DEPARTMENT OF GENERAL PLANNING
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RH/DGP 4/89-1253
89/E-2

May 4, 1989

Honorable Marvin T. Miura, Director
Office of Environmental Quality Control
State of Hawaii
465 South King Street, Room 104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Final Environmental Impact Statement (FEIS)
Ko Olina Phase II - West Beach Estates
Tax Map Key 9-1-15: por. of 4 and 18

We are notifying you of our acceptance of the above EIS as in fulfillment of the requirements of Chapter 343, HRS, and the EIS Rules.

There are a number of concerns that must be addressed prior to the subsequent zoning process.

These issues are discussed in the attached Acceptance Report. If there are any questions, please contact Randy Hara of my staff at 523-4483.

Sincerely,

Donald Clegg

DONALD A. CLEGG
Chief Planning Officer

DAC:js

Attachment

cc: Mr. Ernest M. Takahashi, Wilson Okamoto & Associates

DEPARTMENT OF GENERAL PLANNING (DGP)

ACCEPTANCE REPORT: CHAPTER 343, HRS
ENVIRONMENTAL IMPACT STATEMENT (EIS)
KO OLINA PHASE II
WEST BEACH ESTATES
EWA, OAHU, HAWAII
TAX MAP KEY 9-1-15: POR. 4 AND 18

A. Background

The master plan for Ko Olina Resort Phase II calls for the development of two 18-hole championship golf courses, commercial development on the eastern portion of the site, and relocation of the existing neighborhood park. The applicant has requested an amendment to the Ewa Development Plan for the following land use changes (quantities in acres):

	From	To	Net Change
Low-Density Apartment	118	0	-118
Medium-Density Apartment	57	0	-57
Parks and Recreation	166	333	+167
Commercial	30	38.5	+8.5
Public Facilities	0.5	0	-0.5
TOTAL	371.5	371.5	0

The DP amendment would provide for one additional golf course to help meet the demand for golf at the Ko Olina Resort and additional commercial acreage but would result in the loss of 3,510 housing units (1501 low density apartment and 2009 medium density apartment units). The development of the golf courses and retail/office complex is expected to generate 2,450 jobs. Retail space of approximately 200,000 square feet would be provided in Phase II to meet the needs of residents of the Ko Olina Resort Phase I. Office space of approximately 375,000 square feet is planned in Phase II to complement the developments at Kapolei Town Center.

The project is located south and east of the Honokai Hale/Nanakai Gardens Subdivision, south of Interstate H-1 and Farrington Highway, west of Kalaeloa Boulevard, and north of the abandoned railroad right-of-way.

The subject property is owned by the Estate of James Campbell. A major portion of the project area (298 acres) is presently under lease from Campbell Estate to the Oahu Sugar Company. A neighborhood park at the eastern end of the Honokai Hale Subdivision is currently under lease to the City Department of Parks and Recreation.

Through a development agreement executed with Campbell Estate, West Beach Estates intends to purchase and develop the entire Phase II site. Approximately 80% of the project site or 298 acres is presently in sugarcane cultivation by Oahu Sugar Company. The City's Kamokila Park occupies 5.8 acres of the site. The remaining land is vacant.

Development Timetable

Construction of infrastructure and amenities for the first phase of the Ko Olina Resort has been underway since 1987. These first phase improvements are expected to be completed in 1989. At the same time, efforts to market the hotel parcels to developer/operator teams are proceeding. One developer has been identified for the first hotel and discussions are ongoing with a number of other groups to develop the remainder of the sites. It is anticipated that several hotels will be under construction and/or opened by 1991/1992.

The Phase II development will commence upon the receipt of all necessary governmental permits and approvals. Construction of the golf courses and on- and off-site infrastructure is expected to start by mid-1990. Based on a one and one-half year construction timetable, the golf courses and required infrastructure would be completed by early 1992.

Development of the retail center consisting of 200,000 square feet is expected to occur in equal increments of 100,000 square feet in 1994 and 2000. The office complex is expected to be developed in increments of 40,000 square feet annually over a total period of 9.5 years.

Housing

The EIS indicated that, while the proposal would result in a reduced housing supply, recent DP amendments and the current Ewa population capacity would minimize the impacts. However, this circumstance does not minimize the City's policy to encourage the full development of a secondary urban center in the West Beach-Makakilo area. The proposed amendment would result in a loss of approximately 175 acres of land designated for Low Density Apartment and Medium Density Apartment uses or approximately 3,510 potential housing units. Amendments were approved in the 1988 DP Annual Review adding 2,500 potential units to the Ewa housing supply (2,000 units, Ewa Gentry; 500 units, Lusk's Kapolei Knolls). The Ewa population capacity would exceed the GP population distribution for Ewa for the year 2010, based on planned and recently adopted developments. According to the EIS, approval of these amendments and the estimated Ewa population capacity would minimize the effects of the reduction in units in the project area and Ewa.

Notwithstanding the EIS comments, the allocation of housing capacity through the DP is one measure to implement the City's GP population distribution policy. A reduced housing capacity in favor of golf course may militate against the development of a secondary urban center and a desired population distribution.

Water

Total water demand is estimated at 1.50 mgd (0.23 mgd potable water; 0.07 mgd non-potable water; 1.20 mgd golf course irrigation water). The applicant will prepare and submit a revision to the Ewa Water Master Plan for approval by the Board of Water Supply. Proposed water sources which are located in the Pearl Harbor Ground Water Control Area will require approval by the State Water Commission.

Mauka of the project site and along Farrington Highway, construction is underway for water transmission mains, reservoirs, and non-potable wells for the Ko Olina Resort. New potable water wells have been identified for development at the 440-foot elevation of upper Honouliuli, mauka of H-1 Freeway and west of Kunia Road. This is within the Pearl Harbor Ground Water Control Area. Once completed, all off-site water facilities will be dedicated to the Board of Water Supply.

Wastewater

The proposed development of Ko Olina Phase II will generate approximately 500,000 gallons per average day of wastewater. The wastewater will be conveyed via 33- and 36-inch trunk sewers located on the mauka side of the railroad right-of-way to the municipal Makakilo Interceptor Sewer, which carries the sewage to the Honouliuli Wastewater Treatment Plant. The Honouliuli Wastewater Treatment Plant will be expanded from 25 to 38 mgd, with completion scheduled for 1993.

The proposed on-site collection and conveyance sewer systems will be designed and constructed to City and County standards. A wastewater master plan will be prepared and submitted for City concurrence prior to grant of tentative subdivision approval.

Access and Traffic

Interstate H-1 and Farrington Highway are the major roadways carrying traffic through the area in the east-west direction. Kalaeloa Boulevard provides north-south access to and from Campbell Industrial Park. Interstate H-1 is a four-lane limited access highway which merges with Farrington Highway at the Palailai Interchange. Farrington Highway is a two-lane arterial roadway east of the Palailai Interchange and a four-lane arterial roadway west of the Palailai Interchange.

The proposed development is expected to generate approximately 1,462 vehicle trips per day in 1992 and 17,869 vehicle trips per day in 2005 when the project is completed.

Planned roadways include:

1) An extension, referred to as the Ko Olina Parkway which bisects Ko Olina Phase II, of the Kapolei Parkway from Kalaeloa Boulevard west to Farrington Highway.

2) Ko Olina Connector, a north-south connector road between Farrington Highway and Ko Olina Parkway.

3) Construction of Kapolei Boulevard, a north-south connector roadway located east of Kalaeloa Boulevard and connecting Farrington Highway and Kapolei Parkway.

4) Access driveways to the golf course and commercial development.

Based on the traffic capacity analysis, the intersections of the Ko Olina Parkway/driveway to Ko Olina commercial area, Ko Olina Parkway/Ko Olina Connector, and the Ko Olina Parkway/Kalaeloa Boulevard will operate at Level of Service D in 2005 based on estimated traffic volumes with proposed mitigation measures. The eastbound on-ramp and west bound off-ramp at the Palailai Interchange which will be congested by 2005 due to the volume of traffic generated by all future development in the area should be widened to two lanes.

Drainage

Existing off-site downstream drainage facilities are adequate for development of the project site. The unlined channel constructed along the Barbers Point boundary (south and east of the project site) and recently completed drainage improvements in Ko Olina Resort Phase I were designed and built to accommodate storm runoff from the project site as well as sub-tributary mauka areas.

In the project area south of Honokai Hale Subdivision, an existing grassed channel will be maintained through the planned park. Storm runoff from the commercial site and remainder lot will be collected on-site and piped to the proposed roadway system which will be connected to the existing three 48-inch culvert outlets at Kalaeloa Boulevard. For temporary erosion control, appropriately sized ponding basins will be constructed on-site for desilting storm runoff prior to discharge into the existing outlet channels. A drainage master plan will be prepared and submitted for City review at the appropriate stage of the development process.

Fertilizer and Pesticides

The consultant's findings on the potential impact of fertilizers and pesticides to be used on the proposed golf courses for Ko Olina Phase II indicate that development of the proposed golf courses and the associated use of chemical fertilizers and pesticides will not pose adverse environmental risks. The combination of soil properties (60" deep and moderate organic content), gently sloping topography, and a net evapotranspiration deficit suggests that there will be no recharge of the brackish groundwater from rainfall. Runoff should be minimal except during prolonged high intensity storms which are infrequent to the area.

The total amount of nitrogen used in sugarcane production is similar to that which would be used on the proposed golf courses. The presence of caprock between the proposed site and the Pearl Harbor aquifer will serve as an effective barrier between the brackish and potable groundwater sources. Therefore, the proposed conversion of land from sugarcane production to golf courses would cause no significant degradation of potable ground water quality.

The pesticides approved for use on golf courses are known to degrade relatively quickly. Although some are potential leachers or can otherwise move off-site, the specific site and environmental conditions will minimize movement. Avoidance of over-irrigation and the application of good management practices will further decrease the likelihood of vertical movement. Airborne drift can be controlled by using low pressure nozzles, lowering application booms, using drift control agents, selecting proper formulations, observing local weather conditions, and making applications under the direct supervision of certified or properly trained personnel.

Air Quality

Results of air pollution modeling indicated that the primary long-term air quality impact will result from increased carbon monoxide concentrations along roadways leading to and from the proposed development. State ambient air quality standards (AAQS) may be exceeded.

The long-term projected impacts of carbon monoxide emissions from vehicular traffic associated with the completed development assume that all of the mitigative measures suggested in the traffic impact study will be employed to move traffic efficiently through the project area. In addition, the results of this air quality modeling study assume that merge lanes will be provided both on Kalaeloa Boulevard and on Ko Olina Parkway to receive right turning vehicles from traffic heading westbound on Kapolei Parkway and southbound on Kalaeloa

Boulevard. A merge lane on Kalaeloa Boulevard near the H-1 eastbound off-ramp may also be necessary to receive traffic exiting from the freeway. The modeling results indicate that the heavy right turning traffic at these intersections must be kept moving to maintain the national AAQS for carbon monoxide.

Agricultural Land

An estimated 298 acres or 80 percent of the 372.6-acre site is currently in sugarcane production.

Some of the site and environmental factors which lessen the site's desirability for sugarcane production include: (1) somewhat lower quality of soils than for the average of the plantation, (2) higher irrigation requirements than for mauka lands, (3) greater distance from the mill than for most parcels, and (4) possible conflicts in burning and transporting sugarcane associated with the surrounding urban areas.

The EIS further indicates that major alternative crops are limited by the small local market and by the competitive market of other production areas.

The EIS indicated that development of Ko Olina Phase II would have a minimal effect on the economic viability of Oahu Sugar Company but that development of the estimated 5,400 acres of approved and pending projects would have a more serious effect. According to the EIS, Oahu Sugar Company can compensate for decreasing economics of scale by shifting from the double mill to a single mill operation.

Parks and Recreation

The applicant intends to relocate Kamokila Park and is discussing its relocation plans with the Department of Parks and Recreation (DPR). The DPR has indicated the following concerns regarding the relocation of Kamokila Park: location of the proposed site, site grades, location of major drainage channels, and access by residents of Honokai Hale. The Honokai Hale/Nanakai Gardens Community Association has also indicated their concern regarding the relocation of Kamokila Park and access to the new park.

B. Procedures

1. An EIS Preparation Notice, for the proposed project, appeared in the November 23, 1988 Office of Environmental Quality Control (OEQC) Bulletin. Copies of this notice were distributed to interested Federal, State, and City and County agencies, as well as community interest groups.

2. Nineteen parties responded to the EIS Preparation Notice.

3. The notice that the Draft EIS was available for public review was published in the January 23, 1989 issue of the OEQC bulletin. The deadline for public review was then set for March 9, 1989.

4. Twenty-seven parties responded to the request for comments on the Draft EIS. Five of the 27 replies were postmarked or received after the deadline for public review. The applicant made point-by-point responses to all substantive comments on the 22 replies received by the public review deadline and three replies received after the public review deadline. Replies from the State DOT and U.S. Navy, which were received after the deadline for public review were too late to receive a response in the Final EIS.

5. The consultant filed an addendum to the Final EIS which included the comments of the parties responding to the EIS Preparation Notice. These comments were not included in the Final EIS.

C. Content

The Final EIS for the proposed Ko Olina Phase II Development adequately addresses the content requirements specified in Sections 11-200-17 and 11-200-18 of the EIS Rules.

D. Responses to Comments

The applicant provided adequate point-by-point responses to all comments received within the 45-day review period established for the Draft EIS.

E. Unresolved Issues

The following unresolved issues require resolution prior to acceptance of an application for rezoning:

1. The project will require new potable water source approval from the State Department of Health, well drilling and water withdrawal approval for public potable and non potable water from the State Water Commission, water allocation approval from the Ewa Plains Water Development Corporation, and approval from the Board of Water Supply of a revised water master plan.

2. Highway and street improvement plans and programs as required by the City Department of Transportation Services and the State Department of Transportation.

3. Coordination of air quality monitoring with the State Department of Health to assess the impact of traffic mitigative measures to maintain national air quality standards and minimize exceedances of State air quality standards.

4. A drainage and erosion control plan for on- and off-site improvements funded by the applicant and approved by the Department of Public Works.

5. The project will require a park and recreation plan approved by the Department of Parks and Recreation.

F. Determination

The Final EIS is determined to be acceptable under the procedures and requirements established in Chapter 343, HRS, and the State "EIS Rules." This determination in no way implies a favorable recommendation on the applicant's request for any approvals required by the Department of General Planning.

Donald Clegg

DONALD A. CLEGG
Chief Planning Officer

DAC:js

Ko Olina

PHASE II

Final Environmental Impact Statement

Prepared for:

West Beach Estates

Prepared by:

Wilson Okamoto & Associates, Inc.

April 1989

KO OLINA

PHASE II

FINAL ENVIRONMENTAL IMPACT STATEMENT

Prepared for:

West Beach Estates

Prepared by:

Wilson Okamoto & Associates, Inc.

April 1989

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D. NOISE STUDY, Y. Ebisu & Associates

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PROJECT SUMMARY

PROJECT SUMMARY

PURPOSE

This Environmental Impact Statement (EIS) is prepared pursuant to Chapter 343, Hawaii Revised Statutes and the rules and regulations established by the Office of Environmental Quality Control. The purpose of the EIS is to ensure that environmental, economic and technical considerations are given appropriate consideration and exposure to public officials and members of the community. The EIS requirement is based on the need for an amendment to the City and County of Honolulu's Ewa Development Plan as part of the required land use approvals for Ko Olina Phase II.

PROPOSED ACTION

With the first phase of development of the Ko Olina Resort well underway, the planning emphasis has shifted to its second phase to provide the necessary amenities to support the first phase. To increase the overall success and marketability of the Ko Olina Resort, a high demand has emerged for resort championship golf courses as a recreational amenity. For these reasons, Phase II plans provide for the development of two (2) 18-hole championship golf courses. Also planned are commercial development on the east end of the site, and relocation and expansion of an existing neighborhood park.

Golf course development will consist of two golf courses, each of which will be of championship length. Each course is planned to have its own clubhouse and dining facility, parking lot, driving range and maintenance facility. A collector road will bisect the site and provide vehicular access from the primary resort area. It is anticipated that the golf course will serve residents, hotel guests, golf memberships as well as play from the general public.

The proposed commercial parcel is planned to incorporate a commercial retail village directed at both resort and residential markets. Within the commercial parcel, a low-rise office complex with garden or park-like open space amenities is also planned.

The existing 5.8 acre Kamokila Neighborhood Park is proposed for relocation to the western end of the site. Upon redevelopment, park acreage would be increased to 9.5 acres.

SUMMARY

Applicant:	West Beach Estates
Property Owner:	Estate of James Campbell
Accepting Agency:	Department of General Planning
Project Location:	Ewa, Oahu, Hawaii.
Project Area:	372.6 acres
Tax Map Key:	9-1-15: portion of 4 and 18
State Land Use District:	Agricultural, Urban
Development Plan Designations:	Low Density Apartment, Medium Density Apartment, Parks and Recreation, Commercial, Public Facilities.
Zoning:	AG-1 and P-2
Existing Use:	Agriculture and vacant uses
Proposed Use:	Golf course, commercial, park

ALTERNATIVES CONSIDERED

Four alternatives to the proposed action examined include: the no-action alternative, alternative locations, alternative agricultural uses, and the alternative of current development plan land use. The "no-action alternative" examines what would occur if the site were allowed to remain in agricultural use for sugarcane cultivation. Analysis of this alternative indicates that the long-term outlook for sugarcane cultivation in Hawaii is not promising. The "alternative locations" alternative examines the potential for other locations for the proposed siting of two golf courses and the commercial development. This alternative is not feasible since there are no other suitable locations for siting golf courses in close proximity to the Ko Olina Resort. The "alternative agricultural uses" alternative examines the feasibility of other agricultural crops. An analysis of this alternative indicates that currently there are no alternative crops that are competitive in the marketplace. The "alternative of current development plan land use" considers the use of the project site for the designated land uses contained in the existing Ewa Development Plan. Examination of this alternative indicates that development of one golf course would be inadequate to meet the golf demands of the resort.

ANTICIPATED IMPACTS AND MITIGATIVE MEASURES

Short term-impacts as a result of construction-related activities and long-term impacts from the implementation and operation of the project were assessed.

Short-term impacts associated with the project include an increase in noise, an increase in fugitive dust emissions, an increase in construction machinery exhaust emissions, temporary disruption of traffic, and the creation of construction jobs. No short-term impacts are anticipated from development of the project on water quality and drainage, flora and fauna, and archaeological resources.

Major long-term impacts are summarized as follows.

Water Quality - Non-potable water sources will be used for irrigation of the golf courses with no adverse impacts to potable supplies.

Flora and Fauna - No rare or endangered species were identified on the site. The proposed action may result in an increase in some of the introduced and migratory bird species.

Archaeological Resources - No adverse impacts are expected due to the absence of any indication of archaeological resources.

Pesticides - Application and use of chemical fertilizers and pesticides on the golf courses will not pose significant adverse environmental risks or degradation of potable groundwater quality.

Noise - The project is not expected to generate any significant long-term noise that will be of concern to neighboring residential areas.

Drainage and Flood Hazard - The project site is not located within a flood hazard area. General on-site improvements are proposed to improve drainage and storm runoff conditions within the project area. Upon development, the golf course will function as a retention/flood basin to lessen storm flows to lower-lying areas and will help to mitigate any flood hazard.

Air Quality - The primary long-term air quality impact from the project will arise from the increased motor vehicle traffic associated with the project.

Traffic - Traffic volumes in the area will increase as the result of proposed development. Planned roadways and mitigative measures are proposed to alleviate adverse impacts and maintain volumes within roadway capacities.

Loss of Agriculture Lands - The withdrawal of the project site from sugar production is not expected to have a major adverse impact on sugar production efficiency for Oahu Sugar Company. Withdrawal of the project

site from sugarcane cultivation is expected to have a less adverse effect than withdrawal of most similar sized parcels elsewhere on the plantation due to lower quality of soils, higher irrigation requirements, and greater distance from the mill.

Public Services and Utilities - The sewer system should be adequate to accommodate the wastewater generated by the planned clubhouse and commercial use. Electrical and communications improvements necessary to support the requirements of this project will be served from existing utility systems.

Socioeconomic - With no residential units planned on the site, there would be no direct impacts on population and housing stock. The removal of planned residential development from the Phase II site is not expected to delay the provision of housing in view of other proposed Ewa developments which would more than offset this shortfall. Development of Ko Olina Phase II will also create a variety of employment opportunities. Projected long-term employment generated by the proposed development, primarily from the commercial development, will result in 2,450 new jobs.

UNRESOLVED ISSUES AND COMPATIBILITY WITH LAND USE PLANS AND POLICIES

There are no major unresolved issues with respect to the development of Ko Olina Phase II. All of the necessary land use permits and approvals will be obtained prior to development. The proposed action is generally consistent and compatible with State and County land use plans, policies and programs.

NECESSARY PERMITS AND APPROVALS

Prior to development, a number of governmental permits and approvals must be secured. Major necessary permits and approvals are listed below.

PERMITS AND APPROVALS

AUTHORITY	APPROVAL/PERMIT REQUIRED
<u>State of Hawaii</u>	
Land Use Commission	State Land District Use Boundary Amendment
Dept. of Health	Wastewater System Approval
Dept. of Land and Natural Resources, State Water Commission	Withdrawal and Use Approval from the Pearl Harbor Ground Water Control Area

<u>City and County of Honolulu</u>	
Dept. of General Planning	Ewa Development Plan Land Use Amendment Ewa Development Plan Public Facilities Map Amendment
Dept. of Land Utilization	Change of Zone Approval
Dept. of Public Works	Grading Permit
	Drainage Master Plan Approval
	Wastewater System Approval
Board of Water Supply	Dual Water Master Plan Approval
Building Department	Building Permit

INTRODUCTION

I. INTRODUCTION

A. LOCATION

The project site for Ko Olina Phase II is located within the Ewa District, approximately 20 miles west of Honolulu. (See Figure I-1) The Ewa area encompasses the entire Ewa Plain (approximately 34,000 acres), from Kunia Road on the east to Kahe Point on the west. Located within this area are a planned destination resort, residential communities, a major industrial park, a deep draft harbor, a major military installation, and a portion of Oahu's largest sugar plantation.

The Phase II site encompasses 372.6 acres of land and is bounded to the north by the H-1 Freeway, Farrington Highway, Honokai Hale and Nanakai Gardens Subdivision; to the east by the western boundary of the proposed Kapolei Town Center near Kalaeloa Boulevard; to the west by Ko Olina Resort; and to the south by Ko Olina Resort and the abandoned OR&L railroad right-of-way. The site is nearly a mile inland from the shoreline and is serviced by the Palailai Interchange and by Farrington Highway and Kalaeloa Boulevard.

The property is defined by Tax Map Key 9-1-15: portion of 4 and 18. Within the 372.6-acre site, 5.89 acres are located in Tax Map Key 9-1-15: portion of 18 and the remaining 366.71 acres are located in Tax Map Key 9-1-15: portion of 4.

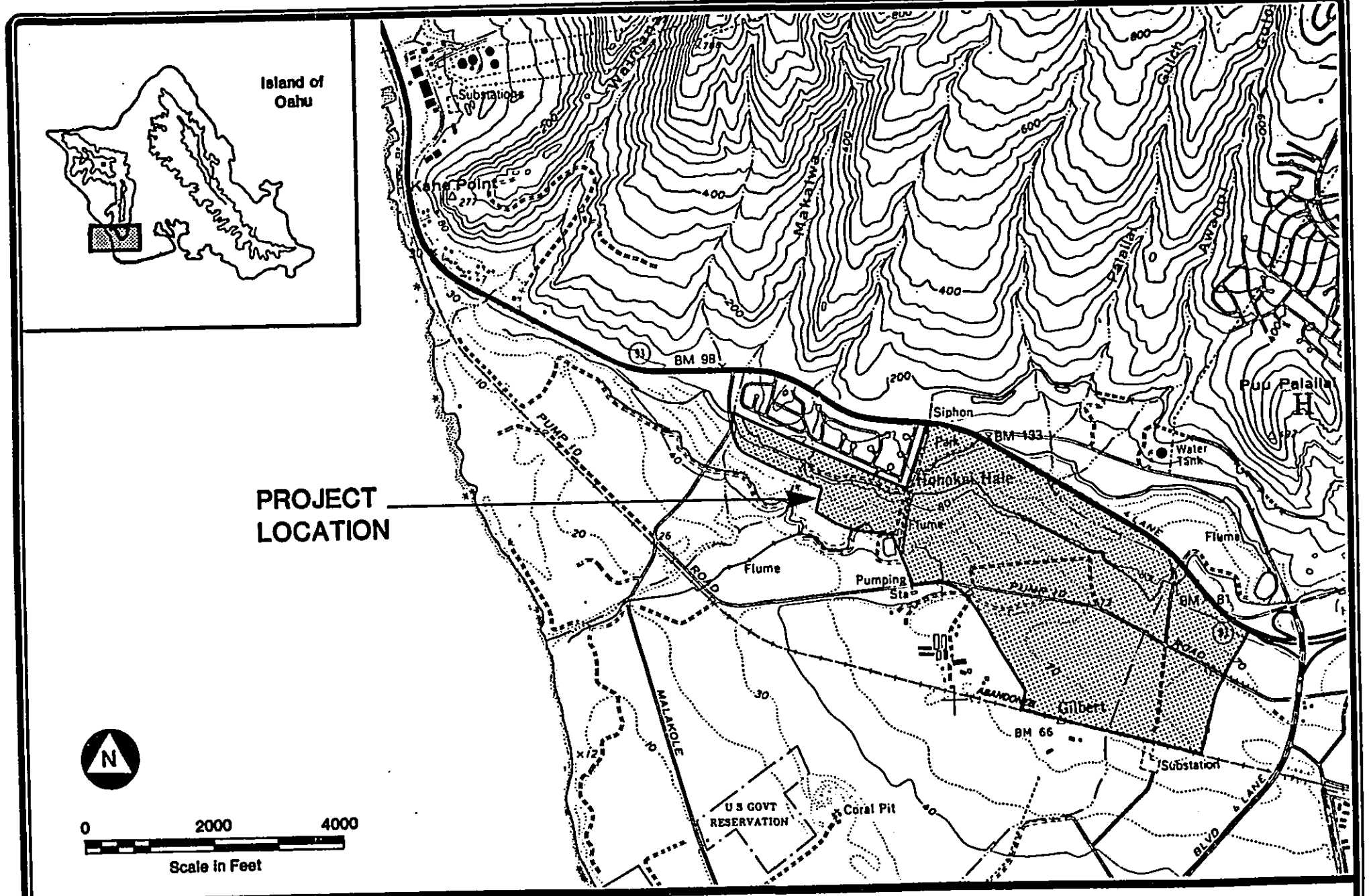
B. LAND OWNERSHIP

All of the lands within the Ko Olina Phase II project area are owned by the Estate of James Campbell. Nearly all of the project area is under a lease from Campbell Estate to the Oahu Sugar Company for sugarcane cultivation. A neighborhood park consisting of 5.8 acres adjacent to the eastern end of Honokai Hale Subdivision is currently under a lease from Campbell Estate to the City and County of Honolulu's Department of Parks and Recreation which expires in 1995.

Through a development agreement executed with Campbell Estate, West Beach Estates intends to purchase and develop the entire Phase II site.

C. EXISTING LAND USES

Most of the project site is presently in active use for sugarcane cultivation by the Oahu Sugar Company. The Oahu



Ko Olina Phase II
West Beach Estates

Fig. I-1
LOCATION MAP

Prepared by:
WILSON OKAMOTO & ASSOCIATES, INC.

Sugar Company is the Island's largest sugar producer and cultivates approximately 13,500 acres of sugar cane land in the Ewa and Central Oahu areas.

An estimated 298 acres or 80% of the project site is currently under cultivation. The remaining 69 acres are vacant lands.

Existing uses also include a 5.8-acre City-run park known as Kamokila Park located adjacent to the eastern end of the Honokai Hale/Nanakai Gardens subdivision. Facilities at the park include a multi-purpose room, a basketball and volleyball court, a small slide for children, and a softball field.

D. SURROUNDING LAND USES

Surrounding land uses in the immediate vicinity of the project site include the Ko Olina Resort, the Honokai Hale/Nanakai Gardens Subdivision, and the proposed Kapolei Town Center.

Ko Olina Resort: Ko Olina Resort is a 642-acre planned residential/resort community located adjacent to the western end of the project site. Land and infrastructure development began in 1987 with completion anticipated in 1989. Planned for the resort area are 4,000 visitor units and 5,200 housing units. of which 3,700 units will be medium density apartment units and 1,500 units will be low density units. Planned amenities within the development include: 4 oceanfront sandy beach lagoons; a 170-acre, 18-hole championship golf course and clubhouse; a 450-slip marina; a Hawaiian cultural center; three public parks consisting of two large beach parks and a community park; sites for a school, child care center, and fire station; two commercial centers, one featuring a waterfront-theme shopping center. The project is expected to create at least 5,000 new permanent jobs.

Honokai Hale/Nanakai Gardens: Honokai Hale/Nanakai Gardens is an older, completed residential tract located adjacent to, and north of the project site. Honokai Hale subdivision, built in 1971, is located on the eastern end of the tract and consists of approximately 160 single family units. Nanakai Gardens consists of approximately 130 single family units located on the western end of the subdivision. Nanakai Gardens was constructed in the mid-1960's. Overall, this residential community has an estimated population of 1,150 in approximately 290 residential units.

Kapolei Town Center: Campbell Estate is proposing the development of Kapolei Town Center on 890 acres of land east of the project site. The Town Center is planned to be intimate in scale with low building heights, utilizing native building material. City blocks will be uniquely Hawaiian in character. An 80-acre park will be the focal amenity within the town itself. Development of the Town Center will help Ewa become a "self contained community". To achieve this, a major emphasis within the Town Center will be on employment generating land uses such as commercial/retail, business parks/light industrial development, and governmental offices and facilities. Other land uses proposed for the site include: offices, public facilities, residential development, mixed use development, two major parks and open space.

Just east of the Kapolei Town Center development are planned residential developments known as Kapolei Villages and Kapolei Knolls. Kapolei Villages is being undertaken jointly by the State and City on 830 acres, on which 4,871 homes are planned. Included in this development are an 18-hole municipal golf course, several schools, and a number of parks and recreation centers. Kapolei Knolls is a residential development of 500 single family homes on about 79 acres south and east of Makakilo between the H-1 Freeway and Farrington Highway.

DESCRIPTION OF THE PROPOSED PROJECT

II. DESCRIPTION OF THE PROPOSED PROJECT

A. PROJECT DESCRIPTION

With the first phase of the Ko Olina Resort development well underway, the second phase of development planning has been initiated to support and help assure the economic success of Ko Olina as a world class destination resort. The master plan for Ko Olina Phase II calls for the development of two (2) 18-hole championship golf courses, commercial development on the east end, and relocation of the existing neighborhood park. See Figure II-1.

1. GOLF COURSES

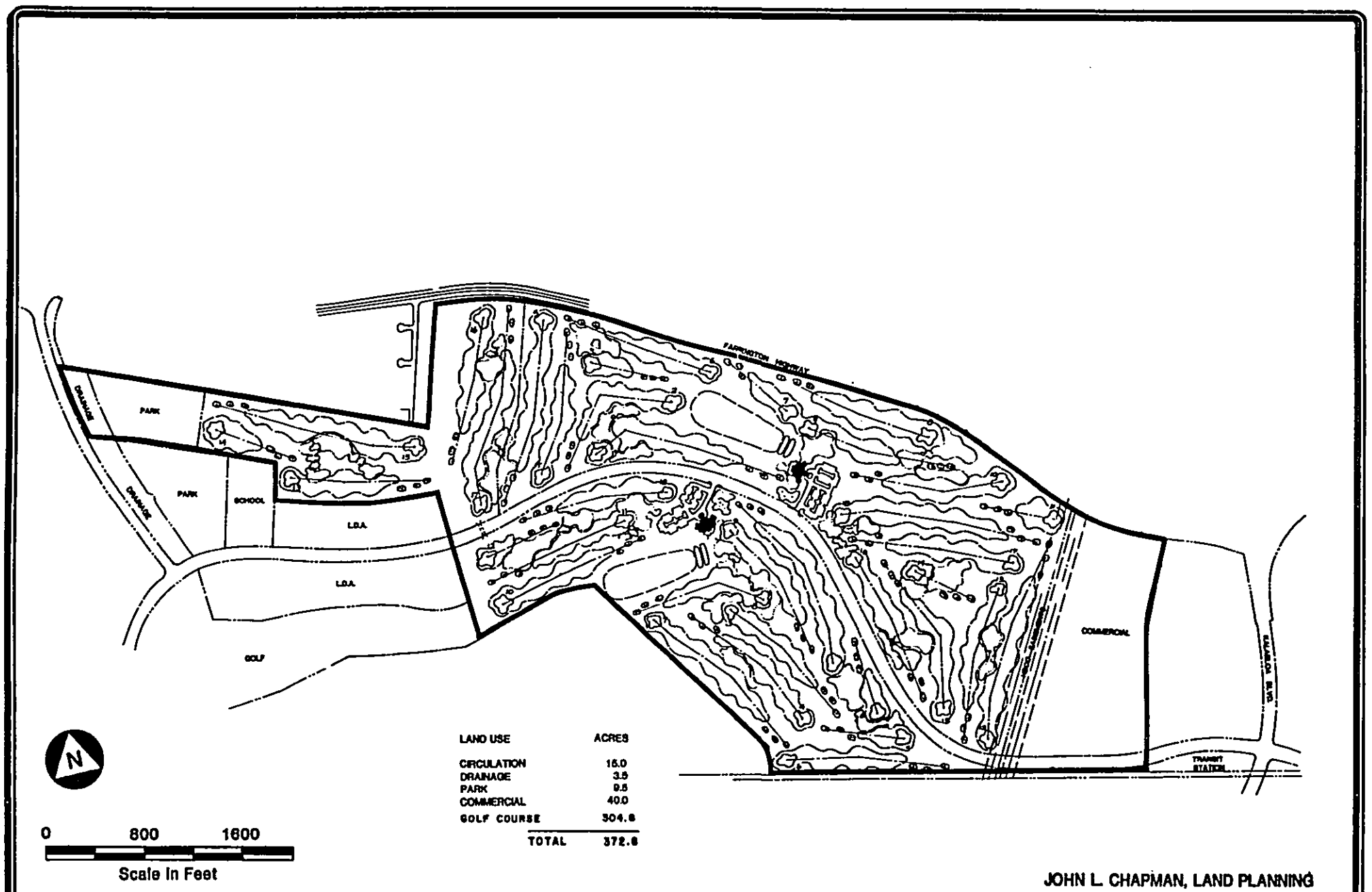
The development of two (2) 18-hole championship golf courses is planned on approximately 305 acres of the Phase II site. The golf course development will consist of two courses, each of which will be of championship length. It is likely that each course will have its own clubhouse and dining facility, parking lot, driving range, and maintenance facility. Grading and landscaping are anticipated to provide water features, tree massing, bunkers, and earth berms and mounds.

The proposed collector road (referred to in this report as Ko Olina Parkway) which will bisect the site provides vehicular access from the primary resort area and generally separates the two golf courses. On the preliminary layout plan, several golf holes on the west end of the project site are apportioned to the lower course, with a golf cart underpass to facilitate access across the Ko Olina Parkway. The golf courses will be irrigated using non-potable water.

The golf courses are intended to serve the visitor demand for resort and residential golf play generated from the Phase I development. It is anticipated that the courses will accommodate residents, hotel guests, golf memberships, as well as play from the general public.

2. COMMERCIAL PARCEL

On the east end of the project site, a 40-acre commercial parcel is proposed for a commercial village directed at both the resort and residential markets. Included in the commercially designated area will be a low-rise office complex with garden or park-like open space amenities.



LAND USE	ACRES
CIRCULATION	15.0
DRAINAGE	3.5
PARK	9.5
COMMERCIAL	40.0
GOLF COURSE	304.8
TOTAL	372.8

JOHN L. CHAPMAN, LAND PLANNING

Ko Olina Phase II
West Beach Estates

Fig. II-1

MASTER PLAN

WILSON OKAMOTO & ASSOCIATES, INC.

The Ko Olina Village retail center is anticipated to contain approximately 200,000 square feet of retail space on about 16 acres of land. The tenant mix could be a combination of urban service, food service, and retail and resort facilities. Anchor tenants could include a supermarket and drug as well as a mix of resort and service shops. Service establishments such as financial, real estate, medical and professional would also be accommodated.

The Ko Olina Office Center is anticipated to provide approximately 375,000 square feet of office space in a series of low-rise garden office buildings on about 24 acres of land. The development would target the service businesses needed to support urban development in the Ewa area as well as economical office alternatives for those currently occupying space in Honolulu's central business district.

Other amenities which would be provided include a park-like open space area for passive recreation and visual relief, and support services. Also under consideration is a railroad museum concept which could be the theme and focal point for the "Old Town".

3. PARK RELOCATION

The existing 5.8-acre Kamokila Neighborhood Park is proposed to be relocated to the western end of the project site. Park acreage would be increased to 9.5 acres upon redevelopment. In conjunction with park plans proposed under the first phase of the Ko Olina Resort, the total contiguous park acreage would be about 20.5 acres. With the increased acreage, passive recreational activities such as picnicking could be accommodated at the park along with active uses such as ballfields and ballcourts. The park relocation will allow for more coordinated recreational uses and facilities in conjunction with the proposed school and park site (located adjacent and south of the relocated Park site). The relocation will also facilitate and improve access to park facilities for residents of Honokai Hale and Nanakai Gardens subdivision.

B. PROJECT NEED

1. GOLF COURSE DEMAND

The prospects for golf in the State of Hawaii are tied to the growth of population and tourism as well as the potential growth in the participation of golf. Because

of the important role tourism plays in the economy of Hawaii, resort development is a primary factor in projecting demand for golf in the State of Hawaii. In 1965, only two golf courses in Hawaii could be considered resort courses. By 1985, there were 20 golf courses classified as resort courses out of the 57 golf courses in the State. Presently, only three of the State's resort courses are on Oahu, although additional courses are expected to be built at Ko Olina and at Turtle Bay (Kuilima).

The availability of championship golf courses at premier resorts has become a highly desirable if not vital amenity to the economic success of a resort. A recent study on the State's participation in the recreational industry indicated that in 1985, Hawaii attracted 200,000 golfers who spent $30,000,000 at the State's resort courses. The increasing popularity and reputation of Hawaiian resort golf is reflected in the inclusion of resort courses as a prominent feature in nearly all major proposed resort developments. With the trend towards catering to the upscale visitor market, the demand for resort golf is expected to rise accordingly. It should be noted that Oahu, which has an average daily visitor census of over 50 percent of the State's total, contains only 15% of the State's resort golf courses.

Demand for golf at the Ko Olina Resort is expected to be extremely high due to the proximity of the proposed golf developments to the resort development. In the course of discussions and negotiations with major developer/operator teams for the hotel sites in Phase I, a major concern that has arisen is the adequacy of golf facilities. Many of the potential operators have expressed skepticism about the ability of Ko Olina to function adequately as a resort with only one golf course.

