups above, with little new activity by heavy industrial users.

1980-1989

Absorption rate slower as JCIP reaches maximum tenancy (97% as of mid-1989).

Major industrial tenants move to absorb remaining JCIP acreage to expand their current operations on existing park acreage:

- Pacific Resources, Inc. (PRI). PRI acquired the additional space to accommodate future growth of the Hawaiian Independent Refinery.
- Hawaiian Electric Company (HECO). Space was acquired for construction of a "purchased power" electrical generation plant.
- Jorgenson Steel. In mid-1989 they announced plans to add approximately 36,000 square feet of office and warehouse space to a 6,000 square foot office building which they purchased earlier adjacent to their current facility.

Conclusion - The above discussion highlights two major trends in heavy industrial land use on Oahu:

- An overall decreased demand for heavy industrial uses; and
- The ability of existing Oahu's heavy industrial users to acquire acreage to handle long-term growth needs within the existing James Campbell Industrial Park.

IV. FUTURE DEMAND FOR INDUSTRIAL LAND

A. The Effect of the Growing Service Economy

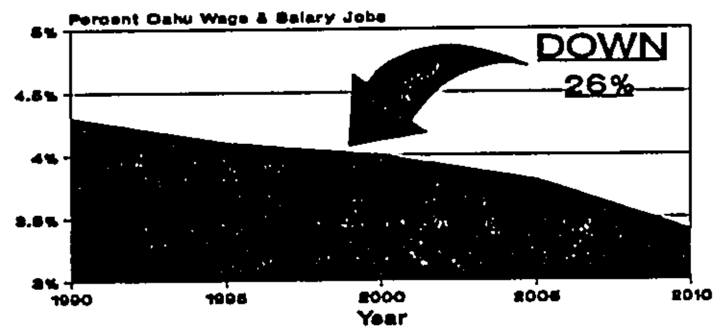
Information furnished by the Estate of James Campbell indicates that newer Oahu industrial parks are generally comprised of general manufacturers (50%) and warehousers (20%). This mix, which favors light rather than heavy industry, together with the evolution of JCIP land absorption, indicates that the demand for industrial land island-wide is moving away from heavy industry and toward light and service-oriented industrial activities.

The impact of a service-based economy on the nature of demand for industrial land will only increase over time. This contention is supported by the State of Hawaii's projections for wage and salary jobs on three major economic fronts (*Figure 1*): manufacturing; transportation, communications and utilities; and non-hotel services. The clear trends are:

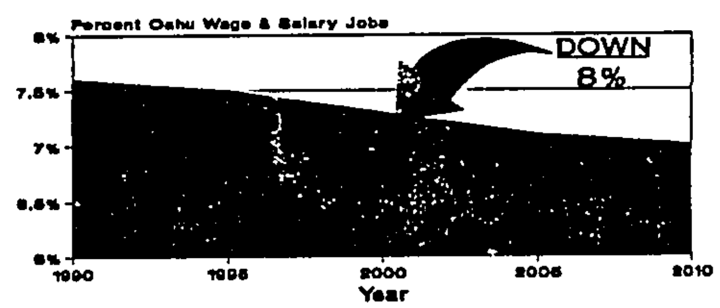
- Relative increase in service jobs;
- A major decline in the proportion of manufacturing jobs (although there is an increase in jobs in absolute terms); and
- A more modest decline in the proportion of jobs in the transportation / communications / utilities sector.

FIGURE 1
CHANGES IN OAHU WAGE & SALARY JOBS
(As A Percent of total Jobs)

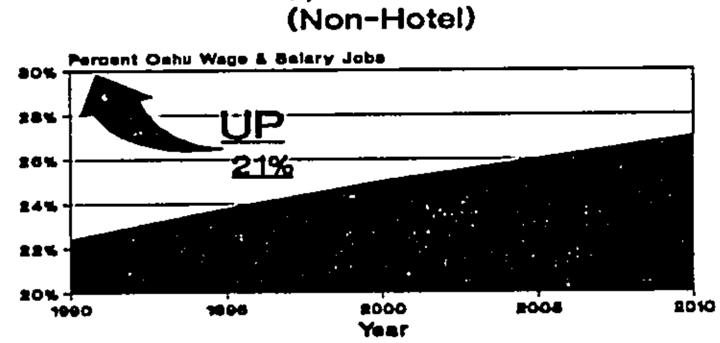
1) MANUFACTURING



2) TRANSPORTATION, COMMUNICATIONS & UTILITIES



3) SERVICE (Non-Hotel)



SOURCE: *Population & Economic Projections for the State of Hawaii to 2010*, (DBED), Series M-K

V. DEMAND ANALYSIS INDUSTRIAL (I-2)

A. Projected Demand for Industrial (I-2) Land on Oahu

This section examines the major factors contributing to demand for industrial land on Oahu, and hence in Ewa over the next 20 years. The factors include:

1. Population and job growth trends;
2. Effect of land use policy, i.e. the Industrial Mixed Use (IMX) designation, on the location of industrial activity; and,
3. Need for vacant industrial land.

The total demand for industrial (I-2) land on Oahu and the allocation to Ewa is summarized in *Figure 2* below and explained in detail in the subsequent discussion.

Figure 2
Total Demand For Industrial Land, Job Growth,
Relocation, Vacant Land @ 7.5%
Total Oahu
1990-2010
October 1989

Demand Source	Oahu
Job Growth	543 [1]
Relocation	222
Vacant Land	429
	1,194

1 - Assumes 10% of Oahu allocated to I-3

1. I-2 DEMAND FACTOR ONE: Population and Job Growth Trends

Oahu Demand - Population growth is expected to translate into *job growth*. The impact of job growth on demand for industrial land on Oahu was quantified based on the following factors:

- Growth in major industrial job categories, such as manufacturing, construction, transportation and warehousing.
- Employment per acre factor by job category. See *Figure 3* below.

FIGURE 3
Employment
Employment per Acre 1975
Industrial Land
Estimated by Department of General Planning
April 1980

	Land Area (Acres)	Jobs	Jobs/Acre
Sugar Processing	145	894	6.17
Pineapple & Other Food Processing	161	4,637	28.79
Misc. Manufacturing	1,166	11,250	9.65
Construction	436	23,300	53.50
Transportation & Warehousing	2,235	13,282	5.94
	4,143	53,363	12.88

* *Development Plan Land Use Analysis* Department of General Planning, April 1980

Demand for industrial acreage was estimated for Oahu using Department of Business and Economic Development M-K projections for job growth until the year 2010 times the jobs/acre factor. Using this rationale, total Oahu demand due to job growth is estimated at 603 acres (See *Figure 4*).

To arrive at the proportion of acres demanded for industrial growth in Ewa until 2010, the relative population growth factor for Ewa (55%, as derived in *Figure 5*) was applied to the Oahu acreage. The result is demand for 332/acres of industrial (I-2 and I-3) land in Ewa, 1990-2010. (See *Figure 4*)

This process is illustrated on the following page.