While a number of new courses have been proposed, only two new courses (the Ko Olina Golf Course and the City's West Loch Course) are under construction. The first full year of operation for both courses is expected to be 1990.

Of the four other golf courses planned for Ewa, the Meyer's course has received all of the major approvals for development, the Makakilo course is on hold because of the City-imposed moratorium, the Ewa Gentry golf course has obtained State Land Use District and Development Plan amendment approvals, and the Kapolei

Village golf course has received State Land Use District reclassification to Urban. In the Central Oahu area, the golf course at Waikele has received all of the major land use approvals for development, the Waiawa golf course has received Land Use Boundary reclassification, and the Royal Kunia Phase I courses have received Development Plan amendment partial Land Use District reclassification.

The growth in golf as a leisure time activity has translated into the growth of golf as an activity for tourists. In 1955, none of the golf courses in the State of Hawaii could be classified as being resort courses; in 1965 only the Mauna Kea and the Kaanapali courses could be classified as resort courses; by 1985 there were 20 golf courses in the State classified as resort golf courses.

An examination of golf courses by island indicates that resort courses have developed on the neighbor islands to a greater degree than on Oahu when measured against average visitor census or visitor expenditures by county. This can probably be explained by the more recent growth of the neighbor island visitor industry and its focus on destination resorts. Proposed additions to Oahu's visitor plant such as Ko Olina and the Kuilima Expansion include golf facilities as prominent features of the proposed resort development plans.

As destination resorts have matured, the number of resort units providing potential golf users has increased, occupancy rates have improved and planned densities for developments have been reduced with a consequent upscaling of accommodations. These factors have encouraged the growth of the golf playing visitors.

Another factor encouraging the expansion of the golf playing visitor market has been the expansion, availability and marketing of resort golf facilities. The islands of Maui and Hawaii have led the State in the expansion of golf facilities. Twenty years ago on Maui, there was a single golf facility at the "infant" Kaanapali Resort. Today, there are seven resort golf courses with a number of new facilities in the planning stages. Maui has marketed its golf on a national basis under the heading "Maui Golf Coast". Unlike a tennis court, each golf course is unique. Avid golfers seek opportunities for experiencing a number of championship facilities, the availability of

which encourages them to return more frequently. This has also resulted in word-of-mouth advertising upon their return home.

During the past few years, interest in golf at local courses has increased at most of the local courses, increasing utilization and fees. Municipal courses on Oahu are some of the busiest in the country and the world. Public pressure has been increasing to construct new municipal courses and four alternative sites are under consideration. There is also strong interest in development of private courses, with 28 course locations under consideration by various developers. For the Ewa, Waianae, and Central Oahu areas, 17 golf sites are proposed, of which 2 are under constructino (at Ko Olina and at West Loch). The remaining 15 are in various stages in the approvals process. Only a half to three-quarters of these golf sites are expected to be approved within the 20-year planning horizon because of factors such as community sentiment, lack of infrastructure, incompatibility with existing and proposed uses, water availability and access, and inability to obtain the necessary financing.

The need for additional courses in the Ewa, Central Oahu, and Waianae areas were estimated by adding resort and residential growth projected for these areas. Two-thirds of the residential growth and three-quarters of the resort development growth are anticipated in these areas based on the DGP residential population allocation of DBED M-K projections. Depending on the annual growth in golf participation, it is estimated that the demand exists for between 10 and 20 new golf courses by the year 2010.

Golf course capacity itself is the product of a number of physical and aesthetic considerations. Resort courses in Hawaii have in general limited play to between 175 and 215 rounds per day. At this level of play, golfers can enjoy the game at a leisurely pace with only a minimum of waiting and with minimum interaction with other golfers on the course. Assuming an average of 200 rounds per day and 350 playing days per year, the capacity of resort courses should be 70,000 rounds annually. Experience has shown that demand for golf from resort guests is strongest during the winter months. In addition, demand for golf is also skewed in favor of morning times. Therefore, resort courses are generally

operated below capacity during most of the year. A yearly average of 50,000 rounds per year is considered achievable and desirable by resort golf operators.

While the guests' desire for golf is impacted by the demographics of a typical guest and by pricing, a fair indicator of the golf requirements of guests can be estimated by the demands for golfing privileges made by potential hotel developers and operators. These individuals, due to their experiences at other resort properties, have determined the level of golf availability to make their operations competitive with other resort operations of similar types. While this figure varies from resort to resort, a ratio of 1 round of golf per 10 rooms per day is a standard commitment sought by resort operators in today's marketplace. It is further estimated that every 15 residential units in a destination resort will generate one round of golf per day.

A sampling of golf demand at selected resorts showed that hotels generated rounds on a daily basis ranging from 1 round per 2.5 rooms at Mauna Kea and Mauna Lani to 1 round per 12 rooms at Wailea. Resort residential units generated between 1 round per 9 units at Wailea and 1 round per 19 units at Princeville.

With 4,000 visitor units (1 round per 10 units) and 5,200 residential units (1 round per 15 units) planned for Ko Olina Resort, this translates to a need for 750 rounds per day, or 3.5 golf courses, assuming 200 rounds per day per course. The Ko Olina development at completion is thus expected to generate a demand for approximately 4 golf courses. Based on the projected absorptions, the second Ko Olina course (first course in Phase II) should be made available in January of 1993, and the third Ko Olina course (second in Phase II) should be made available by January of 1996.

The developer intends to open both courses by 1992, to help meet the anticipated demand and to enhance the attractiveness of hotel sites to hotel developers. Even with the two courses being proposed, the total of three courses provided at Ko Olina will fall short of meeting the ultimate demand. The proposed resort courses, however, will relieve the demand pressures which would otherwise be placed on other golf courses in the Ewa, Central Oahu, and Waianae area.

2. COMMERCIAL DEMAND

Retail demand within the Ko Olina Development is expected to be primarily the result of internal demand from residents and visitors, although a significant amount of business from surrounding areas may develop as Ko Olina develops a good reputation for providing eating and entertainment facilities. The resort retail demand for the anticipated visitor population is based on an estimate of daily non-hotel expenditures per visitor.

Using alternate assumptions as to the percentage of these funds that would be expended at the retail establishments within the Ko Olina Resort and estimating sales per square foot at between $300, $400, or $500 per square foot, an estimated 200,000 to 427,000 square feet of space would be needed. A conservative level of 250,000 square feet has been determined to reflect the resort demand for the anticipated visitor population, assuming $400 per square foot in sales.

The retail demand from the 5,200 residential units approved for development in the first phase will be met by the second phase development. It is anticipated that Ko Olina residents will use the shopping facilities within the development to meet those shopping needs generally provided by neighborhood shopping facilities, i.e., grocery, drugs, convenience items and other day-to-day needs for retail services. Based on experiences such as in Mililani Town, a conservative estimate of residential retail demand is 200,000 square feet of commercial space.

Accordingly, approximately 450,000 square feet (250,000 resort and 200,000 residential) of retail space will be required to meet the internal needs of visitors and residents of the Ko Olina Resort. The 200,000 square feet of retail space to be provided in Phase II would bring the total retail square footage for the Ko Olina Resort to 460,000 square feet, which is in line with the estimated demand. No demand from surrounding areas has been included in this analysis, although experience strongly suggests that resort areas also attract local residents to the dining and entertainment facilities available at these resorts.

3. OFFICE SPACE DEMAND

The future office demand for Oahu has been estimated from the projections of economic growth and job creation developed by the State Department of Business and Economic Development. Based on the estimated growth in employment per the "M-K" estimates and the per capita office space absorption over the past ten years, it appears that office space needs on Oahu will grow by approximately 400,000 square feet annually by the year 2000. Experience reveals, however, that actual absorption can vary greatly from year to year, from 100,000 square feet to 600,000 square feet.

The decision to locate an office is not always a technical one. Factors such as employee preference or executive preference often decide the location rather than strictly economic factors. There appears to be strong inducements which will eventually encourage the development of an office market in the Ewa area. These advantages include lower cost for office space than in downtown Honolulu, availability of parking, less traffic for commuting employees, and proximity to a large workforce given the numerous residential subdivision developments undertaken in the Ewa and Central Oahu areas.

The proposed office center on the Phase II site is planned for 375,000 square feet of office space. The absorption of this space is projected at an average of 40,000 square feet (10% of Oahu's estimated demand) of space per year, and thus could take approximately 9.5 years to be completely absorbed. The proposed developments at Kapolei Town Center, while competitive, will actually enhance the potential to attract office users to the Ewa area due to more intensive marketing efforts and wider variety of sites available to prospective tenants. The plans of Campbell Estate and others to relocate to the Ewa area should make the area an attractive location for office development.

C. DEVELOPMENT TIMETABLE

Construction of infrastructure and amenities for the first phase of the Ko Olina Resort has been underway since 1987. These first phase improvements are expected to be completed in 1989. At the same time, efforts to market the hotel parcels to developer/operator teams are proceeding. One developer has been identified for the first hotel and discussions are ongoing with a number of other groups to

develop the remainder of the sites. It is anticipated that several hotels will be under construction and/or opened by 1991/1992.

The Phase II development will commence upon the receipt of all necessary governmental permits and approvals. Construction of the golf courses and on and off-site infrastructure is expected to start by mid-1990. Based on a one and one-half year construction timetable, the golf courses and required infrastructure would be completed by early 1992.

Development of the retail center consisting of 200,000 square feet is expected to occur in equal increments of 100,000 square feet in 1994 and 2000. The office complex is expected to be developed in increments of 40,000 square feet annually over a total period of 9.5 years.

D. ESTIMATED COST

The preliminary estimates for the construction of the two 18-hole golf courses, clubhouse and associated facilities, all required roads, landscaping and utilities, site improvements for the commercial site (but excluding the costs of land and the commercial buildings), is approximately $48 million in 1988 dollars.

DESCRIPTION OF THE EXISTING ENVIRONMENT

III. DESCRIPTION OF THE EXISTING ENVIRONMENT

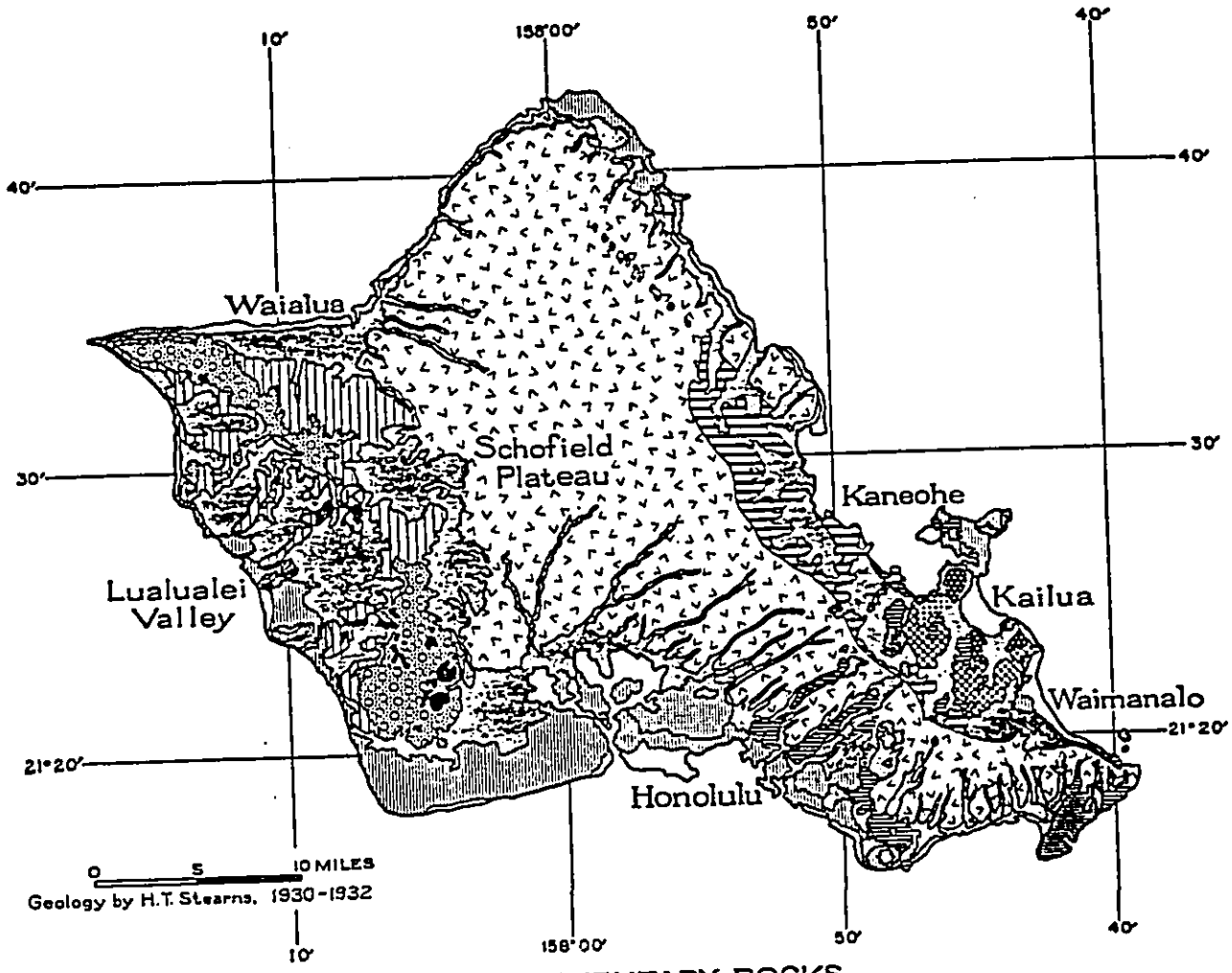
A. GEOLOGY

Major regional features in Ewa include the Waianae Mountain Range, the flat plain area, cinder cones and natural drainage basins. The Ko Olina Phase II project site is located at the upper edge of the Ewa Plain, at the foot of the Waianae Mountain Range. The Ewa Plain is an emerged ancient coral-algae calcareous reef formed during the Pleistocene Period when the ocean level was at a higher elevation. The Ewa plain is basically flat with a few isolated bluffs eroded by Honouliuli Stream. It is underlain by calcareous material which has been modified, consolidated, and cemented by rain, air and other chemical factors to form a hard but extremely permeable surface.

In general, the Ewa Plain below an elevation of approximately 100 feet below mean sea level consists of caprock comprised of terrestrial and marine sedimentary deposits forming a wedge that retards the seaward movement of fresh groundwater from the inland basaltic aquifer. At lower elevations the ground surface is made of alluvium and sedimentary deposits washed downslope over the millennium.

The Waianae range, which comprises the Waianae Volcanic Series, is divided into lower, middle and upper members. (see Figure III-1) The lower member comprises the lava flows and associated pyroclastic rocks which created the main mass of the Waianae shield volcano. The middle member consists of rocks that accumulated in the caldera, gradually filling the caldera. The upper member is the relatively thin cap that appears to have covered the entire top of the shield volcano late in its history. The lower and most of the middle members consist of rocks of the tholeiitic group. Towards the top of the middle member, alkalic basalts begin to appear and the upper member is largely hawaiite with lesser amounts of alkalic olivine basalts. (MacDonald, 1970) The upper member of the Waianae Volcanic Series is basaltic andesite which does not weather easily--absorption of rainfall and vertical percolation is poor.

Located at the base of the Waianae mountain range are five very late cinder cones which add character to the relatively flat topography of the sloping plain. Two of these cinder cones, Puu Palailai and Puu Kapolei, are located near the project area. These cones are composed of a varied mixture of cinder, spatter, and lava flows. For both of these cones, the original cinder carapace has been largely stripped away by erosion, leaving only the core of more resistant lava that filled the crater of the cone and the



SEDIMENTARY ROCKS

RECENT — PLEISTOCENE

Beach and dune sand

Alluvium

Limestone (Reefs and dunes)

VOLCANIC ROCKS

KOOLAU RANGE

WAIANAE RANGE

QUATERNARY

Lavas — Pyroclastics

Honolulu volcanic series

⊗ Kolekole volcanics

EROSIONAL UNCONFORMITY

TERTIARY

Flows — Dike complex

Caldera complex: Lava flows; Vent breccia; Dike complex

Koolau volcanic series

Upper member — Cone

Lower and middle members — Vent breccia

Waianae volcanic series

Geologic map of the island of Oahu. (Modified after Stearns, 1946.)

Ko Olina Phase II
West Beach Estates

Fig. III-1

GEOLOGY OF OAHU

Prepared by:
WILSON OKAMOTO & ASSOCIATES, INC.

upper part of the underlying conduit. (Macdonald, 1970) Quarrying has also removed a large part of the crater fill at Puu Palailai.

B. TOPOGRAPHY AND DRAINAGE

The project site is located at the foot of the Waianae Range, with slopes generally ranging from 1% to 3%. In certain small portions on the western end of the site, the slope ranges from 20-30%. The ground elevation of the site ranges from approximately 65 feet near the abandoned railroad right-of-way to 100 feet near the Highway.

The proposed project is located directly south of three gulches: Awainui Gulch, Palailai Gulch, and an unnamed gulch to the west of Palailai Gulch. Created from erosional processes, these gulches serve as natural drainage basins. Surface drainage conditions in the Ewa Plain are rather unique in that runoff from the Waianae Mountains discharges onto the plain but is readily absorbed by the porous coral substrate so that most of the discharge never reaches the ocean. There are no well-defined natural surface drainage patterns on the lower areas of the coral plain since its absorptive capacity accommodates most of the storm runoff. According to an EIS of potential leeward landfill sites, Makaiwa Gulch located above the western end of the project contains a perennial stream which conducts overland surface runoff during severe, but infrequent storms. Runoff from the gulch rarely reaches the ocean, dispersing instead into the sediments of the Ewa Plain below the highway. Because of the similarity between this gulch and those mentioned above, similar hydrologic phenomenon can be expected.

Currently, existing improvements along Farrington Highway, Nanakai Gardens and Honokai Hale Subdivisions channelize the flow from these drainage areas into culverts and lined channels. Runoff from two gulches (Makaiwa Gulch and an unnamed gulch to the east of Makaiwa Gulch) is controlled by the existing improvements along Honokai Hale/Nanakai Gardens Subdivision and Farrington Highway. Runoff from the remaining gulches flows into the existing cane field and collects into unimproved channels and depressions. Erosion occurs during heavy storms (during times when the cane fields are fallowed), but as the area is generally dry and as these storms occur infrequently, they have not necessitated improvement. (FSEIS West Beach, 1986)

C. HYDROLOGY

Groundwater in the Barbers Point area occurs in two aquifers, the deeper (and higher quality) Waianae Volcanics

and the overlying (mostly brackish to salt water) coral aquifer. Materials of low permeability including marine clay and silt sediments, alluvium and weathered volcanics, separate the two aquifers and form an aquiclude referred to as "caprock". Because of its low permeability, the caprock retards the flow of water between the two aquifers. (FEIS Kapolei Town Center, 1988) This barrier may be better described as an "aquitard" since these soils and clays are permeable, and there is hydraulic continuity between the Waianae aquifer and the coral aquifer. The light density, high head Waianae aquifer water flows through the aquitard into the coral aquifer to be mixed with high salinity salt water. Discharge to the sea from the coral aquifer is unrestricted by an aquiclude or aquitard.

The Waianae aquifer is a source of potable fresh water supply and is recharged by infiltration from precipitation in the Waianae Range. The Ewa Plain lies outside the recharge area for the Waianae aquifer.

The coral aquifer is recharged: by direct infiltration of rainfall on the Ewa Plain, by the seaward movement of groundwater from the Waianae aquifer, by infiltration of stream runoff, and by infiltration of irrigation water applied in excess of crop requirements. The majority of recharge can be attributable to upward leakage from the underlying Waianae aquifer. The coral aquifer consist of a thin lens of fresh to brackish groundwater which mixes with sea water as it approaches the shore. The movement of groundwater in the coral aquifer is seaward in a southwest direction. (FSEIS West Beach, 1986)

The project lies within the Pearl Harbor Ground Water Control Area (GWCA), withdrawals from which are regulated by the State Board of Land and Natural Resources (BLNR). In 1980, BLNR certified the sustainable yield of the Pearl Harbor subareas within the Pearl Harbor GWCA at 225 million gallons per day (mgd). In 1984, the BLNR established three subareas within the Pearl harbor GWCA: the Koolau subarea; the Waianae subarea; and the coastal caprock subarea. (FEIS Kapolei Town Center, 1988) The sustainable yield for the Koolau subarea was set at 200 mgd. The Waianae subarea included the Waianae basal aquifer and was determined to have a sustainable yield of 25 mgd. At present, the Koolau subarea has an unallocated water resource of 1.70 mgd and the Waianae subarea has an unallocated water resource of 4.46 mgd. (DOWALD, 1988)

D. CLIMATE

The Ewa Plain receives high solar insolation year-round and modest amounts of rainfall, with average annual precipitation of about 20 inches. Much of the total annual rainfall can be attributed to several storms during the winter rainy season from October to April. The summer months are particularly hot and dry. The prevailing winds are trade winds blowing from a northeasterly direction. Southeasterly (Kona) winds can be expected 5-8% of the time. The average annual temperature is 77 degrees Fahrenheit, ranging from 72 degrees in February to 79 degrees in July, August, and September.

E. SOILS AND AGRICULTURAL PRODUCTIVITY

Land capability for agricultural production was based on soil classifications by the U.S. Department of Agriculture Soil Conservation Service, the University of Hawaii Land Study Bureau, and were supplemented by on-site observations. Because recommendations of the final report of the Land Evaluation Site Assessment Commission have not been formally established in statutory or administrative rules, the Land Evaluation and Site Assessment System (LESA) is not utilized for evaluating land capabilities for agricultural production in the project area. Utilization of both the Soil Conservation Service and Land Study Bureau Classification systems serve as a check to ensure a more thorough evaluation. The study on agricultural feasibility conducted by Frank S. Scott for the project site is included in Appendix A and the soils analysis is summarized here.

Lands of Importance to the State of Hawaii (ALISH) Classifications. Approximately 359 acres in the project site are classified as "Prime Agricultural lands" and the remaining 14 acres consist of "Other" and "Unclassified" lands. Within the 14-acre site, three parcels are classified as "Other" agricultural lands and four parcels are "Unclassified".

Soil Conservation Service (SCS). SCS soil capability classifications are based on soil profile, topography, water holding capacity, drainage, erosion hazard, pH, workability and depth of root penetration. SCS soil capability classifications range from I to VIII, with I representing the highest capability and VIII the lowest. Class I soils have no more than minimal limitations that restrict crop production. Class III is marginal and classes IV and above are unsuitable for crop production, with Class VIII having the most severe limitations. Table III-1 presents a summary of the SCS soil capability classifications identified within

TABLE III-1

ACREAGE OF EACH LAND TYPE, KO OLINA PHASE II,
SCS LAND CAPABILITY CLASSIFICATIONS

Soil Type	Acreage	Capability Classification Nonirrigated	Irrigated
LuB	22	IVs	IIIe
LvA	10	IVs	IIIe
LvB	102	IVs	IIIe
LPE	10	VIIs	VIIs a/
EmA	48	IVs	IIs
EmB	14	IVs	IIe
MnC	26	IVs	IIIs a/
HxA	136	IVc	I
KmaB	2	Vw	IIIw
CR	2	VIIIs	VIIIs a/
RSY	1	VIIs	VIIs a/
Total	373 (372.6)	373	373
Class I & II		0	198
Class III		0	162
Class IV-VIII		373	13

a/ Classified only for nonirrigated because irrigation is infeasible. Thus, irrigated is given the same crop productivity rating as nonirrigated.

Source: Frank S. Scott, Jr., Agriculture Feasibility of Ko Olina Phase II Lands & the Effects of Conversion to Golf Course Use on Oahu Agriculture, prepared for West Beach Estates, 1988.

the study area along with their respective acreages. SCS capability classifications identified within the project area are described below.

Lualualei Series. This series consists primarily of nearly level to gently sloping soils on coastal plains, alluvial fans and talus slopes, developed in alluvium and colluvium. Some extremely stony soils in the series are moderately sloping to steep. The topsoil is very dark grayish-brown, very sticky and very plastic clay. The subsoil, is of the same color and texture as the topsoil, except that it includes gypsum. The soil is underlain by coral, gravel, sand or clay below 40 inches in depth. The soil cracks widely upon drying. The topsoil is neutral in pH and the lower layers are medium acid to moderately alkaline. Permeability is slow and runoff and erosion hazard vary by subsoil. The available water capacity is about 1.4 inches per foot of soil and the shrink-swell potential is high.

This series includes 144 acres of four subseries, constituting 39% of the project area. The four subseries include: Lualualei clay, 2 to 6% slopes (LuB), 22 acres; Lualualei stony clay, 0 to 2% slopes (LvA), 10 acres; Lualualei stony clay, 2 to 6% slopes (LvB), 102 acres; and Lualualei extremely stony clay, 3 to 35% slopes (LPE), 10 acres.

For the four subseries, soil capabilities ratings range from IIIe if irrigated to VIIs if nonirrigated. Adaptability for agricultural uses range from land which is adaptable only to pasture or woodland to land which is adaptable to sugar cane, truck crops and pasture. Currently, only the LuB and LvA soil capability categories are in sugarcane use.

Ewa Series. This series consists of well-drained soils in basins and alluvial fans which developed in alluvium derived from basic igneous rock. The soils are nearly level to moderately sloping. The series includes small areas of Honouliuli and Malama soils and soils with silt loam topsoils and subsoils. In a representative profile, the top soil is dark reddish-brown silty clay. The subsoil is dark reddish-brown and dark-red silty clay loam with a subangular blocky structure. The substratum is coral limestone sand, or gravelly alluvium. Both the topsoil and the subsoil are neutral in pH. Permeability is moderate, runoff is slow and the erosion hazard is slight. The available water capacity is low at 1.3 inches per foot in the topsoil and 1.4 inches per foot in the subsoil.

The project contains 62 acres of this series, consisting of 14 acres of Ewa silty clay loam, moderately shallow, 2 to 6%

slopes (EmB) and 48 acres of Ewa silty clay loam, moderately shallow, 0 to 2% slopes (EmA). For these subseries, crop capability classifications are IVs if nonirrigated and IIe and IIs (respectively) if irrigated. The soil is adaptable to sugarcane, truck crops and pasture.

Malama Series. This series consists of shallow, well-drained soils along coastal plains which were formed in alluvium deposited over coral limestone and consolidated calcareous sand. the soils are nearly level to moderately sloping. There are 26 acres of this series in an isolated pocket in the southwest section of the project. Soil characteristics are described below in one subseries.

Malama stony silty clay loam, 0 to 12% slopes (MnC), 26 acres. A representative topsoil of this series is dark reddish-brown stony silty clay loam. The subsoil is dark reddish-brown silty clay loam. The underlying layer consists of coral limestone and consolidated calcareous sand 8 to 20 inches thick. Stones, consisting mostly of coral rock fragments, are common in the surface layer and in the profile. The series includes some Ewa soils, some nonstony areas and areas with slopes as great as 20%. Both the topsoil and the subsoil are neutral to mildly alkaline. Permeability is moderate, runoff is very slow and the erosion hazard is slight to moderate. The available water capacity is high at about 2.2 inches per foot in the topsoil and 1.9 inches per foot in the subsoil. Root penetration is affected by the coral limestone and consolidated sand. The soil has a capability classification of VIs if nonirrigated and IIIs if irrigated, with downgrading due to severe limitations for crop production resulting from shallowness and stoniness. The soil is adaptable to sugarcane, truck crops, and pasture.

Honouliuli Series. This series consists of well-drained soils on coastal plains in Ewa which developed in alluvium from basic igneous material. The soils are nearly level to gently sloping. This series encompasses 136 acres at the east end of the project. Soil characteristics are discussed in the narrative for subseries HxA below.

Honouliuli clay, 0 to 2% slopes (HxA), 136 acres. This subseries includes small areas of fine-textured alluvial soils with stony subsoils and small areas of shallow, red, friable soils underlain with reef limestone. A representative topsoil is dark reddish-brown very sticky and very plastic clay about 15 inches in depth. The subsoil and substratum are of the same color as the topsoil and have subangular blocky structures with some layers in common. The soil is neutral to mildly alkalic. Permeability is

moderately slow, runoff is slow, and erosion hazard is no more than slight. The available water holding capacity of the combined layers is moderately high at 1.8 inches per foot of soil. Workability is slightly difficult because of the very sticky and very plastic nature of the clay and the shrink-swell potential is high. Capability classification is IVc if nonirrigated, because of draughty conditions in a limited rainfall area, and I if irrigated. The soil is well adapted to sugarcane, truck crops and pastures under irrigation.

Keeau Series. The Keeau series consists of poorly drained soils on coastal plains on Oahu that developed in alluvium deposited over reef limestone or consolidated coral sand. The soils are nearly level or gently sloping. Three acres of this soil type are located in the center of the project area. Soil characteristics are discussed below.

Keeau stony clay, 2 to 6% slopes (KmaB), 2 acres. The representative top soil is dark grayish-brown clay. The subsoil is very dark grayish-brown and dark mottled clay with a subangular and angular blocky structure. The substratum is white to very pale brown reef limestone or consolidated coral sand. The topsoil and subsoil are mildly alkaline and the substratum is moderately alkaline. Workability is difficult because the soil is very sticky and very plastic and the shrink-swell potential is high. Capability classifications are Vw if nonirrigated and IIIw if irrigated. The soil is marginally adaptable to sugarcane and pasture, but is unsatisfactory for truck crops.

Coral Outcrop (Cr), 2 acres. The coral outcrop consists of coral or cemented calcareous sand. About 80 to 90% of the area is coral outcrop and the remainder consists of a thin layer of friable, red soil material in cracks, crevices and depressions. The crop capability classification is VIIIs (nonirrigated) and the soil is not adaptable to any type of crop cultivation or grazing.

Stony Land (rST), 1 acre. Stony land occurs in this instance on sideslopes of drainageways. It consists of a mass of boulders and stones deposited by water and gravity. Stones and boulders cover 15 to 90% of the surface. The stones are interspersed with reddish silty clay loam and very dark grayish-brown clay which provide a foothold for plants. The capability classification is VIIs, nonirrigated. The land is not suited for crop production or grazing.

SCS Soils. If nonirrigated, soils within the project area range from IVs to VIIIs because of stoniness, shallowness,

unfavorable texture and/or low water holding capacity. The infeasibility for crop production if nonirrigated is also due to a mean annual rainfall of only 20 inches. If irrigated, 198 acres, constituting 53% of the project area are upgraded to capability classifications I and II. Approximately 163 acres or 44% of the project areas is classified by SCS as Class IIIe. These lands have severe limitations, but are marginally adaptable to cultivated crop production. The remaining 13 acres are classified in the categories of IVs through VIIIs. This includes areas not available to agriculture because of conversion to other uses.

On-site observations indicate that approximately 60 of the 162 acres classified as III with irrigation are not used for crop production because of poor texture and dense intrusion of rocks. It appears that these areas should retain the nonirrigated classification of IVs since they are nonirrigable in their present state. This modification would decrease SCS class IIIe acreage to 102 acres and increase the area with capability classifications of IVs through VIIIs to 73 acres.

Land Study Bureau Classification (LSB). LSB classifies soils by land type in which classifications are provided for general crop productivity ratings with or without irrigation. Classifications also include ratings for 7 selected crops, namely; pineapple, vegetables, sugarcane, forage, grazing, orchards and timber. The timber rating is not utilized in this report, since the report is concerned only with potentials for cultivated crop production and grazing. General or overall ratings range from "A" to "E", with "A" being the best. Selected ratings for individual crop categories range from "a" to "e"., with a being the best. Table III-2 presents a summary of the LSB capability classifications and their respective soil types and acreages within the project site. A description of the soil types identified within the study area is presented below.

B63. This series encompasses 135 acres interspersed with other soil types in the southwest section of the site. The overall crop productivity rating is "E" if nonirrigated and "B" if irrigated. Selected crop productivity ratings are "e" for all crops if nonirrigated. If irrigated, selected crop productivity ratings are "a" for sugarcane and grazing, "b" for orchards, "c" for vegetables and forage, and "d" for pineapple.

B16. This land type includes 114 acres located in the extreme eastern section of the project. The overall LSB rating is "E" if nonirrigated and "B" if irrigated.

TABLE III-2

ACREAGE OF EACH LAND TYPE, KO OLINA PHASE II,
LSB LAND CAPABILITY CLASSIFICATIONS

Soil Type	Acreage	Capability Classification Nonirrigated	Irrigated
B63	135	E	B
B16	115	E	B
B75	71	E	B
E112	19	E	E a/
C72	8	E	C
A69	4	E	A
E115	4	E	E a/
A11	3	E	B
A82	2	E	A
Res	2	E	E a/
U	6	E	E a/
Total	373 (372.6)	373	373
Class A & B		0	334
Class C		0	8
Class D & E		373	31

a/ Classified only for nonirrigated because irrigation is infeasible. Thus, nonirrigated is given the same crop productivity rating as irrigated.

Source: Frank S. Scott, Jr., Agricultural Feasibility of Ko Olina Phase II Lands & the Effects of Conversion to Golf Course Use on Oahu Agriculture, prepared for West Beach Estates, 1988.

Selected crop productivity ratings are "d" for forage and grazing and "e" for all other crops if nonirrigated. If irrigated, selected crop productivity ratings are "a" for sugarcane; "b" for vegetables, forage and orchards; and "e" for pineapple.

B71. This unit includes 71 acres in the south central area of the project. The overall LSB rating is "E" if nonirrigated and "B" if irrigated. Selected crop productivity ratings are "d" for forage and grazing, and "e" for all other crops if nonirrigated. If irrigated, crop productivity ratings are "a" for sugarcane, grazing and orchards; "b" for vegetables; "c" for forage; and "e" for pineapple.

E112. This land type encompasses 19 acres consisting of 3 parcels in the extreme west and northwest areas of the project. The overall LSB crop productivity rating is "E" and the selected crop productivity rating is "e" for all crops, nonirrigated or irrigated.

C72. This unit contains a small isolated parcel of 8 acres in the central southwest area of the project. The overall LSB crop productivity rating is "E" if nonirrigated and "C" if irrigated. The selected crop productivity ratings are "e" for all crops if nonirrigated. If irrigated, crop productivity ratings are "b" for sugarcane, grazing, and orchards; "c" for vegetables and forage; and "e" for pineapple.

A69. This small parcel of 4 acres is located in the southwestern section of the project site near the pumping station. The overall LSB rating for this soil classification is "E" if nonirrigated and "A" if irrigated. Selected crop productivity ratings are "d" for forage and grazing and "e" for all other crops if non-irrigated. If irrigated, crop productivity ratings are "a" for all crops except for pineapple, which has a rating of "e".

E115. This 4-acre parcel is located in the central part of the project. The overall LSB classification is "E" and the selected crop productivity rating is "e" for all crops, nonirrigated or irrigated.

A11. This 3-acre parcel converges into the project at the extreme southwest corner. The overall LSB classification is "E" and the selected crop productivity ratings are "d" for pineapple, forage and grazing; and "e" for all other crops if nonirrigated. If irrigated, crop productivity ratings are "a" for sugarcane, grazing and orchards; "b" for pineapple and vegetables; and "c" for forage. The Alli

classification on the soils map is inconsistent with the LSB land classification table which gives this land type an overall rating of "B" under irrigation.

A82. The 2-acre parcel classified as A82 is located in the extreme northeast corner of the project. If nonirrigated, the overall LSB rating is "E" and selected crop productivity ratings are "d" for pineapple, forage and grazing; and "e" for all other crops. The overall rating is "A" and the selected crop productivity rating is "a" for all crops if irrigated.

Reservoir. A reservoir occupies 2 acres of the project along the west-south central border.

U. Six acres in the northwest section of the project near the urban development are unclassified.

LSB classifies all project lands under crop productivity rating "E" if nonirrigated, which is comparable to SCSs capability rating of VII This indicates that the soils are infeasible for cultivated crop production without irrigation. If irrigated, LSB classifies 6 acres as "A", 328 acres as "B", 8 acres as "C" and 31 acres as "D" and "E". Classification by LSB of 334 acres in classes "A" and only 8 acres in class "C" as compared with SCS classification of only 198 acres in classes I and II and 162 acres in class III might indicate superficially that there is a discrepancy in classification between the two systems. Some and perhaps a major portion of the apparent discrepancy may be attributed to differences in the number of land capability classifications. Based on this difference, one LSB category includes the equivalent of 1.6 SCS classifications. Thus, the "B" category of LSB could conceivably include the entire SCS II category plus 30% of the lower quality of land in group I and 30% of the better land in category II.

On-site observations, as previously discussed, indicate a lower capability classification for land type LvB than provided by SCS (IVs and compared to IIIe). LSB classification B63 includes most of the land area in LvB and thus should be downgraded from "B" to "C". This would increase the acreage in class "C" from 8 to 143 acres and reduce the "A" and "B" acreage from 334 acres to 159 acres.

In summary, SCS soil capability classifications modified by on-site observations are considered to provide the most realistic evaluation of the adaptability of project lands to crop projection (particularly with respect to sugar). Based on this analysis, 198 acres or 53% of the project areas

(class I and II lands) are well adapted to sugarcane production under irrigation, 102 acres or 30% are marginally adaptable to sugar production, and the remaining 73 acres or 20% are not adaptable to cultivated crop production.

It is estimated that approximately 298 acres or 80% of the project site is currently in sugarcane production. There is no evidence of sugarcane production in the makai panhandle and the estimated 20 acres bordering the highway (including Honokai Hale). This appears to be close to the maximum that could be expected, considering soil capabilities for cultivated crop production. This represents about 2.2 percent of the 13,441 acres of sugarcane acreage reported by Oahu Sugar Company in 1987.

F. BIOLOGY

1. FLORA

A botanical survey of the project area was conducted by Kenneth Nagata in June, 1987. The report is included in Appendix B and summarized below.

Most of the site is occupied by sugarcane fields which have been in operation for decades. The fields in the east portion of the site are continuous but those toward the west are interlaced by gullies and rock debris piles. Scrub grasslands are found in the extreme west and along Farrington Highway near the Honokai Hale/Nanakai Gardens Subdivision.

Five vegetation types were identified within the study area. These are described below.

Sugarcane Fields - Sugarcane fields and their network of cane haul roads and irrigation and drainage system cover 80% of the property. The dominant species throughout most of the site is sugarcane (Saccharum officinarum). Cane fields are dynamic systems, changing with the different stages of cultivation. Cane fields may vary from newly harvested, bare fields to short stature, open stands to tall stature, very dense stands. At the time of the survey, the fields had been recently planted and the sugarcane had not yet formed a complete canopy. Although an open canopy and bare soils usually present optimal conditions for invasion of herbaceous weedy species, very few species were found, and in small numbers. Within the cane fields nut grass (Cyperus rotundus) and castor bean

(Ricinus communis) are the most important weeds identified.

Koa-Haole - Guinea Grass Wasteland - This vegetation type occurs in uncultivated areas generally in ravines and where debris and boulders have been piled up. Guinea grass (Panicum maximum) is the dominant species in major drainage areas where moisture is readily available. In the smaller ravines and on rock and debris piles koa haole is dominant. Several other species are associated with this vegetation type, but generally occur in small numbers. Of secondary importance and recorded as "occasional" were virgate mimosa (Desmanthus virgatus), castor bean (Ricinus communis) and hi'aloa (Waltheria americana). Just below Honokai Hale Subdivision there is a narrow band of Koa-Haole - Guinea Grass Wasteland with kiawe trees.

Scrub Grassland - Along Farrington Highway and in the uncultivated areas in the west and northwest portions of the site, the vegetation is dominated by buffel grass (Cenchrus ciliaris) and guinea grass with occasional emergent koa-haole and kiawe. Many of the species within the site are associated with the Scrub Grassland but mostly in small numbers. Feather fingergrass and hi'aloa were common and 'ilima (Sida fallax), hoary abutilon (Abutilon incanum), klu (Acacia farnesiana), false mallow (Malvastrum coromandelianum), wild spurge (euphorbia geniculata) and virgate mimosa were recorded as "occasional". Seventeen other species were recorded as "uncommon" or "rare". Most of this vegetation type has evolved from sugar cane fields which have been harvested and fallowed since 1979.

Roadway - The vegetation along the roadways generally consist of grasses and other herbaceous species with occasional shrubs. Buffelgrass and bermuda grass (Cynodon dactylon) were found to be the most abundant and koa-haole was regarded as "common". Golden crownbeard (Verbesina encelioides), field bindweed (Convolvulus arvensis)and guinea grass were recorded as "occasional". Twenty-two other species were regarded as "uncommon" or "rare". Guinea grass and Christmas berry (Schinus terebinthifolius) were locally common especially along the railroad easement.

Cultivated - Several ornamental species were found around the pumphouse. Although probably once cultivated, the area is presently dominated by such

common species as guinea grass, koa-haole, feather fingergrass, virgate mimosa, nut grass, and goose grass (Eleusine indica). The main cultivated species include: banana (Musa x paradisiaca), mango (Mangifera indica), croton (Codiseum variegatum var. pictum) and panini'awa'awa or aloe (Aloe vera) are the main cultivated species.

2. FAUNA

Two general groups of birds are found in the West Beach area: migratory shorebirds and introduced or exotic species. (See Table III-3) Of a total of 16 species observed by Berger, all but two species (Golden Plover and Wandering Tattler) are exotic birds and have been introduced to the Hawaiian Islands. The scant native vegetation in the dry leeward areas of Oahu were destroyed so long ago that there are no records of any other endemic landbirds that may have occupied such habitat prior to 1786. (FSEIS, West Beach, 1986) Introduced species consist of 14 species belonging to six bird families. None of the introduced bird species are of any concern in relationship to the Endangered Species Act of 1973 (16 U.S.C. Subsection 1531 et seq, 1974). Also, the introduced plant species do not provide suitable habitat for the endemic Hawaiian birds, with the possible exception of the Hawaiian Owl. (FEIS West Beach, 1985)

There are no suitable ponds or marshes in the study area to accommodate endemic Hawaiian water birds. It is possible that the Hawaiian Owl or Pueo (Asio flammeus sandwichensis) occurs in dry leeward regions. However, none were seen during Berger's studies. The Hawaiian Owl is identified as an endangered species on the island of Oahu under Regulation 6, State Department of Land and Natural Resources. (FEIS, West Beach, 1985) The Pueo prefers open grasslands and forested areas. A study prepared by Berger for the Ewa Gentry Environmental Impact Statement notes that the Pueo does not inhabit sugarcane fields or residential areas. (DEIS Ewa Gentry, 1988) Since most of the project area is under sugar cane cultivation and is adjacent to the Honokai Hale/Nanakai Gardens Subdivision, it is probably not used by the Pueo.

Table III-4 contains a list of terrestrial fauna which may inhabit the project site based on a survey of adjacent areas. (FEIS West Beach, 1985) Additionally,

TABLE III - 3

BIRDS OF THE WEST BEACH AREA

The sequence of bird families follows Van Tyne and Berger (1976).

Migratory Shorebirds

Family Charadriidae, Plovers, Turnstones, Surbirds

1. Pacific Golden Plover	(Pluvialis dominica fulva)
2. Wandering Tattler	(Heteroscelus incanum)

Introduced Birds

Family Ardeidae, Herons and Egrets

1. Cattle Egret	(Bubulcus ibis)

Family Columbidae, Pigeons and Doves

2. Spotted or Chinese Dove	(Streptopelia chinensis)
3. Barred Dove	(Geopelia striata)

Family Sturnidae, Starlings and Mynas

4. Common Myna	(Acridotheres t. tristis)

Family Zosteropidas

5. Japanese White-eye	(Zosterops j. japonicus)

Family Ploceidae, Weaverbirds and their Allies

6. Orange cheeked Waxbill	(Estrilda melpoda)
7. Red-eared Waxbill	(Estrilda troglodytes)
8. Strawberry Finch	(Amandava amandava)
9. Ricebird or spotted Munia	(Lonchura punctulata)
10. Black-headed Mannikin	(Lonchura malacca atricapilla)
11. House Sparrow	(Passer domesticus)

Family Fringillidae, Sparrows, Cardinals, and Buntings

12. Red-crested Cardinal	(Paroaria coronata)
13. Cardinal	(Cardinalis cardinalis)
14. House Finch	(Carpodacus mexicanus frontalis)

Source: U.S. Army Corps of Engineers Final Supplemental Environmental Impact Statement, U.S. Department of the Army Permit Application, Proposed Swimming Lagoons and Marina for West Beach Development, Honouliuli, Ewa District, Oahu, Hawaii, March 1986.

TABLE III-4

BARBERS POINT CHECKLIST OF MAMMALS

Common Name		Scientific Name	Status	ES	EF	Wildlife Habitat Relative Abundance				
						C	S	O	K	P
Feral dog, ilio	(Canidae)	Canis familiaris	X			O		O	R	O
Feral cat, popoki	(Felidae)	Felis catus	X			R	U			R
House mouse, iole li'ili'i	(Muridae)	Mus musculus domesticus	X				C	R	C	
Hawaiian rat, iole		Rattus exulans	E				O			
Brown rat, po'o-wai		R. norvegicus	X				R			
Black rat, iole nui		R. rattus	X					R	O	O
Mongoose, iole-manakuke	(Viverridae)	Herpestes auropunctatus	X			R	O	O	C	U

Source: M & E Pacific, Inc., Revised Environmental Impact Statement for the Barbers Point Deep Draft Harbor, June, 1978.

a review of the habitats on the project site indicates that there are no suitable feeding or breeding habitats for those species considered endangered.

G. HISTORICAL AND ARCHAEOLOGICAL RESOURCES

A archaeological reconnaissance survey of the project area was conducted in May, 1987 by Paul H. Rosendahl, Ph.D., Inc. The report is included in Appendix C with findings from the report summarized below.

The entire area has been extensively modified in recent times, primarily by sugarcane cultivation. Oahu Sugar Company currently cultivates virtually all of the project area, except for portions immediately adjacent to Honokai Hale Subdivision and the H-1 freeway (where sugarcane was formerly grown). Sugar cane cultivation involved extensive clearing, as evidenced by several large piles of boulders noted throughout the project area.

No archaeological sites of any kind were encountered within the project area during the reconnaissance survey of the Ko Olina Phase II project area. However, a previously identified site is located immediately adjacent to it. The Oahu Railroad and Land Company right-of-way (railroad bed) bounds the project area on the south side, and is listed on the National Register of Historic Places (Site 50-80-12-9714).

H. NOISE

A noise study for Ko Olina Phase II was conducted in November, 1988 by Y. Ebisu and Associates. The study is summarized below and attached as Appendix D.

Traffic Noise. Traffic noise contours of 70 to 60 Ldn (Ldn is the day-night sound level metric which averages noise levels over a 24-hour period) were identified for the Base Year (CY 1986) period along Farrington Highway in the area of the proposed golf course. Because the development of a golf course is not considered to be a noise sensitive land use, golf course development will not be incompatible with the highway noise levels.

Aircraft Noise. Aircraft noise contours for CY 1985 and CY 2005 were developed over the proposed Phase II development area to identify potential noise complaint and noise impact zones resulting form aircraft operations at NAS, Barbers Point and Honolulu International Airport. Results of the consultant's study indicate that aircraft noise levels over the project site are consistent with and actually more

conservative than the recent draft aircraft noise study prepared for Naval Air Station Barbers Point.

I. AIR QUALITY

An air quality study was conducted for the Ko Olina Phase II project area by Barry D. Root and Barry D. Neal in January, 1989. The study is included in Appendix F with portions of it summarized here.

Ambient air quality standards have been established for six pollutants: particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, and lead. National Ambient Air Quality Standards (AAQS) are stated in terms of primary and secondary standards. Primary standards are designed to protect the public health with an "adequate margin of safety". Secondary standards define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health welfare and to prevent the significant deterioration of air quality". Thus, State of Hawaii AAQS are in some cases considerably more stringent than comparable national AAQS. The AAQS specify a maximum allowable concentration for a given pollutant for one or more averaging times to prevent detrimental effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hr.) AAQS, both national and state standards allow one exceedence per year.

Present air quality at the Ko Olina Phase II project site is likely to be affected by air pollutants from four types of sources: natural, industrial, agricultural, and vehicular. Natural air pollution sources which could affect Ko Olina air quality include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the island of Hawaii. Nearby industrial sources of emissions include the Hawaiian Electric Company power plant at Kahe Point and the Campbell Industrial Park.

The predominant wind pattern in the Ewa area carries emissions from these facilities offshore and away from the site, but occasional impacts are possible. Sugar cane harvesting is the primary source of air pollution in the area related to agriculture. Vehicular-related emissions affecting the site occur mostly from the Farrington Highway and the H-1 freeway.

The State Department of Health maintains an air quality monitoring station in Campbell Industrial Park, about one mile southeast of the project site. Measurements for particulates, sulfur dioxide, and nitrogen dioxide have been made at this station. Measurements for the other regulated pollutants have been made by the State in and around Honolulu. From the data recorded at these stations, it appears that State of Hawaii AAQS for particulates, sulfur dioxide, nitrogen dioxide and lead are currently being met. The ozone AAQS has not been exceeded during the past two years at the Sand Island monitoring station. Carbon monoxide readings form urban Honolulu, which has the only monitoring station on Oahu, indicate that the state AAQS for carbon monoxide may be exceeded at a rate of one to three times per year in traffic congested areas. However, in the vicinity of the project, traffic congestion is not a problem at the present time.

J. SCENIC AND VISUAL RESOURCES

Travelling along Farrington Highway, Waianae bound, the open expansive view of the Ewa Plain is predominant. As one approaches the site, expansive mauka views of the Waianae mountain range and Puu Palailai can be experienced from Farrington Highway. Major view objects within the makai view plane include the Campbell Industrial Park, sugar cane fields, the Barbers Point Deep Draft Harbor, the Ko Olina Resort and the Pacific Ocean. The Honokai Hale and Nanakai Gardens subdivision are adjacent to the Farrington Highway and partially restrict views of the Ewa Plain from Farrington Highway.

The Coastal View Study conducted for the City Department of Land Utilization notes that "Ewa has never been acclaimed for its scenic qualities and not a single scenic lookout or provision for roadside viewing can be found within the district". (Chu and Jones, 1987) To better identify aspects of visual quality, the Coastal View Study divides the island into viewsheds. The Ewa Plain is divided into two viewsheds. Ko Olina Phase II is located in the West Beach Viewshed which, except for a few strands of coconut palms, are considered to hold no particular significance in its foreground or background. (Chu and Jones, 1987)

K. SOCIO-ECONOMIC CHARACTERISTICS

1. POPULATION

Demographic characteristics of the Ewa and Waianae districts were extracted from the 1980 Census of the Population. Where relevant, data on Waianae is

included in view of the district's proximity to the project site. The Ewa District is defined by census tract numbers 83, 84, 85, 86.01 and 86.02. The Waianae District is defined by tracts 96.01, 96.03, 96.04, 97, and 98. Table III-5 presents a summary of these findings.

Ewa District

Based on 1980 Census data, the Ewa District's population grew from 24,087 (3.9% of Oahu's population) in 1970 to 36,234 (4.8% of the Oahu's population) in 1980. Within this decade, growth in Ewa represented a 50% increase corresponding to an annual growth rate of 4.17%. This is well above the annual growth rate of 1.96% for the island of Oahu. In 1985, the Department of General Planning's estimate for the population of Ewa was 37,400.

Existing population centers include: Ewa Beach (1985 population of 14,500), Barbers Point Naval Air Station (1985 population of 2,924), Honokai Hale/Nanakai Gardens (estimated population of 1,150), Makakilo (1985 population of 8,922) and the Ewa Villages (1985 population of 3,000).

For the Ewa area, ethnic composition differs from the overall islandwide population with more Caucasians, Filipinos and Hawaiians. Caucasians are the largest ethnic group among Ewa's population. Nearly half of the area's residents are Caucasian (44.5%) and almost a quarter (24.8%) are Filipino. These percentages are higher than the respective percentages for the islandwide population.

The Ewa District has a relatively young population. Compared with the islandwide population, the Ewa District has a higher percentage of residents under 5 years of age (10.7%) and between 5 and 17 years of age (27.8%). The proportion of residents aged 18-64 and aged 65 years and older is lower in the Ewa District. Senior citizens constitute 7.3% of Oahu's population but only 3% of Ewa's population.

Ewa's population has a greater amount of residents that were born elsewhere in the United States (36% of the residents from Ewa were born outside of Hawaii compared with 30.1% for Oahu). Ewa is also characterized as having a lower percentage of residents who were born in Hawaii (49.6% for Ewa compared with 55.1% for Oahu).

Table III-5: Selected Demographic Characteristics
(1980)

	City and County* of Honolulu	Ewa D.P. Area* (C.T. 83-86.02)	Waianae D.P Area (C.T. 96.01-98)
TOTAL POPULATION	762,545	36,234	31,496
ETHNICITY	(percent)	(percent)	(percent)
Caucasian	41.2%	44.5%	25.5%
Japanese	24.9	8.8	7.7
Chinese	6.9	2.0	1.9
Filipino	12.6	24.8	15.4
Hawaiian	10.5	12.4	39.8
Other	5.5	7.5	9.7
AGE			
Less than 5 years old	7.9	10.7	11.5
5 - 17 years of age	20.2	27.8	29.2
18 - 64 years of age	64.6	58.6	54.2
65 or older	7.3	3.0	5.1
PLACE OF BIRTH			
Hawaii	55.1	49.6	76.5
Other US **	30.1	36.0	15.9
Foreign Country	14.8	14.5	7.6
RESIDENCE 5 YRS PREVIOUS (people aged 5+ yrs.)			
Same house	48.2	44.0	53.1
Same island	25.5	23.6	33.6
Different island	1.3	0.8	1.3
Different state	18.4	26.1	10.4
Different country	6.6	6.1	1.6
EDUCATION (people aged 25+ yrs.)			
0 - 8 years only	14.4	14.3	19.8
High school only	45.5	55.5	61.0
College, 4+ yrs.	40.0	30.2	19.3

Notes: ** Including persons born in U.S. territories, and abroad or at sea to American parents.

*** Except for Total Population and Age, all figures based on 15% sample.

\+ Because Ewa area census tracts are not coterminus with the DP area, the small town of Kunia in Central Oahu (1980 pop. 829) is included in this study because it falls into one of the Ewa census tracts.

Source: * Community Resources, Inc., 1986.
U.S. Department of Commerce, Bureau of the Census. Census of Population and Housing, 1980--Summary Tape File 3A.

Ewa residents show greater mobility than the Oahu population as a whole. Relatively fewer Ewa residents (44% versus 48.2% for Oahu) reported living in the same house five years earlier. Ewa residents were markedly more likely (26.1%) to have resided in a different state five years previously than Oahu residents (18.4%).

The adult population of Ewa contains proportionately fewer highly-educated people than does Oahu as a whole. Compared to the islandwide population, a slightly lower proportion of Ewa residents have had eight or fewer years of schooling. The proportion of high school graduates is higher, but the percentage who completed four years of education beyond high school (30.2%) is considerably lower than for Oahu as a whole (40.0%).

Waianae District

The Waianae population grew from 24,077 (3.8% of Oahu's population) in 1970 to 31,496 (4.1% of Oahu's population) in 1980. Growth in Waianae within this decade represented a 30.8% increase, corresponding to an annual growth rate of 2.7%. Growth in Waianae is higher than the Oahu annual growth rate of 1.96%. The Department of General Planning's most recent estimate of the population in the Waianae District is 34,903 in 1985.

Compared with the islandwide population, the most significant difference in the ethnic composition for the Waianae District is the high percentage of people of Hawaiian ancestry (39.8%). The Waianae District also has a higher percentage of Filipinos (15.4%) and those of "Other" ethnicities (9.7%), and significantly lower percentages of individuals of Caucasian, Japanese and Chinese descent.

The Waianae District has a relatively young population. Compared to the islandwide population, Waianae has a higher percentage of residents under 5 years of age (11.5%) and between 5 and 17 years of age (29.2%). The percentage of residents aged 18-64 (54.2%) and 65 or older (5.1%) is lower than that of the islandwide population.

Little over three-quarters (76.5%) of Waianae's residents were born in the State of Hawaii. Compared to the islandwide population, a smaller percentage of

Waianae residents were born outside the State of Hawaii.

Waianae area residents tend not to be as mobile as the islandwide population. Relatively more Waianae residents (53.1%) reported living in the same house or on the same island for the previous five years.

Compared with the islandwide population, Waianae has a higher percentage of individuals who have completed eight or fewer years in school (19.8%) and are high school graduates (61.0%). The percentage of those with four years of education beyond high school (19.3%) is significantly lower than that of the islandwide population (40.0%).

Future Projections

Official population projections for the Ewa and Waianae District were prepared by the City and County of Honolulu's Department of General Planning.

Ewa District

The Ewa District is projected to grow rapidly from a projected population of 36,845 in 1985 to 83,096 in 2005. (see Table III-6) During this 20-year period, population within the Ewa area is expected to increase from 4.5% (of the total population on Oahu) to 8.7%. For Ewa, the projected population growth represents a gain of 46,251 persons or a 125.5% increase over 1985 population levels. Compared to the projected islandwide annual growth rate of 0.79%, the Ewa District would have a substantially higher annual growth rate of 4.15%.

Waianae District

Over the next 20 years, Waianae is not expected to experience any substantial growth. (see Table III-6) From 1985 to the year 2005, the population of Waianae is projected to increase from 33,716 to 39,350. Population growth within the Waianae District is expected to remain proportionally constant at 4.1% (of the total population on Oahu) from 1985 to 2005. For Waianae, the projected population growth represents a gain of 5,634 persons or a 16.7% increase over 1985 population levels. The Waianae District is expected to grow annually at a rate of 0.79%, the same rate as for Oahu.

TABLE III-6

POPULATION PROJECTIONS BY DEVELOPMENT PLAN AREA:
1985-2005

Development Plan Area	1985 Total	1985 % Total	1995 Total	1995 %Total	2005 Total	2005 %Total
PUC	440,201	54.0%	467,500	52.1%	480,008	50.3%
Ewa	36,845	4.5%	64,499	7.2%	83,096	8.7%
Central	116,839	14.3%	127,640	14.2%	139,849	14.7%
East Honolulu	46,533	5.7%	52,106	5.8%	58,509	6.1%
Koolaupoko	114,631	14.1%	120,795	13.5%	124,225	13.0%
Koolauloa	12,334	1.5%	13,109	1.5%	13,826	1.4%
North Shore	14,200	1.7%	15,041	1.7%	15,635	1.6%
Waianae	33,716	4.1%	36,211	4.0%	39,350	4.1%
Total Oahu	815,299	100.0%	896,901	100.0%	954,498	100.0%

Source: Department of General Planning, Residential Development Implications of the Development Plans, August, 1985; Helber, Hastert, Kimura Final Environmental Impact Statement, Kapolei Town Center, prepared for the Estate of James Campbell, August 1988.

2. EMPLOYMENT

Employment and economic characteristics for the Ewa and Waianae Districts are presented in Table III-7.

Ewa District

Based on the 1980 Census, there are marked differences in labor force characteristics between the Ewa District and the islandwide population. A relatively high proportion of Ewa residents in the labor force are employed in armed forces occupations. Armed forces occupations employ 18% of the Ewa labor force, compared with 10% for the islandwide population.

Compared with the islandwide unemployment rate of 4.6% in 1980, the Ewa District had a higher unemployment rate of 8.0%. The Ewa District's labor force contains a higher proportion of blue collar workers (service, farm, precision, craft, repair, laborers, etc.) and a lower proportion of white-collar occupations (managerial- professional, technical, sales and administrative), when compared to the islandwide population. Workers in Ewa experience longer times in commuting to work than the average for Oahu. A significantly higher percentage of workers face a 45-minute plus commute time (22.6%) when compared with the Oahu average (12.0%). Mean travel time for Ewa residents is just under a half hour.

Median and mean incomes for Honolulu County households were $21,077 and $25,180 respectively in 1979. Ewa median income was similar although lower ($20,184) as a whole. Mean income of Ewa residents was lower at $20,455.

Employment projections for the Ewa Development Plan area indicate that development of the Secondary Urban Center will create a major new employment center in Ewa. Employment will be concentrated in three major employment centers: Kapolei Town Center, the James Campbell Industrial Park, and the Ko Olina Resort. A study done by Kenneth Leventhal and Co., in 1986 in conjunction with plans for the Kapolei Town Center estimates an increase in employment in Ewa from 4,400 in 1985 to 26,170 in the year 2005. (FEIS, Kapolei Town Center, 1988)

Table III-7: Labor Force Size and Characteristics (1980)

	City and County* of Honolulu	Ewa D.P. Area* (C.T. 83-86.02)	Waianae D.P Area (C.T. 96.01-98)
POTENTIAL LABOR FORCE			
(aged 16+/-)	574,903	23,862	20,062
not in labor force	30.8%	31.9%	45.9%
armed forces	10.1%	18.5%	4.2%
civilian labor force	59.1%	49.5%	46.0%
CIVILIAN LABOR FORCE	339,863	11,821	10,008
unemployed	4.6%	8.0%	7.7%
TOTAL EMPLOYED			
CIVILIAN LABOR FORCE	324,113	10,874	9,236
OCCUPATION			
service	17.6%	19.5%	19.8%
manager/professional	24.7%	14.2%	13.5%
technical,sales & admin.	33.8%	31.0%	22.2%
farm/fish/forest	1.8%	3.9%	6.6%
precision,craft,repair	11.3%	15.5%	16.7%
operators,fabricators,laborers	10.9%	16.3%	21.2%
INDUSTRY(selected)			
agriculture,forest,fish,mining	1.7%	6.1%	4.9%
construction	6.6%	7.5%	12.6%
manufacturing	7.7%	12.0%	10.1%
retail trade	20.5%	20.1%	17.6%
financial,insurance,real est.	8.1%	5.2%	3.6%
personal,entertain.& rec.serv.	8.1%	5.9%	5.9%
health,educ., & professional	18.5%	12.7%	13.8%
public administration	10.9%	13.4%	15.5%
COMMUTE TO WORK			
45 minutes or more	12.0%	22.6%	37.9%
mean travel time(min.)	22.6	25.8	32.8

Notes: All figures based on 15% sample

Source: * Community Resources, Inc., 1986.
U.S. Dept. of Commerce, Bureau of the Census. Census of Population and Housing, 1980--Summary Tape File 3A.

Waianae District

Compared to the islandwide population, Waianae has a higher percentage of individuals who are not in the labor force (45.9%). The Waianae District has a lower percentage of individuals employed in the civilian labor force (46.0% compared to 59.1% islandwide) or employed in armed forces occupations (4.2% compared to 10.1% islandwide).

Compared with the islandwide unemployment rate in 1980 of 4.6%, Waianae had a higher unemployment rate of 7.7%. The Waianae District labor force has a higher proportion of blue collar workers and a lower proportion of white collar workers. Compared with the island as a whole, Waianae has a significantly higher amount of individuals who commute 45 minutes or more to work (37.9%). Mean travel time for Waianae residents is a little over a half-hour.

Compared with the islandwide median and mean household incomes ($21,077 and $25,180, respectively), Waianae median and mean incomes are significantly lower at $15,552 and $18,254, respectively.

3. HOUSING

Housing in Ewa resembles the overall pattern for Oahu, where 49.8% of dwelling units are owner-occupied. Crowded units, those occupied by more than 1.51 persons per room, are somewhat more common in Ewa, with 8.5% of all homes defined as crowded by this standard. This is related to a larger than average family size in Ewa (3.96 persons per household, compared with 3.15 for all Oahu). While the 1980 median value of owner-occupied housing was lower than for the island as a whole, median monthly mortgage payments (at $514) were higher than the island-wide average of $494. In general, this would suggest that Ewa homeowners had purchased their homes more recently than the island-wide norm. (FEIS, West Loch Golf Course and Shoreline Park, 1988)

According to an estimate by the Department of General Planning, the Ewa Development Plan area in 1984 contained 9,300 housing units, or about 3.5% of the total Oahu housing stock of 265,600 units. Existing residential communities in the Ewa area include: Makakilo (2,700 units in 1985), Ewa Beach (3,465 units in 1985), Ewa Villages (900 units in 1985), Honokai Hale/Nanakai Gardens (290 units), and Naval Air

Station Barbers Point (850 military housing units in 1985).

Future Projections. The Department of Business and Economic Development (DBED) projects a resident population increase for the island of Oahu from 814,642 in 1985 to 954,500 persons by 2005. This translates to a need for an additional 48,000 housing units islandwide. Due to the increased employment opportunities, a greater demand will be placed on housing within the Ewa area. There are a number of residential housing projects planned for the Ewa District. Planned developments which would substantially increase Ewa's housing stock over the next 20 years include: Ko Olina residential development (5,200 units), additions to the existing Makakilo residential development (2,700 units), Ewa Gentry (7,150 units), Ewa Marina (4,800 units), Kapolei Knolls (500 units), Kapolei Village (4,871 units), West Loch Estates (1,500 units) and the Kapolei Town Center (1,708 units).

L. PUBLIC SERVICES AND FACILITIES

1. Access and Traffic

A traffic impact study was conducted for Ko Olina Phase II by Wilbur Smith Associates in January 1989. The study is attached as Appendix E with portions of it summarized below.

Interstate H-1 and Farrington Highway provide access to the site from the east and west. Interstate H-1 is a four-lane limited access facility running east-west through the study area. East of the Palailai Interchange, Farrington Highway is a two-lane arterial roadway extending from Waipahu to the project area where it merges with the Interstate H-1 facility. Farrington Highway is a four-lane arterial continuation of the H-1 facility west of the Palailai Interchange.

Access from H-1 to the project area is provided by the Palailai and Makakilo Interchanges. Kalaeloa Boulevard provides north/south access to and from the Campbell Industrial Park (JCIP) to the south of the Palailai Interchange. With the project area presently under sugarcane cultivation, private cane haul roads run through much of the area connecting with the existing transportation networks. Traffic generated by existing activities onto public roadways consist of

agricultural vehicles which have a negligible impact on peak hour traffic.

2. Public Transportation

The City and County of Honolulu, Department of Transportation Services (DTS), operates The BUS on a supply and demand basis, subject to availability of resources. Existing public transit service to the vicinity is provided by the City, with Route 51 between Honolulu and Makaha passing on Farrington Highway in front of the project area. A bus stop is located at the Kalaeloa Boulevard intersection for westbound buses. Eastbound buses exit the four-lane Farrington Highway to a bus stop at Makakilo Drive before proceeding back onto H-1. Existing weekday bus service is four buses per hour with weekend service approximately two buses per hour.

3. Water System

Ko Olina Phase II is located within the Board of Water Supply's Ewa - Waianae district. Major elements of the BWS system include source well fields in Waipahu, primarily Kunia I Wells (4.81 mgd) and Hoaeae Wells (6.61 mgd), and major transmission lines servicing the communities of Honouliuli, Ewa Village, Ewa Beach, Makakilo, Campbell Industrial Park, and Honokai Hale/Nanakai Gardens. Major transmission lines include: the 30-inch transmission main along Farrington Highway connecting the Hoaeae Wells with the Barbers Point 215 Reservoir and Booster, a 20-24 inch main along Kalaeloa Boulevard servicing the Campbell Industrial Park, and 16-inch mains along Makakilo Drive and Fort Weaver Road servicing the communities of Ewa Beach and Makakilo, respectively. The BWS also maintains a number of reservoirs and booster pumps within the planning area. In addition to serving the Ewa area, BWS also transmits water through Ewa and around Kahe Point to Waianae Coast communities. (FEIS, Kapolei Town Center, 1988)

The Ewa Water Master Plan approved by the Board of Water Supply is a compilation of projected water uses and a plan for the construction of offsite water facilities to serve development on the Ewa Plain. Total water use for the Ewa Plain for projects identified in the Ewa Water Master Plan is projected to be 31.4 mgd. Of this total amount, 24.1 mgd will be supplied by potable and non-potable systems owned and operated by the Board of Water Supply (BWS). The

remaining 7.3 mgd would be provided by private, non-potable irrigation systems. (Ewa Water Master Plan, 1988)

The Ewa Water Master Plan identifies the necessary source, transmission, and storage systems for potable and non-potable water supplies necessary to accommodate planned developments. As a conservation measure, the water master plan promotes the use of dual water systems wherever possible using non-potable water for irrigation use. Mauka of the project site and Farrington Highway, construction is underway for water transmission mains, reservoirs, and non-potable wells for Ko Olina resort. New potable water wells have been identified for development as part of the Water Master Plan at the 440-foot elevation of upper Honouliuli, mauka of H-1 Freeway and west of Kunia Road. New wells will be located in the Waianae subzone of DLNR's Pearl Harbor Ground Water Control area. Once completed, all off-site water facilities will be dedicated to the Honolulu Board of Water Supply for operation and maintenance.

Desalting Plant. The State of Hawaii, Department of Land and Natural Resources, Division of Water and Land Resources is planning to build a demonstration desalting plant in Campbell Industrial Park, southeast of the project site. The plant will purify brackish water to produce approximately 1 million gallons of fresh water a day. Operation of the project is expected to commence in April 1989.

4. Wastewater System

On the mauka side of the railroad right-of-way, 33 and 36-inch trunk sewers connect to the municipal Makakilo Interceptor Sewer which conveys and discharges wastewater to the Honouliuli Wastewater Treatment Plant. The Honouliuli Wastewater Treatment Plant, which is part of the Mamala Bay Sewerage District, also services Central Oahu and the Primary Urban Center Development Plan districts west of Red Hill (not including Pearl Harbor Naval Base), Campbell Industrial Park, Schofield-Wheeler and Wahiawa-Whitmore Village. It has a capacity of 25 million gallons per day (mgd) with a current flow of 21 mgd.

Once treated, the primary treated effluent is discharged by deep outfall off the Ewa Coast via the Barbers Point Ocean Outfall. The Barbers Point Outfall has a capacity of 112 mgd, the projected peak

flow for the year 2020. Currently, the Division of Wastewater Management has requested funding to expand the plant capacity to 38 mgd by the year 1993 to accommodate proposed developments in Central and Leeward Oahu.

5. Solid Waste Disposal

Residential areas near the Ko Olina Phase II project site are serviced by the City and County of Honolulu, Division of Refuse. Non-residential uses and multi-family residential areas are serviced by private refuse collection companies. Solid wastes are disposed of at the Waipahu Incinerator. The Palailai Sanitary Landfill ceased operation on May 31, 1988. The Waipahu Incinerator is currently operating at capacity and the disposal site adjacent to the incinerator is estimated to reach capacity in 1989. The Waimanalo Gulch Sanitary Landfill is currently under construction by the City Department of Public Works. The new landfill site is scheduled to begin operations in mid-1989. The City is also in the process of developing a waste-to-energy recovery facility (HPOWER) within the Campbell Industrial Park which is also scheduled to become operational in 1989. It is expected to have a capacity of 560,000 to 750,000 tons per year, a capacity sufficient to accommodate most of Oahu's solid waste. Ash and residue from the HPOWER facility will be disposed of at the Waimanalo Gulch Sanitary Landfill.

6. Drainage System

According to the Federal Flood Insurance Administration maps for Oahu, the project site is located in Zone D which consists of "areas of undetermined but possible flood hazard".

The project site lies within three natural drainage basins which extend off-site to the Waianae Mountains and down to the ocean. Storm runoff from the offsite mauka lands above Farrington Highway, including the Honokai Hale/Nanakai Gardens Subdivision, traverses the project area in its flow to the ocean. Runoff from the west end of the project site presently drains to the recently built improvements in the Ko Olina Resort development. Storm runoff from this tributary drainage area is conveyed by grassed channels in the golf course to the Ko Olina Marina.

Storm runoff from the central portion of the site is presently conveyed through an existing unlined channel (constructed by the sugar plantation company) from Farrington Highway to a bridge crossing at the existing railroad right-of-way. From there, the storm runoff continues in an existing unlined channel to its ocean discharge on the west side of the Chevron Refinery.

The eastern portion of the site presently drains to three existing 48-inch culverts which cross Kalaeloa Boulevard near the railroad right-of-way. Thereafter, the flow continues in an unlined ditch to an existing major unlined channel along the Barbers Point-Campbell Industrial Park boundary and discharges into the ocean.

7. Electrical and Telephone System

The Hawaiian Electric Company (HECO) generates electric power from its Kahe and Waiau generating stations for most of the areas within the planning area. Major electrical transmission facilities within the areas include a pair of 138 KV overhead lines extending from the Kahe Power Plant to the James Campbell Industrial Park substation (traversing the project site) and 46 KV overhead lines (also traversing the site) servicing Makakilo, Honokai Hale, Naval Air Station Barbers Point, Honouliuli, Ewa Beach and Iroquois Point.

The Hawaiian Telephone Company provides local residential and business telecommunication services to existing communities. The American Satellite Company has recently constructed a satellite communications station at the base of Puu Palailai. AT&T maintains an underground optical cable running along Farrington Highway.

An existing fuel oil pipeline which runs underground from the Chevron Refinery, within JCIP, along Kalaeloa Boulevard and thence along the makai side of the OR&L Right-of-Way to the Kahe Power Plant runs adjacent to the southern end of the project.

8. Schools

Enrollment in the Leeward School District more than doubled in size from 15,227 students in 1960 to 33,420 in 1972 as a result of intensive construction of large tract type housing at Pearl City, Waipahu, Makakilo,

and Ewa Beach. The next five years marked a decline in enrollment from 33,640 students in 1976 to 29,022 in 1984. A comparison of enrollments with design capacity indicates that most Ewa schools have 20% and 60% of their capacity available to accommodate future growth. (FEIS Kapolei Town Center, 1988)

The Ko Olina Resort plan provides a site for an elementary school with adjacent park space for student use should it be required. The new school site would be developed when the Ko Olina community has generated a sufficient demand for a new facility. Also, the Kapolei Village development has provided areas to accommodate two elementary schools, one intermediate school and a high school.

9. Parks and Recreational Facilities

There are a limited number of facilities located within the immediate vicinity of the site. Existing recreational facilities include regional parks, community parks, neighborhood parks and beach/shoreline parks. Regional parks are intended to serve the islandwide population. They are high intensity use areas that may include a variety of recreation park types and facilities, and natural and cultural sites. The 28.0 acre Kapolei Park is the only regional park located within the Ewa area. Community parks serve an approximate population of 10,000 people. They normally include playfields, courts and a recreation building. There are four community parks located in or near the project area. They include the 13.3 acre Ewa Beach Community Park, the 8.5 acre Makakilo Community Park, the 5.8 acre Kamokila Park (located within the project area), and the 6.3 acre Ewa Mahiko Park. The Ko Olina Resort in its phase one plans also provides for an 11-acre park adjacent to a proposed school site and just below the western end of the Phase II site. Neighborhood parks serve an approximate population of 5,000 people. They normally include playfields and courts, and a comfort station. There are three neighborhood parks within the Ewa District. They include the 4.3 acre Puuloa Playground, the 4.0 acre Makakilo Playground, and the 4.4 acre Mauka Lani Neighborhood Park.

The 5.8-acre Kamokila Park is located within the project area. Current facilities at the park include a multi-purpose room, a basketball and volleyball court, a small slide for children, and a softball

field (which is currently closed for maintenance purposes).

The City and County of Honolulu, Department of Parks and Recreation has plans for expansion of the Kapolei Park and Ewa Mahiko Park. The City will also develop a 17-acre district park at West Loch. The City also has plans for the expansion of Kahe Beach Park (located in the Waianae District, but near the vicinity of the study area). The 13-acre proposed park expansion will include a comfort station and parking.

There are also a number of private developments that incorporate recreational facilities into their master plans. A number of these developments are proposed or will be developed in the near future in the vicinity of the project area. The Kapolei Village residential development proposes the development of two 6-acre neighborhood parks and a 14-acre community park within the major residential areas. The Kapolei Town Center development proposes a number of recreational activities within its plan. A district park of approximately 78 acres as well as a number of smaller park facilities have been proposed for the project. The Puu Palailai landfill will be reclaimed and developed into a regional park. A portion of the park will be used for an outdoor amphitheater. (FEIS, Kapolei Town Center, 1988)

Existing Golf Courses. Currently, there are eight golf courses located in the Ewa, Waianae, and Central Oahu area; three are military, one is municipal, two are private courses and two are resort courses. The military courses at Schofield Barracks and Barbers Point are operated solely for the benefit of military personnel. The remaining five courses - Mililani, Hawaii Country Club, Ted Makalena, Makaha West and East - are currently well utilized, with most operating near capacity.

10. Police and Fire Protection

Police service to the Ewa area is provided by the Pearl City station, which is staffed by 161 police officers who rotate on three different shifts. The Pearl City Station patrols three districts: the Waianae Coast, Waipahu/Ewa Beach, and Aiea/Pearl City. (FEIS, Kapolei Town Center, 1988)

Fire services to the proposed development site are now provided from the Makakilo station, which houses an engine company and five fire-fighters. Additional City Fire Department units are available from the Waipahu and Nanakuli stations.

A proposed amendment to the Ewa Development Plan, Public Facilities Map has designated a new fire station at the Campbell Industrial Park. (FSEIS West Beach, 1986) A fire station is also included within the Ko Olina Phase One area and another is under consideration as part of the Kapolei Town Center development.

11. Health Care Services

Existing health and medical care facilities are located in Waianae, Ewa Beach, and Waipahu. These facilities consist of medical clinics and physician offices. Presently, the hospitals located closest to the project area are the Wahiawa General Hospital and the Kaiser Moanalua Medical Center. The closest ambulance service is provided by the City and County of Honolulu, Department of Health and is located at the Waipahu Fire Station.