FIGURE 4
Demand for Industrial Acreage
(Based on Job Growth DBED Series M-K Long Range Projections)
Total Oahu
1990 - 2010

	Jobs 1990 [1]	Jobs 2010 [1]	New Jobs Created	Jobs Per Acre [2]	Total Acres
Miscellaneous Manufacturing	16,600	17,800	1,200	9.65	124
Construction	17,200	20,300	3,100	53.50	58
Transportation & Warehousing[3]	20,900	23,400	2,500	5.94	421
	54,700	61,500	6,800		
		DEMAND IN ACRES - Total Oahu:			603
		Allocation to Ewa [4]			55%
		DEMAND IN ACRES - EWA			332

[1] Source: *Population and Economic Projections for the State of Hawaii to 2010*, (DBED), Series M-K, November 1988, page 10.

[2] Source: *Development Plan Land Use Analysis*, Department of General Planning, April 1980

[3] Source: Personal Communication Dr Tu Pham DBED allocation of jobs within Transportation Comm Util October 1989.

[4] Source: *General Plan*, Oahu Resident Population (87,700 out of 161,000 or 55 per cent of total Oahu resident population growth will be in Ewa by year 2010)

Ewa Demand. The City and County of Honolulu's General Plan and Policy reflect a commitment to ensuring a major population shift westward by the year 2010. Over the next 20 years, Ewa is expected to grow almost three times faster than the PUC, with more than half of the resident population growth occurring in the Ewa DP area. See *Figure 5* below.

Figure 5
Oahu Resident Population Growth
Relative Share by DP Area

Development Plan Area	Resident Population (12/88)[1]	Resident Population (2010)[2]	Change	% Total
PUC	443,200	474,300	31,100	
Ewa	38,700	119,900	87,700	55%
Central	127,700	156,450	28,750	
East Honolulu	48,200	55,500	7,300	
Koolaupoko	119,100	115,900	(3,200)	
Koolauloa	12,400	13,500	1,100	
North Shore	14,000	17,000	3,000	
Waianae	35,200	40,000	4,800	

1 **Source:** Department of General Planning Estimates, December 1988.

2 **Source:** *General Plan* (coincides with *Population Projections for the State of Hawaii to 2010,* (DBED), Series M-K)

2. DEMAND FACTOR TWO: Relocation Of Industrial (I-2) Activities From The Primary Urban Center

Oahu Demand - The fairly new Industrial Mixed Use (IMX) designation was initially used by the City and County of Honolulu to acknowledge already-existing situations in which commercial activities were occupying industrially-designated lands. This was true of both the Iwilei and Airport areas. Additional requests for *Development Plan* Amendments are being considered by the City and County of Honolulu — such as Gentry Business Park in Central Oahu — and more are expected over time.

Assuming that the past is a guide, the future mix of land uses in IMX areas should become more heavily weighted in favor of non-industrial uses. The rationale for this is threefold: first, IMX areas are, by definition, areas in transition from primarily industrial use to commercial and residential use; second, a number of uses previously permitted in industrial districts were eliminated by the City's 1986 Land Use Ordinance; third, a recognition of the change in the state and county economies with much greater growth anticipated in the service sectors of the economy. While it is difficult to estimate the exact impact of IMX on industrial land use on Oahu over time, it is certain that IMX will affect the distribution of industrial activity throughout the island.

Relocation of industrial businesses from IMX areas is estimated at 11.1 acres per year, for a total of 222 acres over 20 years. See *Figure 6*.

FIGURE 6
Impact of the IMX Designation on Demand for Industrial Land

KAKAAKO	Area in industrial use 1980	147.0 acres [1]
	Area in industrial use 2010	74.0 acres
	Relocation Demand	73.0 acres
	Annual Relocation (73/30)	**2.4 acres/year**
IWILEI KALIHI	Area designated in 1987	513.0 acres
	Annual Relocation (1%)	**5.1 acres/year**
AIRPORT	Area designated in 1989	57.0 acres
	Annual Relocation (1%)	**0.6 acres/year**
GENTRY WAIPIO	Area proposed in 1988	120.0 acres
	Reduction in area	60.0 acres
	Annual Relocation (60/20)	**3.0 acres/year**
	Total Annual Relocation Industrial Use (Oahu)	**11.1 acres/year**
	Total 1990 - 2010 (11.1 X 20)	**222.0 acres**

1 DGP *Industrial Land Needs on Oahu*, April 1983 (Land Use under control of the Hawaii Community Development Authority)

2 Annual reduction is Consultant's estimate

Ewa Demand - Allocation of relocation from the PUC expected in Ewa is based on:

- The inability of the PUC to absorb relocation of industrial activities due to saturation
- Vacant land available outside of the PUC (specifically Ewa, Central and Koolaupoko areas)
- Demand for a larger share of industrial jobs based on population growth.

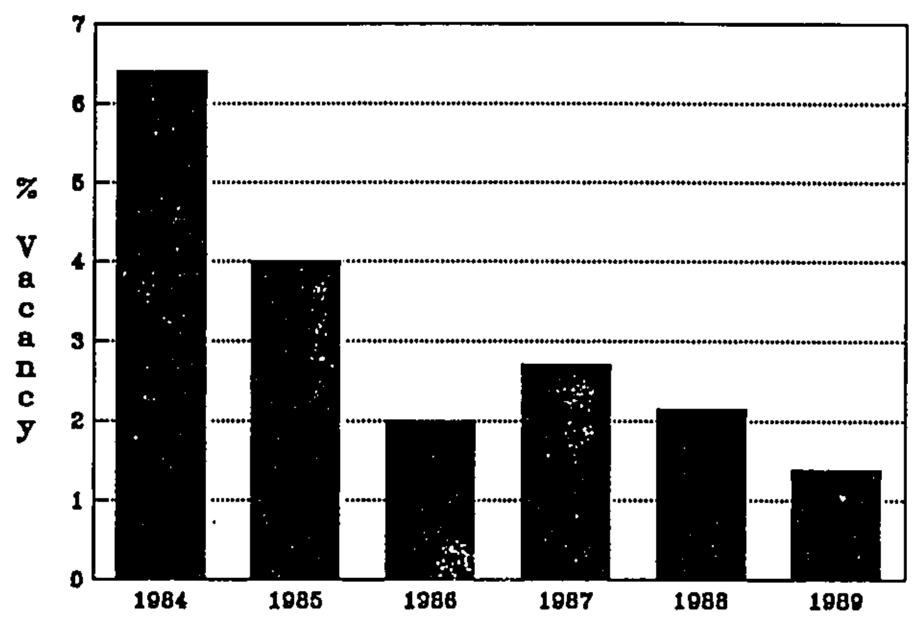
Demand for land to relocate industrial activities from the PUC to Ewa is estimated at approximately 122 or 55% of 222 acres (derived in *Figure 6*) acres over the 20-year planning period. The same percent (55%) used to allocate demand due to growth in jobs was used to allocate relocating industrial activities.

3. **DEMAND FACTOR THREE: Need for Vacant I-2 Land**

Oahu Demand - Good planning indicates the need for a certain amount of vacant land which is ready for industrial development. The ideal industrial vacancy rate is 10%, according to the real estate firm of Grubb and Ellis, who prepares annual *Real Estate Updates* for major urban areas nationwide. However, in the *National Real Estate Investor* in September 1989, an article entitled "Real Estate in the 1990's" stated that industrial vacancy nationally had reached a new low of 7%.