New hospital facilities which have been approved by the State Department of Health include a 116-bed facility at Pearl Ridge (Pali Momi) and a 136-bed facility in Waipahu (St. Francis). The Pali Momi Medical Center includes a medical building which will house 56 physician's office suites and a 116-bed hospital. Pali Momi is scheduled to open in July 1989. St. Francis Hospital is in the process of constructing a new hospital facility and medical plaza (St. Francis Medical Center West and St. Francis Medical Plaza West, respectively) in the Ewa-Waipahu area. Both facilities are located on Fort Weaver Road across from the West Loch Estates development. The 136-bed hospital facility will provide both Emergency room service and ambulance service. The facility is currently nearing completion and is expected to be operational by Fall of 1989.

RELATIONSHIP TO PLANS, POLICIES AND CONTROLS

IV. RELATIONSHIP TO PLANS, POLICIES AND CONTROLS

A. HAWAII STATE PLAN

The Hawaii State Plan, adopted in 1978 and revised in 1986, establishes the overall theme, goals, objectives and priority guidelines for the future long-range development of the State. The project supports and is consistent with the following State Plan objectives and policies:

Section 226-6 Objectives and Policies for the Economy-in General (a)(1) Increased and diversified employment opportunities to achieve full employment, increased income and job choice, and improved living standards.

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

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

Comment: Phase II activities will help sustain the level of construction activity in the State, and benefit the Ewa and Waianae areas by the additional employment opportunities. After construction the new facilities are expected to provide full-time employment for approximately 2,450 residents. The new jobs created by the proposed project will help to diversify economic opportunities for the Ewa and Waianae area and will reduce the number of residents that will have to commute to Honolulu for employment.

Section 226-7 Objectives and Policies for the Economy-Agriculture.
(b)(6) Assure the availability of agriculturally suitable lands with adequate water to accommodate present and future needs.

Comment: Withdrawal of the project site in itself would not significantly impact the availability of agriculturally suitable lands. Agriculturally zoned A and B lands on Oahu exceeded the land required for crop production in 1987 by approximately 8,000 acres. The development of Ko Olina Phase II will not have a significant impact on present and future water requirements.

Section 226-8 Objectives and Policies for the Economy-Visitor Industry.
(b)(1) Support and assist in the promotion of Hawaii's visitor attractions and facilities.

(b)(3) Improve the quality of existing visitor destination areas.

(b)(4) Encourage cooperation between the public and private sectors in developing and maintaining well-designed, adequately serviced visitor industry and related developments which are sensitive to neighboring community and activities.

(b)(5) Develop the industry in a manner that will provide new job opportunities and steady employment for Hawaii's people.

Comment: The construction of the golf courses, community park and commercial development will support the promotion of Hawaii's visitor industry and improve the quality of the Ko Olina Resort destination area. The new facilities will provide a variety of activities to meet the diverse needs of both visitors and residents. The new development will also provide a number of permanent job opportunities for residents in the neighboring communities.

Section 226-12 Objectives and Policies for the Physical Environment-Scenic, Natural Beauty, and Historic Resources
(b)(3) Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.

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

Comment: The construction of golf courses and community park will help preserve the open views of the Ewa plain along Farrington Highway. The open space created by golf course development which will border the majority of the project area along Farrington Highway will help to complement the natural beauty of the Ewa plain.

Section 226-13. Objectives and Policies for the Physical Environment-Land, Air, and Water Quality
(b)(7) Encourage urban developments in close proximity to existing services and facilities.

Comment: The project area is adjacent to the Farrington Highway, the Ko Olina Resort complex, Barbers Point Harbor and the Honokai Hale/Nanakai Gardens subdivision. Future developments within the vicinity of the proposed project include the Kapolei Town Center, Makakilo expansion, and Kapolei Village. The proposed development will provide employment as well as commercial and recreational

opportunities which are in a close proximity to a variety of existing and future developments.

Section 226-14 Objectives and Policies for the Facility Systems-General
(b)(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.

Section 226-16 Objectives and Policies for Facility Systems-Water
(b)(1) Coordinate development of land use activities with existing and potential water supply.

Comments: An assessment of groundwater resources has been undertaken in conjunction with the Ewa Water Master Plan to ensure that the required facility system can be supported within the existing resource capacities. To preserve potable water supply, non-potable water sources will be developed for irrigation of the golf courses.

Section 226-18 Objectives and Policies for Facility Systems - Energy/Telecommunications
(a)(2) Increased energy self-sufficiency.
(c)(3) Promote prudent use of power and fuel supplies through conservation measures including education and energy-efficient practices and technologies.

Comments: The proposed developments do not involve the production of energy and will not of itself promote increased energy self-sufficiency for the State.

Section 226-23. Objectives and Policies for Socio-Cultural Advancement-Leisure
(b)(2) Provide a wide range of activities and facilities to fulfill the cultural, artistic, and recreational needs of all diverse and special groups effectively and efficiently.

(b)(5) Ensure opportunities for everyone to use and enjoy Hawaii's recreational resources.

(b)(6) Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.

Comment: The golf course and neighborhood park expansion will help to fulfill the recreational needs of the resort and surrounding community. They will provide a range of activities to accommodate both current user groups as well as the demand that will be generated by future development and growth in the area.

Part II Priority Guidelines

The purpose of establishing priority guidelines is to address areas of statewide concern. The proposed development supports or conforms to the following priority guidelines.

Section 226-103 Economic Priority Guidelines

(b)(2) Encourage the development and maintenance of well-designed, adequately serviced hotels and resort destination areas which are sensitive to neighboring communities and activities and which provides for adequate shoreline setbacks and beach access.

(b)(7) Maintain and encourage a more favorable resort investment climate consistent with the objectives of this chapter.

Comment: The intent of the golf course, park and commercial development is to provide for a more favorable resort investment climate. Development will help to improve the overall functional relationship within the Ko Olina resort community. The proposed development will also provide new commercial and office facilities to support the resort and the Second City communities.

(c)(1) Provide adequate agricultural lands to support the economic viability of the sugar and pineapple industries.

Comment: The effects of removing lands from sugar cane cultivation are not expected to materially affect the economic viability of the sugar industry. Only 2.2% of Oahu Sugar lands would be affected leaving about 10,000 acres under continued cultivation in Ewa. Thus, withdrawal of this parcel will have no significant impact on the economic viability of the sugar industry. Withdrawal is not applicable to pineapple, which is better adapted ecologically to other areas on Oahu.

(d)(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.

Comment: The subject lands are indicated to be viable only for sugarcane. The agricultural feasibility study indicates that long term viability for sugarcane is questionable because of opposition to sugar price supports and the possibility of non-renewal of the 1985 Food Security Act in 1990. Also, there is a possibility that this parcel would be phased out of sugarcane even if price supports are

continued in the event that costs increase at a greater rate than prices. No alternative crops have been identified for the project area.

(e)(2) Encourage the improvement of irrigation technology and promote the use of economically feasible alternative water sources.

Comment: The source of water for irrigation of the golf course and landscaping will be from non-potable source. Thus, water use for the golf course will not significantly alter any potable water sources.

(f)(1) Encourage the development, demonstration, and commercialization of renewable energy sources.
(f)(2) Initiate, maintain, and improve energy conservation programs aimed at reducing energy waste and increasing public awareness of the need to conserve energy.

Comment: Some of the electricity for the project may be provided by the H-POWER project which produces energy from solid waste, however, the project proponents have no control over the source for the provision of this power. Since the project is still in its conceptual phase of planning, the consideration of energy conservation measures such as in building design must await more detailed development and design plans. The developer is supportive of energy conservation programs, however, since this wuold also result in lower operating costs for the development. An energy conservation ethic will be maintained as more detailed designs are pursued.

Section 226-104 Population Growth and Land Resources Priority Guidelines
(a)(3) Ensure that adequate support services and facilities are provided to accommodate the desired distribution of future growth throughout the State.

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

Comment: All infrastructure costs will be borne by the developer. The general public will benefit from use of the access road, community park, golf course, and commercial area. Development of the golf courses and community park will help to preserve open space within the project area. The proposed development will provide a variety of jobs and support facilities to help accommodate the resort needs and the projected growth within the Ewa district.

(b)(2) Make available marginal or non-essential agricultural lands for appropriate urban uses while maintaining agricultural lands of importance in the agricultural district.

Comment: Approximately 47% of the land areas in the project has been identified as marginal or sub-marginal for crop production, although a considerable portion of it is currently used for sugarcane production. Withdrawal of this site from sugar cultivation is expected to have a less adverse effect than withdrawal of most similar sized parcels elsewhere on the plantation due to lower quality soils, higher irrigation requirements, and greater distance from the mill. In addition, under the current Development Plan designations, the various urban developments in the surrounding area would render the site incompatible for agricultural use.

B. STATE FUNCTIONAL PLANS

The Hawaii State Plan directs appropriate State agencies to prepare Functional Plans which address statewide needs, problems, and issues, and recommend policies and actions to mitigate those problems. State functional plans must implement and be in conformance with the overall themes, goals, objectives, policies and priorities of the State Plan. There are twelve functional plans for the State of Hawaii: agriculture, transportation, conservation lands, education, tourism, water resources, energy, recreation, historic preservation, health, housing, and higher education.

The following section presents a review of the functional plans which are applicable to the proposed project.

State Tourism Functional Plan. The overall theme of the State Tourism Functional Plan is "[t]he achievement of a visitor industry that constitutes a major component of steady growth for Hawaii's economy." The plan identifies "major issues and problems areas and sets forth policies and actions to insure against unplanned growth which could be damaging to the visitor industry and to the quality of life and well-being of the people of Hawaii.". The Plan addresses four sub-areas within the visitor industry, which include: tourism promotion, physical development, employment and career development, and community relations.

Ko Olina Phase II is in compliance with the following objectives of the Tourism Functional Plan.

Objective B(1)(a) Ensure that visitor activities are in keeping with the economic and physical needs and aspirations of Hawaii's people.

Objective (B)(2) Improve the quality of existing visitor destination areas.

Objective B(3) Encourage greater cooperation between the public and private sectors in developing and maintaining well-designed and adequately serviced visitor industry and related developments.

Objective B(4) Ensure that visitor facilities and destination areas are carefully planned and sensitive to existing neighboring communities and activities.

Comment: The proposed development is part of the overall Ko Olina Resort community. The golf courses, park, and commercial area will provide a variety of jobs and facilities for the anticipated population growth in Ewa. Thus, the proposed project serves to enhance the quality of the Ko Olina resort development. Ko Olina Phase II will also provide added infrastructure, facilities, and recreational and commercial opportunities for both residents and visitors. Overall, the development of the Ko Olina Resort helps to fulfill the successful development of the Secondary Urban Center in Ewa.

State Recreation Functional Plan. The purpose of the State Recreation Functional Plan is to "assess present and potential demand and supply of outdoor recreation resources and to guide State and County agencies in acquiring or preserving lands of recreation value, providing adequate recreational facilities and programs, and ensuring public access to recreation areas.". Major areas of concern were categorized into the following categories: land use planning, conservation, resource management, recreation facilities and programs, access and coordination. The plan further refines and implements the objectives, policies and priority directions of the Hawaii State Plan.

For the Ewa area, the plan identifies a need for new facilities and improvements to existing recreation facilities. More specifically, for facility based recreation, the plan states that, "[t]here is expected to be a high need for action on facility based recreation, such as field games, court games, playground equipment, pool swimming and tennis.".

The proposed project complies with the following objectives and policies of the State Recreation Functional Plan.

Objective A(3) Emphasize the scenic and open space qualities of physical resources and recreation areas.

Objective C(1) Maintain an adequate supply of recreation facilities and programs which fulfill the needs of all recreation groups.

Objective E(3) Coordinate visitor and resident recreation interests to achieve compatible recreation usage.

Comment: Development of Ko Olina Phase II golf courses and community park will help to preserve open space and views along Farrington Highway. Development will accommodate the recreational activity needs of visitors for resort golf which will ease the demand on other golf courses more accessible to residents. Overall, the proposed development will provide a variety of recreational opportunities for residents and visitors.

State Agriculture Functional Plan. The purpose of the State Agriculture Functional Plan is to set forth objectives, policies, programs, and projects to guide State and County agencies in implementing the agriculture and agriculture related objectives, policies and priority guidelines contained in the Hawaii State Plan.

Objective B(5)(c) 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.

Comment: Reclassification of the project lands to "Park" would be in compliance with the overriding public interest for the site. Under existing and impending developments of the City's Development Plan for Ewa, the project area will be completely surrounded by urban development. The "Park" designation would provide an additional 167 acres of open space than that which has been allocated in the existing development plan. Golf course use would assure open space and provide recreational facilities for adjoining urban developments. The various urban developments within the Development Plan would render the project site incompatible for agriculture use.

C. STATE LAND USE DISTRICT CLASSIFICATION

Pursuant to the Hawaii Land Use Law (Chapter 205, HRS), the State Land Use Commission has classified all lands in the State into four land use districts: Urban, Agricultural, Conservation and Rural. The 372.6 acre petition area is almost entirely within the State Agricultural District (See Figure IV-1). The proposed uses and developments will require a district boundary amendment to change the underlying land use classification from Agricultural to Urban.

It should be noted that the Phase II boundary along the western edge does not coincide exactly with the State Land Use boundaries separating the Urban from the Agricultural districts. With the existing classification, a small portion of the Phase II site is already designated Urban and a small portion of the Phase I area is still in Agricultural. The remaining Agricultural acreage in Phase I will be submitted for reclassification to Urban along with the boundary amendment petition for Ko Olina Phase II.

The decision-making criteria for district boundary amendments include:

- Compliance with the Hawaii State Plan, priority guidelines and Functional Plans; and also the Coastal Zone Management (CZM) objectives and policies.

- Conformance to the applicable district standards;

- Impact of the proposed reclassification on the following areas of state concern:

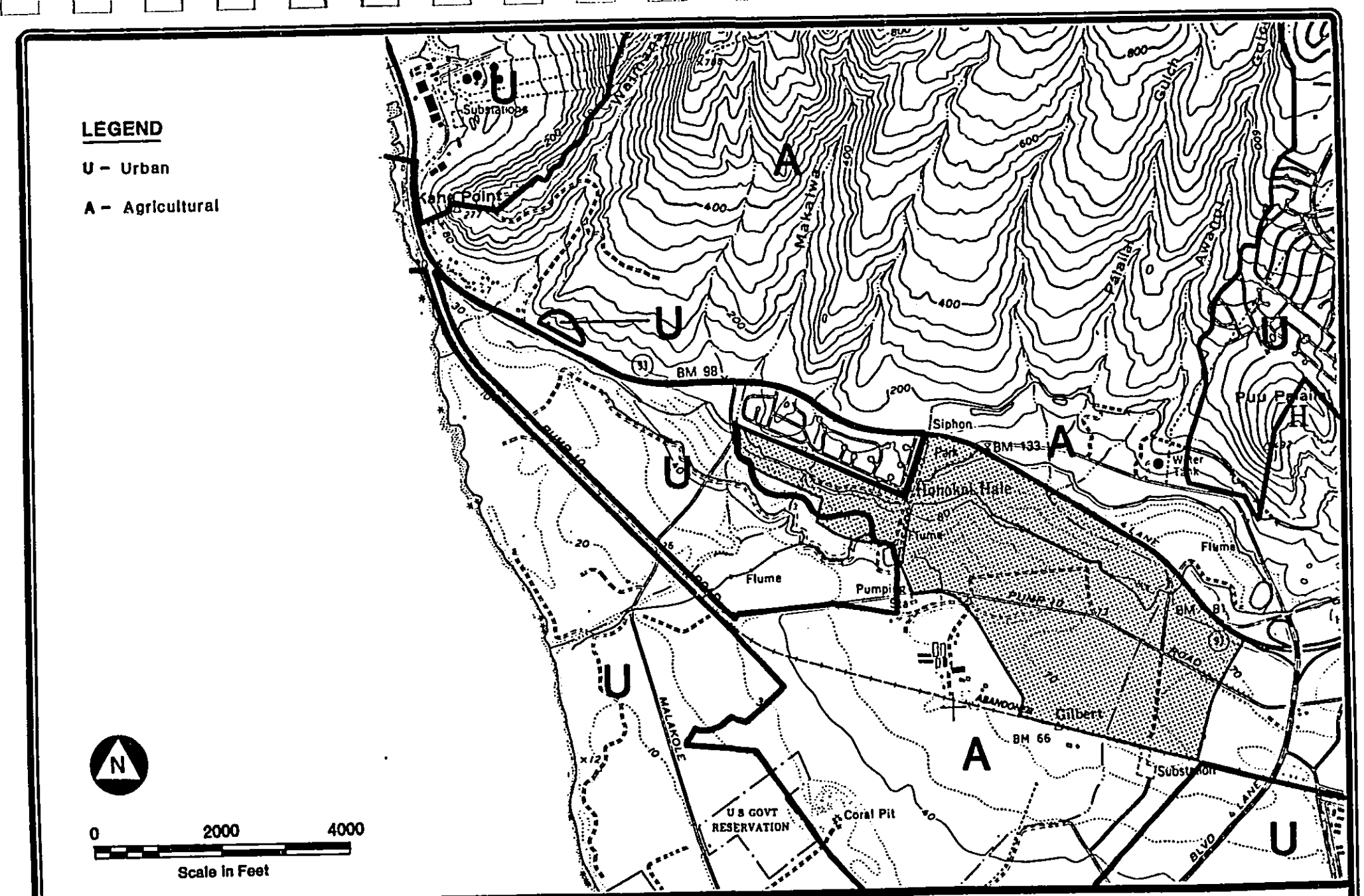
  Preservation or maintenance of important natural systems or habitats;

  Maintenance of valued cultural, historical, or natural resources;

  Maintenance of other natural resources relevant to Hawaii's economy, including, but not limited to agricultural resources;

  Commitment of state funds and resources;

  Provision for employment opportunities and economic development; and



Ko Olina Phase II
West Beach Estates

Fig. IV-1
STATE LAND USE DISTRICTS

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Provision for housing opportunities for all income groups, particularly the low, low-moderate and gap groups.

- Consideration of the general plan of the county in which the land is located. (Department of Planning and Economic Development, 1986)

D. OAHU GENERAL PLAN

The City and County of Honolulu General Plan specifies long-range objectives and policies to guide both the quantity and quality of future growth on Oahu. The General Plan is a statement of the long-range social, economic, environmental, and design objectives for the general welfare and prosperity of the people of Oahu. The General Plan also provides broad policies which facilitate the attainment of the objectives of the Plan. The General Plan was first adopted in 1977 and subsequently amended in 1979, 1982, 1985, and 1987. The project is consistent with the following General Plan objectives and policies.

Population Objectives and Policies
Objective B, Policy 2 Provide adequate support facilities to accommodate future growth in the number of visitors to Oahu.

Objective C, Policy 2 Encourage the development of a secondary urban center in the West Beach-Makakilo area to relieve development pressures in the urban-fringe and rural areas.

Comment: The Ko Olina Resort supports and is consistent with the designation of Ewa as the Secondary Urban Center for growth and development on Oahu. The proposed golf course, park and commercial area will provide the adequate support facilities to accommodate the development and growth of the Ko Olina Resort. The facilities will provide visitors with a number of recreational and commercial activities near the destination area. The proposed development will also help relieve development in the urban fringe and rural areas by concentrating growth in the vicinity of the existing and proposed developments.

Economic Activity
Objective B, Policy 6 Permit the development of secondary resort areas in West Beach, Kahuku, Makaha and Laie.

Objective B, Policy 7 Manage the development of secondary resort areas in a manner which represents the existing lifestyle and the natural environment, and avoids

substantial increase in the cost of providing public services in the area.

Objective B, Policy 9 Encourage the visitor industry to provide a high level of service to visitors.

Comment: The proposed project serves to enhance the overall quality of the Ko Olina Resort development. The proposed development will provide a variety of quality recreational and commercial activities and serve to enhance the needs of both visitors and residents. The development of the golf courses, community park and commercial facilities will also serve to accommodate the demand for facilities created by the increasing resident and visitor population within the resort area and the Ewa District.

Objective C, 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.

Objective C, Policy 6 Encourage the more intensive use of productive agricultural lands.

Comment: The proposed development would not adversely affect the viability of the sugar industry, as nearly 10,000 acres remain in sugarcane cultivation in other areas of the Ewa plain. The affected acreage also has higher costs of transportation due to its distance from the mill, has lower quality of soils on average than elsewhere, and has higher irrigation water requirements.

Objective G, Policy 1 Direct economic activity primarily to Honolulu, Aiea, and Pearl City; and, secondarily to the West Beach-Makakilo area and to provide full government services in both the Primary Urban Center and the Secondary Urban Center.

Objective G, Policy 3 Maintain sufficient land in appropriately located commercial and industrial areas to help ensure a favorable business climate on Oahu.

Comments: Jobs and activities generated from the proposed project would assist in directing economic activity to the Ewa district. The commercial development proposed in this project would provide retail and office space which will help meet the needs of the anticipated growth in the Ewa district and beyond.

Natural Environment
Objective B, Policy 2 Protect Oahu's scenic views, especially those seen from highly developed and heavily travelled areas.

Objective B, Policy 4 Provide opportunities for recreational and educational use and physical contact with Oahu's natural environment.

Comment: The proposed park and golf course development will provide green open space for a major portion of the project area. This will provide for broad views from Farrington Highway which better promote the visual and aesthetic qualities of the Ewa Plain. The community park will provide residents and visitors with opportunities for recreational use and physical contact with the natural environment.

Physical Development and Urban Design
Objective A, Policy 7 Locate new industries and new commercial areas so that they will be well related to their markets and suppliers, and to residential areas and transportation facilities.

Objective A, Policy 8 Locate community facilities on sites that will be convenient to the people they are intended to serve.

Objective C, Policy 2 Encourage the development of a major residential, commercial and employment center within the secondary urban center.

Comment: The proposed project will be located adjacent to the first phase of the Ko Olina Resort development. The project is also located in close proximity to major transportation facilities (the Barbers Point Deep Draft Harbor and the Farrington Highway). The new facilities will help accommodate the growing demand created from the increase in population growth which is projected for the Ewa Plain. The new activities will be located in a close, convenient proximity for residents in neighboring and nearby residential communities and will accommodate their employment, recreational and commercial needs.

Objective D, Policy 1 Develop and maintain community-based parks to meet the needs of the different communities on Oahu.

Objective D, Policy 7 Provide for recreation programs which serve a broad spectrum of the population.

Objective D, Policy 9 Require all new developments to provide their residents with adequate recreation space.

Comment: The variety of activities and facilities provided by the proposed project will accommodate the needs of a larger number of residents and visitors. Development of the park and golf courses will provide additional recreational space for the Ko Olina Resort development as well as for new and existing residential developments in the area.

E. CITY AND COUNTY OF HONOLULU DEVELOPMENT PLAN

Development Plans prepared for the eight planning districts on Oahu provide detailed schemes for implementing the objectives and policies of the General Plan. The Development Plans guide the desired sequence, patterns and characteristics of future development. Development Plans consist of three elements: Common Provisions, Special Provisions (for each of the eight planning areas), and Development Plan Land Use Maps and Public Facility Maps. These plans also provide maps that indicate: 1) the planned distribution and intensity of land uses and public facilities; 2) statements of standards and principles with respect to land uses; 3) statements of urban design principles and controls; and 4) statements indicating the sequence in which future development is to occur.

The proposed project is in conformance with the following general principles set forth in the Development Plan Common Provisions.

General Urban Design Principles and Controls-Public Views. The urban design principles and controls for public views state that "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.".

General Urban Design Principles and Controls-Open Space. The open space principles and controls state that "The functions of open space areas are to provide visual relief and contrast to the built environment, to serve as outdoor space for public use and enjoyment. The preservation and enhancement of areas that are well suited to perform these functions shall be given priority".

Comment: Golf course development will occupy 305 acres or approximately 82% of the project area. Thus, the major portion of the project area along Farrington Highway will be green open space. The golf course and park development will also provide visual relief and contrast to the new and

existing developments in the vicinity of the project area. Thus, the project is sensitive to public views and open space preservation and will help to preserve and protect these amenities from future development.

General Principles and Controls for Parks, Recreation and Preservation Areas. This section sets forth general principles and controls for the establishment of a parks and recreation systems. Specific principles regarding State and County Parks and recreation site and community-based parks and recreation sites are addressed in this section. Guidelines for community-based parks and recreation sites apply for the proposed community park. The guidelines state that "[e]ach community shall have reasonable accessibility to all types of public parks and facilities according to population size and/or community preferences. Community-based parks and recreation include public and legislatively required private park and recreational facilities.".

Comment: The proposed park will provide new and improved recreational activities which will be available to the public. The new park will also improve recreational opportunities and services to the existing residential community. These facilities will also help accommodate the additional growth from the new developments in the Ewa Plain.

Social Impact of Development. The purpose of this section is "[i]n evaluating any proposed development, the general plan policies and objectives relating to the distribution of social benefits and the mitigation of negative social impacts shall be considered." The Development Plan points out the following development factors to be examined: demographic effects, economic effects, and effects on housing, public services, and physical or environmental factors.

Comment: The proposed project is not expected to have any direct effect on population growth. The new facilities may result in increased visitor usage in the vicinity of the project area. The project is expected to create 2,450 new jobs. These jobs will provide residents with a variety of employment opportunities in the commercial, retail, recreational, and visitor industries. New public services provided by the development are limited to park and new road developments. The project will help to preserve views along Farrington Highway and will improve the overall attractiveness and quality of the Ewa plain.

Development Plan Special Provisions for Ewa. The proposed project complies with the following principles and controls of the Development Plan Special Provisions for Ewa.

Principles and Controls for Special Areas West Beach Area:

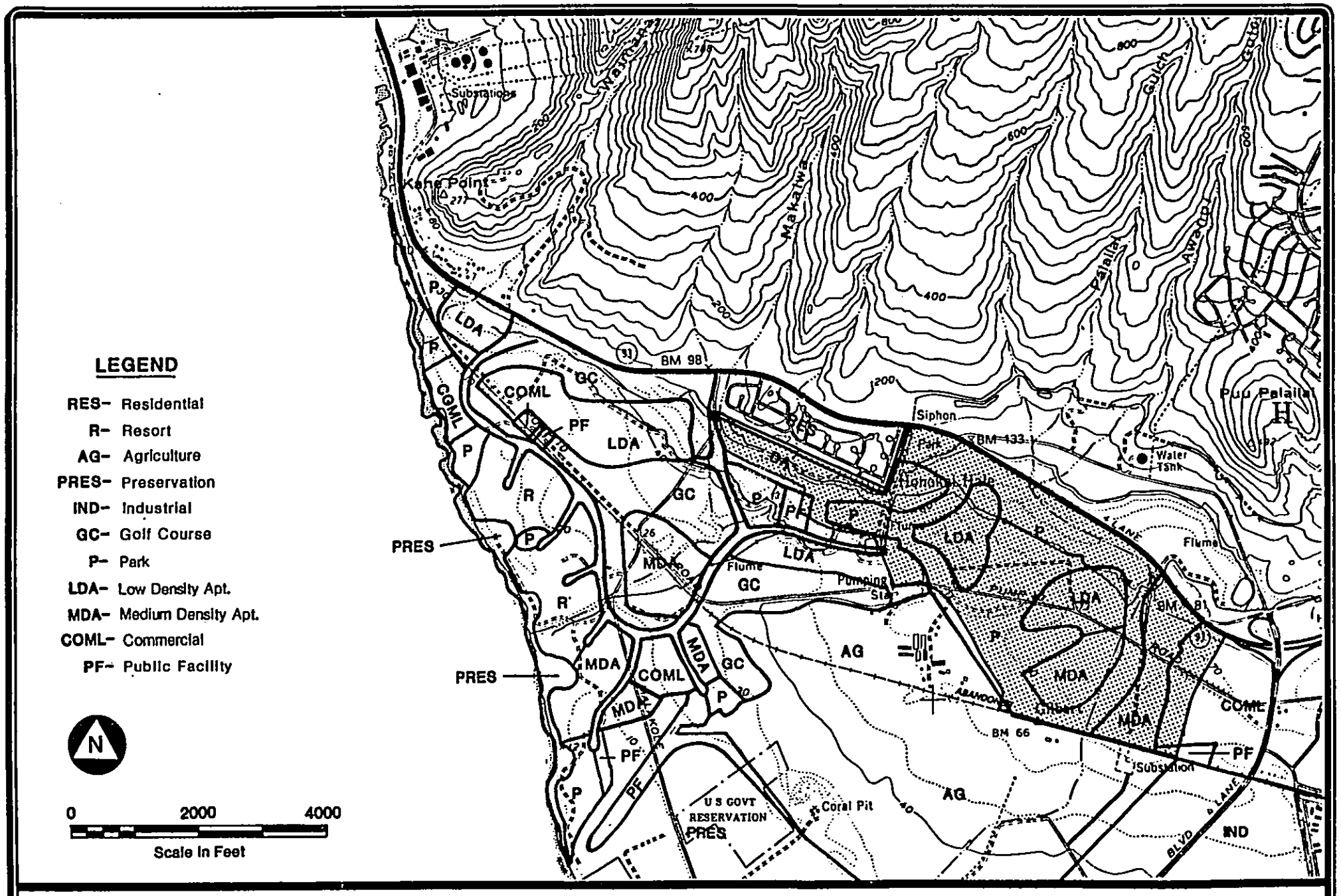
(J) The West Beach Special Area may be gradually enlarged subject to demonstrated availability of a market, noise and safety conditions, the adequacy of public facilities, and compatibility with agricultural land requirements. Such areas shall be designed as integral parts of the central core of the West Beach-Makakilo Secondary Urban Center and may include a mixture of such uses as a regional commercial-office complex, civic and transportation centers, a community college, and light industry.

Comment: Ko Olina Phase II will help to enlarge the Ko Olina Resort development by providing recreational and commercial activities for both residents and visitors of Ko Olina. The decision to develop Phase II is based on the premise that development will help to create a more successful resort development. Adequate public facilities exist to accommodate the new development. The demand exists for additional golf courses and commercial development. The new development is expected to create many new employment opportunities for local residents.

Development Plan Maps for Ewa. The Development Plan Land Use Map depicts a land use pattern that is consistent with the objectives and policies of the general plan and is used as the basis for public facility planning. The Land Use Map for Ewa presently provides for a mixture of Commercial, Low Density Apartment, Medium Density Apartment, and Park uses on the project site. See Figure IV-2.

The proposed golf course, park and commercial development concept will require amendments to the Ewa Development Plan. The Low Density Apartment and most of the Medium Density Apartment areas will need to be designated as Park to allow golf course development and the neighborhood park. See Figure IV-3. The Commercial area is proposed to be expanded by 10 acres. The small area designated as Public Facility is proposed for deletion on the Ko Olina site.

The existing and proposed acreages involved in the DP land use amendment for the approximately 373-acre site are presented below.



Ko Olina Phase II
West Beach Estates

Fig. IV-2

COUNTY DP LAND USE

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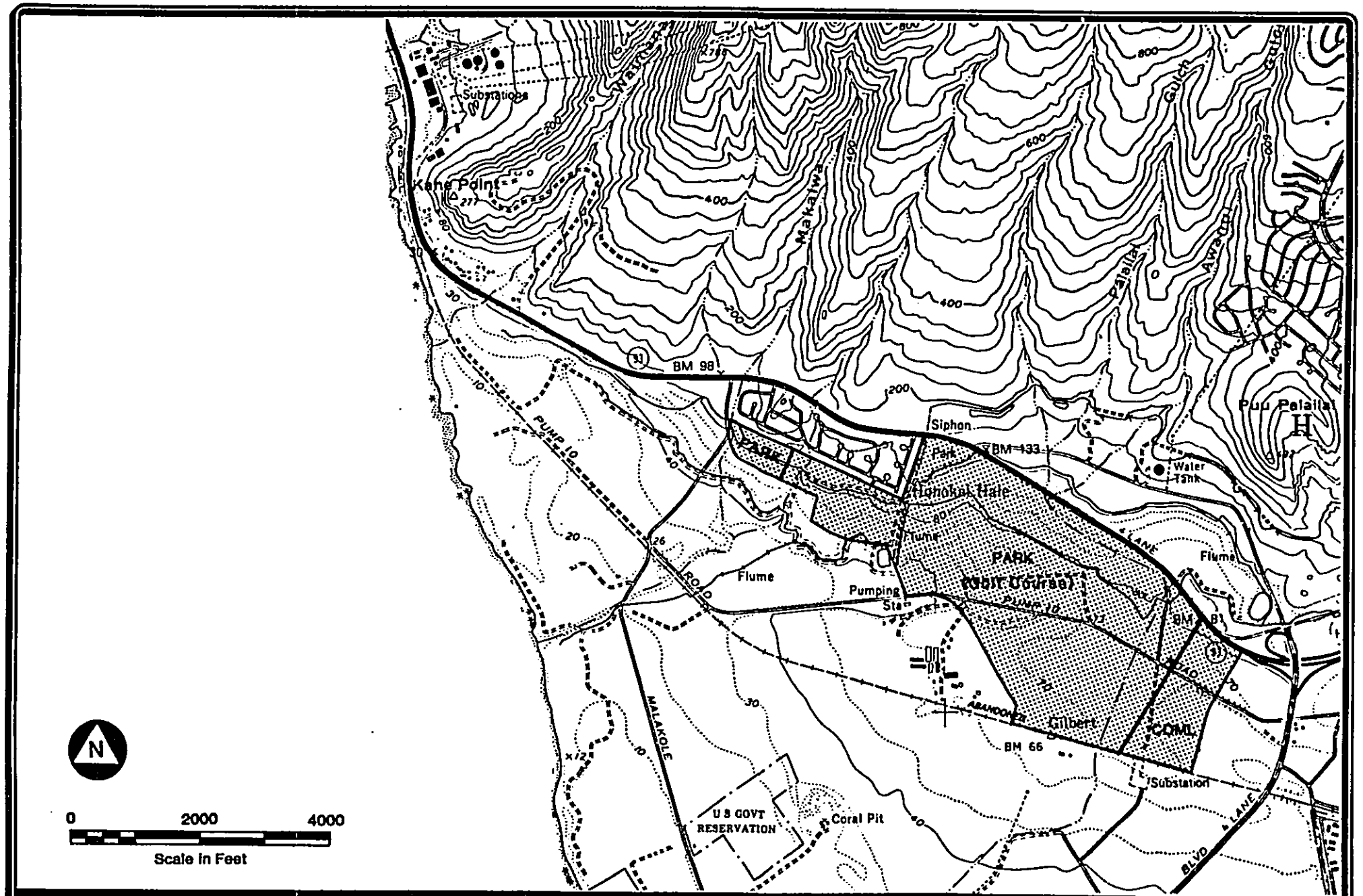

Ko Olina Phase II
West Beach Estates

Fig. IV-3

PROPOSED DP LAND USE

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	Existing	Proposed
Low Density Apartment	118	0
Medium Density Apartment	57	0
Parks and Recreation	167	333
Commercial	30	40
Public Facilities	.5	0

The most significant change is from Low and Medium Density Apartment designations to Park use which will allow for an additional golf course on the Phase II site. The elimination of residential units from the designated land use will result in a less intensive development and provide more open space.

The Public Facilities Map for the Ewa Development Plan Area identifies public and private proposals for parks, streets and highways, major public buildings, utilities, terminals, and drainage. Within the Phase II site area, no public facilities are indicated as planned or programmed on the existing Facilities Map (See Figure IV-4). Of potential long term significance (beyond 7 years), the abandoned railroad right-of-way is designated as a Transit Corridor. Should the proposed rapid transit system become a reality, the availability of this Corridor would facilitate its development and provide convenient access between the Second City and the Central Honolulu area.

Plans for the development of the Ko Olina Parkway which bisects the project area and the system of privately-developed water, sewer, and drainage lines to implement the project will require an amendment to the Ewa Development Plan Public Facilities Map. Requests to amend the Map will be initiated separately under the Independent Consideration process.

F. EWA ZONING

The City and County of Honolulu Land Use Ordinance and accompanying maps define the allowable uses of land zoned for residential, apartment, business, resort, industrial, agricultural, preservation, and mixed uses. The current zoning for the project area is AG-1 Restricted Agricultural District, with the exception of the 5.8-acre Kamokila Park adjacent to Honokai Hale which is zoned P-2 General Preservation District (See Figure IV-5).

Golf courses are classified as "outdoor recreational facility" and are not permitted uses in AG-1 lands. Upon amendment of the Development Plan, a zoning change would be required from AG-1 to P-2 General Preservation to enable the golf course development, and also from AG-1 to B-2 Community

LEGEND

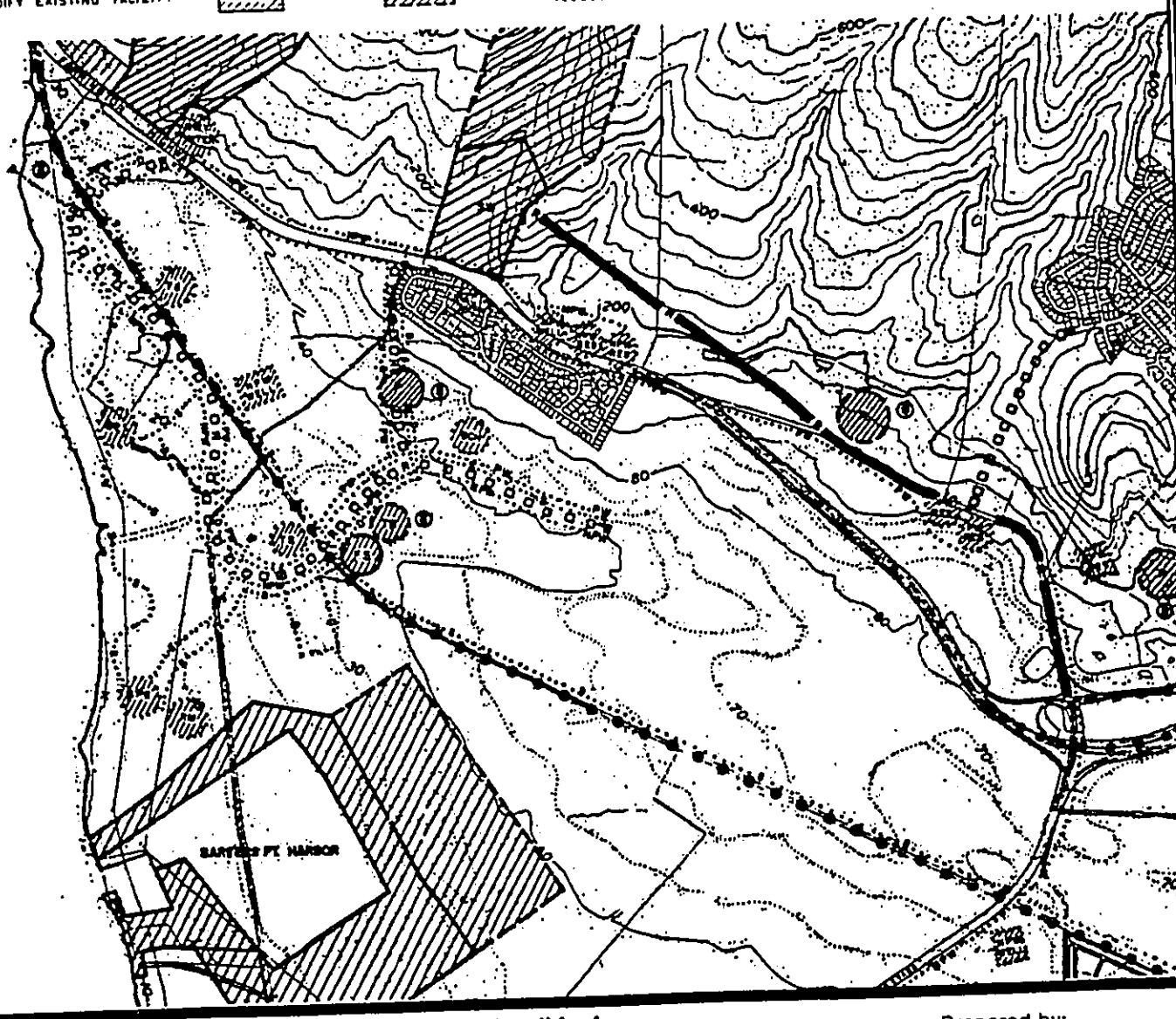
	GOVERNMENT OR PUBLIC UTILITY PROGRAMMED FOR COMMENCEMENT OF LAND ACQUISITION AND/OR CONSTRUCTION (WITHIN 6 YEARS)	GOVERNMENT OR PUBLIC UTILITY PROGRAMMED FOR COMMENCEMENT OF LAND ACQUISITION AND/OR CONSTRUCTION (BEYOND 6 YEARS)	PRIVATE FUNDING (NO TIMING SCHEDULE)
SEWER SYSTEM	S——S——S	S——S——S	S·····S·····S
WATER SYSTEM POTABLE WATER	PW——PW——PW	PW——PW——PW	PW·····PW·····PW
NON POTABLE WATER	NPW——NPW——NPW	NPW——NPW——NPW	NPW·····NPW·····NPW
DRAINAGE SYSTEM	D——D——D	D——D——D	D·····D·····D
TRANSPORTATION SYSTEMS			
ADDITIONAL RIGHT OF WAY AND NEW STREETS	R	R	R
IMPROVEMENTS WITHIN EXISTING RIGHT OF WAY	R	R	R
TRANSIT CORRIDOR	TC	TC	TC
PUBLIC FACILITY			
SITE DETERMINED (BY PROPERTY LINE)	STP	STP	STP
SITE UNDETERMINED (IN GENERAL AREA	STP	STP	STP
MODIFY EXISTING FACILITY	STP/M	STP/M	STP/M

P - PARK AND RECREATION
SW - SOLID WASTE
TS - TRANSIT STATION
SPS - SEWAGE PUMP STATION
WELL - WATER WELL
SCH - SCHOOL
RM - RECREATION MARINA
NPW - NON POTABLE WATER
PW - POTABLE WATER

N

0. 2000 4000

Scale in Feet



Ko Olina Phase II
West Beach Estates

Fig. IV-4
DP PUBLIC FACILITIES

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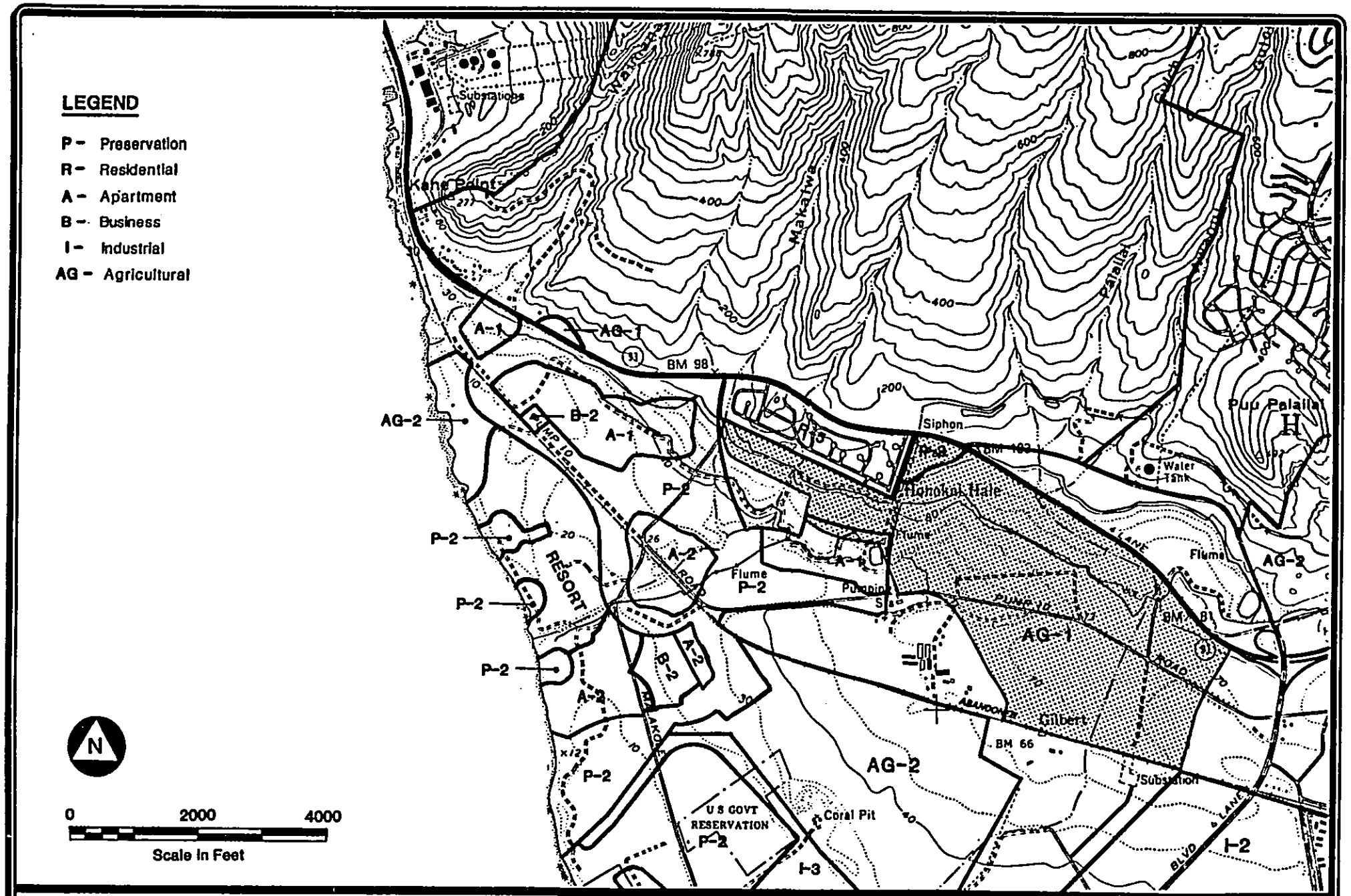

Ko Olina Phase II
West Beach Estates

Fig. IV–5
COUNTY ZONING

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Business District for the commercial parcel. Requests for zoning changes are evaluated with respect to conformance with the Development Plan land use designations.

The project site is not located within the Special Management Area (SMA) boundaries established pursuant to Honolulu's SMA Ordinance and the State Coastal Zone Management Law.

ANTICIPATED IMPACTS AND PROPOSED MITIGATION MEASURES

V. ANTICIPATED IMPACTS AND PROPOSED MITIGATION MEASURES

A. SHORT-TERM CONSTRUCTION-RELATED IMPACTS

1. WATER QUALITY AND DRAINAGE

The project site is located nearly a mile from the ocean at its closest point, and there are no surface water bodies or perennial streams located on the site. Consequently, eroded soil and airborne dust are not anticipated to have an adverse impact on surface water quality. All proposed site grading will essentially maintain the present storm drainage pattern.

For the golf courses, grading generally will consist of excavation, hauling, and placement of on-site material in embankments to create the undulations required for a challenging course as well as construction of ponds, sumps, and drainage channels. Park development will be graded in conformance with the requirements of the City's Department of Parks and Recreation. For the commercial site, minimum grading is planned to provide a uniform slope from Farrington Highway to the railroad right-of-way.

All grading will be in accordance with the City's Grading Ordinance and the recommendations of a soils engineer. Erosion control measures including temporary desilting basins, berms, swales, grassing and watering will be employed during grading operations. These measures will be included in the preparation of an erosion control plan which will be submitted for City review and approval.

2. FLORA AND FAUNA

The vegetation on the project site to be displaced by the proposed development is dominated by agricultural and weedy species. Of the sixty-one species identified within the study area, only five common native species were identified. No endemic or rare and endangered species were identified and no native ecosystems will be affected by construction and development activities.

The fauna on the project site consists of species commonly found in other areas of Oahu. Development of Ko Olina Phase II will modify or destroy the present habitats of wildlife such as feral cat, feral dog, mongoose, rat, gecko and skink. The loss of these

habitats will not result in any significant impact to the overall species population on the island of Oahu.

3. ARCHAEOLOGICAL RESOURCES

Based on the absence of any indications of archaeological sites on the project site during the reconnaissance survey, no further archaeological work was deemed to be necessary.

The OR & L Right of Way extends approximately 3,200 feet along a portion of the southern boundary of the project site. The anticipated Phase II land uses adjacent to the railway bed in this area include a portion of the golf course and a portion of the Ko Olina Parkway. Neither the golf course nor the road will cross or encroach upon the railway in any manner.

During any construction activity involving the extensive modification of the land surface, there is always the possibility, however remote, that previously unknown or unexpected subsurface cultural features or deposits might be encountered. In such a situation, construction will be halted and immediate archaeological consultation shall be sought from the State Historic Preservation Office.

4. NOISE

Noise levels in the immediate vicinity of the project site will increase as a result of operating heavy vehicles and other power equipment during construction. It shall be the contractor's responsibility to minimize noise by complying with Title 11, State Department of Health Administrative Rules, Chapter 42 - Vehicular Noise Control for Oahu and Chapter 43 - Community Noise Control for Oahu. Accordingly, the contractor shall be responsible for properly maintaining mufflers and other noise attenuating equipment. A noise permit will be required if it is anticipated that noise levels will exceed allowable limits as specified in the regulations.

5. AIR QUALITY

Ambient air quality is expected to temporarily decrease as a result of construction related activities. Uncontrolled fugitive dust emission will be generated from construction and grading activities. During construction, emissions from engine exhaust

(primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers traveling to and from the project.

To mitigate fugitive dust emissions from construction activities, compliance with State of Hawaii Air Pollution Control Regulations regarding establishment of a regular dust-watering program and covering of dirt-hauling trucks will be adhered to. Twice daily watering should reduce dust emissions by up to 50 percent. Increased vehicular emissions due to the disruption of traffic by construction equipment and/or commuting construction workers will be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

6. TRAFFIC

During construction, trucks, heavy equipment and other vehicles will use existing roads to transport materials and to access construction areas. The increased traffic from construction-related vehicles is not anticipated to be significant, but may cause some minor inconveniences in the immediate vicinity for the duration of construction. If required, flagmen shall be employed to ensure traffic safety.

7. EMPLOYMENT

Short-term employment will be created by the proposed development in the form of construction jobs for the development of the golf courses, retail center and office complex. The number of construction jobs generated may be roughly estimated in terms of the construction costs involved in the proposed development. In 1985, there was one direct construction job per year for each $83,000 of construction put in place (Department of Business and Economic Development, 1986).

The estimated cost for the golf courses, clubhouses, and on-site and off-site improvements is approximately $48,000,000. Construction of the commercial developments, including the retail establishments and office complex, is estimated at $54,000,000. With the total construction costs thus estimated at $102,000,000, the direct employment to be generated by the proposed development is estimated to be 250 construction jobs per year, assuming a five-year construction timetable.

B. POTENTIAL LONG-TERM IMPACTS

1. WATER QUALITY AND SUPPLY

The Ewa Water Master Plan promotes the use of a dual water system wherever possible, using non-potable water for irrigation. The proposed water system improvements will be constructed in accordance with the Board of Water Supply standards for eventual dedication, operation and maintenance. These water distribution system improvements and planned water wells, reservoirs and transmission mains are adequate to accommodate the potable and non-potable average daily water demands of 0.30 mgd (0.23 mgd potable water demand and 0.07 non-potable water demand) for the Ko Olina Phase II project.

Irrigation of the landscaping in the golf courses will be provided by private wells (one for each course) and storage ponds designed for an average daily demand of 600,000 gallons per day for each golf course. Although the brackish golf course water systems will remain private, the proposed water sources (wells) for the project are located in the Pearl Harbor Ground Water Control Area (PHGWCA), and, therefore, require the approval of the State Water Commission (SWC) for withdrawal and use. The Board of Water Supply will assist the applicant in filing an application with SWC for approval of the planned use of public potable and non-potable water. The Board of Water Supply concurs in the conservation value of a dual water system and is already operating the Kalauao Springs non-potable water system. The applicant must file an application directly with the SWC for the withdrawal of irrigation water for the two golf courses.

Although the non-potable demand will increase as a result of the addition of a second golf course, the proposed change in the development plan for Ko Olina Phase II will result in a reduction in the total water demand than was originally projected with the residential uses included. A revised dual master plan will be prepared and submitted for approval of the Board of Water Supply to note the change in the development plan for Ko Olina Phase II, and subsequent reduction in water demand. Total water withdrawal and use requested would total 1.50 mgd (0.23 mgd potable water; 0.07 mgd non-potable water; 1.20 mgd irrigation water).

2. FLORA AND FAUNA

Flora. The vegetation in the project site is dominated by agricultural and weedy species, with only five common native species found. No endemic or rare and endangered species were found despite a careful search and no native ecosystems will be affected by the proposed project.

Fauna. There are no rare or endangered species currently inhabiting the site. There have been no published studies for Hawaii that report on habitat modification and the resultant change in species' abundance. Golf course, park and commercial development may increase the population of some of the introduced and migratory bird species. As cane lands are converted to the proposed uses, there will be more habitat for introduced bird species. Moreover, none of these species are found in deep forests and most are adapted to live in close association with man. Changes in habitat resulting in an increase, decrease, or no change in populations are likely to have no significant impact to the overall islandwide population of introduced bird species. The population of migratory shorebirds in the area may also increase with the removal of sugarcane lands and the construction of golf courses. One migratory species, the Golden Plover, is a common winter resident and finds golf courses and lawns to be excellent habitat during the winter months. (FEIS West Beach, 1985)

3. PESTICIDES

A study of the potential impact of fertilizers and pesticides to be used on the proposed golf courses for Ko Olina Phase II was conducted by Barry Brennan, Carl Miles, and Harry Sato. The consultant study is included in Appendix G and summarized here.

The study's findings show that development of the proposed golf courses and the associated use of chemical fertilizers and pesticides will not pose adverse environmental risks. Over 70% of the soils on this relatively flat topography are 60 inches deep and have moderate organic matter content. The site has low rainfall and has a net evapotranspiration deficit. The combination of soil properties, gently sloping topography, and a net evapotranspiration deficit suggests that there will be no recharge of the brackish groundwater from rainfall. Runoff should be

minimal except during prolonged high intensity storms which are infrequent to the area.

The total amount of nitrogen used in sugarcane production is similar to that which would be used on the proposed golf courses. The presence of caprock between the proposed site and the Pearl Harbor aquifer will serve as an effective barrier between the brackish and potable groundwater sources. Therefore, the proposed conversion of land from sugarcane production to golf courses would cause no significant degradation of potable ground water quality.

The pesticides approved for use on golf courses are known to degrade relatively quickly. Although some are potential leachers or can otherwise move off-site, the specific site and environmental conditions will minimize movement. Avoidance of over-irrigation and the application of good management practices will further decrease the likelihood of vertical movement. The presence of turfgrass will further reduce runoff and leaching. Airborne drift can be controlled by using low pressure nozzles, lowering application booms, using drift control agents, selecting proper formulations, observing local weather conditions, and making applications under the direct supervision of certified or properly trained personnel. None of the pesticides used on golf courses in Hawaii have been shown to adversely affect birds or other beneficial wildlife. The conversion of the proposed area from sugarcane cultivation to a well-managed golf course is consistent with the State's goal of preserving and protecting ground water.

4. DRAINAGE

Existing off-site downstream drainage facilities are adequate for development of the project site. The unlined channel constructed along the Barbers Point boundary (south and east of the project site) and recently completed drainage improvements in Ko Olina Resort Phase I were designed and built to accommodate storm runoff from the project site as well as sub-tributary mauka areas.

In general, proposed on-site improvements include construction of underground pipe drain systems within the collector road (in accordance with City and County Standards) and grassed swales, ditches and channels in the golf course. Storm runoff from the golf course and other areas mauka of the planned roadway will be

conveyed within grassed swales and channels to two proposed roadway crossings. On the makai side of the road, the runoff will continue in proposed grassed channels in the golf course to existing drain outlets.

In the project area south of Honokai Hale Subdivision, an existing grassed channel will be maintained through the planned park. Storm runoff from the commercial site and remainder lot will be collected on-site and piped to the proposed roadway system which will be connected to the existing three 48-inch culvert outlet at Kalaeloa Boulevard. For temporary erosion control, appropriately sized ponding basins will be constructed on-site for desilting storm runoff prior to discharge into the existing outlet channels. A drainage master plan will be prepared and submitted for City review at the appropriate stage of the development process.

Flood Hazard. The project area is located in Zone D, defined as "areas of undetermined, but possible flood hazard" according to maps prepared by the Federal Insurance Administration for Oahu. Some runoff is expected during high intensity storms due to the slowly permeable soils in this area. With very low rainfall in this area, these infrequent occurrences will be limited to a few months of the year. Upon development, the golf courses will also function as retention/flood basins to lessen storm flows to lower-lying areas and therefore will mitigate any potential flood hazard. Because of its elevation and distance from the coastline, Ko Olina Phase II is not situated in an area that is subject to storm waves or tsunami inundation.

5. NOISE

Long term impacts from noise surrounding the project site are not expected to be of concern. The proposed development includes golf course, commercial and park development which are not considered to be noise-sensitive uses. Existing and projected traffic and aircraft noise levels in the vicinity should be fully compatible with the planned activities on the project site. Following construction, activities within the project area itself will not be generating any noise of potential concern to neighboring residential areas. Golf course maintenance activities adjacent to the residential subdivision will be limited to daytime hours and minimized to contain noise within the golf course proper.

6. TRAFFIC

A traffic impact study was prepared for Ko Olina Phase II by Wilbur Smith Associates. The report is included in Appendix E with the impacts and proposed mitigation summarized here.

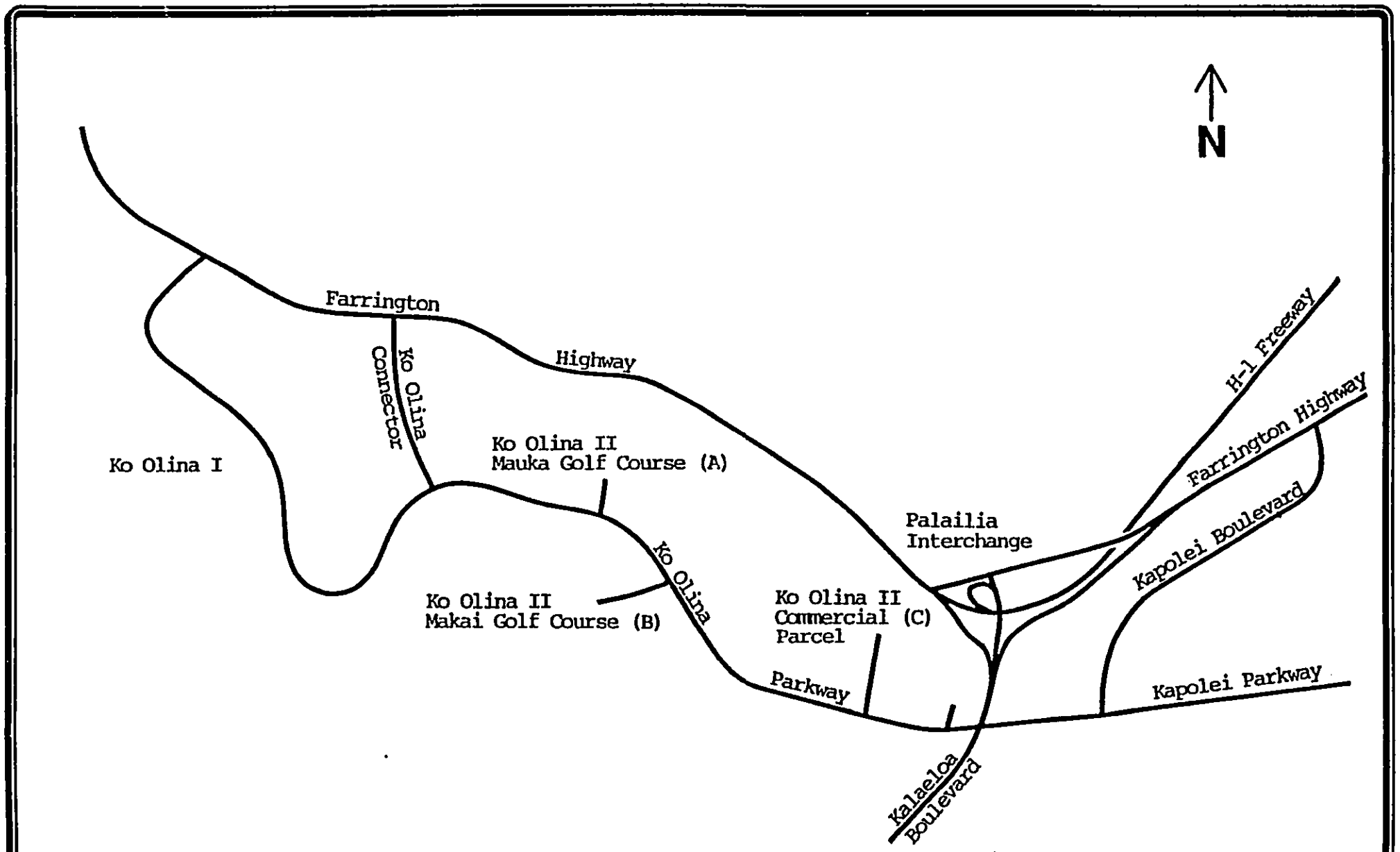
The traffic study included a review of existing traffic conditions, estimating future traffic volumes, analyzing capacities of planned roadways, and development of traffic mitigation measures at the key intersections and project driveways.

The planned roadways within the study area, shown in Figure V-1 include:

- An extension of the Kapolei Parkway referred to herein as Ko Olina Parkway, from Kalaeloa Boulevard west to Farrington Highway.
- Ko Olina Connector, a north-south connector road between Farrington Highway and the Ko Olina Boulevard.
- The construction of Kapolei Boulevard, a north-south roadway connecting Farrington Highway to the future Kapolei Parkway on the Koko Head side of Kalaeloa Boulevard.
- Access driveways to the golf courses and commercial development.

The proposed development is expected to generate approximately 1,462 vehicle trip ends per day in 1992 and 17,869 vehicle trip ends per day in 2005 when the project is complete.

The planned roadways were analyzed based on the projected land use of proposed development projects within the Ewa area. The estimated future traffic volumes included traffic generated by these proposed development projects as well as the traffic generated by Ko Olina Phase II. A capacity analysis yielding level of service ratings, ranging from A (free flow) to F (forced flow), at each of the key intersections affected by the project is presented in Table III-8. Also indicated are the level of service ratings with mitigation measures incorporated.



Ko Olina Phase II
West Beach Estates

Fig. V-1

PLANNED ROADWAYS

WILSON OKAMOTO & ASSOCIATES, INC.

The intersection of the Ko Olina Parkway and the driveway to the commercial areas will operate at Level of Service "F" (forced flow, traffic jam; frequent interruptions and breakdown of flow, volumes below capacity with low operating speeds). At this intersection, the estimated 2005 traffic volumes indicate that additional improvements are required to obtain a satisfactory level of service. With the project, the Ko Olina Parkway/Ko Olina Connector intersection and the Ko Olina Parkway/Kalaeloa Boulevard intersection will also be operating at Level of Service "F". At both of these intersections, additional turning lanes are be required to improve the level of service to satisfactory levels. It should be noted that these levels of service assume the cumulative impact of other developments surrounding the Phase II site.

Table III-8

"LEVEL OF SERVICE" (LOS) ROADWAY SERVICE LEVELS
Afternoon Peak Hour
With Project Traffic and With Mitigating Measures

Intersection	LOS w/ Project	LOS w/ Mitigation
Ko Olina Pkwy/Mauka Golf Course Driveway	C	C
Ko Olina Pkwy/Makai Golf Course Driveway	B	B
Ko Olina Pkwy/Commercial Driveway	F	D
Ko Olina Pkwy/Ko Olina Connector	F	D
Ko Olina Pkwy/Kalaeloa Blvd	F	D

Assumptions:

1. Four lanes plus left-turn lanes on Ko Olina Parkway and Kalaeloa Boulevard, and signalization of each intersection along Ko Olina Parkway.

Source: Wilbur Smith Associates, Traffic Impact Study Ko Olina Phase II, Prepared for West Beach Estates, January, 1989.

Recommendations from the traffic study for mitigation measures include the following:

- Prohibit left-turns at the intersection of Ko Olina Connector and Farrington Highway. A diverging lane should be provided for right-turn into the Connector and a merge land should be provided for right-turn from the Connector to Farrington Highway.

- The intersection of the Ko Olina Connector and Ko Olina Parkway can be stop-controlled initially, but to serve the forecasted volumes separate left- and right-turn lanes should be provided, with signalization possibly needed in the future.

- The access driveways to the golf courses can be stop-controlled initially, but increasing traffic volumes on Ko Olina Parkway may warrant traffic signals in the future.

- The driveway to the commercial area will require signalization and separate left- and right-turn lanes. This driveway may require dual left-turn lanes for southbound exiting traffic. A right-turn lane on westbound Ko Olina Parkway should be provided to serve forecasted volumes.

- Construction of the intersection of Ko Olina Parkway and Kalaeloa Boulevard should include two through lanes and left-turn lanes on the eastbound and westbound approaches.

- At the Ko Olina Parkway/Kalaeloa Boulevard intersection, dual left-turn lanes may be required on all approaches. Separate right-turn lanes may be required on the northbound, southbound and westbound approaches. Two through lanes are required on the westbound, eastbound and northbound approaches. Incremental lane improvements attributable to the proposed project include a southbound right-turn lane and an additional eastbound left-turn lane.

- At the Palailai Interchange, the eastbound on-ramp and westbound off-ramp should be widened to two lanes by 2005 due to traffic generated from the total proposed developments in the area. A study should also be undertaken to determine if

the eastbound off-ramp to Farrington Highway should be removed due to high weaving volumes.

7. AIR QUALITY

An air quality study was prepared for Ko Olina Phase II by Barry Root and Barry Neal. The report is included in Appendix F with the impacts and proposed mitigation summarized here.

To evaluate the potential long-term air quality impact of increased roadway traffic associated with the development of Ko Olina Phase II, three scenarios were selected for the air quality study. The scenarios included projections for the year 1988 with present conditions, year 2005 without the project, and year 2005 with the project. Data on existing and future roadway conditions used in this analysis were obtained from the traffic impact study for Ko Olina Phase II prepared by Wilbur Smith Associates. The two models utilized in this study were the Environmental Protection Agency's (EPA) MOBILE 3 model, used to calculate vehicular carbon monoxide emission estimates; and the CALINE4 computer model, used to calculate vehicular movement and atmospheric dispersion. Input meteorological conditions for this study were defined to provide "worst-case" results.

Results of the air pollution modeling indicates that the primary long-term air quality impact will result from increased carbon monoxide concentrations along roadways leading to and from the proposed development. With or without the development of Ko Olina Phase II, carbon monoxide concentrations in the vicinity of the project will unavoidably increase by the year 2005. Results indicate that all estimated worst-case 1-hour carbon monoxide levels are well within the national ambient air quality standards (AAQS). However, year 2005 estimates indicate that the State of Hawaii 1-hour ambient air quality standard could be exceeded on occasion near the Kalaeloa Boulevard/Kapolei Parkway intersection either with or without the proposed project (see Figure V-1 for the location of future and existing roadways in the project area). With development of the project, the state AAQS may be exceeded during the afternoon peak hour near the intersection of the Ko Olina Parkway and the driveway for the proposed commercial center and near the intersection of Kalaeloa Boulevard and Farrington Highway.

Projected worst-case 8-hour carbon monoxide concentrations indicate that all carbon monoxide concentrations would be within the national AAQS. Predicted present levels are within the State of Hawaii AAQS; however, future scenarios may result in exceedence of the state 8-hour standard either with or without the project. With development of Ko Olina Phase II, State air quality standards could be exceeded at the following intersections: Kalaeloa and Kapolei/Ko Olina Parkway intersection; Ko Olina Parkway and the commercial driveway intersection; and the Kalaeloa and Farrington Highway intersection.

Air quality impacts of the project from electrical power demand and from solid waste disposal are expected to be negligible. Pesticides will be used on the project golf courses to maintain turf quality. If applied during low wind conditions using proper application techniques, contamination of nearby, downwind areas by airborne drift should not be a problem.

Through appropriate improvements to roadway and traffic control facilities, long-term air quality impacts can be mitigated. The long-term projected impacts of carbon monoxide emissions from vehicular traffic associated with the completed development assume that all of the mitigative measures suggested in the traffic impact study will be employed to move traffic efficiently through the project area. In addition, the results of this air quality modeling study assume that merge lanes will be provided both on Kalaeloa Boulevard and on Ko Olina Parkway to receive right turning vehicles from traffic heading westbound on Kapolei Parkway and southbound on Kalaeloa Boulevard. A merge lane on Kalaeloa Boulevard near the H-1 eastbound off-ramp may also be necessary to receive traffic exiting from the freeway. The modeling results indicate that the heavy right turning traffic at these intersections must be kept moving to maintain the national AAQS for carbon monoxide.

8. SCENIC AND VISUAL IMPACTS

The proposed golf course and park development will help to preserve and enhance visual quality within the study area. The commercial developments will be low-rise in character with height limits established such that obstruction of coastal views will be minimized. The freeway is at a sufficiently high elevation that it overlooks the project site, but makai views are

already impacted by industrial development along the coast. Makai views along the highway will be enhanced by the extensive landscaping and open space provided by the golf course development. The golf course development provides an open space and visually acceptable alternative to development which is sensitive to the preservation of visual quality in the Ewa viewshed.

9. LOSS OF AGRICULTURAL LANDS

An important consideration with respect to withdrawal of the project area from sugarcane production is the probable effect on economies of scale and production efficiency. An estimated 298 acres or 80 percent of the 372.6-acre site is currently in sugarcane production. This represents only 2.2% of the 13,441 acres of sugarcane reported for Oahu Sugar Company for 1987. Thus, withdrawal of this parcel would not be expected to have a major adverse impact on sugar production efficiency.

Net return on capital to the Hawaii Sugar Industry amounted to only 0.2 percent in 1987 as compared with 3.7% in 1986. Thus the loss in net returns through withdrawal of sugarcane products in the project area would be of a very small magnitude, assuming that the return on capital for Oahu Sugar Company is comparable to that for the Hawaii Sugar Industry as a whole.

Furthermore, withdrawal of the project site from sugarcane production is expected to have a less adverse effect than withdrawal of other similar-sized parcels elsewhere on the plantation. Some of the site and environmental factors which lessen the site's desirability include: (1) somewhat lower quality of soils than for the average of the plantation, (2) higher irrigation requirements than for mauka lands, (3) greater distance from the mill than for most parcels, and (4) possible conflicts in burning and transporting sugarcane associated with the surrounding urban areas.

Whereas Ko Olina Phase II would have minimal effect on the economic viability of Oahu Sugar Company, the combined effect of the withdrawal of an estimated 5,400 acres in sugarcane to accommodate all approved and pending projects would have a much more serious effect. The agricultural feasibility analysis indicates, however, that Oahu Sugar Company can compensate for decreasing economies of scale to a

considerable extent by shifting from the double mill to a single mill operation. This would permit the company to continue as an economically viable unit, assuming adequate sugar prices in relation to input costs, which will depend upon renewal of the 1995 Food Security Act in 1990.

Although the project area is currently in sugarcane cultivation, there is no indicated need for the lands for cultivated crop production on Oahu. Recent trends in sugarcane and agricultural production show that the acreage in cultivated crops on Oahu has steadily declined during the past 10 years from 49,100 acres in 1978 to 41,100 acres in 1987. Most of this decline was in sugarcane cultivation, which has experienced low prices and increasing competition from sugar substitutes such as high fructose corn syrup. Alternative crops on the project site are not believed to be economically feasible.

The Hawaii Sugar Industry employed 6,230 workers in 1987 for all activities, including factory, field, clerical, miscellaneous, and supervisors. Proportionate employment would have amounted to 601 employees for Oahu Sugar Company and 13 for the project area. Total 1987 wages for those 13 employees is estimated at $273,000. The elimination of agricultural jobs related to the project area for this number of employees could be handled through normal attrition.

10. PUBLIC SERVICES AND UTILITIES

Wastewater System. The proposed development of Ko Olina Phase II will generate approximately 500,000 gallons per average day of wastewater. The wastewater will be conveyed via 33- and 36-inch trunk sewers located on the mauka side of the railroad right-of-way to the municipal Makakilo Interceptor Sewer, which then goes to the Honouliuli Wastewater Treatment Plant.

The proposed on-site collection and conveyance sewer systems will be designed and constructed to City and County standards. A wastewater master plan will be prepared and submitted for City concurrence prior to grant of tentative subdivision approval.

Although the municipal Honouliuli Wastewater Treatment Plant is nearing its capacity of 25 mgd, the City plans to expand the plant to 38 mgd, with completion

scheduled for 1993. With this expansion, the Honouliuli Plant will have more than adequate capacity to treat and dispose of the wastewater generated by Ko Olina Phase II activities.

Electrical and Communications. Electrical and communications improvements necessary to support the requirements of this project can be served from existing utility systems, with some off-site work involved. The existing Hawaiian Electric Company's overhead 138 KV line that traverses the project site and the existing overhead 46 KV lines paralleling the railroad right-of-way are expected to remain. The existing overhead 46 KV line adjacent to Honokai Hale will be removed and will be relocated by HECO on facilities planned for the Ko Olina Resort in the Phase I area.

The projected peak demand for this project is estimated at approximately 4 MVA. Based on the projected loading, Hawaiian Electric does not anticipate that a new substation will be required to serve the project.

The electrical system will be an underground facility with the exception of the 46 KV and 138 KV overhead lines and structures, the switching vaults, and service transformers. A network of underground ducts and handholes will be provided to facilitate cable installation.

Telephone cross-connect pedestals will be provided by the Hawaiian Telephone Company at various locations throughout the site to permit access and telephone service to the project facilities. The telephone system will be an underground facility with the only exceptions being the cross-connect pedestals.

11. SOCIO-ECONOMIC IMPACTS

Population and Housing. The proposed golf course and commercial development will not directly impact the population levels and housing stock in the area, since no residential units are planned on the site. The surrounding area is expected to see an increase in population growth and residential development in the future. Such residential development would provide housing in proximity to the employment and new jobs available with the Phase II retail development, office complex, and golf courses. The proposed development is thus compatible and supportive of the increase in

housing planned for Ewa as part of the Secondary Urban Center thrust.

The residential communities in the adjacent Honokai Hale and Nanakai Gardens Subdivision may be expected to experience an increase in property values due to their proximity to the Phase II golf courses which will be developed. This would be particularly so for those residences located adjacent to the Phase II site which will have the amenities of golf course frontage and landscaped open spaces.

Employment. The development of Ko Olina Phase II will result in a variety of employment opportunities. The projected long-term employment generated by the proposed development in terms of direct jobs is presented below.

Golf Course (excluding Clubhouse dining)
50 jobs x 2 courses = 100 jobs

Clubhouse (Restaurant/Banquet)
25 jobs x 2 clubhouses = 50 jobs

Commercial-Retail Trade
.005 jobs/SF x 200,000 SF = 1,000 jobs

Office Complex
1 job/290 SF x 375,000 SF = 1,300 jobs

Based on the above, the proposed Phase II developments will result in a total of 2,450 direct jobs.

Overall, the economic impacts of Ko Olina Phase II on the availability of jobs and diversity of employment will be a beneficial impact of the development. The increased number of jobs should provide for greater employment opportunities, particularly for residents in Ewa and Waianae where there are higher unemployment rates than the average for Oahu. The provision of employment in proximity to these areas is also important since the time it takes to commute to work in Honolulu from these areas is often much longer than what most other Oahu workers experience.

Loss of Housing. The proposed project will remove approximately 135 acres of land presently designated as Low Density Apartment and Medium Density Apartment from the Ewa Development Plan. This would result in a reduction of 3,510 potential residential units based

on the Development Plan allocations. Some concern has been expressed regarding the deletion of these residential units in view of the overall islandwide need for housing and need for attaining the Secondary Urban Center population objectives of the Oahu General Plan.

The emergence of Ewa from an area of planned residential growth to an area where actual development has been initiated successfully (Gentry Soda Creek and West Loch Estates) has reflected the strong interest by developers to pursue residential development in the area. Recently, amendments were approved in the Development Plan Annual Amendment Review of 1988 for 2,000 units for Ewa Gentry and 500 units for the Lusk Company in the vicinity of Kapolei Town Center. The approval of these amendment requests substantially minimizes any effects in the number of planned units caused by the reduction in residential units in the Ko Olina Phase II area.

Similarly, the Ewa population objectives are not expected to be adversely affected. The future population projections provided by the Department of General Planning in 1988 indicated that the Ewa population capacity already exceeds the 2010 population projection by 4,000, based on planned developments. While recently approved amendments to the General Plan have increased the population capacity of Ewa to relieve this situation, the proposed reduction of residential units is unlikely to have any major impact on the Ewa area's ability to meet its share of housing units and population growth over the 20-year planning horizon.

Finally, unlike the other planned residential developments in Ewa, Ko Olina will also provide a substantial portion of the future jobs for the Ewa area and beyond, in addition to providing future housing for Oahu. The provision of future employment is a key ingredient toward the success of the Second City in Ewa and is what will distinguish it from becoming another residential suburb of Honolulu.

ALTERNATIVES TO THE PROPOSED ACTION

VI. ALTERNATIVES TO THE PROPOSED ACTION

A. NO ACTION ALTERNATIVE

The no-action alternative would allow the land on the site to remain in agricultural use for sugarcane cultivation. The long-term prospects for this use, however, are not promising given the continuing low world market prices for sugar and the uncertainty of Federal price supports beyond 1990. Furthermore, with the impending developments proposed for the entire Ewa region, including the neighboring Kapolei Town Center development, continued agricultural use of the project site, particularly activities such as cane burning, will increasingly become incompatible with surrounding and planned uses.

This alternative would also leave the Ko Olina Resort with an inadequate amount of golf courses to support the anticipated 4,000 visitor units and 5,200 residential units within the Resort. This shortfall could substantially affect the current marketing efforts for the resort development by lessening its attractiveness as a world quality destination resort. The availability of adequate championship golf course facilities at premier resorts has in recent years become a highly desirable if not vital amenity to the economic success of a resort.