In contrast to the new national low of 7%, in mid-1989 a vacancy of 1.38% exists for industrial space on Oahu, despite the addition of almost one million square feet of new industrial space. The trend in Oahu industrial vacancy in the past years is illustrated below (*Figure 7*).

FIGURE 7
Oahu Industrial Vacancy Rates
(Square Feet of Space)



Source: Grubb and Ellis *Real Estate Updates*, 1984-1989

Ideal Industrial Vacancy on Oahu. Even considering the compact and land-poor nature of the Oahu market, good planning would indicate a minimum of 5% vacancy, with a more desirable goal being approximately 7.5%. To arrive at an estimate of desirable vacant industrial acreage, total Oahu I-2 acreage (5732 acres, according to the Department of General Planning estimates as of December 1988) was multiplied by a mid-range vacancy factor of 7.5%, to arrive at acres.

Ewa Demand. Allocation of Oahu vacant industrial acreage to Ewa was based on the following assumptions:

- The Primary Urban Center (PUC) is currently saturated for industrial use and has a limited potential for growth.
- The demand for vacant land will therefore be primarily in other Development Plan areas.

- The proportion of the desirable (7.5%) vacant industrial acreage allocated to Ewa is equivalent to the proportion of vacant I-2 land in that DP area.

FIGURE 8
Vacant Industrial (I-2) Land on Oahu

Development Plan Area	I-2	
PUC	116	
Ewa	568	(65%)
Central	157	
North Shore	15	
Waianae	13	
TOTAL	869	

Source: Department of General Planning

Demand for Industrial (I-2) vacant land in Ewa will be 65% of the total need for Oahu vacant acreage (429.9), or 279.4 acres. This figure is conservative based on the assumption that the PUC will not be a viable source of vacant land over the next twenty years and that the amount of vacant I-2 land existing as of 12/88 is indicative of the ability of DP areas to provide additional land for industrial use in the future.

B. Summary of Demand for (I-2) Land at Ewa

Demand for Ewa is shown in *Figure 9.*

Allocation of Ewa Demand between I-2 and I-3 - The Ewa acreage demand due to industrial job growth of 332 acres is an aggregate number that includes both Industrial (I-2) and Waterfront Industrial (I-3) jobs. Therefore an allocation between these designations was necessary to complete this analysis of demand for I-2 land. The allocation between I-2 and I-3 was based on the relative proportion of I-2 Land and I-3 Land on Oahu. (Only I-3 Lands surrounding Honolulu Harbor were included as they are the only developed I-3 Lands.)

Ten percent of total jobs were allocated to I-3 based on the ratio of I-2 Land to I-3 Land at Honolulu Harbor (570 (I-3) / 5,700 (I-2)). Since Barbers Point Harbor is the only alternate commercial harbor, the I-3 generated was allocated all to Ewa.

Figure 9
Total Demand for I-2 Industrial Land
Job Growth, Relocation, Vacant Land @ 7.5%
Total Oahu/Ewa
1990-2010
October 1989

DEMAND SOURCE	OAHU	EWA
Job Growth	543 [1]	271 [1]
Relocation	222	122
Vacant Land	429	278
	1,194	672

[1] Assumes 10% of Oahu allocated to I-3 and all of I-3 land assumed to be in Ewa

C. Supply Of Vacant Industrial I-2 Land At Ewa

Based on the Department of General Planning estimates of I-2 land inventory, as of December 1988 the Ewa DP area contained 568 acres of vacant I-2 land. *Figure 10* below identifies the necessary adjustments to reflect the current status of the inventory.

The primary adjustment in the availability of vacant land in Ewa is the changes in inventory at the James Campbell Industrial Park where 253 acres are shown as vacant. Major changes include the following:

1. Ninety-four acres of land at JCIP is controlled by an investor group. Managers of the property, John Andersen and Warren Haight, stated that approximately 30 acres are committed to AES Hawaii to develop a power plant. The plant will supply purchase power to HECO, the local utility, under an agreement recently approved by the Public Utilities Commission and is expected to be under construction in the near future. The remaining 64 acres have been split into two subdivisions of seven lots each. Processing of the first subdivisions has begun, the second subdivision requires an SMA review. Processing of the SMA is scheduled in the near future. According to Andersen and Haight, they have had strong interest in the

lots from both short and long term tenants and are projecting total absorption within three to five years.

2. Seventy-two (72) acres for Pacific Resources, Inc PRI refinery expansion.

3. Fifteen (15) acres for Trans Pacific Hawaii slated for multi-tenant warehouse operation with a construction start in 1989.

4. The remainder of the acreage within the existing JCIP is expected to be committed prior to the end of 1990.

Other changes to supply are identified in *Figure 10* and explained by appropriate footnotes.

FIGURE 10
Supply of I-2 Zoned Land December 1988 (DGP Files)
Total Oahu/Ewa
And Adjustments thru 1990
October 1989

	OAHU	EWA
Existing I-2	869	568
Adjustments:		
Deletions		
JCIP [1]	253	253
Halawa Ind. [2]	20	
Central Ind. Park [3]	15	
Mililani Tech Park [4]	100	
	388	253
Additions		
Gentry Ewa [5]	30	30
Gentry Waiawa [5]	70	
Servco [5]	15	
	115	30
Total Adjustments	(273)	(223)
Total Potential Supply	596	345

1 - Lands Within Existing JCIP Committed to Specific Developments in the Near Future

2 - Halawa Industrial Park containing 43 acres completed in 1989, all lots sold est. 50% buildout by 1990.

3 - Central Industrial Park 15 acre site acquired by Crazy Shirts for manufacturing facility.

4 - Mililani High Tech Park - Approval Ordinance incorporates restrictions preventing non high tech uses.

5 - Development Plan Amendments approved for Industrial after 12/88

Based on information developed in *Figure 9* and *10*, the supply/demand comparison for Ewa I-2 lands shows a short fall of 597 acres on Oahu and 327 acres in Ewa by 2010 (see *Figure 11*).

FIGURE 11
Total Demand and Supply
Oahu/Ewa
1990-2010
October 1989

	OAHU	EWA
Total Demand[1]	1,194	672
Total Supply[2]	596	345
Excess/(Shortfall)	(597)	(327)

1. *Figure 9*
2. *Figure 10*

E. Proposed Land Uses For Redesignated Ewa I-2 Lands

The character of Kapolei Business-Industrial Park will be complementary as opposed to similar to the existing Campbell Industrial Park. This is due to a number of factors:

- The need for services anticipated for the fast-paced population growth in Ewa (a minimum of 5% per year)
- The ability of current heavy industrial land users to meet future needs through existing JCIP industrial parcels
- The trends already established in newer industrial parks on Oahu (primarily light industry and services)

Projected land uses for I-2 lands at Kapolei Business-Industrial Park include:

- *Light manufacturing and warehousing* in proportions similar to other industrial parks on Oahu
- *Service businesses* supporting the population in Ewa

- *Innovative land uses* within the current *Land Use Ordinance* parameters for I-2, including:

  Multi-franchise auto dealerships

  Car service centers

  Auto storage

  Self-storage (mini-storage facilities for individuals)

The "innovative" land uses proposed above are discussed below.

Multi-Franchise Auto Dealerships - An early trend in the increasingly tight industrial land market on Oahu was the displacement of car service facilities and auto dealerships from Primary Urban Center locations such as Kakaako and the Kapiolani corridor. This trend was spotted as early as 1983 by the City and County of Honolulu in its study entitled *Industrial Land Needs on Oahu*.

In the past, the west Oahu area could not have supported successful auto dealerships and service establishments due to the lack of a critical mass of population and economic development.

However, the nationwide trend now is toward the "multi-franchise" auto mall concept in which many makes of automobile are marketed from one mega-lot. Although this is a novel concept for Oahu, experience on the Mainland suggests that the first group of consolidated dealerships in any metropolitan area has a distinct competitive advantage.

Auto malls are generally comprised of more than three auto lines in a single facility. Economies of scale are realized by sharing financing, insurance and service facilities. This arrangement has many advantages.

Car buyers enjoy one-stop comparison and "destination" shopping as opposed to travelling from one car lot to another.

Neighbors of auto malls are enthusiastic because they are environmentally sensitive and have the advantages of planned development, such as attractive landscaping and security.

Auto manufacturers like auto malls because of the restrictive nature of the land use and prospects for maintaining market presence in a high-traffic area.

Car Service Centers - Specialty franchise shops control about half of the auto care market nationally, according to an April 1989 article in *Skylines* magazine. A car service center is a form of industrial subdivision — essentially a take-off on the strip shopping center concept. In this sort of industrial development, a variety of auto service facilities cluster into one development to provide synergistic auto-related services such as:

- Repair and body work
- Auto accessories, such as stereos or alarm systems
- Auto parts
- Mufflers
- Tune-ups
- Lubrication

This type of development would be complementary to the potential auto mall concept which is also a viable land use for I-2 land in Ewa.

Auto Storage - Honolulu Harbor facilities for auto storage are extremely tight. Moving a portion of this land-intensive requirement to Kapolei Business-Industrial Park would be complementary to the auto sales and service complex concept discussed above. It would also free the Honolulu waterfront of some of its present congestion.

Self- (or "Mini") Storage Facilities - Every three years, half of the families in the U.S. move. Retailers consistently look for affordable storage facilities for records and inventory. Thus mini-storage is another viable alternative for I-2 acreage at the proposed Kapolei Business-Industrial Park. This is a typical service business responding to the needs of a nearby population base.

An advantage to developers of self storage facilities include making use of odd-shaped parcels. This is already a proven concept in the City and County of Honolulu — self-storage facilities are located under H-1 Freeway in Makiki.

VI. BACKGROUND ON DEMAND FOR WATERFRONT INDUSTRIAL (I-3) LAND

This section includes discussion of:

- Public policy regarding Waterfront Industrial (I-3) land use on Oahu
- The role of the *1989 Honolulu Waterfront Master Plan* on future demand for I-3 land at Barbers Point Harbor

Public Policy - The City and County of Honolulu and the State of Hawaii have long been committed to development of alternative port facilities on Oahu at Barbers Point Harbor as an integral part of plans for the second city.

In the *Development Plan*, the City and County has stipulated the following policies:

> "Use the transportation and utilities systems as a means of guiding growth and the pattern of land use on Oahu." (*Transportation and Utilities*, Objective D, Policy 2)
>
> "Encourage the continuing development of Barbers Point Harbor as a major industrial center." (*Physical Development and Urban Design*, Objective C, Policy 3)
>
> "Facilitate the development of a second deep water harbor to relieve congestion in Honolulu Harbor." (*Transportation and Utilities*, Objective A, Policy 13)

State support has taken the form of authorization of funds for the incremental development of shoreside facilities. Although state plan objectives and policies are not specific, they support county development plans. State policies relevant to the development of the second city at Ewa include:

> "Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans."
>
> "Encourage flexibility in the design and development of facility systems to promote prudent use of resources and Accommodate changing public demands and priorities."

1989 Honolulu Waterfront Master Plan - The *1989 Honolulu Waterfront Master Plan* makes the following statements about the critical nature of the City and County of Honolulu's waterfront resources:

> No state is as dependent on ocean surface transportation as Hawaii, and there are no other economic transportation alternatives for its economic well-being.
>
> Approximately 80 percent of the goods needed to support the Hawaii economy are imported, and 98% of these imported goods are delivered by ship into the state's port system. Exports, likewise, are transported almost entirely by surface vessels. (pages 3-11 and 3-12)

The purpose of this master planning effort for the waterfront areas of Honolulu was to develop a "comprehensive and integrated" view of Honolulu's waterfront resource.

The *Honolulu Waterfront Master Plan* is comprised of both short-term and long-term scenarios. Both scenarios address the waterfront resource at Barbers Point Harbor.

Short-Term

Plans call for "completion of the 1,600 feet of wharf and 30 acres of backland currently under construction at Barbers Point, and the provision of facilities to handle a combination of cargoes, principally neo-bulk, dry bulk and liquid bulk.

"In addition, *if further technical and economic studies indicate it is in the State's best interests to provide container facilities at the Barbers Point Harbor, then improvements to permit safe navigation of containerized cargo ships and other vessels with loaded draft in excess of 34 feet should be implemented.*" (page 3-30, emphasis added)

Long-Term

"The [master plan] investigation presented a series of long-term options which must be considered by policy makers over the coming years such as... *capital improvements to expand existing harbor facilities within Honolulu Harbor, on the neighbor islands and/or Barbers Point* . . . " (Executive Summary, emphasis added)

At Barbers Point, long-term plans call for "possible construction of a new slip with two or four 800-foot cargo berths in the Barbers Point Harbor mauka of the existing basin along with up to 120 acres of backland." (page 3-35)

VII. INDUSTRIAL I-3

A. Projected Demand for I-3 Lands at Ewa

Key sources of future demand for I-3 lands in Ewa include:

1. Major changes in the commercial environment in west Oahu due to the implementation of the Ewa Master Plan
2. Displacement due to redevelopment of the Honolulu waterfront
   - Displacement of harbor-related activities
   - Kapalama purchase assumption
3. Saturation of Honolulu Harbor I-3 lands
4. Pent-up demand for Barbers Point Harbor
5. Growth of Foreign Trade Zone activity
6. Need for vacant I-3 lands for future development

NOTE: The analysis of demand for I-3 lands was performed on an Ewa basis (rather than the allocation methodology above used for I-2 demand) because of the unlikelihood of demand for Waterfront Industrial land being met outside of Barbers Point Harbor.

**1. DEMAND FACTOR ONE:
Impact of Major Changes in
the Ewa Commercial Environment**

The tripling of population in Ewa expected by 2010 will result in major opportunities for business activity at Barbers Point Harbor. I-3 lands will be in demand in response to the job growth associated with population growth, similarly to I-2 lands.

Allocation of the portion of job growth anticipated for I-3 land is based on ten percent of the total new industrial jobs that will be directed to I-3 lands. Total demand is 60 acres.

**2. DEMAND FACTOR TWO:
Displacement Due To
Redevelopment Of The Honolulu Waterfront**

The *1989 Waterfront Master Plan* emphasizes the importance of creating recreational, commercial, cultural and residential opportunities in addition to the traditional maritime industrial uses of the Honolulu waterfront.