The no-action alternative would also reduce the possibility of relocation and expansion of the Kamokila Park to a more favorable and accessible location south of the subdivision and adjacent to the park and school site provided for in the Phase I resort plans.

B. ALTERNATIVE LOCATIONS

The potential for alternative locations for the proposed siting of two championship courses and the planned commercial developments are restricted mainly by the lack of available and suitable land for this purpose. The acreage necessary for additional golf course development is not available in the Phase I area, and alternative sites within the Ewa area are either reserved or planned for other uses as reflected in the Ewa Master Plan developed by Campbell Estate. Locations beyond the Ewa area and even beyond the Phase II site would also be unfeasible due to the desirability for close proximity of the golf courses to the Ko Olina Resort.

C. ALTERNATIVE AGRICULTURAL USES

Beyond the current use of land for the cultivation of sugarcane, alternative agricultural crops were considered in the assessment of agricultural feasibility in the event that a sugar industry in Hawaii were to become uneconomical. This assessment has shown that there are no other indicated agricultural uses for most of the land area in the project. Extensive research by the Hawaii Sugar Planters Association and the University of Hawaii has failed to identify major alternative crops to sugar on Oahu. Major limiting factors to diversified crop production on sugarlands are the limited extent of the Hawaii market for non-export crops and inability to compete pricewise in the marketplace in relation to other producing areas.

Ecologically, the project area is best suited for the production of sugarcane, for which it is currently used, or for selected truck crops. However, ongoing research indicates that Hawaii constitutes a small, pocket market which is readily saturated by ecologically adaptable fruits and vegetables. Because of perishability related to shelf life and high costs of transportation, opportunities for marketing locally produced perishable products outside of Hawaii are limited. Other than sugar, pineapple, macadamias, papayas, coffee, some processed tropical nectars, flowers and foliage and a few other minor products, export opportunities are few. With much lower costs of production in competing areas, numerous fruits and vegetables can be imported to Hawaii at prices equal to or below wholesale prices of Hawaii produced products. Among these are bananas, dry onions, sweet potatoes, broccoli, sweet corn, cucumbers, green peppers, squash, and tomatoes. While there is some potential for displacing some of the inshipments in these products, the marketplace for these products is limited.

D. ALTERNATIVE OF CURRENT DEVELOPMENT PLAN LAND USE

This alternative considers the use of the project site for the designated land uses as contained in the existing Ewa Development Plan Land Use Map. The existing planned uses call for a single golf course, low and medium density apartments within the golf course, park use, and commercial development on the east end of the site.

The primary difference between the proposed development and this alternative is the substitution of an additional golf course for the residential developments. With the current development plan allocations, 1,501 low density apartment units and 2,009 medium density apartment units could be

developed within the project site. The medium density apartment designations could have maximum heights of up to 150 feet. This alternative constitutes a more intensive development concept with less open spaces than that envisioned with the proposed project.

While this alternative would result in the development of one golf course, this would still be inadequate to meet the golf demands of the resort. As noted, the increasing popularity and reputation of Hawaiian resort golf has made the provision of adequate golf facilities an important ingredient to the viability of a destination resort.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES AND RELATIONSHIP BETWEEN LOCAL SHORT TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

A. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Golf course development is not necessarily an irreversible commitment of resources. Nonetheless, the loss of approximately 298 acres of currently cultivated agricultural land constitutes the primary commitment of resources affected by the project. As discussed previously, however, there is a considerable excess of prime agricultural land over what is required for production on Oahu. Notwithstanding, ample acreage remains in Ewa and elsewhere on Oahu to ensure the continued viability of the sugar industry.

B. RELATIONSHIP BETWEEN SHORT AND LONG TERM USES OF THE ENVIRONMENT

The proposed Phase II developments will preserve some future planning options due to the conversion of most of the land in agricultural uses to golf course uses. The golf course development will preserve the open space character of the area over most of the project site, and will preserve views to and along roadways in the area.

From a more regional perspective, the development of Ko Olina Phase II will bridge the resort development with the planned Kapolei Town Center and create a compatible environment of urban and resort-related uses in the area. Park and open space amenities will be enhanced for the Honokai Hale/Nanakai Gardens subdivisions, while the provision of golfing recreational amenities and additional commercial and office development will help to satisfy the expected resort demand and complement the other Ewa developments in the surrounding areas. Thus, development of Ko Olina Phase II serves to enhance and support the overall long term development of the Second City.

UNAVOIDABLE ENVIRONMENTAL IMPACTS

VIII. PROBABLE ADVERSE ENVIRONMENTAL IMPACTS WHICH CANNOT BE AVOIDED

The development of Ko Olina Phase II involves no significant adverse impacts to the environment. With most of the existing site in sugarcane cultivation, no impacts are expected on biological or archaeological resources. The open space character will largely be retained with the proposed development, while adverse impacts on water quality, air quality, noise, and traffic are minimal or adequately mitigated by the project plans.

Some agricultural lands will be removed from active sugarcane cultivation. Withdrawal of the 298 acres under cultivation would cause some loss of economies of scale for the Oahu Sugar Company and further contribute to unused mill capacity, but would not, in itself, have a major impact on sugar production efficiency. Sufficient acreage remains elsewhere to ensure the continued viability of sugarcane production for Oahu Sugar Company.

SUMMARY OF UNRESOLVED ISSUES

IX. SUMMARY OF UNRESOLVED ISSUES

There are no major unresolved issues with respect to the Ko Olina Phase II developments proposed. All of the necessary land use permits and approvals will be obtained prior to development, including State Land Use District Boundary Amendment, City Development Plan Amendment and Zoning Change, and permission from the State Water Commission to withdraw non-potable water for irrigation of the golf courses.

REFERENCES

X. REFERENCES

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LIST OF PREPARERS

XI. ORGANIZATIONS AND INDIVIDUALS ASSISTING IN PREPARATION OF THE EIS

EIS COORDINATION AND PREPARATION

Wilson Okamoto and Associates (Planning)
Gary T. Okamoto
Ernest M. Takahashi
Rodney Y. Funakoshi
Grant T. Murakami

Chaney Brooks & Company (Marketing)
Wendell Brooks, Jr.
John Zapotocky

Community Planning, Inc. (Civil Engineering)
Bernard Kea

NOISE STUDY

Y. Ebisu & Associates
Yoichi Ebisu

BOTANICAL STUDY

Kenneth M. Nagata

ARCHAEOLOGICAL RECONNAISSANCE SURVEY

Paul H. Rosendahl, Ph.D., Inc.
Paul H. Rosendahl

AIR QUALITY STUDY

Root and Neal Air Pollution Consulting
Barry D. Root
Barry D. Neal

TRAFFIC IMPACT STUDY

Wilbur Smith and Associates
Bryant T. Brothers

AGRICULTURAL FEASIBILITY STUDY

Frank S. Scott, Jr.

FERTILIZER AND PESTICIDES USE

Barry D. Brennan, Carl J. Miles and Harry H. Sato

LIST OF ORGANIZATIONS AND AGENCIES CONSULTED

XII. LIST OF ORGANIZATIONS AND AGENCIES CONSULTED

The following comments from governmental agencies and the general public were received on the Draft EIS for the proposed project, availability of which for public review was published in the January 23, 1989 issue of the OEQC Bulletin. The 45 day consultation period ended on March 9, 1989. A total of 25 comments were received.

A double asterisk (**) indicates comments to which substantive responses were required. Both comment and response letters are reproduced in this section.

A single asterisk (*) indicates letters offering "no comments" and for which no responses were provided.

Federal Agencies

** Department of the Agriculture - Soil Conservation Service
* Department of the Army
* Department of the Interior - Fish and Wildlife Service

State Agencies

* Department of Agriculture
** Department of Business and Economic Development - Energy Division
** Department of Business and Economic Development - Housing Finance and Development Corporation
* Land Use Commission
* Department of Defense
** Department of Health
** Department of Land and Natural Resources
** Office of Hawaiian Affairs
* State Public Works Engineer
** University of Hawaii, Environmental Center

City and County of Honolulu

** Board of Water Supply
* Building Department
** Department of General Planning
** Department of Housing and Community Development
** Department of Land Utilization
** Department of Parks and Recreation
** Department of Public Works
** Department of Transportation Services
* Fire Department
** Police Department

Private Organizations

** Hawaiian Electric Company, Inc.
** American Lung Association

XIII. CONSULTATION COMMENTS RECEIVED AND RESPONSES

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. BOX 50004
HONOLULU, HAWAII
96850

February 15, 1989

Dr. Marvin Miura, Director
Office of Environmental Quality Control
State of Hawaii
465 South King Street, Room 104
Honolulu, HI 96813

RECEIVED
FEB 17 1989
WILSON OKAMOTO & ASSOCIATES

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement (DEIS) -
Ko Olina Phase II, Ewa, Oahu

The above-mentioned document has been reviewed as requested and the following statements are offered for consideration:

The document brings out the fact that 298 acres of the proposed development are classified as prime agricultural land, which amounts to over 80 percent of the land affected by the development. The draft EIS further states that only 2.2 per cent of Oahu Sugar Company's producing lands are affected, but it does not discuss any possible relationship to the effect of the combined loss of prime agricultural lands from all of the ptoposed developments for central Oahu at the present time. This combined effect could well present a much more serious problem related to agriculture on Oahu.

We would also point out that 280 acres of the land proposed for development are high shrink-swell soils that could pose problems for structures unless properly treated.

We appreciated the opportunity to review the draft EIS and would appreciate the opportunity to review the final EIS.

Sincerely,

Wm H Mann
WARREN M. LEE
State Conservationist

cc:
Mr. Donald Clegg, Director, City and County of Honolulu, Department of General Planning, 650 South King Street, Honolulu, HI 96813
Mr. Ernest Takahashi, Project Manager, Wilson Okamoto & Associates, Inc., 1150 South King Street, Suite 800, Honolulu, HI 96814

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
PLANNERS

2704-03
March 31, 1989

Mr. Warren M. Lee
State Conservationist
Soil Conservation Service
U.S. Department of Agriculture
P.O. Box 50004
Honolulu, Hawaii 96850

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Lee:

Thank you for your letter and comments of February 15, 1989 regarding the subject project. We offer the following in response to your concerns.

As suggested, we have reviewed the cumulative impacts of the withdrawal of sugar from Oahu Sugar Company lands when other proposed developments are considered. Whereas Ko Olina Phase II would have minimal effect on the economic viability of Oahu Sugar Company, the combined effect of the withdrawal of an estimated 5,400 acres in sugarcane to accommodate all approved and pending projects would have a much more serious effect. Our agricultural feasibility analysis indicates, however, that Oahu Sugar Company can compensate for decreasing economies of scale to a considerable extent by shifting from the double mill to a single mill operation. This would permit the company to continue as an economically viable unit, assuming adequate sugar prices in relation to input costs, which will depend upon renewal of the 1995 Food Security Act in 1990.

The agricultural feasibility study has been revised for the Final EIS to incorporate an analysis of these cumulative impacts.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

2704-01
ET

DEPARTMENT OF THE ARMY
U.S. ARMY ENGINEER DISTRICT, HONOLULU
BUILDING 230
FT. SHAFTER, HAWAII 96858-5440

REPLY TO ATTENTION OF:
Planning Branch

February 3, 1989

RECEIVED
FEB 06 '89
WILSON OKAMOTO & ASSOCIATES

Mr. Donald A. Clegg
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96814

Dear Mr. Clegg:

Thank you for the opportunity to review the Draft Environmental Impact Statement (DEIS) for Ko Olina Phase II, Ewa, Oahu, Hawaii. Our previous comments (letter dated December 14, 1988) have been incorporated into the DEIS. We have no additional comments.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

Copies furnished:

Dr. Marvin Miura
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

✓ Mr. Ernest Takahashi
Project Manager
Wilson Okamoto & Associates
1150 South King Street, Suite 800
Honolulu, Hawaii 96814

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
PLANNERS

2704-03
March 31, 1989

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Attention: Planning Branch

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Cheung:

Thank you for your letter and comments of February 3, 1989 regarding the subject project. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

United States Department of the Interior

FISH AND WILDLIFE SERVICE
PACIFIC ISLANDS OFFICE
P.O. BOX 50167
HONOLULU, HAWAII 96850

ES
Room 6307

MAR 9 1989

RECEIVED
MAR 10 1989
WILSON OKAMOTO & ASSOCIATES

Dr. Marvin Miura, Director
Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Re: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu

Dear Dr. Miura:

We have reviewed the subject Environmental Impact Statement dated January 1989, and to the best of our knowledge, no listed or proposed endangered species, migratory birds, or anadromous fishes within our jurisdiction occur in the proposed project area(s). However, due to current manpower and budget restrictions, the Office of Environmental Services cannot devote the time necessary to conduct a thorough review of fish and wildlife concerns associated with the referenced action at this time. We strongly recommend that you consult directly with the State Department of Land and Natural Resources.

Please be advised that this notification does not represent Service approval of, or support for, the proposed activity. The Service may review future actions related to this proposal should administrative constraints be alleviated or if adverse impacts to significant fish and wildlife resources are identified. Please continue to keep this office apprised of the project's status.

Sincerely yours,

for William R. Ramsey
Ernest Kosaka
Field Office Supervisor
Environmental Services

cc: DLNR
Dept. of General Planning
Wilson Okamoto & Assoc., Inc.

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
ARCHITECTS
PLANNERS
1150 SOUTH KING STREET
HONOLULU, HAWAII 96814
PHONE (808) 531-5761
Mailing address
P.O. Box 50744
Honolulu, Hawaii 96850

2704-03
March 31, 1989

Mr. Ernest Kosaka
Field Office Supervisor
Environmental Services
U.S. Fish and Wildlife Service
Pacific Islands Office
P.O. Box 50167
Honolulu, Hawaii 96850

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Kosaka:

Thank you for your letter and comments of March 9, 1989 regarding the subject project. The State Department of Land and Natural Resources has been directly consulted with; no wildlife concerns were expressed. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

JOHN WAIHEE
GOVERNOR

YUKIO KITAGAWA
CHAIRPERSON, BOARD OF AGRICULTURE

SUZANNE D. PETERSON
DEPUTY TO THE CHAIRPERSON

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 So. King Street
Honolulu, Hawaii 96814-2512

Mailing Address:
P. O. Box 22159
Honolulu, Hawaii 96822-0159

March 7, 1989

MEMORANDUM

To: Mr. Donald A. Clegg, Chief Planning Officer
Department of General Planning
City and County of Honolulu

Subject: Draft Environmental Impact Statement (DEIS) for
Ko'Olina - Phase II
West Beach Estates
TMK: 9-1-15: por. 4 and 18 Ewa, Oahu
Area: 372.6 acres

The Department of Agriculture has reviewed the subject DEIS and offers the following comments.

The DEIS satisfactorily addresses most of concerns found in our letter to Mr. Ernest Takahashi of Wilson, Okamoto and Associates (dated December 13, 1988).

We would like to receive a copy of the Final EIS.

Thank you for the opportunity to comment.

Suzanne D Peterson

YUKIO KITAGAWA
Chairperson, Board of Agriculture

cc: OEQC
Wilson, Okamoto and Associates

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. Yukio Kitagawa
Chairperson
Board of Agriculture
1428 South King Street
Honolulu, Hawaii 96814-2512

Subject: Draft Environmental Impact Statement, Ko Olina
Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Kitagawa:

Thank you for your letter and comments of March 7, 1989 regarding the subject project. We greatly appreciate your time and effort in reviewing the Draft EIS. As requested, a copy of the Final EIS will be provided to your office.

Sincerely,

Ernest M. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

2701-01

JOHN WAIHEE
GOVERNOR
ROGER A. ULVELING
DIRECTOR
BARBARA KIM STANTON
DEPUTY DIRECTOR
LESLIE S. MATSUBARA
DEPUTY DIRECTOR

DEPARTMENT OF BUSINESS
AND ECONOMIC DEVELOPMENT

ENERGY DIVISION, 335 MERCHANT ST., RM. 110 HONOLULU HAWAII 96813

89:0701e

March 9, 1989

RECEIVED
MAR 10 1989
WILSON OKAMOTO & ASSOCIATES

Mr. Donald Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement for Ko Olina Phase II

The Energy Division has received the above-referenced Draft Environmental Impact Statement (DEIS) and has the following comments:

We note that the DEIS contains minimal discussion of energy impacts that will result from the proposed project, in particular from the proposed forty-acre commercial village. The DEIS contains neither an estimate of total electricity consumption within the project nor a discussion of energy conservation or renewable energy sources that might help meet the project's energy requirements.

We note also that in Chapter IV neither the State Plan's guidelines for energy use and development nor the State Energy Functional Plan were examined for their relationship to the proposed project. The requirement for such an examination is spelled out in the enclosed excerpt from the OEQC BULLETIN.

In light of the fact that the impacts of the Ko Olina Resort, Phase II, are cumulative with the impacts of Phase I, we believe it is appropriate to include in the DEIS an examination of the above-mentioned relationships as well as discussions of the application of energy conservation and renewable energy resources.

Thank you for the opportunity to comment on this DEIS. I hope these comments will be useful to you.

Sincerely,

Maurice H. Kaya
Energy Program Administrator

MHK/PE:ef
Enclosure
cc: Mr. Ernest Takahashi

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. Maurice H. Kaya
Energy Program Administrator
Department of Business and Economic
Development
Energy Division
335 Merchant Street, Room 110
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement, Ko Olina
Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Kaya:

Thank you for your letter and comments of March 9, 1989 regarding the subject project. We wish to provide the following supplemental information in response to your comments.

The annual electrical demand for the project when fully developed is not expected to exceed 40 million kilowatt-hours. This power demand would most probably be provided by oil-fired generating facilities on Oahu. However, with H-POWER currently under construction and plans for a coal-fired power plant at Campbell Industrial Park, some of the project power could well come from sources burning other fuels.

State Plan objectives and policies for facility systems in Section 226-18 advocate increased energy self-sufficiency and promoting the prudent use of power and fuel supplies through conservation measures including education and energy efficient practices and technologies. Priority Guidelines in Section 226-103 encourage the development, demonstration, and commercialization of renewable energy sources, and initiate, maintain, and improve energy conservation programs aimed at reducing energy waste and increasing public awareness of the need to conserve energy.

The Ko Olina Phase II development consisting of golf courses, commercial development, and park does not involve the production of energy and will not promote increased energy self-sufficiency for the State. While some of the electricity for the project may be provided by the H-POWER project which produces energy from solid waste, we have no control over the source for the provision of this power. Since we are also at the conceptual phase of development planning, the consideration of energy conservation measures such as in building design must await more detailed development and design plans. The developers are supportive of energy conservation programs, however, since this would also result in lower operating costs for the development. An energy conservation ethic will be maintained as we proceed with more detailed designs.

As requested, further discussion of the relationship of the project with the appropriate energy policies will be provided in the Final EIS.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

JOHN WAIHEE
GOVERNOR

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT
HOUSING FINANCE AND DEVELOPMENT CORPORATION
P. O. BOX 29340
HONOLULU, HAWAII 96820-1750

IN REPLY REFER TO:

89:PLNG/725B JT

March 3, 1989

RECEIVED
MAR 0 ...
WILSON OKAMOTO & ASSOCIATES

MEMORANDUM

TO: Dr. Marvin T. Miura, Director
Office of Environmental Quality Control

FROM: Joseph K. Conant

SUBJECT: Draft Environmental Impact Statement for the Proposed Ko Olina, Phase II

We have reviewed the subject draft EIS and offer the following comments.

The applicant is requesting a Development Plan land use amendment from low and medium density apartment to park and recreation for the purpose of developing an additional golf course at Phase II of Ko Olina. While we understand that the proposed action would increase the viability of Ko Olina as a destination resort, we are concerned with the loss of 3,500 planned and approved housing units from the overall housing stock.

The draft EIS does not indicate the proposed sales prices of the 3,500 units. However, even if all of the units were intended to reach an upscale market, the overall housing market would have benefitted from the development of these units since the housing supply would have been increased. We therefore believe that a portion of the approved housing units should be developed elsewhere if the proposed action is granted.

Additionally, as advocates for affordable housing, we believe that if a portion of the 3,500 units was intended to reach lower and moderate income families, then those affordable housing units should be developed at another site.

With respect to the proposed golf courses, we believe that consideration should be given to the needs of residents. For example, kamaaina rates and priority starting times could be offered to residents.

Thank you for the opportunity to comment.

JOSEPH K. CONANT
Executive Director

cc: Department of General Planning
Wilson Okamoto and Associates, Inc.

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES
ENGINEERS
PLANNERS

Mr. Joseph K. Conant
Executive Director
Housing Finance and Development
Corporation
P.O. Box 29360
Honolulu, Hawaii 96820-1760

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Conant:

Thank you for your letter of March 3, 1989 regarding the subject project. We offer the following in response to your comments.

First of all, we would like to take issue that there is a "loss" of housing in the almost actual sense that your letter connotes. As far as the State is concerned, please bear in mind that the land is presently classified Agricultural, and uses such as housing are prohibited (until the State Land Use Commission is petitioned and grants a District Boundary Amendment to Urban). Furthermore, the City's zoning indicates AG-1 Restricted Agricultural, in which housing is not a permitted use. We could not build housing on the project site even if we wanted to without significant changes to State and County land uses.

What is expressed is the City's desire for a portion of the project site to be planned for low and medium density residential development as reflected in its Ewa Development Plan. City planning, however, is an ongoing process that allows for amendments. Furthermore, the emphasis on planning regions such as the Ewa DP area provides the City with needed flexibility to accomplish the objectives of the General Plan. Private sector initiatives most often provide the means to achieve the objectives related to population and housing. For the Ewa area, a large number of residential development proposals have surfaced from both the public and the private sector that would help attain the Ewa area's population objective.

As indicated in the EIS, the golf courses are intended to serve the visitor demand for resort and residential golf play generated from the Phase I development. However, public play will be considered on a space available basis. The local golfing community will indirectly benefit since the proposed golf courses will largely absorb the demand for golf play from Ko Olina Resort which could otherwise spill over to affect other private and municipal golf courses in the surrounding area.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M Takahashi

Ernest M. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

STATE OF HAWAII

DEPARTMENT OF BUSINESS
AND ECONOMIC DEVELOPMENT

LAND USE COMMISSION

Room 104, Old Federal Building, 335 Merchant Street
Honolulu, Hawaii 96813 Telephone: 548-4611

JOHN WAIHEE
Governor

RENTON L.K. NIP
Chairman

LAWRENCE F. CHUN
Vice Chairman

COMMISSION MEMBERS:

Sharon R. Himeno
Teofilo Phil Tacbian
Allen Hoffman
Robert Tamaye
Frederick P. Whittemore
Toru Sakai
Allen K. Hoe

ESTHER UEDA
Executive Officer

February 7, 1989

Mr. Rodney Y. Funakoshi, Planner
Wilson Okamoto & Associates
P. O. Box 3530
Honolulu, Hawaii 96811

RECEIVED

Dear Mr. Funakoshi:

Subject: Draft EIS for Ko Olina Phase II

Thank you for the opportunity to comment on the proposed Ko Olina Phase II.

Our review of the State land use district maps for the project area confirms that most of the project is within the State Agricultural District. It is our understanding that the developer will be seeking a land use district boundary amendment from Agricultural to Urban for the portion of the site within the agricultural district and we have no further comments at this time.

Sincerely,

ESTHER UEDA
Executive Officer

EU:to

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

2704-03
March 31, 1989

Ms. Esther Ueda
Executive Officer
Land Use Commission
Old Federal Building, Room 104
335 Merchant Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, THK: 9-1-15: por. 4 & 18

Dear Ms. Ueda:

Thank you for your letter and comments of February 7, 1989 regarding the subject project. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

2704-03

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD, HONOLULU, HAWAII 96816-4495

JAN 26 1989

RECEIVED
JAN 27 1989
WILSON OKAMOTO & ASSOCIATES

Engineering Office

City & County of Honolulu
Dept. of General Planning
650 S. King St.
Honolulu, Hawaii 96813

Office of Environmental Quality Control
465 S. King St., Rm. 104
Honolulu, Hawaii 96813

Dear Gentlemen:

Ko Olina Phase II
Ewa, Oahu, Hawaii TMK: 9-1-15: portion of 4 & 18

Thank you for providing us the opportunity to review the subject project.

We have no comments to offer at this time regarding this project.

Sincerely,

SIGNED

Jerry H. Matsuda
Major, Hawaii Air
National Guard
Contr & Engr Officer

Enclosures

cc: Ernest Takahashi ✓

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES
ENGINEERS
PLANNERS

Mr. Jerry Matsuda
Major, Hawaii Air National Guard
State Department of Defense
Office of the Adjutant General
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Matsuda:

Thank you for your letter and comments of January 26, 1989 regarding the subject project. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

OGP 3/87 989

JOHN WAIHEE
GOVERNOR OF HAWAII

JOHN C. LEWIN, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:
EPHSD

March 17, 1989

MEMORANDUM

To: Mr. Donald A. Clegg, Chief Planning Officer
Department of General Planning, City & County of Honolulu

From: Deputy Director for Environmental Health

Subject: Draft Environmental Impact Statement (DEIS) for Ko Olina Phase II, Ewa, Oahu, Tax Map Key 9-1-15: Por. 4 and 18

We have reviewed the subject DEIS and have the following comments:

Wastewater Disposal

1. The wastewater generated from the golf course facilities must be connected to the City's municipal sewer system. No other system will be permitted. The nearest sewer connecting point is the Makakilo Interceptor Sewer.

2. The developer should consult with the City for specific details regarding the connection.

Drinking Water

1. The DEIS indicates that new potable water wells have been identified for development as part of the Ewa Water Master Plan. If these wells serve 25 or more individuals at least 60 days per year or will have a minimum of 15 service connections, they will be required to comply with the Department's Administrative Rules, Title 11, Chapter 20, "Potable Water Systems."

2. Section 11-20-29 of Chapter 20 requires that a new source of potable water serving public water systems be approved by the Director of Health prior to its use. Such an approval is based primarily upon the submission of a satisfactory engineering report which addresses the requirements set in Section 11-20-29.

3. The preceding comments are also applicable to the desalting plant.

Air Pollution

The air quality impact analysis conducted by Barry D. Root and Barry D. Neal for the DEIS concluded that the exceedances of the State one-hour and eight-hour carbon monoxide standards may occur in the future with or without the proposed project at some locations. The proposed project will not cause but rather will contribute to those exceedances. Due to the potential exceedances, the mitigating actions should be

implemented and a monitoring program be initiated to verify that the State standards, in fact, will not be exceeded.

Hazardous Waste Program

The proposed project states that maintenance facilities are planned for each golf course. Solid wastes, including spent solvents and pesticides (off-specification and/or discarded), generated from these facilities may be subject to Federal regulations promulgated under the Resource Conservation and Recovery Act (RCRA) of 1976, as amended. Management should be advised of hazardous waste regulations set forth in 40 CFR Parts 260-270.

Underground Storage Tank Program (UST)

If the proposed project intends to use UST's for fuels and/or hazardous substances, the facility's management should be advised of applicable Federal regulations promulgated under RCRA, as amended. The UST's must be designed, installed and operated in accordance with 40 CFR Parts 280 and 281.

Bruce S. Anderson
BRUCE S. ANDERSON, Ph.D.

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES
ENGINEERS
PLANNERS

Dr. Bruce S. Anderson
Deputy Director for Environmental
Health
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Subject: Draft Environmental Impact Statement, Ko Olina
Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Dr. Anderson:

Thank you for your letter and comments of March 17, 1989 regarding the subject project. We offer the following in response to your expressed concerns.

Wastewater Disposal: The wastewater generated from the proposed project will be serviced by connection to the municipal Makakilo Interceptor Sewer. A wastewater master plan will be prepared and submitted for City concurrence prior to the receipt of final approvals.

Drinking Water: Compliance with the Department's Administrative Rules for potable water systems will be addressed by the Ewa Plains Water Development Corporation, a joint venture which administers the Ewa Water Master Plan.

Air Pollution: As noted in the air quality study, the State Ambient Air Quality Standards are in some cases considerably more stringent than the comparable national standards. The State standard for carbon monoxide, for example, is two to four times as strict as the national limit. Although the State standards could be exceeded, the predicted concentrations are within the national standards, and it is unlikely that the public's health would be endangered. After project completion, we would be willing to consider spot check measurements of carbon monoxide to determine if a problem truly exists.

Hazardous Waste Program and Underground Storage Tank Program: The developer will comply with the applicable provisions of these regulations as may be required prior to the receipt of final development approvals.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

JOHN WAIHEE
GOVERNOR OF HAWAII

WILLIAM W. PATY, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
LIBERT H. LANDGRAF
MANABU TAGOMORI
RUSSELL N. FUKUMOTO

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

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

REF: OCEA-sor

FEB 28 1989

RECEIVED
MAR 01 1989
WILSON OKAMOTO & ASSOCIATES

FILE NO.: 89-387
DOC. NO.: 5188E

The Honorable Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

SUBJECT: Ko Olina Phase II - Draft Environmental Impact Statement
Ewa, Oahu, Hawaii
TMK: 9-1-15: portion of 4 & 18

Thank you for giving our Department the opportunity to comment on this matter. We have reviewed the materials you submitted and have the following comments.

Our Department's Historic Sites Section indicates that an archaeological survey for this project area was completed in 1987. No archaeological sites were found. However, the OR & L Right of Way (80-12-9714), a site which is listed on the National Register of Historic Places, forms the southern boundary of the project area. This information is correctly included in the DEIS section of Historical and Archaeological Resources.

In the section entitled "Anticipated Impacts and Proposed Mitigation Measures," no assessment of impact on the OR & L railway bed is presented. Such an assessment needs to be included in the final EIS. If the OR & L is to be impacted in any way, proposed mitigation and restoration measures must be included in this section.

Our Aquatic Resources Division states that the proposed project should not result in adverse impacts to aquatic resources.

Please feel free to call me or Roy Schaefer of our Office of Conservation and Environmental Affairs, at 548-7837, if you have any questions.

Very truly yours,

WILLIAM W. PATY

cc: Mr. Ernest Takahashi

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. William W. Paty
Chairperson
Department of Land and Natural
Resources
P.O. Box 621
Honolulu, Hawaii 96809

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Paty:

Thank you for your letter and comments of February 28, 1989 regarding the subject project.

The OR & L Right of Way extends approximately 3,200 feet along a portion of the southern boundary of the project site. The anticipated Phase II land uses adjacent to the railway bed in this area include a portion of the golf course and a portion of the Ko Olina Parkway. Neither the golf course nor the road will cross or encroach upon the railway in any manner.

The Final EIS will be amended to reflect this assessment of impact. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
1600 KAPIOLANI BLVD., SUITE 1500
HONOLULU, HAWAII 96814
(808) 548-6960
(808) 948-2542

RECEIVED
ALLISON CHANNON & ASSOCIATES

March 7, 1989

Dr. Marvin Miura, Director
Office of Environmental Quality Control
465 S. King St. Rm 104
Honolulu, HI. 96813

Dear Dr. Miura:

Subject: Draft EIS: Ko Olina Phase II, Honouliuli, O'ahu
TMK: 9-1-15: por. 4 and 18

Thank you for sending our office a copy of the Draft EIS for this project, and for the opportunity to comment. More information should be provided on the archaeology of the project area. The Draft EIS implies that the project area has no Hawaiian history, and that the events and activities associated with ancient Hawaiians left no trace in the project area. A surface survey was conducted and noted nothing; but the survey lacked a rigorous research design, and no subsurface testing was conducted.

A research design normally includes background research to assess an area's research potential based on existing data. Thus, we would expect a review and analysis of previous archaeological study in the region to understand the particular needs of archaeological study in the project area. Two of the largest archaeological projects ever done in Hawaii were done on lands immediately adjacent to the project area: the West Beach survey and salvage excavations and the additional studies in the Barbers Point Harbor area (Stockpile Area 3, 37-acre reserve parcel, 12-acre parcel). It is incongruous that so much archaeology could be done in adjoining parcels of land, while nothing of archaeological interest could be found in the Ko'olina project area.

A research design would review what has been learned so far about the Ko'olina karst and its valuable faunal deposits, about the relationship between the faunal remains in the Ko'olina area and prehistoric micro-environments, and about the uncomformity that exists in the Barbers Point Harbor area and how the study of alluvial deposits in the West Beach project area have shed new light on this problem. Such a review would point to the research that could be done in the project area to help fill in the gaps. A review of previous work in the area would show that the project area is immediately adjacent to the Barbers Point Harbor Archaeological District,

and would indicate the kinds of sites that were found in the Barbers Point area that might also be found in the project area. A review of previous work would indicate the probable locations of ancient Hawaiian trails in the area, including the heavily travelled route between Honolulu and Wai'anae, and suggest areas that warranted closer inspection. A review of previous work would indicate the probable location of ancient Hawaiian burials in the area, and suggest a plan for avoiding these burials or providing for their preservation and protection during construction. Such a review would reference Emory's visit to a possible heiau site in the Gilbert area, and indicate what further archaeological work needed to be done related to that site, if any.

It is possible to say that the previous work in the Barbers Point Harbor Archaeological District has resulted in a substantial shift in the paradigm archaeologists use when they interpret Hawaii's culture history. The existing boundary of the District was arbitrarily drawn and it is reasonable to expect that related sites of interest exist in the Ko'olina project area. As much of the soil in the project area is alluvial deposits less than 200 years old, it is reasonable to expect that these deposits overlie deposits that contain garden areas and resource related sites from the prehistoric period. The purpose of an archaeological reconnaissance report is to determine the general nature of archaeological resources in an area and to arrive at a preliminary evaluation of these resources based on surface study and subsurface testing. As modern land use has obscured the evidence for prehistoric Hawaiian use of the Ko'olina area, subsurface testing is warranted, and none was done. Since no subsurface testing was done, the archaeological survey included with the Draft EIS is incomplete.

Another limitation of the appended archaeological survey report is the lack of an adequate description of the project area. A survey report should provide an accurate description of the project area and relate the data to the archaeological potential of the area. Such information as the location of two acres of coral outcrop containing cracks, crevices and depressions, and that the soils in the area are underlain by the same coral layer that contained significant bird bone deposits in the Barbers Point Harbor Archaeological District is important information that suggests the area contains archaeological resources of interest, and should not have been left out of the survey report. The presence of banana and mango near the pumphouse suggests the possibility of a historic period house site in the area, perhaps Hawaiian, and is information that should not have been left out of the survey report.

Neither the archaeological report nor the Draft EIS mentions the prominent topographic feature immediately adjacent to the project area which has important scientific, interpretive, and educational potential that will be adversely affected by the project unless plans are made to allow access to the site.

There is no contingency plan in the Draft EIS for the preservation and protection of prehistoric Hawaiian skeletal remains that are likely to be disturbed during construction.

Sincerely,

Richard K. Paglinawan

Richard K. Paglinawan
Administrator

cc: City and County of Honolulu/Dept. of General Planning
Wilson, Okamoto & Associates, Inc.
Environmental Center/U.H.
Anthropology Dept./U.H.
Historic Sites/DLNR
National Park Service/San Francisco
ACHP

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. Richard K. Paglinawan
Administrator
Office of Hawaiian Affairs
1600 Kapiolani Boulevard, Suite 1500
Honolulu, Hawaii 96814

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Paglinawan:

Thank you for your letter and comments of March 7, 1989 regarding the subject project.

In general, we believe your concerns for the historical significance of the site do not warrant the level of archaeological scrutiny you suggest. An archaeological reconnaissance survey was conducted in accordance with the guidelines of the Society of Hawaiian Archaeology which did not suggest the need for further archaeological work of any kind. As you may know, our archaeological sub-consultant, Paul H. Rosendahl, Ph.D., Inc., also conducted the extensive archaeological investigations and surveys for the Ko Olina Resort Phase I. We would refer you to the in-depth survey findings and recovery work documented as part of the Phase I effort for any desired background on the historical significance of the area.

Our archaeological sub-consultant also informs us that even if the Phase II area were included as part of the archaeological work effort undertaken for the Phase I area, they would not have recommended anything more intensive than the surface reconnaissance survey undertaken for the project site.

This position is corroborated by the State Historic Preservation Office, which has reviewed the archaeological survey report and has not suggested any need for further archaeological study. The one comment from the State Historic Preservation Office was that, if the adjacent OR & L Right of Way would be impacted in any way, that proposed mitigation and restoration measures must be included in the EIS.

Notwithstanding the negative findings of the archaeological reconnaissance, care will be taken during any development activity to seek archaeological consultation in the event that any subsurface cultural features or deposits might be encountered.

West Beach Estates has been and will continue to be extremely sympathetic to the archaeological and historical significance of the region as evidenced by the extensive and intensive

archaeological undertaking to-date. Given the circumstances of the site, however, including its extensive modification by sugarcane cultivation in recent times, we believe that reasonable procedures have been followed for evaluating the archaeological significance of the site.

We appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M Takahashi

Ernest Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

(P)1081.9

JAN 30 1989

City and County of Honolulu
Department of General Planning
650 South King Street
Honolulu, Hawaii 96813

Office of Environmental
Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Gentlemen:

Subject: Draft Environmental Impact Statement
for Ko Olina Phase II

We have reviewed the subject document and have no comments to offer.

Very truly yours,

TEUANE TOMINAGA
State Public Works Engineer

MY:jk
cc: Mr. Ernest Takahashi

RECEIVED
JAN 31 1989
WILSON OKAMOTO & ASSOCIATES

2704-03
March 31, 1989

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
PLANNERS

Mr. Teuane Tominaga
State Public Works Engineer
Department of Accounting and
General Services
P.O. Box 119
Honolulu, Hawaii 96810

Subject: Draft Environmental Impact Statement, Ko Olina
Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Tominaga:

Thank you for your letter and comments of January 30, 1989 regarding the subject project. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

RECEIVED
MAR 09
WILSON OKAMOTO & ASSOCIATES

March 8, 1989
RE:0522

Office of Environmental Quality Control
465 South King Street, Room 104
Honolulu, Hawaii 96813

Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Sirs:

Draft Environmental Impact Statement
Ko Olina Phase II
Ewa, Oahu

The proposed Ko Olina Phase II provides additional amenities to Ko Olina Resort, a part of West Beach Estates. It will include two 18-hole, championship golf courses, each with its own clubhouse and dining facilities. In addition, each golf course will have a parking lot, a driving range, and a maintenance facility. Also planned are commercial developments on the east end of the site, and relocation and expansion of an existing neighborhood park. A vehicular access road from the primary resort area will bisect the site. The proposed commercial parcel will incorporate a retail village directed at both resort and residential markets. Within the commercial parcel, a low-rise office complex with garden or park-like open space amenities is also planned.

The Environmental Center has reviewed the above referenced document with the assistance of Bertell Davis, Anthropology; Paul Ekern and Edwin Hurabayashi, Water Resources Research Center; James R. Hollyer, Agricultural and Resource Economics; and Carolyn D. Cook, Environmental Center.