Such non-maritime activities, while critical to the integrated waterfront development plan, are expected to displace certain Primary Urban Center harbor-related activities including:

- Major container operations;
- Foreign Trade Zone activities at Pier 2; and
- Food distribution activities on the Kakaako peninsula.

Relocation is primarily targeted for the area known as Kapalama Military Reservation, which is currently owned by the federal government. Relocation to Kapalama is wholly contingent on successful and timely purchase of these lands by the State of Hawaii. The *1989 Waterfront Master Plan* states:

> "Further utilization of this [Kapalama Military Reservation] area for expanded container operations, possibly in the 5- to 10-year short-term timeframe, make the purchase of this property *mandatory* at this time." [page 3-27, emphasis added]

Good planning would indicate the need for a contingency plan for this planned displacement, given the "mandatory" nature of obtaining suitable lands for relocation. With the lack of guarantees that the purchase of Kapalama lands will be successfully accomplished to meet short-term (5-10) year master plans, proposed I-3 lands at Kapolei Business-Industrial Park would provide a feasible area for at least some of the activities planned for relocation. Demand from this source could approximate the 70-90 acres to be purchased at Kapalama military reservation.

3. **DEMAND FACTOR THREE:**
   Saturation Of Honolulu Harbor I-3 Lands

A study conducted for The Estate of James Campbell in 1987 estimated a theoretical level of saturation of Honolulu Harbor maritime facilities by 1995. If this proves true, the study contends that at least one container carrier will have to establish operations at Barbers Point Harbor to satisfy market demand.

Further, one of the long-range Waterfront Master Plan intentions is to possibly provide two to four 800-foot cargo berths at Barbers Point Harbor. Additional displaced container operations could be located at Kapolei Business-Industrial Park to support traffic on these additional berths. Potential I-3 acreage is 120 acres.

4. **DEMAND FACTOR FOUR:**
   Pent-up Demand For Barbers Point Harbor

This potential demand includes the following potential opportunities for Barbers Point Harbor usage:

- Inbound containers destined for locations in closer proximity to Barbers Point Harbor than Honolulu Harbor
- Dry bulk importers at existing James Campbell Industrial Park
  - Mainland barge operators
  - Contract carriers
- Foreign automobile carriers
- Liquid bulk cargo, e.g. bunkering fuel barge
- Ship repair and dry docking

The Estate of James Campbell has been approached by a number of potential users. They believe pent up demand could be 50 to 60 acres.

5. **DEMAND FACTOR FIVE:**
   Growth in Foreign Trade Zone (FTZ) Activity

Two factors will contribute to demand for I-3 land to accommodate growth in Foreign Trade Zone (FTZ) activity at Barbers Point Harbor:

Passage Of The Omnibus Trade Bill In 1988 - This law changed the way the U.S. classifies its tariffs (they are now in line with Europe's and Japan's). The impact of this law on JCIP is that it increases the potential for manufacturing that may be conducted in a Foreign Trade Zone.

Planned Displacement Of Foreign Trade Zone Activity At Pier 2 In Honolulu Harbor - If the relocation of this FTZ activity cannot occur elsewhere in Honolulu Harbor, Barbers Point will be the contingency location.

Consultant estimates potential demand at 20 to 40 acres.

6. **DEMAND FACTOR SIX:**
   Need For Vacant I-3 Land For Future Use

The current supply of vacant I-3 land on Oahu, according to the Department of General Planning, indicates that nearly nine-tenths of vacant I-3 land on Oahu is at Barbers Point Harbor (172 out of 197 acres).

The vacancy demand calculation is based on 7.5% of 890 acres (total Oahu I-3 acreage including recent newly approved land owned by the Estate of James Campbell (64 acres) and application made by the State Department of Transportation, Harbors Division (83 acres)), or 67 acres. (For a discussion of the 7.5 vacancy rate see the demand analysis for I-2 land earlier in the Market Assessment.) Assuming saturation of Honolulu Harbor early in the 20-year planning horizon, it is assumed that 100% of this demand will fall upon Barbers Point Harbor, or the entire 67 acres.

B. Summary of Demand for I-3 Industrial Land

FIGURE 12
Estimated Demand
I-3 Industrial Land at Ewa
1990 to 2010
October 1989

	LOW[1]	MEDIUM[2]	HIGH[3]
Job Growth Allo. Oahu (10%) Ewa (20%)	60	60	
Displacement at Honolulu Harbor		70	90
Saturation at Honolulu Harbor	30	30	120
Pent up Demand at Barbers Point		30	50
Foreign Trade Zone		20	40
Vacancy	67	67	67
	97	277	427

1 - Assumes Waterfront revitalization not undertaken only 30 acre pier and backland under construction developed and minimum vacancy provided.

2 - The underlying assumption for I-3 demand at Barbers Point Harbor is lack of expansion area at Honolulu Harbor. The above estimates have been developed by the consultants based on information contained in the Honolulu Waterfront Master Plan and other reports which have been undertaken for the Estate of James Campbell. Acreages shown assume the waterfront revitalization is undertaken as discussed in the Waterfront Master Plan but that Kapalama Military Reservation acquisition cannot be completed or completed in a timely manner. In addition, demand for foreign trade zone acreages was estimated by the consultant.

3 - Assumes long range development beyond 2010.

A range of demand has been provided due to the uncertainty surrounding the implementation of the Waterfront Master Plan and its impact on demand at the Barbers Point Harbor.

C. Supply of Waterfront Industrial (I-3) Land at Ewa

The supply of I-3 land at Barbers Point Harbor is summarized in *Figure 13*.

FIGURE 13
Estimated Supply I-3 Lands at Ewa
1990-2010
October 1989

Existing Ewa I-3 Land	172
Additions:	
JCIP DP Approved 1989	64
State Land DP Applied for 1989	84
	148
Total I-3 Potential	320

D. SUPPLY/DEMAND ANALYSIS FOR I-3 LANDS IN EWA

Based on the analysis above, the supply/demand comparison for Ewa I-3 lands is as follows:

FIGURE 14
Estimated Surplus/Shortfall
I-3 Industrial at Ewa
1990-2010
October 1989

	LOW	MEDIUM	HIGH
Demand	97	277	427
Supply	320	320	320
Surplus/(Shortfall)	223	43	(107)

Although the evident supply of I-3 land at Barbers Point Harbor in 2010 is still sufficient with Low and Medium demand assumptions, good planning supports the proposed redesignation of 109.30 acres to I-3 in this DP Amendment based on these factors:

Barbers Point represents the only feasible back-up for Honolulu Harbor redevelopment and saturation. The *Development Plan* for Ewa should include ready availability of properly zoned I-3 land to support both City and County and State of Hawaii planning objectives.

Current plans call for possible expansion of the harbor basin or dredging of an additional slip which would require additional acreage. Reserving these I-3 lands at this time would assure availability of land for implementating such a program.

E. Proposed Land Uses For Redesignated Ewa I-3 Lands

It is anticipated that the uses of I-3 lands in Kapolei Business-Industrial Park will be similar to businesses within the proposed Kapolei Business-Industrial Park but with a harbor or water orientation.

Projected land uses for proposed I-3 lands in Ewa include:

- **Harbor-Support Activities.** As harbor use expands, so will the need for supportive industrial activities. The proposed I-3 land would also accommodate heavy industrial and light industrial needs.
- **Transportation.** Goods coming into the harbor will have to be moved to their destination markets.
- **Warehousing.** Storage of bulk and other cargo will be necessary.
- **Manufacturing.** It is anticipated that light manufacturing will take place on I-3 lands in Ewa. This will be encouraged by the favorable federal trade legislation described above.
- **Overflow Of Honolulu Harbor Activities.** With the implementation of the *1989 Honolulu Waterfront Master Plan*, three major activities are slated for relocation: container facilities, food processing now performed on the Kakaako peninsula, and Foreign Trade Zone activities conducted currently at Pier 2.
- **Car Storage.** Currently, significant acreage in the Honolulu Harbor area is encumbered for car storage. Barbers Point Harbor I-3 lands would more readily accommodate this sort of land-intensive use than the current location.

VIII. COMMERCIAL (B-2)

A. Demand For Commercial Land At Barbers Point Harbor

This request for a *Development Plan* amendment includes redesignation of 19.2 acres of land from agricultural to Commercial. It is evident that despite the relatively small acreage of this parcel, its strategic location near the mouth of Barbers Point Harbor and adjacent to the Ko Olina development lends significance to this request.

The consultants estimate approximately 15 acres of demand for this parcel by the year 2010, with development commencing in the 1995-2000 time frame. The chief sources of demand for this commercial parcel include:

- Location:
    - Proximity to the harbor
    - Proximity to Ko Olina development
- Need for existing JCIP and proposed Kapolei Business-Industrial Park tenants for supportive commercial space near their operations

B. Demand Analysis For Commercial Lands At Barbers Point Harbor

As stated above, the proposed commercial parcel is 19.2 acres at the mouth of Barbers Point Harbor. Based on its strategic location, the relatively small size of the parcel, and viable land uses discussed below, absorption of 15 acres is anticipated by 2010. This will result in approximately four additional acres available for further commercial development after 2010.

C. Proposed Land Uses For Redesignated Commercial Lands

The location of the commercial parcel will play a major role in future usage of the land. Likely uses include:

- Support of Waterfront Industrial (I-3) uses
- Potential for a harbor/marina-view retail and restaurant complex
- Service to the adjacent Ko Olina hotel and residential community

IX. ABSORPTION, EMPLOYMENT AND BUILDING SQUARE FOOTAGE

Figures 15 thru *22* contain the estimated absorption, employment and building square footages. Each individual figure contains assumptions appropriate to the figure. However, a brief overview is provided here.

A. Absorption

The absorption schedule provided shows total absorption between 1990 and 2010 based on the total uncommitted acreage within the James Campbell Industrial Park/Kapolei Business-Industrial Park complex. It also indicates the estimated absorption for the properties being proposed in this application. Absorptions from 2010 are provided as extrapolations, however, there are no supporting assumptions for absorptions after year 2010.

While the text of the report incorporates a demand for vacant acreage, for the purposes of actual absorption the vacant land has been excluded from the "absorption" schedule as it technically will not actually be absorbed during the specific time periods identified, but will be needed in order to insure availability and to discourage pricing spikes due to shortages of supply.

The following is a reconciliation of the acreages shown in the text and the acreages shown in the absorption figures.

Industrial (I-2)

Total Ewa demand for I-2 is estimated at 672 acres. Demand less demand for vacant space of 279 is 393 acres. Thirty of the acres of demand are assumed to be met at the Gentry Ewa project leaving Kapolei Business Industrial Park to absorb the remaining 363 acres.

Industrial (I-3)

Total Ewa demand for I-3 land assuming the mid-range estimate is 277 acres. Demand, less demand for vacant space of 67 acres is 210 acres. Assuming that the area is absorbed in the same ratio as the ultimate ownership of I-3 lands, then state lands would absorb approximately 60%, Cooke Inlet 13% and the Kapolei Business-Industrial Park 27% so approximately 57 acres.

Total absorption shown for Industrial thru 2010 is 420 acres.

B. Employment

The consultants have determined acreage demand based on the average industrial acreage demand used in the Department of General Planning's "Development Plan Land Use Analysis" Dated April 1980. However, when specifically identifying employment within a development plan area, a closer look at the assumptions are necessary in order to insure that the regional characteristics of the area and of the specific industrial uses attracted are not overlooked.

The consultants have described in the text why the Kapolei Business-Industrial Park will have characteristics more similar to urban industrial developments than the existing JCIP. However, the

Kapolei Business-Industrial Park also includes a commitment on the part of the Estate of James Campbell to provide areas within the amendment area to provide for heavy and waterfront industrial development. The most recent survey available indicates that employment within JCIP stands at about 3,000 persons. Assuming employment growth of 500 within the existing JCIP results in an employment rate below three persons per acre. Longer term the Estate of James Campbell expects these levels to be maintained. Thus for the areas within the Kapolei Business-Industrial Park which are expected to be reserved for heavy and waterfront industrial, employment levels of 3.5 persons per acre have been estimated. Areas within the Kapolei Business-Industrial Park which are expected to contain light industrial and service businesses, the employment rate is expected to approximated the average for Oahu industrial land (excluding sugar and pineapple production).

C. Building Square Footage

A range of floor area ratios of .3 to .4 have been used to determine building square footage. Only the areas scheduled for light industrial demand have been computed because of the lack of a standard for square footage in heavy and waterfront industrial acreages.

X. CONCLUSION

There is a demonstrated need for additional industrial land in the Ewa development plan area thru the year 2010. The proposed development plan amendment consisting of 533 acres of industrial land and 19 acres of support commercial will insure the availability of adequate industrial land for Oahu's vital industrial sector. Land for new businesses generated by the projected rapid population growth in the Ewa area as well as land for existing industrial businesses which are relocating from within the existing Primary Urban Center. Land is also being set aside to meet the projected needs of the Barbers Point Harbor, Oahu's only alternative commercial harbor. The Kapolei Business-Industrial Park proposal anticipates and responds to long-term needs for an adequate supply of industrial land of various types as well as changing use patterns. In addition, it proposes to do so in a manner consistent with responsible planning with care taken to insure the most compatible relationships of uses within the Kapolei Business-Industrial Park and with surrounding land uses.

FIGURE 15
JAMES CAMPBELL INDUSTRIAL PARK/KAPOLEI BUSINESS-INDUSTRIAL PARK
ACREAGE SUMMARY
OCTOBER 1989

	ACRES	ACRES	ACRES
Existing JCIP			
Developed (below Malakole)	1,366.00		
DP'd but Undeveloped			
I-2	315.06	315.06	
I-3	63.57	63.57	
Proposed Expansion			
I-2	423.59	423.59	423.59
I-3	109.30	109.30	109.30
Commercial	19.20	19.20	19.20
Exist. & Planned JCIP/Kapolei Bus. Park	2,296.72		
Total Approved and Undeveloped Area		930.72	
Total Area Proposed for Amendment			552.09

PERCENTAGE ALLOCATION
INDUSTRIAL ACREAGE
ABSORPTION ALLOCATION

PROPOSED FOR AMENDMENT	532.89	(1) 58.46%
TOTAL	911.52	

(1) The percentage allocation has been developed to allocate industrial acreage absorption, employment and building square footage development between areas proposed for amendment and areas approved for industrial use but currently undeveloped. It is assumed that planning and demand considerations will dictate the actual physical phasing of the development in a manner unrelated to the existing approved and proposed boundaries.