Water Quality and Supply

The Draft EIS inadequately addresses problems of water supply, water quality, and wastewater disposal. The report states that water requirements for irrigation purposes will average 600,000 gallons per day per course

(page 60). However, the methodology used to derive this estimate is unstated. Results of studies in progress at the University suggest that this figure may underestimate the actual needs significantly. We surmise that data from Oahu Sugar Co. (Appendix A, page 23) formed the basis for the calculation (ie. 92.5 in./year = 0.25 in./day - 7000 gal./acre.day x 86 acres - 600,000 gal./day). However, Oahu Sugar Co. utilized drip irrigation which provides roughly twice the uniformity of application of sprinklers, and the average course acreage (86 acres) is significantly less than the estimated 150 acres per course specified in the Draft EIS.

Page 6 of Appendix G estimates typical evapotranspiration rates in Ewa of 0.1 to 0.3 inch/day, but does not give the source. Pan evaporation data for this area (90 inches/year; Ekern & Chang, 1985 R74) correspond closely with the actual use by Oahu Sugar. Here, again, the derivation of the irrigation demands for fairways and greens is unstated, but the projected water use appears to be somewhat conservative.

Appendix G, page 3, also contains a major error (possibly typographical). The evapotranspiration rate for irrigated sugar cane should be 82.4 rather than 26.4 inches/year. The resulting rainfall deficit equals 67.08 inches/year.

Our concerns about water usage are not merely academic. In the absence of recharge with fresh water from another source, the Ewa caprock aquifer cannot be expected to maintain its present quality while being depleted at projected rates. The degree to which this resource remains usable depends on careful evaluation of cumulative demands.

Soils

The Lualualei and Keeau series are unstable soils that exhibit substantial expansion and contraction on wetting and drying and are subject to differential settling as well. Concrete floors, walls, driveways, etc., are prone to crack and buckle if building sites are not properly engineered to insulate and stabilize the underlying soil. Rigid pipelines are also prone to break over time. The Honouliuli series exhibits similar properties to a lesser extent.

Archaeology

The Archaeological report meets the minimum standards for a reconnaissance survey set by the Society for Hawaiian Archaeology. The reconnaissance, however, should be carefully monitored in the lower elevations of the proposed project, because it is in these areas where archaeological features and artifacts are most likely to be found.

Economic Projections

Demand for these propose facilities may not meet economic projections in the draft. Results of ongoing studies at the University's Department of

Agricultural and Resource Economics note that the average number of rounds for Hawaii's resort courses during 1987 was considerably lower than figures indicated on page 12.

The projected employment figure of 1 construction job per year for each $83,000 of construction seems ambiguous. Does the $83,000 refer to the value of construction within one year or to a segment of the total project cost? By calculating the number of jobs based on total construction costs, the duration of construction becomes a factor, in which case only 1/4 to 1/2 as many jobs will be created, but they will last for a number of years.

Our reviewers have noted that the average golf course crew is far less than 50, and that economies of scale would preclude duplication of support crews for adjacent facilities. This also applies to the average club house/banquet/proshop staff size.

Housing

The proposed project differs from the existing Ewa Development Plan in substituting a second golf course for 1,501 low density apartment units and 2,009 medium density apartments. However, the Draft EIS fails to evaluate the impact of this substitution of projected housing needs for the Ewa region. In view of current housing controversies, further discussion of this issue would be appropriate.

Corrections

Page 80, citation 2 "Charles J. Miles" should read Carl J. Miles.

Figure 1-1 (map), the location of the project on the large map does not match the insert map in the upper left corner of the same page.

From the comments provided by our reviewers, it is apparent that the document, in its current form, has not adequately addressed a number of vital issues. We would strongly recommend inclusion of more specific data on the concerns we have voiced in the Final EIS.

Yours truly,

John Harrison
Environmental Coordinator

cc: DLNR
State Water Commission
Ernest Takahashi, Wilson Okamoto & Assoc. ✓
L. Stephen Lau
Bertell Davis
Paul Ekern
Edwin Hurabayashi
James R. Hollyer
Carolyn Cook

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
&
PLANNERS

Mr. John Harrison
Environmental Coordinator
Environmental Center
University of Hawaii at Manoa
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Harrison:

Thank you for your letter and comments of March 8, 1989 regarding the subject project.

Water Quality and Supply: The estimated water requirement for golf course irrigation of 600,000 gallons per day per course is based on 4,000 gallons per day per acre. This figure has been derived from design criteria developed by the Board of Water Supply and incorporated for the dual water system concept in the Ewa Water Master Plan. Under the dual system, the water system design criteria for golf courses and parks is 600 potable and 3,400 non-potable gallons per day per acre. We have also reviewed the projected water usage for nearby golf courses in Kunia which show comparable estimated irrigation requirements.

We stand corrected on the error noted in the evapotranspiration rate for irrigated sugar cane.

Soils: The high shrink-swell potential of soils in the project area is acknowledged and will be considered in the design of roads and structures.

Archaeology: Notwithstanding the negative findings of the archaeological survey, care will be taken during any development activity to seek archaeological consultation in the event that any subsurface cultural features or deposits might be encountered.

Economic Projections: The figures quoted on page 12 were not meant to be projections, but rather to reflect the capacity of the resort courses. The anticipated demand for golf play is reflected in the ratio of rounds per number of rooms: 1 round of golf per 10 rooms per day is the standard commitment sought by resort operators. With 4,000 visitor units and 5,200 residential units (residential units anticipated to generate 1 round per 15 units), this translates to a need for 750 rounds per day, or 3.5 golf courses, assuming 200 rounds per day per course.

As you have noted, the projected short term employment should have accounted for the duration of the construction phase rather than reflecting the projected employment as occurring within one year. The EIS will be revised to reflect an assumption based on a 5-year construction timetable, in which case the yearly employment during this period would be an estimated 250 construction jobs.

The projected 50 employees per golf course were based on a review of other resort courses.

Housing: An extensive discussion of the substitution of golf course for residential units has been addressed in the Draft EIS, on page 72 in the discussion of socio-economic impacts, and on page 75 in the discussion of alternatives considered.

Corrections: The corrections you have noted will be incorporated in the Final EIS.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest H. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

March 15, 1989

RECEIVED
MAR 20 1989
WILSON OKAMOTO & ASSOCIATES

Dr. Marvin T. Miura, Director
Office of Environmental Quality Control
State of Hawaii
Kekuanaoa Building No. 104
465 South King Street
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Your Letter Received on January 25, 1989 on the Draft Environmental Statement for Ko Olina, Phase II, Ewa, Oahu, Hawaii, TMK: 9-1-15: Por. 4 and 18

We have the following comments on the proposed project:

1. The developer should submit to us a letter from the Ewa Plains Water Development Corporation stating that water for Ko Olina, Phase II will be allocated from Honouliuli Wells.

2. Potable water service will not be available until the Honouliuli Wells are constructed and placed in operation.

3. The developer should submit a revised water master plan for our review and approval.

4. Water System Facilities Charges for the transmission main shall be applicable for potable water service.

5. Page 61, first paragraph, we request revision to the sentence which presently reads as follows:

   "The applicant must request that the Board of Water Supply file an application with SWC for approval of the planned use of public potable and non-potable water."

   The replacement sentences should read as follows:

   "The Board of Water Supply will assist the applicant in filing an application with SWC for approval of the planned use of public potable

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

and non-potable water. The Board of Water Supply concurs in the conservation value of a dual water system and are already operating the Kalauao Springs non-potable water system."

If you have any questions, please contact Lawrence Whang at 527-6138.

Very truly yours,

Kazu Hayashida

KAZU HAYASHIDA
Manager and Chief Engineer

cc: Ernest Takahashi
(Wilson Okamoto and Associates, Inc.)

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Subject: Draft Environmental Impact Statement for
Ko Olina, Phase II, Ewa, Oahu, TMK: 9-1-15:
por. 4 & 18

Dear Mr. Hayashida:

Thank you for your letter of March 15, 1989 regarding the subject project. We provide the following in response to your numbered comments.

1. As requested, a letter will be requested from the Ewa Plains Water Development Corporation stating there will be an allocation and source of water for the Ko Olina Phase II development.

2. Noted.

3. A revised water master plan will be submitted for your review and approval at the appropriate stage in the review process.

4. Noted.

5. The requested revision to the sentence on Page 61 will be incorporated in the Final EIS.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest M. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

PB 89-99

February 3, 1989

MEMO TO: DONALD CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: HERBERT K. MURAOKA
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)
KO OLINA, PHASE II
TMK: 9-1-15: PORTION OF 4 AND 18
EWA, OAHU, HAWAII

We have reviewed the draft EIS for Phase II of the Ko Olina project and have no comments.

Thank you for the opportunity to review the document.

HERBERT K. MURAOKA
Director and Building Superintendent

TH:jo
cc: Wilson Okamoto & Assoc.
J. Harada

2704-03
March 31, 1989

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
PLANNERS

Mr. Herbert K. Muraoka
Director and Building Superintendent
Building Department
650 South King Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Muraoka:

Thank you for your letter and comments of February 3, 1989 regarding the subject project. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest M. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

DEPARTMENT OF GENERAL PLANNING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

DONALD A. CLEGG
CHIEF PLANNING OFFICER

GENE CONNELL
DEPUTY CHIEF PLANNING OFFICER

RH/DGP 2/89-256

March 8, 1989

RECEIVED
MAR 10 1989

Mr. Ernest Takahashi
Project Manager
Wilson Okamoto and Associates
1150 South King Street, Suite 800
Honolulu, Hawaii 96814

Dear Mr. Takahashi:

Draft Environmental Impact Statement (DEIS)
for the Ko Olina Resort, Phase II

We have reviewed the subject Draft EIS and have the following comments.

The discussion regarding Golf Course Demand on page 11, Section II.B.1 indicated that only two new courses (the Ko Olina Golf Course and the City's West Loch Course) are under construction and expected to be operational by 1990. The discussion should also indicate the implementation status of the three golf courses being developed in Ewa (Meyer's, Makakilo, and Kapolei Village Golf Courses) and of the five golf courses being developed in the adjacent Central Oahu area, (two at Royal Kunia Phase I, one at Waikele, and two at Waiawa). Please clearly detail the formulation resulting in the demand for approximately four golf courses. A discussion evaluating the expected supply and demand would also be appropriate here.

Your assumptions regarding Commercial Demand, Section II.B.2, and Office Space Demand, Section II.B.3, should be provided in the EIS.

The discussion on page 56, Section IV.E, City and County of Honolulu Development Plan, should reflect our understanding that the small area designated as Public Facility is proposed for deletion from the Ko Olina site and not for relocation. It is also our understanding that the acreage involved is 0.5± acres rather than 2 acres.

An estimate of storm runoff, and a brief description of existing and proposed drainage improvements which are keyed to a map of the drainage tributary areas would add to the discussion under Section V.B.4, Drainage, on page 63.

Under Section V.B.6, Traffic, please describe the proposed vehicle and pedestrian access to the relocated Kamokila Neighborhood Park, in particular for the residents of Honokai Hale and Nanakai Gardens.

Since it is assumed that all mitigative measures will be employed to move traffic efficiently in order to maintain national air quality standards and minimize the exceedences of State air quality standards, comments from City and State Transportation agencies and the State Department of Health with respect to these measures would assist in the evaluation of the project.

Expanding the discussion regarding the impact on Oahu Sugar Co. (Section V.B.9, page 69) would help in analyzing the long-term potential impacts. A more realistic analysis would address the impact of this project on Oahu Sugar Co. economies of scale and production efficiencies with the withdrawal of sugarcane lands in Ewa and Central Oahu which have already been approved for development. This analysis may affect the conclusions indicated in Section VII.A, page 77, and Section VIII, page 78.

The discussion on the Ewa population objectives (Section V.B.11, page 72) may need to be updated based on recently adopted GP and DP amendments. The GP amendment among other things revised the Ewa percentage of the islandwide population range to 12.0 - 13.3% based on DPED's latest population projection for the year 2010 of 999,500 for Oahu. Amendments in the 1988 Ewa DP Annual Review included Kapolei Knolls (500 units) and Ewa-Gentry (additional 2,000 units).

Please include the Master Plan and Development Plan Land Use Map for the entire resort in the EIS.

Sincerely,

Donald A. Clegg

DONALD A. CLEGG
Chief Planning Officer

DAC:js

cc: OEQC

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
650 South King Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Clegg:

Thank you for your letter of March 8, 1989 regarding the subject project. We offer the following in response to your comments and concerns.

Golf Course Demand: As requested, the implementation status of other golf courses in the surrounding area is provided here, based on our knowledge and as obtained from various public sources. The City Department of Land Utilization or your department may have more current information on the discretionary permits which are pending.

Meyer's:	Zoning and Conditional Use Permit obtained; construction pending.
Makakilo:	Conditional Use Permit approved, but project on hold because of City-imposed golf course moratorium.
Kapolei Village:	Land Use District Boundary Amendment approved; may be exempt from City approvals because of HFDC development.
Ewa Gentry:	Land Use District Boundary Amendment and DP approved.
Royal Kunia Ph.I:	DP Amendment obtained for both courses; Land Use Boundary Amendment pending for one course.
Waikele:	Permits received; construction pending.
Waiawa:	Land Use Boundary Amendment approved; DP pending.

The anticipated demand for golf play is reflected in the ratio of rounds per number of rooms: 1 round of golf per 10 rooms per day is the standard commitment sought by resort operators. With 4,000 visitor units and 5,200 residential units (residential units

generate 1 round per 15 units) planned for Ko Olina Resort, this translates to a need for 750 rounds per day, or 3.5 golf courses, assuming 200 rounds per day per course. This has been rounded to the need for approximately 4 golf courses.
During the past few years, interest in golf at local courses has increased at most of the local courses, increasing utilization and fees. Municipal courses on Oahu are some of the busiest in the country and the world. Public pressure has been increasing to construct new municipal courses and four alternative sites are under consideration. There is also strong interest in development of private courses, with 28 course locations under consideration by various developers. For the Ewa, Waianae, and Central Oahu areas, 17 golf sites are proposed, of which 2 are under construction (at Ko Olina and at West Loch). The remaining 15 are in various stages in the approvals process. Only a half to three-quarters of these golf sites are expected to be approved within the 20-year planning horizon because of factors such as community sentiment, lack of infrastructure, incompatibility with existing and proposed uses, water availability and access, and inability to obtain the necessary financing.

The need for additional courses in the Ewa, Central Oahu, and Waianae areas is estimated by adding resort and residential growth projected for these areas. Two-thirds of the residential growth and three-quarters of the resort development growth are anticipated in these areas based on the DGP residential population allocation of DBED M-K projections. Depending on the annual growth in golf participation, it is estimated that the demand exists for between 10 and 20 new golf courses by the year 2010.

Assumptions for Commercial and Office Space Demand: We note this planned commercial area is already designated as Commercial on the Ewa Development Plan. Demand for commercial space is separately calculated for visitor demand and residential demand. Assuming that visitor spending trends will remain consistent in the future, an average expenditure of $91 per visitor per day is expected beyond hotel and airfare expenditures. Assuming that a percentage of these funds would be expended at retail establishments within the Ko Olina Resort ($400 per square foot in sales), 250,000 square feet will be needed to service the resort demand. To meet the residential demand for commercial space for the 5,200 residential units approved for development, the experience of Mililani Town is used. Proportionately, Mililani Town with 8,374 units and 410,000 square feet of retail space successfully leased would indicate a demand of 255,000 square feet for the Ko Olina residentials. To be conservative, the residential demand is rounded down to 200,000 square feet.

Office space demand is estimated based on growth in employment per the M-K estimates, and per capita office space absorption over the past ten years. Office space needs on Oahu are thus expected to grow by 400,000 square feet annually through the year 2000, although annual absorption rates could vary from 100,000 square feet to 600,000 square feet. Assuming development takes place within the Ewa area as envisioned by the General Plan, there will be a demand for office space to support the urban activities which will be taking place. The absorption of office space to be developed on the 20-acre site is projected at 40,000 square feet annually, or 10 percent of Oahu's estimated demand of space per year.

The proposed commercial and office developments at the Kapolei Town Center, while competitive with the Ko Olina development, will actually enhance the potential to attract office users to the Ewa area because of more intensive marketing efforts and wider variety of sites available to prospective tenants. The planned development of over 20,000 residential units in Ewa and Central Oahu are further inducements because of the proximity to the site and traffic congestion through the central Honolulu corridor.

Deletion of Public Facility: The Final EIS will be revised as you have indicated.

Runoff and Drainage Improvements: Enclosed is a map of the storm drainage system plan which shows the drainage area and computed storm runoff at the project boundary for the three tributaries.

Access to Relocated Kamokila Park: The Department of Parks and Recreation is in the process of preparing a master plan for the relocated and expanded park area, which would include the necessary provision of pedestrian and vehicular access to the Park. Such access is necessarily dependent on the layout of facilities within the Park, which are as yet undetermined at this time.

Impact on Oahu Sugar Company: As suggested, we have reviewed the cumulative impacts of the withdrawal of sugar from Oahu Sugar Company lands when other proposed developments are considered. Whereas Ko Olina Phase II would have minimal effect on the economic viability of Oahu Sugar Company, the combined effect of the withdrawal of an estimated 5,400 acres in sugarcane to accommodate all approved and pending projects would have a much more serious effect. Our agricultural feasibility analysis indicates, however, that Oahu Sugar Company can compensate for decreasing economies of scale to a considerable extent by shifting

from the double mill to a single mill operation. This would permit the company to continue as an economically viable unit, assuming adequate sugar prices in relation to input costs, which will depend upon renewal of the 1995 Food Security Act in 1990.

Ewa Population Objectives: The discussion on page 72 of the Draft EIS will be revised as appropriate to reflect the updated GP and DP amendments.

Master Plan and DP Land Use Map: The map following page 56 of the Draft EIS shows the DP Land Use designations for the entire Ko Olina Resort. The master plan for the resort is essentially reflected in this and the Zoning map which follows.

We greatly appreciate your time and effort in reviewing the Draft EIS.

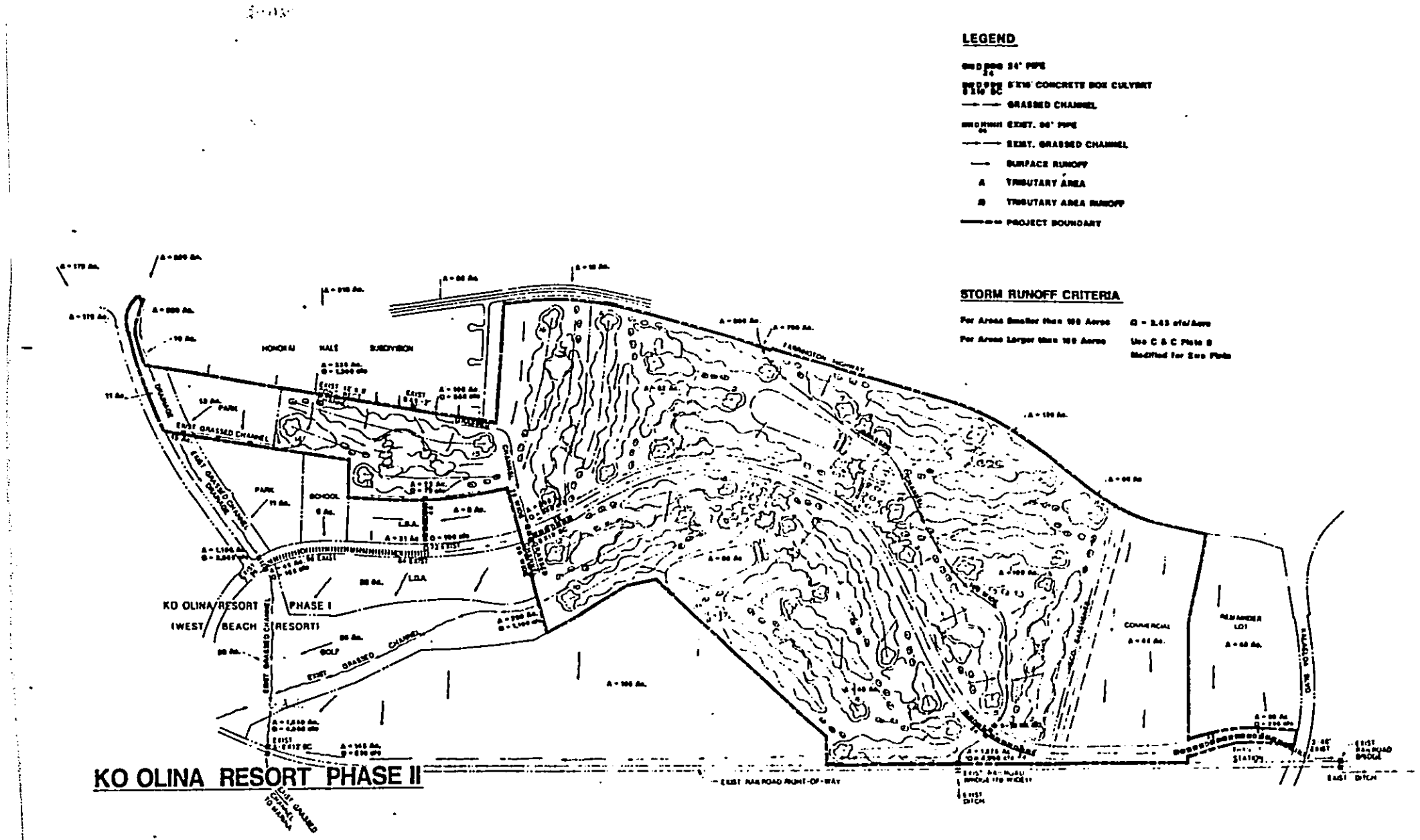
Sincerely,

Ernest M. Takahashi

Ernest M. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF



KO OLINA RESORT PHASE II

Storm Drainage System Plan

EXHIBIT

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 5TH FLOOR
HONOLULU, HAWAII 96813
PHONE 523-4427

FRANK F. FASI
MAYOR

MICHAEL N. SCARFONE
DIRECTOR

HIRAM M. KAMAKA
DEPUTY DIRECTOR

February 10, 1989

Mr. Ernest Takahashi, Project Manager
Wilson Okamoto and Associates, Inc.
1150 South King Street, Suite 800
Honolulu, Hawaii 96814

Dear Mr. Takahashi:

Subject: Draft Environmental Impact Statement
Ko Olina Phase II
Ewa, Oahu, Hawaii

Thank you for the opportunity to review and comment on the Draft EIS for Ko Olina Resort Phase II.

The Department of Housing and Community Development has been requesting that ten (10) percent of all residential units be set aside for low- and moderate-income households, or an acceptable in-kind substitute be provided for all development plan amendments involving residential uses. This policy has up to now only affected residential projects, however, all developments requesting rezoning actions would be subject to some kind of requirement under a Bill for a Community Benefit Assessment Ordinance currently before the City Council. Therefore, the proposed project could be affected by the change in policy. The Department will inform the developer of any requirements should the Community Benefit Assessment bill be enacted.

Thank you for the opportunity to provide these comments.

Sincerely,

MICHAEL N. SCARFONE
Director

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
PLANNERS

2704-03
March 31, 1989

Mr. Michael N. Scarfone
Director
Department of Housing and
Community Development
650 South King Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Scarfone:

Thank you for your letter and comments of February 10, 1989 regarding the subject project. We appreciate your informing us of the potential requirements which the proposed development might be subject to under the proposed Community Benefit Assessment Bill. Thank you for your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

DGP 3/89 904

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

FRANK F. FASI
MAYOR

JOHN P. WHALEN
DIRECTOR

RECEIVED
'89 MAR 10 P3:06
CITY CLERK
HONOLULU, HAWAII

89/EC-9(ask)

March 9, 1989

MEMORANDUM

TO: DONALD CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
FOR KO OLINA PHASE II, EWA, OAHU
TAX MAP KEY 9-1-15: PORTION OF 4 AND 18

We have reviewed the subject document and offer the following comments and questions:

Parks

Relocation and expansion of Kamokila Neighborhood Park should be coordinated with the City Department of Parks and Recreation. Park relocation may adversely impact adjacent residential units. Measures to avoid and/or mitigate possible noise, lighting, and visual impacts on neighboring homes should be addressed.

The Environmental Impact Statement should describe the recreational facilities that will be made available at the park.

How will the "general public" be accommodated at the golf courses?

Agriculture

The study briefly describes several alternative crops but concludes that, based on Hawaii Sugar Planter's Association and University of Hawaii research, none are economically feasible substitutes for sugarcane. Diversified agriculture is not discussed as an alternative for the project site.

Land Uses

The Environmental Impact Statement should include a description of existing and proposed land uses immediately east and south of the makai golf course.

The Ewa plain has been designated as the site of Oahu's second city, where new job-producing activities and residences are to be concentrated. Displacing planned low- and medium-density apartment uses with a golf course appears unjustified in light of the City's land use policy.

Traffic

Have the appropriate government agencies approved of the proposed traffic improvement proposals? Who will be responsible for constructing the proposed improvements? The air quality study assumes right turn merge lanes at a number of intersections. Will these improvements also be undertaken?

How will the proposed development impact traffic levels on Farrington Highway, Kalaeloa Boulevard or H-1?

Water

Will non-potable sources be adequate to satisfy the irrigation requirement? What is the salinity of the non-potable water? Is this water suitable for golf course irrigation in this area?

Air Quality

The Air Quality Study reveals that State Ambient Air Quality Standards will be violated as a result of traffic generated by this project. Would measures such as alternate traffic patterns mitigate air quality impacts?

What land uses are down wind of the golf courses? Are these uses sensitive to aerial applications of pesticides or fertilizers?

MEMO: DONALD CLEGG
Page 3

Thank you for the opportunity to comment on the proposed project. If you have any questions, call Ardis Shaw-Kim of our staff at 523-4648.

John P. Whalen
JOHN P. WHALEN
Director of Land Utilization

JPW:61
0227N

2704-03
March 31, 1989

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
PLANNERS

Mr. John P. Whalen
Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Whalen:

Thank you for your letter and comments of March 9, 1989 regarding the subject project.

Parks: We are actively coordinating the relocation and expansion of Kamokila Park with the Department of Parks and Recreation (DPR). The DPR is presently preparing a master plan scheme for the proposed park. The new park site at a minimum will have the same facilities presently available at Kamokila Park, as well as additional facilities made possible by the expanded park site. As necessary and appropriate upon design of the park master plan and pursuant to discussions with the affected community, mitigation measures will be incorporated into the park's layout and design. Public play for the proposed golf course development will be considered on a space available basis.

Agriculture: Diversified agriculture has been considered as an alternative for the project site. The Agricultural study concludes, however, that the major limiting factors to diversified crop production on sugarlands are the limited extent of the Hawaii market for non-export crops and the inability to compete pricewise in the marketplace in relation to other producing areas.

Land Uses: Existing land uses immediately east and south of the proposed golf course is presently under sugarcane cultivation. Regarding proposed land uses east of the project site, commercial use is indicated between the eastern boundary of the project site and Kalaeloa Boulevard as part of the Campbell Estate's Kapolei Town Center development. South of the project site is designated Agriculture under the present Development Plan, but indicated for future business park and light industrial uses in Campbell Estate's Ewa Long Range Master Plan.

Traffic: The road and traffic improvements proposed in the EIS are subject to approval by the State Department of Transportation and the City Department of Transportation Services and are expected to be expressed in the course of the land use development permissions required for the proposed project. West Beach Estates will assume responsibility for constructing any on-site improvements proposed. Every effort will be made to incorporate the air quality recommendations and those of the traffic impact study in the implementation of the project. The development's impacts on traffic levels on Farrington Highway/H-1 and Kalaeloa Boulevard are discussed in detail in the Traffic Impact Study included in Appendix E of the Draft EIS, with mitigating measures identified to accommodate projected traffic volumes.

Water: Non-potable sources should be adequate to satisfy the irrigation demand for the golf courses. The expected salinity of the non-potable water is 500 to 600 ppm chloride, a concentration suitable for the irrigation of golf courses.

Air Quality: As noted in the air quality study, the State Ambient Air Quality Standards are in some cases considerably more stringent than the comparable national standards. The State standard for carbon monoxide, for example, is four times as strict as the national limit. The traffic improvements proposed would enable meeting the Federal standards, but would not be adequate for the State standards to be met.

Presently, no residential uses would be affected by being downwind of the proposed golf courses. In the future, some low-density residential units planned as part of the Phase I resort development would be downwind of the golf course. Recommended mitigating measures identified in the Draft EIS include the use of a coarse rather than fine spray, and application under low wind speed conditions to minimize any airborne drift of chemical sprays.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest M. Takahashi, Project Manager

ET/RYF

cc: West Beach Estates

DEPARTMENT OF PARKS AND RECREATION

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

WALTER M. OZAWA
DIRECTOR

March 21, 1989

Dr. Marvin Miura, Director
Office of Environmental Quality Control
State of Hawaii
Kekuanaoa Building, Room 104
465 South King Street
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Environmental Impact Statement
Ko Olina Phase II - Ewa
Tax Map Key 9-1-15: Por. 4 & 18

We have reviewed the Environmental Impact Statement (EIS) for the Ko Olina Phase II and make the following comments.

The applicant's proposal to relocate Kamokila Park is under discussion with the department. Until such time that conditions of relocation are satisfactorily negotiated, we cannot concur with the proposed relocation. The location of the proposed site, site grades, location or major drainage channels and access to Honokai Hale are points of concern that need to be resolved.

Thank you for the opportunity to review the EIS.

Sincerely,

WALTER M. OZAWA, Director

WMO:ei

cc: Department General Planning
Mr. Ernest Takahashi - Wilson Okamoto & Associates

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. Walter M. Ozawa
Director
Department of Parks and Recreation
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement for
Ko Olina, Phase II, Ewa, Oahu, TMK: 9-1-15:
por. 4 & 18

Dear Mr. Ozawa:

Thank you for your letter and comments of March 21, 1989 regarding the subject project.

Based on our preliminary discussions with your staff on planning for the relocation and expansion of the Kamokila Park, we believe that your expressed concerns can be resolved to our mutual satisfaction. We wish to express our appreciation for the assistance and cooperation rendered by your staff and look forward to the continued coordination of our efforts.

Thank you for your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

SGP 2/89-510

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

RECEIVED
'89 FEB 6 P1
GENERAL PLANNING
C & C HONOLULU

FRANK F. FASI
MAYOR

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
ENV 89-18(449)

February 2, 1989

MEMORANDUM

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: SAM CALLEJO, DIRECTOR AND CHIEF ENGINEER

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
KO OLINA PHASE II
(TAX MAP KEY: 9-1-15: POR. 4 AND 18)

We have reviewed the subject DEIS and have the following comment:

1. We have no objection to the proposed development which consists of two (2) 18-hole championship golf courses, commercial development, and relocation of the existing neighborhood park.

SAM CALLEJO
Director and Chief Engineer

WILSON
OKAMOTO
& ASSOCIATES
ENGINEERS
PLANNERS
1150 SOUTH KING STREET
HONOLULU, HAWAII 96814
PHONE (808) 531-1308

2704-03
March 31, 1989

Mr. Sam Callejo
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Callejo:

Thank you for your letter and comments of February 2, 1989 regarding the subject project. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest M. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

RECEIVED
MAR 24 1989
WILSON OKAMOTO & ASSOCIATES

JOSEPH M. MAGALDI, JR.
Acting Director

March 20, 1989

TE 461
PL1.1443

MEMORANDUM

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: JOSEPH M. MAGALDI, JR., ACTING DIRECTOR

SUBJECT: KO OLINA - PHASE II
DRAFT ENVIRONMENTAL IMPACT STATEMENT
TMK: 9-1-15: POR. 4 & 18

We have reviewed the subject draft Environmental Impact Statement as requested and have the following comments to offer:

1. The QRS II model used for estimating traffic should be justified for local conditions if the ITE trip generation factors are not used. The higher ITE rates may require additional mitigation measures.

2. Adequate R.O.W. should be provided and should include a determination of required roadway widths to accommodate all the proposed mitigation measures. In particular, roadway dimensions should be provided for the proposed roadway section containing ten-twelve lanes which is being recommended for the Ko Olina Parkway and Kalaeloa Boulevard intersection.

3. Pullboxes and underground conduits should be installed at all intersections where the potential for warrants exist in anticipation of signalization.

4. All roadways should be designed in accordance with all applicable City standards.

5. Access driveways for both golf courses should be directly across one another (to form 1 (one) four leg intersection as opposed to 2 (two) "T" intersections).

Questions may be referred to Mark Kikuchi of my staff at Local 4199.

JOSEPH M. MAGALDI, JR.

cc: Office of Environmental Quality Control
Ernest Takahashi, Project Manager
Wilson Okamoto & Assoc., Inc.

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. Joseph M. Magaldi, Jr.
Acting Director
Department of Transportation Services
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement for
Ko Olina, Phase II, Ewa, Oahu, TMK: 9-1-15:
por. 4 & 18

Dear Mr. Magaldi:

Thank you for your letter of March 20, 1989 regarding the subject project. We provide the following in response to your numbered comments.

1. While the traffic study may not have clearly specified, our subconsultant did use the ITE (Institute of Transportation Engineers) rates for estimating trips to be generated by the proposed project. For the traffic generated from outside the project area, the Hali 2005 forecasts were used. The QRS II model was used only to distribute and assign trips in the planning area.

2. The roadway section which may ultimately be required at the intersection of Ko Olina Parkway and Kalaeloa Boulevard would have a maximum of seven lanes, not ten-twelve as indicated in your letter. The seven lanes include two thru lanes eastbound, two left turn lanes headed mauka towards Farrington Highway, and three thru lanes westbound. The planned 100-foot right-of-way should be adequate to accommodate these lanes.

3. Noted, although we do not anticipate that signalization would be required for the foreseeable future at any of the intersections on the project site.

4. The developer intends to comply with all applicable City standards.

5. While we are at this time only in the conceptual planning stage, this recommendation will be considered as we proceed with more detailed design.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest M. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

FIRE DEPARTMENT
CITY AND COUNTY OF HONOLULU
1455 S. BERETANIA STREET, ROOM 305
HONOLULU, HAWAII 96814

FRANK F. FASI
MAYOR

FRANK K. KAHOOHANOHANO
FIRE CHIEF

LIONEL E. CAMARA
DEPUTY FIRE CHIEF

February 6, 1989

RECEIVED

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: FRANK K. KAHOOHANOHANO, FIRE CHIEF

SUBJECT: KO OLINA PHASE II--EWA, OAHU
TMK: 9-1-15: POR. 4 & 18

We have reviewed the subject material provided and foresee no adverse impact in Fire Department facilities or services, planned or now provided. We have no additional comments at this time.

Should you have any questions, please contact Battalion Chief Kenneth Word of our Administrative Services Bureau at 943-3838.

Frank K. Kahoohanohano
FRANK K. KAHOOHANOHANO
Fire Chief

AKL:ny

(EIS draft returned to OEQC.)

Copy to: Mr. Ernest Takahashi, Project Manager
Wilson Okamoto & Associates, Inc.
1150 S. King St., Suite 800
Honolulu, hawai 96814

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES
ENGINEERS
PLANNERS

Mr. Frank K. Kahoohanohano
Fire Chief
Honolulu Fire Department
1455 South Beretania Street, Room 305
Honolulu, Hawaii 96814

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Kahoohanohano:

Thank you for your letter and comments of February 6, 1989 regarding the subject project. We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

1455 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96814 • (808) 955-0111

FRANK F. FASI
MAYOR

DOUGLAS G. GIBB
CHIEF

MARVIN FERREIRA
DEPUTY CHIEF

OUR REFERENCE KN-LK

February 28, 1989

RECEIVED
MAR 1 1989
WILSON OKAMOTO & ASSOCIATES

TO: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

FROM: DOUGLAS G. GIBB, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: KO OLINA PHASE II, EWA, OAHU, HAWAII
TMK: 9-1-15: PORTION OF 4 & 18

We have reviewed the draft environmental impact statement for Ko Olina Phase II and would like to offer the following comments.

In the interest of traffic safety, we urge that construction tasks, such as the transporting of heavy machinery, are planned to minimize traffic congestion near the Ko Olina Connector/Farrington Highway intersections. Also, we strongly support the traffic mitigation measures proposed for this project.

The district commander anticipates an increase in calls for police service when the commercial retail village and park become operational. Commercial and public-accessed centers often create an opportunity for unwanted activities (e.g., loitering, congregating, vandalism, trespassing, and shoplifting).

To supplement our efforts to minimize criminal activities in that area, Ko Olina Phase II should be designed with environmental security measures (e.g., adequate lighting, video monitors, alarm systems, and highly visible security stations) in mind.

Please keep us informed of the commercial and park developments as designs become available.

Thank you for the opportunity to comment.

DOUGLAS G. GIBB
Chief of Police

By James Femia
JAMES FEMIA
Acting Assistant Chief of Police
Support Services Bureau

cc: Office of Environmental Quality Control
Mr. Ernest Takahashi

2704-03
March 31, 1989

WILSON
OKAMOTO
& ASSOCIATES

ENGINEERS
PLANNERS

Mr. Douglas G. Gibb
Chief of Police
Honolulu Police Department
1455 South Beretania Street
Honolulu, Hawaii 96814

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Gibb:

Thank you for your letter and comments of February 28, 1989 regarding the subject project. We have not as yet considered such safety and security measures as indicated by your comments since we are at this point only in the conceptual design phase of the project. We will retain your comments for our future reference as we progress in developing more detailed designs for the planned developments, and incorporate at that time appropriate measures to address the security concerns you have raised.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

AMERICAN LUNG ASSOCIATION OF HAWAII

RECEIVED
MAR 03
WILSON OKAMOTO & ASSOCIATES

March 4, 1989

Mr. Donald Clegg
Director
Department of General Planning
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: Draft Environmental Impact Statement for the Proposed Ko Olina Phase II

We have reviewed the subject EIS with particular attention to the sections addressing air quality. We found those sections to be generally adequate and offer only one specific comment.

EIS, p. 68 and Appendix F, p. 16: The text indicates that indirect, offsite air quality impacts of the project from electrical power demand and from solid waste disposal are expected to be "negligible." Since no supporting data or discussion are provided, this would appear to be a subjective statement. Given Oahu's continuing population growth and its concomitant pressure on existing infrastructure and the environment, some analysis and discussion of these pressures and their cumulative environmental consequences would seem in order.

Yours truly,

James W. Morrow
Director
Environmental Health

JWM:ct
I8907

cc: OEQC
Environmental Center
E. Takahashi

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
PLANNERS

2704-03
March 31, 1989

Mr. James W. Morrow
Director, Environmental Health
American Lung Association of Hawaii
245 North Kukui Street
Honolulu, Hawaii 96817

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Morrow:

Thank you for your letter of March 4, 1989 regarding the subject project. We offer the following in response to your comments.

Electrical Generation: The annual electrical demand of the project when fully developed is not expected to exceed 40 million kilowatt-hours. This power demand would most probably be provided mainly by oil-fired generating facilities located on Oahu. However, with H-POWER currently under construction and plans for a coal-fired power plant at Campbell Industrial Park in the near future, some of the project power could well come from sources burning other fuels. In order to meet the electrical power needs of the proposed project, power generating facilities would be required to burn more fuel and hence more air pollution would be emitted at these facilities. Given in Table 1 are estimates of the indirect air pollution emissions that would result from the project electrical demand assuming all power is provided by burning more fuel oil at Oahu's power plants. If power is supplied instead or in part by coal or solid waste burning facilities, emissions would likely be higher than the values given in the table.