FIGURE 16
KAPOLEI BUSINESS–INDUSTRIAL PARK
ABSORPTION RATE
DP PROPOSAL

OCTOBER 1989

LAND USE	1990 TO 1995	1995 TO 2000	2000 TO 2005	2005 TO 2010	TOTAL 1990 TO 2010	2010 TO 2015	2015 TO 2020	2020 TO 2025	2025 TO 2030	2030 TO 2035	TOTAL 1990 TO 2035
	OFFICIAL DEVELOPMENT PLAN PLANNING PERIOD					OUTSIDE OF OFFICIAL DEVELOPMENT PLAN PLANNING PERIOD					
INDUSTRIAL (Includes proposed & existing inventory)											
HEAVY/WATERFRONT	40.00	40.00	40.00	40.00	160.00	40.00	40.00	40.00	20.00		300.00
LIGHT	35.00	50.00	75.00	100.00	260.00	100.00	100.00	100.00	51.50		611.50
	75.00	90.00	115.00	140.00	420.00	140.00	140.00	140.00	71.50	0.00	911.50
COMMERCIAL	0.00	5.00	5.00	5.00	15.00	4.20					19.20
TOTAL ABSORPTION	75.00	95.00	120.00	145.00	435.00	144.20	140.00	140.00	71.50	0.00	930.70
CUM. TOTAL IND. ABSORPTIO	75.00	165.00	280.00	420.00	840.00	560.00	700.00	840.00	911.50	911.50	
ABSORPTION IN AMENDMENT AREA											
INDUSTRIAL	43.85	52.62	67.23	81.85	245.54	81.85	81.85	81.85	41.80	0.00	532.88
COMMERCIAL	0.00	5.00	5.00	5.00	15.00	4.20	0.00	0.00	0.00	0.00	19.20
TOTAL	43.85	57.62	72.23	86.85	260.54	86.05	81.85	81.85	41.80	0.00	552.08
CUMMULATIVE ABSORPTION AMENDMENT AREA	43.85	101.46	173.69	260.54		346.59	428.43	510.28	552.08	552.08	

FIGURE 17
KAPOLEI BUSINESS-INDUSTRIAL PARK
EMPLOYMENT AND
FLOOR AREA RATIO ASSUMPTIONS
OCTOBER 1989

LAND USE	EMPLOYMENT	BUILDING DENSITY LOWER RANGE	HIGHER RANGE
INDUSTRIAL			
HEAVY/WATERFRONT	3.50 ACRE	N/A	N/A
LIGHT	12.46 ACRE	30%	40%
COMMERCIAL	30 ACRE	30% 30%	40% 40%

NOTE: For purposes of this analysis the number of jobs generated in industrial areas is expected to be 3.5 jobs per acre in heavy industrial areas and 12.46 jobs per acre in the remaining area. The selection of these ratios is based on the existing and expected jobs per acre in the developed portion of JCIP. The 12.46 jobs per acre is based on the average of industrial jobs per acre estimated by the city in 1975 (excluding sugar & pine) The consultants anticipate that the urbanization of the Ewa area over time will result in longer term park development similar to islandwide norms.

Figure 18
Employment per Acre 1975
Industrial Land
Estimated by Department of General Planning
April 1980

	Land Area (acres)	Jobs	Jobs/Acre
Sugar Processing	144.778	894	6.17
Pineapple & Other Food Processing	161.066	4,637	28.79
Misc. Manufacturing	1,166.264	11,250	9.65
Construction	435.533	23,300	53.50
Transportation & Warehousing	2,235.543	13,282	5.94
	4,143.184	53,363	12.88

* "Development Plan Land Use Analysis" Department of General Planning, April 1980

Figure 19
Employment per Acre 1975
Industrial Land
Estimated by Department of General Planning
(Modified to Exclude Sugar/Pinapple/Other Food Processing)
April 1980

	Land Area (acres)	Jobs	Jobs/Acre
Sugar Processing			
Pineapple & Other Food Processing			
Misc. Manufacturing	1,166,264	11,250	9.65
Construction	435.533	23,300	53.50
Transportation & Warehousing	2,235.543	13,282	5.94
	3,837.340	47,832	12.46

* "Development Plan Land Use Analysis" Department of General Planning, April 1980

FIGURE 20
KAPOLEI BUSINESS-INDUSTRIAL PARK
EMPLOYMENT CREATION
DP PROPOSAL

OCTOBER 1989

	OFFICIAL DEVELOPMENT PLAN PLANNING PERIOD					OUTSIDE OF OFFICIAL DEVELOPMENT PLAN PLANNING PERIOD					
LAND USE	1990 TO 1995	1995 TO 2000	2000 TO 2005	2005 TO 2010	TOTAL 1990 TO 2010	2010 TO 2015	2015 TO 2020	2020 TO 2025	2025 TO 2030	2030 TO 2035	TOTAL 1990 TO 2035
INDUSTRIAL											
HEAVY/WATERFRONT	140	140	140	140	560	140	140	140	70	0	1,050
LIGHT	436	623	935	1,246	3,241	1,246	1,246	1,246	642	0	7,622
	576	763	1,075	1,386	3,801	1,386	1,386	1,386	712	0	8,672
JCIP (BELOW MALAKOLE)(1)	125	125	125	125	500						500
COMMERCIAL	0	150	150	150	450	126	0	0	0	0	576
	701	1,038	1,350	1,661	4,751	1,512	1,386	1,386	712	0	9,748
CUMMULATIVE JOB CREATIO	701	1,740	3,089	4,751		6,263	7,650	9,036	9,748	9,748	
JOB CREATION IN THE AMENDMENT AREA											
INDUSTRIAL	337	446	628	811	2,222	811	811	811	416	0	5,070
COMMERCIAL	0	150	150	150	450	126	0	0	0		576
TOTAL	337	596	778	961	2,672	937	811	811	416	0	5,646
CUMM IN AMENDMENT AREA	337	933	1,711	2,672		3,609	4,419	5,230	5,646	5,646	

(1) Estate of James Campbell Estimates 500 additional jobs in existing JCIP in the future.

FIGURE 21

KAPOLEI BUSINESS-INDUSTRIAL PARK

BUILDING SQUARE FOOTAGE (LOWER RANGE)

DP PROPOSAL

OCTOBER 1989

LAND USE	1990 TO 1995	1995 TO 2000	2000 TO 2005	2005 TO 2010	1990 TO 2010	2010 TO 2015	2015 TO 2020	2020 TO 2025	2025 TO 2030	2030 TO 2035	TOTAL 1990 TO 2035
	OFFICIAL DEVELOPMENT PLAN PLANNING PERIOD					OUTSIDE OF OFFICIAL DEVELOPMENT PLAN PLANNING PERIOD					
INDUSTRIAL											
HEAVY/WATERFRONT	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
LIGHT	457,380	653,400	980,100	1,306,800	3,397,680	1,306,800	1,306,800	1,306,800	673,002	0	7,991,082
	457,380	653,400	980,100	1,306,800	3,397,680	1,306,800	1,306,800	1,306,800	673,002	0	7,991,082
COMMERCIAL	0	65,340	65,340	65,340	196,020	54,886	0	0	0	0	250,906
TOTAL SQUARE FOOTAGE	457,380	718,740	1,045,440	1,372,140	3,593,700	1,361,686	1,306,800	1,306,800	673,002	0	8,241,988
CUMM. SQ. FT.	457,380	1,176,120	2,221,560	3,593,700		4,955,386	6,262,186	7,568,986	8,241,988	8,241,988	
SQUARE FOOTAGE IN AMENDMENT AREA											
INDUSTRIAL	267,392	381,989	572,983	763,977	1,986,341	763,977	763,977	763,977	393,448	0	4,671,722
COMMERCIAL	0	65,340	65,340	65,340	196,020	54,886	0	0	0	0	250,906
TOTAL	267,392	447,329	638,323	829,317	2,182,361	818,863	763,977	763,977	393,448	0	4,922,627
CUMM. SQ. FT. IN AMENDMENT AREA	267,392	714,721	1,353,044	2,182,361		3,001,224	3,765,202	4,529,179	4,922,627	4,922,627	

FIGURE 22
KAPOLEI BUSINESS-INDUSTRIAL PARK
BUILDING SQUARE FOOTAGE (HIGHER RANGE)
DP PROPOSAL

OCTOBER 1989

LAND USE	1990 TO 1995	1995 TO 2000	2000 TO 2005	2005 TO 2010	1990 TO 2010	2010 TO 2015	2015 TO 2020	2020 TO 2025	2025 TO 2030	2030 TO 2035	TOTAL 1990 TO 2035
	OFFICIAL DEVELOPMENT PLAN PLANNING PERIOD					OUTSIDE OF OFFICIAL DEVELOPMENT PLAN PLANNING PERIOD					
INDUSTRIAL											
HEAVY/WATERFRONT	N/A	N/A	N/A	N/A		N/A	N/A	N/A	N/A	N/A	N/A
LIGHT	609,840	871,200	1,306,800	1,742,400	4,530,240	1,742,400	1,742,400	1,742,400	897,336	0	10,654,776
	609,840	871,200	1,306,800	1,742,400	4,530,240	1,742,400	1,742,400	1,742,400	897,336	0	10,654,776
COMMERCIAL	0	87,120	87,120	87,120	261,360	73,181	0	0	0	0	334,541
	609,840	958,320	1,393,920	1,829,520	4,791,600	1,815,581	1,742,400	1,742,400	897,336	0	10,989,317
CUMM. SQ. FT.	609,840	1,568,160	2,962,080	4,791,600		6,607,181	8,349,581	10,091,981	10,989,317	10,989,317	
SQUARE FOOTAGE IN AMENDMENT AREA											
INDUSTRIAL	356,523	509,318	763,977	1,018,636	2,648,455	1,018,636	1,018,636	1,018,636	524,598	0	6,228,962
COMMERCIAL	0	87,120	87,120	87,120	261,360	73,181	0	0	0	0	334,541
TOTAL	356,523	596,438	851,097	1,105,756	2,909,815	1,091,817	1,018,636	1,018,636	524,598	0	6,563,503
CUMM. SQ. FT. IN AMENDMENT AREA	356,523	952,961	1,804,058	2,909,815		4,001,632	5,020,269	6,038,905	6,563,503	6,563,503	

JOHN ZAPOTOCKY, CONSULTANT
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JOHN ZAPOTOCKY, CONSULTANT, Honolulu, Hawaii **1985 - Present**

Principal. Independent consultant specializing in real estate related assignments. Services provided include financial analysis, market assessments, real estate related environmental assessments and environmental impact statements and specific research assignments. Assignments undertaken as the primary contractor, in partnership with other consultants and as a subcontractor. Representative clients and assignments during the past year include:

City Dept. of Housing & Community Development [2] .... Waiola Planned Community Market Assessment

Halekua Development Co. [1] .... Royal Kunia Phase II Market Assessment

West Beach Estates [2] .... Ko Olina Phase II Market Assessment

ANA Hotels Hawaii, Inc. [2] .... Makaha Expansion Market Assessment

VMS Realty Partners [1] .... Planned Community Economic Model

K. G. Hawaii. Inc. [1] ....Ko Olina Phase II Economic Model

Estate of James Campbell [2] ....Kahuku Master Plan Market Assessment

Hawaii States Properties [2] ....Makena Surf Expansion Market Assessment

[1] Prime Contractor
[2] Sub-Contractor

MOKULEIA HOMESTEADS, Honolulu, Hawaii **1979 - 1984**

General Manager. Managed development activities for the $80 million 3,000 acre proposed agricultural/residential community on the site of the former Dillingham Ranch in Mokuleia. Coordinated planners, engineers, attorneys and consultants to obtain infrastructure and subdivision approvals. Met and negotiated with government agencies and achieved approvals for a $5 million water system and a $4 million sewer system. Reviewed bids, selected contractors and administered contracts for drilling of three water wells with a total capacity of 4.5 million gallons per day. Prepared annual budgets for both development and operation activities. Other responsibilities included miscellaneous real estate transactions related to operations, i.e., pasture leases, polo field lease, and guesthouse rentals; and management responsibility for fifteen ranch employees.

WAILEA DEVELOPMENT COMPANY, Kihei, Maui **1975 - 1979**

Project Coordinator. Coordinated development of the Wailea Ekolu project, a $25 million 150-unit luxury condominium within the 1,200 acre Wailea Resort Community. Responsibilities included feasibility analysis, coordination of the design process, preparation of exhibits and communications for government approval authorities. Supervised preparation of sales and condominium documentation and participated in development of the marketing plan. Simultaneously worked on the Wailea Kai project, a $10 million 100-lot residential subdivision, and the Wailea Elua II project, a $20 million 66-unit luxury resort.

Financial Administrator. Supervised the preparation of annual and long-range plans and responsible for cash planning. Participated in the redesign of the accounting reports in order that they be more effective management tools. Supervised the day-to-day financial and accounting activities of the company.

Director of Planning and Budget Analysis. Prepared annual and long-range plans. Performed variance analysis on financial reports. Analyzed financial statements of prospective tenants for the Wailea Town Center, a 50,000 square foot commercial project.

KAISER AETNA (KACOR), Honolulu, Hawaii **1973 - 1975**

Manager, Administration & Contract Control. This position encompassed four primary areas of responsibilities: escrow, contract administration, architectural control and office management.

Manager, Hawaii Kai Golf Courses. Directly responsible for all planning and operations. Prepared operating and capital budgets. Directed operations through three department heads who in turn supervised forty persons. Responsible for developing and implementing the marketing program.

EDUCATION: College of Business Administration
University of Hawaii

1974: Postgraduated work in Finance
1973: M.B.A.
1969: B.A. in Economics

PROFESSIONAL AND VOLUNTEER ORGANIZATIONS:
Land Use Research Foundation
(Mokuleia Representative)
Hawaii Society of Corporate Planners
(President Fiscal Year 1983)
Kukui Plaza Owners Association
(Director)