Solid Waste Disposal: Solid waste generated by the project will most likely be trucked away and either landfilled or burned at another location. If all refuse is landfilled, the only air pollution emissions associated with solid waste disposal would be due to exhaust fumes from the trucks and heavy equipment used to place the refuse in the landfill. If, on the other hand, all or part of the refuse is burned at a municipal incinerator or other facility (such as H-POWER), disposal of solid waste from the project would also result in the emissions of particulate, carbon monoxide and other contaminants from the incineration facility. There are no precise estimates of the amount of solid waste that will be generated by the project, but it will likely be in the range of 10 to 20 tons per day based on experience with similar projects. Table 2 gives worst-case emission estimates for indirect emissions from project solid waste disposal. These assume that all solid waste would be burned in a municipal refuse incinerator that is equipped with only low-efficiency particulate

control devices. If the refuse is burned at H-POWER, particulate emissions would be much lower than those given in the table because emissions will be treated by a high-efficiency particulate control system. It should also be noted that if the project electrical demand is derived all or in part from H-POWER, this will help to offset emissions from burning oil or coal to produce power that might otherwise result.

We greatly appreciate your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M Takahashi

Ernest M. Takahashi, Project Manager

Enclosures

cc: West Beach Estates

ET/RYF

Table 1

ESTIMATED INDIRECT AIR POLLUTION EMISSIONS FROM KO OLINA PROJECT ELECTRICAL DEMAND*

Pollutant	Air Emission Rate (tons/year)
Particulate	3
Sulfur Dioxide	101
Carbon Monoxide	7
Volatile Organics	0.4
Nitrogen Oxides	29

*Based on U.S. EPA emission factors for industrial boilers. Assumes electrical demand of 40 million Kw-hrs per year and low sulfur oil used to generate power.

Table 2

ESTIMATED WORST-CASE INDIRECT AIR POLLUTION EMISSIONS FROM KO OLINA PROJECT SOLID WASTE DISPOSAL[a]

Air Pollutant	Emission Rate (tons/year)
Particulate	<52
Sulfur Dioxide	<9
Carbon Monoxide	<128
Volatile Organics	<6
Nitrogen Oxides	<11

[a]Based on U.S. EPA emission factors for municipal incinerators. Assumes project generates 20 tons per day or less solid waste and all refuse is burned in a municipal incinerator equipped with settling chamber and water spray only.

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840-0001

ENV 2-1
JA/G

William A. Bonnet
Manager
Environmental Department

March 1, 1989

RECEIVED
MAR 0 [illegible]
WILSON OKAMOTO & ASSOCIATES

City & County of Honolulu
Department of General Planning
650 S. King Street
Honolulu, HI 96813

Dear Sir:

Subject: Draft Environmental Impact Statement for Ko Olina Phase II, Oahu, Hawaii

We have reviewed the above subject and have the following comments:

1. It appears that the existing Kahe-CEIP lines are within or border this project.

2. HECO has two 138KV 60-foot wide perpetual easements (R/W 76-6) which are indicated on Fig. II-1 of the EIS. The westernmost easement contains a double circuit 138KV line on steel poles, and the easternmost easement is reserved for a future double circuit 138KV line.

3. These two easements are bounded on the west by the two proposed golf courses, on the east by the proposed commercially-zoned area, on the north by Farrington Highway, and on the south by the railroad right-of-way and the Campbell Industrial Park Substation. The two easements are separated by a 75-foot wide empty strip of land.

4. HECO will not allow buildings or structures within the two easement areas. In addition, vehicular access will be required to each easement area for maintenance and for future construction.

Sincerely,

cc: Marvin T. Miura, OEQC
Ernest Takahashi
Wilson Okamoto & Assoc., Inc.

2704-03
March 31, 1989

WILSON OKAMOTO & ASSOCIATES
ENGINEERS
PLANNERS

Mr. William Bonnet
Manager, Environmental Department
Hawaiian Electric Company, Inc.
P.O. Box 2750
Honolulu, Hawaii 96840-0001

Subject: Draft Environmental Impact Statement, Ko Olina Phase II, Ewa, Oahu, TMK: 9-1-15: por. 4 & 18

Dear Mr. Bonnet:

Thank you for your letter and comments of March 1, 1989 regarding the subject project.

We appreciate your providing us with additional information regarding the HECO easement and future plans for its use. We are well aware of the existence of the HECO easement through the project site and have incorporated it within our master plan for Phase II. The easement demarcates the golf course from the commercial developments. No structures or buildings are planned within the easement.

Thank you for your time and effort in reviewing the Draft EIS.

Sincerely,

Ernest M. Takahashi

Ernest H. Takahashi, Project Manager

cc: West Beach Estates

ET/RYF

APPENDICES

APPENDIX A

AGRICULTURAL FEASIBILITY OF KO OLINA PHASE II LANDS AND THE EFFECTS OF CONVERSION TO GOLF COURSE USE ON OAHU AGRICULTURE

Prepared For

WILSON OKAMOTO & ASSOCIATES, INC.

By

Frank S. Scott, Jr., Agricultural Economist

November 1988
(Revised March 1989)

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SUMMARY AND CONCLUSIONS

This report addresses land capabilities for crop production at Ko Olina and the probable effect on Oahu Sugar Company and Oahu agagriculture in general if the lands are withdrawn from crop production for golf course use.

Soil capability classifications for crop production are based on SCS and LSB crop productivity ratings, supplemented by on-site observations. SCS classifications for the project site are more restrictive than those of LSB and conform more closely with on-site observations. A composite of SCS classifications plus on-site observations, using SCS criteria, indicates that the 372.6-acre-site contains approximately 198 acres of prime Class I and II lands, 102 acres of marginal Class III lands and 73 acres of land classes IV to VIII, which are not suitable for cultivated crop production.

An estimated 80 percent of the project area is currently in sugarcane production. This appears to be close to the maximum that could be expected, considering soil capabilities for cultivated crop production.

The estimated 298 acres in sugarcane production in the project area represent 2.2 percent of the 13,441 acres of sugarcane acreage reported for Oahu Sugar Company in 1987. Withdrawal of this acreage would cause some loss of economies of scale for the plantation and further contribute to unused mill capacity, but would not, in itself, have a major impact on sugar production efficiency. The effects on profitability of eliminating sugarcane production in the project might be expected to have less impact than a proportional 2.2 percent based on acreage, considering soil quality, distance from the mill and high irrigation water requirements.

Whereas Ko Olina Phase II would have minimal effect on the economic viability of Oahu Sugar Company, the combined effect of the withdrawal of 5,400 acres in sugarcane to accomodate all approved and ponding projects would have a much more serious impact. Full development of the 5,400 acres would reduce Oahu Sugar Company acreage from the current 13,000 acres to 7,600 acres. This would reduce raw sugar output to 55,290 tons at 15 tons per acre, resulting in the closing of one track of the double mill, but enabling the remaining mill to operate at 79 percent of of its 70,000 ton capacity. In the event of sugarcane reduction of only 3,600 acres, which is equivalent to the sugar cane acreage in approved projects, the remaining 9,400 acres would provide an output of 68,000 tons of raw sugar and enable the remaining mill to operate at 98 percent of capacity. The analysis indicates that Oahu Sugar Companny can compensate for decreasing economies of scale to a considerable extent by shifting from the double mill

to a single mill operation. This would permit the company to continue as an economically viable unit, assuming adequate sugar prices in relation to input costs, which will depend upon renewal of the 1985 Food Security Act in 1990.

In the event that sugarcane becomes uneconomic, there are no other indicated agricultural uses for most of the land area in the project. Extensive research by HSPA, the University of Hawaii and the sugar plantations has failed to identify major alternative crops to sugar on Oahu. Major limiting factors to diversified crop production on sugarlands are the limited extent of the Hawaii market for non-export crops and the inability to compete pricewise in the marketplace in relation to other producing areas.

Other than the fact that the project area is currently in sugarcane production, there is no indicated need for the lands for cultivated crop production on Oahu. Acreage in cultivated crops on Oahu has steadily declined during the past 10 years from 49,100 acres in 1978 to 41,100 acres in 1987. The acreage of A and B lands as classified by LSB (comparable to SCS classifications I and II and the better Class III soils) outside of urban zoning on Oahu is estimated at 49,121 acres for 1987, which exceeds requirements for cultivated crop production by 8,021 acres. Based on historical trends, this difference could be expected to widen as the decline in crop production on Oahu exceeds the conversion of prime agricultural lands to other uses. Contributing to this pattern is the shifting of production centers for bananas, guavas, papayas and truck crops to the neighbor islands and abandonment of some sugarcane fields as they become uneconomic.

Another means of assessing the need of land for crop production on Oahu is the acreage zoned agricultural in relation to acres in crop production. In 1987, 141,065 acres were zoned agricultural on Oahu by the State Land Use Commission as compared to 41,100 acres in cultivated crop production.

AGRICULTURAL FEASIBILITY OF KO OLINA PHASE II LANDS AND THE EFFECTS OF CONVERSION TO GOLF COURSE USE ON OAHU AGRICULTURE

by

Frank S. Scott, Jr., Agricultural Economist

INTRODUCTION

This report investigates the agricultural feasibility of Ko Olina Phase II lands and the effects of utilizing these lands for golf course and commercial development on the crop production potential for Oahu. Determination of agricultural feasibility is based on appropriate criteria specified in the following section of the report. The agricultural need for the subject lands on Oahu considers the effects of withdrawal on economies of scale, the comparative advantage of crop production on Oahu in relation to neighbor islands and the availability of prime agricultural lands on Oahu relative to potential needs for prime land for crop production.

AGRICULTURAL FEASIBILITY CRITERIA

Determination of the agricultural feasibility of Ko Olina Phase II project lands is based on the following criteria:

1. Ecological Adaptation, consisting of soil type, configuration, topography, accesibility, rainfall, availability of irrigation water, temperature, wind, light intensity and environmentally related disease and insect problems.

2. Sales Poentials, consisting of market potentials and the comparative advantage of ecologically adaptable crops in the project area to compete in the marketplace.

3. Economic Viability, including profitability and comparative costs of production in relation to competing areas.

4. Intensity of Production, consisting of gross and net returns per acre as indicators of use value of the land.

ALISH CLASSIFICATIONS

ALISH classifications (Lands of Importance to the State of Hawaii) by the Hawaii State Department of Agriculture are shown in Figure 1. Approximately 359 acres are classified as Prime Agricultural lands and the remaining 14 acres consist of scattered parcels, three of which are classified as other agricultural lands and four of which are unclassified.

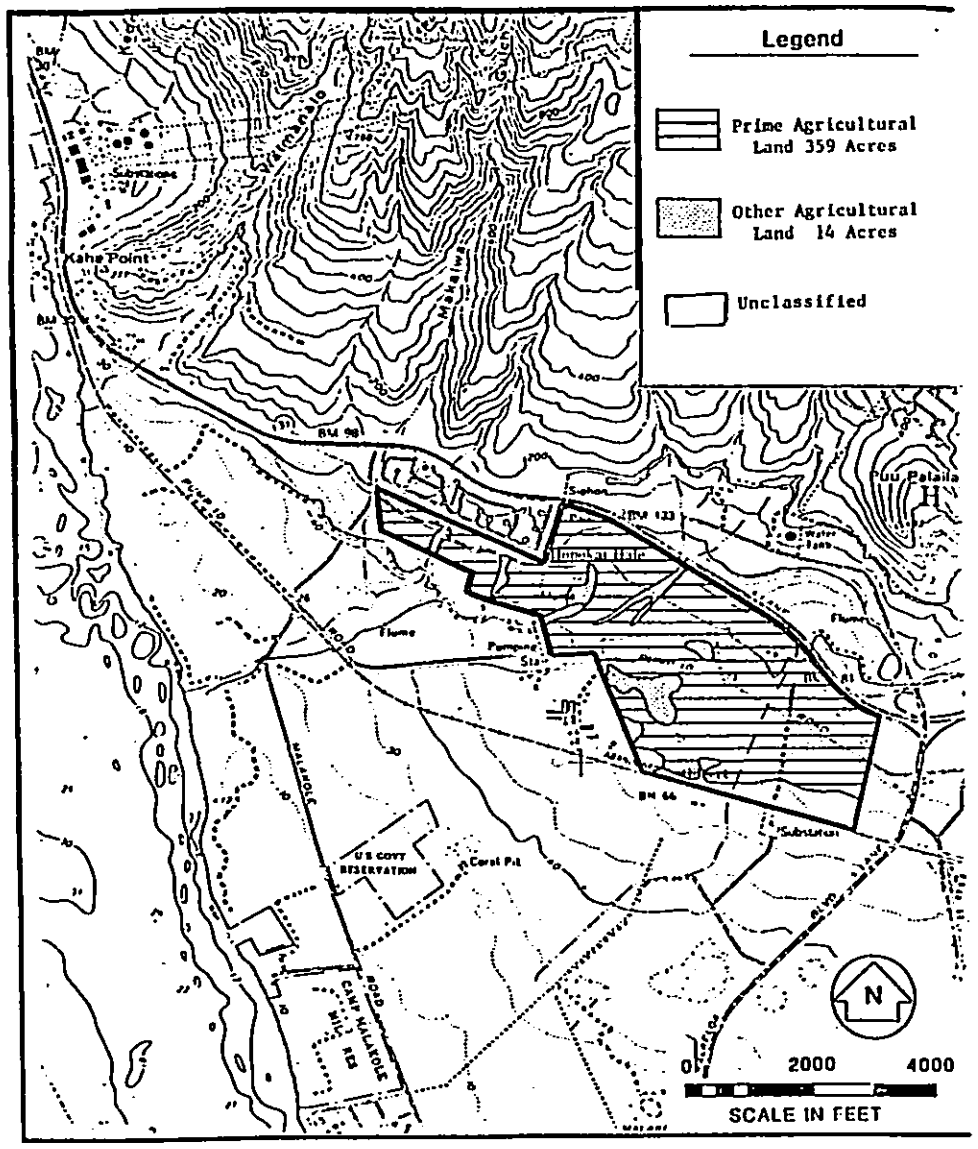

Figure 1. Agricultural Lands of Importance to the State of Hawaii, Ko Olina Phase II

CITY AND COUNTY OF HONOLULU ZONING

The City and County of Honolulu General Plan specifies a development plan for Ewa which provides for a new secondary urban center in the area between West Beach and Makakilo, which includes the project area. The Ko Olina Phase II project proposes a less intensive development with more open space than the Ewa Development Plan as indicated below.

	Ewa Plan (acres)	Ko Olina Plan
Low Density Apartment	118	0
Medium Density Apartment	57	0
Parks and Recreation	166	333
Commercial	30	40
Public Facilities	2	0

Current zoning of the project area by the City and County of Honolulu, prior to implementation of the new general plan, consists of 366.8 acres of Ag-1 Restricted Agricultural District and 5.8 acres of P-2 General Preservation District, which encompasses Kamokila Park.

LAND CAPABILITY CLASSIFICATIONS

Land capability classifications for agricultural production in this report are based on soil classifications by the USDA Soil Conservation Service (12) and the University of Hawaii Land Study Bureau (9) plus on-site observations by the subcontractor. The LESA (Land Evaluation and Site Assessment System) established at the request of the Hawaii State Legislature in 1983 is not utilized for evaluating land capabilities for agricultural production in the project area. The State legislature has not yet approved the recommendations of the final report of the Land Evaluation Site Assessment Commission (February, 1986). Thus the LESA system has not been formally established in either statutory or administrative form.

SOIL CONSERVATION SERVICE CLASSIFICATIONS (SCS)

SCS soil capability classifications are based on soil profile, topography, water holding capacity, drainage, erosion hazard, pH, workability and depth of root penetration. SCS soil capability classifications range from I to VIII, with I being the best. Class I soils have no more than minimal limitations that restrict crop production. Class III is marginal and classes IV are unsuitable for crop production, with Class VIII having the most severe limitations. SCS capability classifications are delineated in Figure 2 and are described as follows:

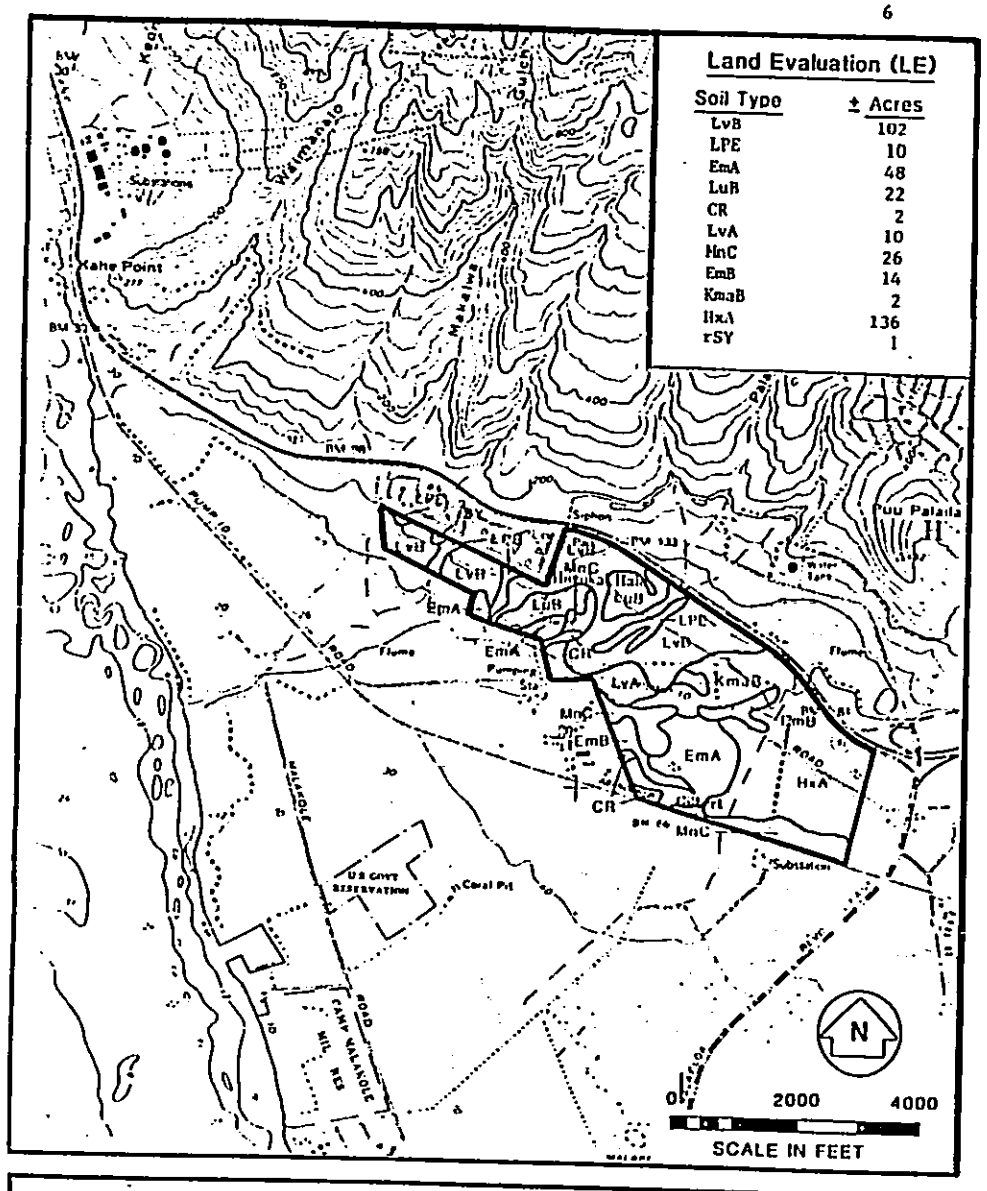

Figure 2. USDA Soil Conservation Service Land Classifications, Ko Olina Phase II, 372.6 Acres

Lualualei Series

This series consists primarily of nearly level to gently sloping soils on coastal plains, alluvial fans and talus slopes, developed in alluvium and colluvium. Some extremely stony soils in the series are moderately sloping to steep. This series includes 144 acres of four subseries, constituting 39 percent of the project area. The topsoil is very dark grayish-brown, very sticky and very plastic clay with a prismatic structure about 10 inches in depth. The subsoil, which is 37 to 42 inches thick is of the same color and texture as the topsoil, except that it includes gypsum. The soil is underlain by coral, gravel, sand or clay below 40 inches in depth. The soil cracks widely upon drying. The topsoil is neutral in pH and the lower layers are medium acid to moderately alkaline. Permeability is slow and runoff and erosion hazard vary by subsoil. The available water capacity is about 1.4 inches per foot of soil and the shrink-swell potential is high. In some areas roots penetrate to a depth of 5 feet or more.

Lualualei clay, 2 to 6 percent slopes (LuB), 22 acres

This subseries meets the foregoing description of the Lualualei series with the additional information that runoff is slow, the erosion hazard is slight and there are small, stony areas and small areas where the slope is as much as 12 percent. The soil is given a capability classification of VIs if nonirrigated because of severe limitations due to stoniness, unfavorable texture and low water holding capacity. With irrigation, the SCS classification is increased to IIIe with downgrading due to severe erosion if cultivated and not protected. On-site observation of an extemely rocky and shal low profile of top soil exposed to erosion between the old flume and the pumping station indicates that some of the acreage in the makai section of this unit should not be classified higher than IVe. This soil type is marginally adaptable to sugarcane, truck crops and pasture and is presently used for sugarcane.

Lualualei stony clay, 0 to 2 percent slopes (LvA), 10 acres

This soil occurs on Oahu adjacent to drainageways. It is the same as Lualualei clay of 0 to 2 percent slopes, except that stones hinder machine cultivation and there are small areas where the slope is 6 to 12 percent. Runoff is slow and the erosion hazard is slight. The soil has a capability classification of IVs without irrigation and IIIs with irrigation. It is adaptable to sugarcane, truck crops and pasture and is currently used for sugarcane.

Lualualei stony clay, 2 to 6 percent slopes (LvB), 102 acres

Similar to LvA, this soil occurs on Oahu adjacent to drainageways. Runoff is slow, the erosion hazard is slight and stones, if not removed, hinder machine cultivation. Also there are small areas where the slope is 6 to 12 percent. Capability classifications are IVs without irrigation and IIIe if irrigated. On-site observation indicates that the entire makai panhandle consisting of the LvB subseries is of poorer quality than the SCS classification indicates. The unit is densely intruded by rocks, varying from pebbles to huge boulders. The stone density is comparable to that of soil type LPE, which is classified as VIIs and is not adaptable to crop production. LvB soils in the panhandle are covered with numerous piles of large boulders, indicating that an aborted attempt was made to clear the land for sugarcane. There is no existing evidence of prior crop production. An appropriate land capability classification is IVe. The LvB parcel in the central part of the project is better than that in the panhandle, but part of the unit is included in a strip of land adjoining Honokai Hale and extending about half of the distance to the East-mauka corner of the project that is not currently planted to sugarcane.

Lualualei extremely stony clay, 3 to 35 percent slopes (LPE), 10 acres

This soil is similar to LvB, except that there are more stones on the surface and in the profile and cultivation is impractical unless the stones are removed. The slope ranges from 3 to 35 percent, but in most places it is moderate to steep. Runoff is medium to rapid and the erosion hazard is moderate to severe. This subseries is classified VIIs if nonirrigated because of severe erosion and is adaptable only to pasture or woodland.

Ewa Series

This series consists of well-drained soils in basins and alluvial fans which developed in alluvium derived from basic igneous rock. The soils are nearly level to moderately sloping. The series includes small areas of Honouliuli and Mamala soils and soils with silt loam topsoils and subsoils. In a representative profile the top soil is dark reddish-brown silty clay about 18 inches in depth. The subsoil is dark reddish-brown and dark-red silty clay loam about 42 inches thick, depending upon the subseries, with a subangular blocky structure. The substratum is coral limestone.

sand, or gravelly alluvium. Both the topsoil and the subsoil are neutral in pH. Permeability is moderate, runoff is slow and the erosion hazard is slight. The available water capacity is low at 1.3 inches per foot in the topsoil and 1.4 inches per foot in the subsoil. Roots may penetrate to a depth of 5 feet or more. The project contains 62 acres of this series, consisting of two parcels of EmB separated by a larger parcel of EmA located in the east-central part.

Ewa silty clay loam, moderately shallow, 0 to 2 percent slopes (EmA), 48 acres

This subsoil has a profile representative of the Ewa Series, except that the depth to coral limestone is only 20 to 50 inches, the runoff is very slow and the erosion hazard is no more than slight. Crop capability classifications are IVs if nonirrigated and IIs if irrigated, with downgrading due to moderate shallowness and low water holding capacity. The soil is adaptable to sugarcane, truck crops and pasture and is currently used for sugarcane.

Ewa silty clay loam, moderately shallow, 2 to 6 percent slopes (EmB), 14 acres

The description of this soil is identical to that of EmA except for the somewhat steeper slope. It is classified as IVs if nonirrigated due to moderate shallowness and low water holding capacity and IIe if irrigated, reflecting a somewhat greater erosion hazard under cultivated crop production than for EmA.

Mamala Series

This series consists of shallow, well-drained soils along coastal plains which were formed in alluvium deposited over coral limestone and consolidated calcareous sand. The soils are nearly level to moderately sloping. There are 26 acres of this series in an isolated pocket in the southwest section of the project. Soil characteristics are described below in the one subseries of the Mamala series.

Mamala stony silty clay loam, 0 to 12 percent slopes (MnC), 26 acres

A representative topsoil of this series and subseries is dark redish-brown stony silty clay loam about 8 inches in depth. The subsoil is dark reddish-brown silty clay loam about 11 inches thick. The underlying layer consists of coral limestone and consolidated calcareous sand 8 to 20 inches thick. The slope does not exceed 6 percent in most areas. Stones, consisting mostly of coral rock fragments, are common in the surface layer and in the profile. The series includes some Ewa soils, some nonstony areas and areas with slopes as great as 20 percent. Both the topsoil and the subsoil are neutral to mildly alkaline. Permeability is moderate, runoff is very low and the erosion hazard is slight to moderate. The available water capacity is high at about 2.2 inches per foot in the topsoil and 1.9 inches per foot in the subsoil. Root penetration is affected by the coral limestone and consolidated sand. The stones hinder but do not prevent cultivation. The soil has a capability classification of VIs if nonirrigated and IIIs if irrigated, with downgrading due to severe limiations for crop production resulting from shallowness and stoniness. The soils is adaptable to sugarcane, truck crops and pasture and is currently used for sugarcane.

Honouliuli Series

This series consists of well-drained soils on coastal plains in Ewa which developed in alluvium from basic igneous material. The soils are nearly level to gently sloping. This series encompasses 138 acres at the east end of the project. Soil characteristics are discussed in the narrative for subseries HxA below

Honouliuli clay, 0 to 2 percent slopes (HxA), 136 acres

This subseries includes small areas of fine-textured alluvial soils with stony subsoils and small areas of shallow, red, friable soils underlain with reef limestone. A representative topsoil is dark reddish-brown very sticky and very plastic clay about 15 inches in depth. The subsoil and substratum are of the same color as the topsoil and have subangular blocky structures with some layers in common. The soil is neutral to mildly alkaline. Permeability is moderately slow, runoff is slow, and erosion hazard is no more than slight. The available water holding capacity of the combined layers is moderately high at 1.8 inches per foot of soil. In some areas roots may penetrate to a depth of 5 feet or more. Workability is slightly difficult because of the very sticky and very plastic nature of the clay and the shrink-swell potential is high. The capability classification is IVc if

nonirrigated because of droughty conditions in a limited rainfall area and I if irrigated. The soil is well adapted to sugarcane, truck crops and pasture under irrigation.

Keaau Series

The Keaau series consists of poorly drained soils on coastal plains on Oahu that developed in alluvium deposited over reef limestone or consolidated coral sand. The soils are nearly level or gently sloping. Three acres of this soil type are located in the center of the project area. Soil characteristics are discussed below in the narrative for subseries KmaB.

Keaau stony clay, 2 to 6 percent slopes (KmaB), 2 acres

The representative top soil is dark grayish-brown clay about 15 inches in depth. The subsoil is very dark grayish-brown and dark brown mottled clay with a subangular and angular blocky structure. The substratum is white to very pale brown reef limestone or consolidated coral sand. The topsoil and subsoil are mildly alkaline and the substratum is moderately alkaline. Workability is difficult because the soil is very sticky and very plastic and the shrink-swell potential is high. Capability classifications are Vw if nonirrigated and IIIw if irrigated, with the downgrading due largely to poor drainage. The soil is marginally adaptable to sugarcane and pasture but is unsatisfactory for truck crops.

Coral Outcrop, 2 acres

Coral outcrop (CR) consists of coral or cemented calcareous sand. The coral reefs formed in shallow ocean water when the ocean was at a higher level. About 80 to 90 percent of the area is coral outcrop and the remainder consists of a thin layer of friable, red soil material in cracks , crevices and depressions. The crop capability classification is VIIIs nonirrigated and the soil is not adaptable to any type of crop cultivation or grazing.

Stony Land, 1 acre

Stony land (rST) occurs in this instance on sideslopes of drainageways. It consists of a mass of boulders and stones deposited by water and gravity. Stones and boulders cover 15 to 90 percent of the surface. The stones are interspersed with reddish silty clay loam and very dark grayish-brown clay which provide a foothold for plants. The capability classification is VIIs, nonirrigated. The land is not suited to crop production or grazing.

LAND STUDY BUREAU CLASSIFICATIONS (LSB)

LSB classifies soils by land type in which classifications are provided for general crop productivity ratings, with or without irrigation, and selected crop productivity ratings for 7 crops, namely, pineapple, vegetables, sugarcane, forage, grazing, orchards and timber. The timber rating is not utilized in this report, since the report is concerned only with potentials for cultivated crop production and grazing. General or overall ratings range from A to E, with A being the best. Selected ratings for individual crop categories range from a to e, with a being the best. LSB ratings are generally comparable to those of SCS, but differ somewhat because of fewer categories (A to E for LSB and I to VIII for SCS) and some differences in evaluating soils in specific areas because of somewhat different soil capability criteria. The use of both systems combined serves as a check and leads to a more thorough evaluation than can be obtained from the use of either system alone. LSB capability classifications of the project area are shown in Figure 3 and are described as follows:

B63

This series encompasses 135 acres interspersed with other soil types in the southwest section of the project. Most of this area is the same as the SCS Lualualei series. The overall crop productivity rating is E if nonirrigated and B if irrigated. Selected crop productivity ratings are e for all crops if nonirrigated and a for sugarcane and grazing, b for orchards, c for vegetables and forage and d for pineapple if irrigated. In contrast, most of this land area was given a capability classification of IIIe by SCS which would be comparable to slighly better than C for LSB.

B16

This land type includes 114 acres located in the extreme eastern section of the project, most of which is classified as Honouliuli clay by SCS. The overall LSB rating is E if nonirrigated and B if irrigated. Selected crop productivity ratings are d for forage and grazing and e for all other crops if nonirrigated and a for sugarcane, b for vegetables, forage and orchards and e for pineapple if irrigated. Most of this area was classified as I by SCS, which is higher than the LSB overall rating but identical to the LSB rating for sugar.

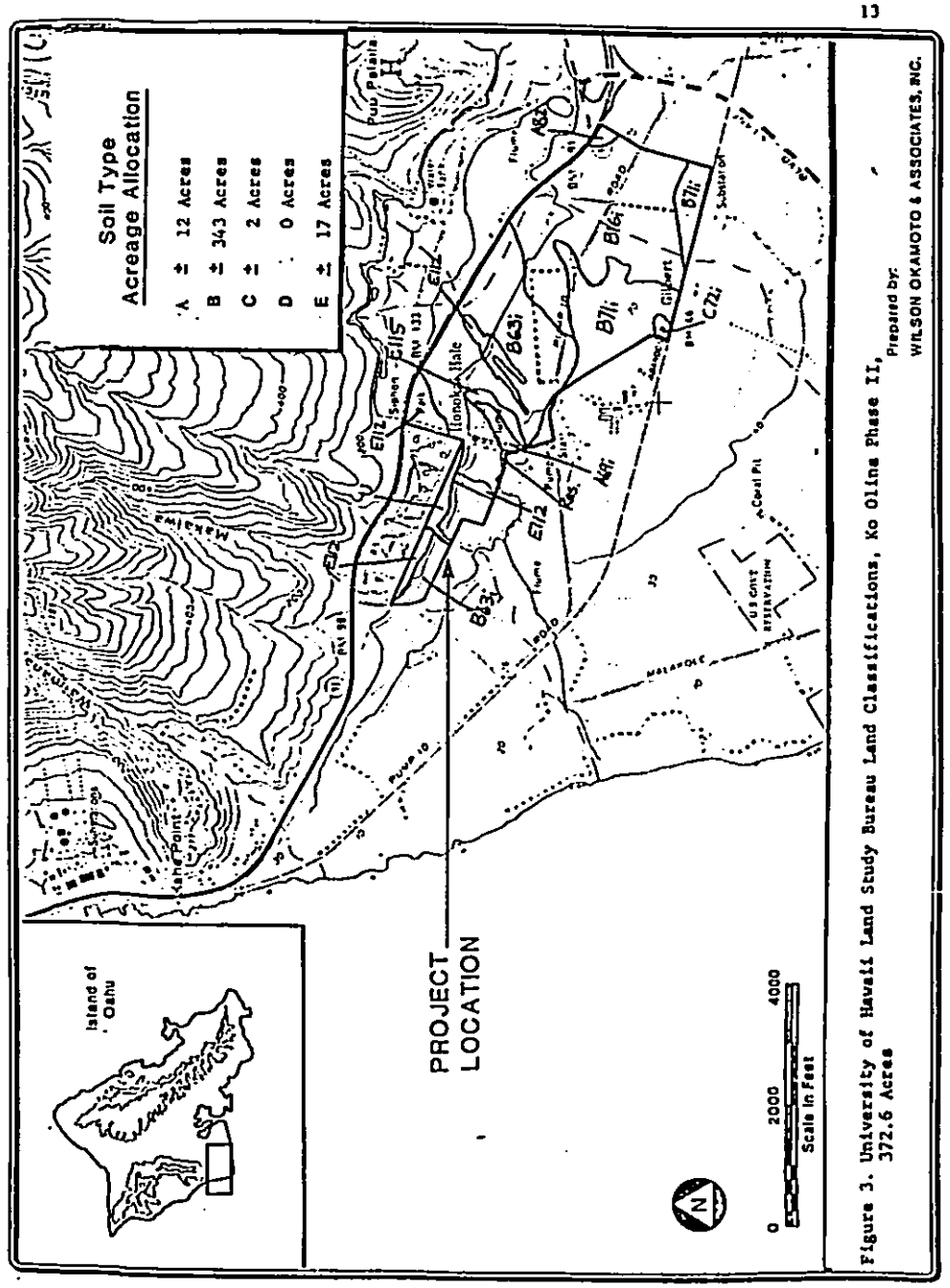

Figure 3. University of Hawaii Land Study Bureau Land Classifications, Ko Olina Phase II, 372.6 Acres

B71

This unit includes 71 acres in the south central area of the project, most of which is classified as Ewa silty clay loam by SCS. The overall LSB rating is E if nonirrigated and B if irrigated. Selected crop productivity ratings are d for forage and grazing and e for all other crops if nonirrigated and a for sugarcane, grazing and orchards, b for vegetables, c for forage and e for pineapple if irrigated. Most of this area was classified as IIs by SCS which generally conforms with the overall LSB classification but is lower than the LSB classification for sugar.

E112

This land type encompasses 19 acres consisting of 3 parcels in the extreme west and northwest areas of the project. The parcels in the western panhandle of the project generally constitute areas classified by SCS as Lualualei extremely stony clay. The area in the northwest, where the park is located is classified by SCS as Lualualei stony clay. The overall LSB crop productivty rating is E and the selected crop productivity rating is e for all crops, nonirrigated or irrigated. The overall rating is comparable to the SCS rating of VIIs for the parcels in the extreme west, but is lower than the SCS ratings of IIIe and IIIs in the park.

C72

This unit contains a small isolated parcel of 8 acres in the central southwest area of the project. The majority of this area is classified as coral outcrop by SCS. The overall LSB crop productivity rating is E if nonirrigated and C if irrigated and selected crop productivity ratings are e for all crops if nonirrigated and b for sugarcane, grazing and orchards, c for vegetables and forage and e for pineapple if irrigated. The overall LSB rating is comparable to the SCS classification of VIIs if nonirrigated but LSB gives a rating of C if irrigated in contrast to no rating with irrigation by SCS. The LSB rating of c for sugarcane if irrigated also has no counterpart rating by SCS.

A69

This small parcel of 4 acres is located in the southwestern section of the project near the pumping station. It constitutes part of the Ewa silty clay loam subseries in SCS classifications. The overall LSB rating is E if nonirrigated and A if irrigated. Selected crop productivity ratings are

d for forage and grazing and e for all other crops if nonirrigated and a for all crops, except for e for pineapple, if irrigated. SCS provides a lower classification of IIs under irrigation.

E115

This 4-acre parcel is located in the central part of the project near the flume. SCS classifies part of this area as coral outcrop and part of it as Mamala stony silty clay loam. The overall LSB classification is E and the selected crop productivity rating is e for all crops, nonirrigated or irrigated. The SCS classification of VIIIs for the part of the parcel consisting of coral outcrop is comparable to the LBS classification of E, but the remainder of the parcel is given a higher classification under irrigation of IIIs by SCS.

A11

This 3-acre parcel converges into the project at the extreme southwest corner. It is part of the SCS Lualualei stony clay subseries. The overall LSB classification is E and the selected crop productivity ratings are d for pineapple, forage and grazing and e for all other crops if nonirrigated and a for sugarcane, grazing and orchards, b for pineapple and vegetables and c for forage if irrigated. The Alli classification on the soils map is inconsistent with the LSB land classification table which gives this land type an overall rating of B under irrigation. The SCS crop productivity rating for this area is IIIe.

A82

The 2-acre parcel classified as A82 is located in the extreme northeast corner of the project and is a small part of the area classified as Honouliuli clay by SCS. The overall LSB rating is E and selected crop productivity ratings are d for pineapple, forage and grazing and e for all other crops if nonirrigated. The overall rating is A and the selected crop productivity rating is a for all crops if irrigated. This is in an area rated I by SCS. Thus the ratings are consistent.

Reservoir

A reservoir occupies 2 acres of the project along the west-south central border.

Table 4. Rainfall recorded at SKN 727.00, Pump 10, Ewa Plantation, 1911 to 1983

Month	Median	Mean	Maximum	Minimum	75% Max a/	25% Min b/
January	2.9	4.1	15.3	0.0	5.9	0.8
February	1.6	2.5	16.7	0.0	3.5	0.5
March	1.3	2.2	16.5	0.0	3.0	0.4
April	0.6	1.4	10.0	0.0	1.6	0.3
May	0.4	0.9	7.1	0.0	1.0	0.1
June	0.1	0.5	6.1	0.0	0.4	0.0
July	0.2	0.3	2.2	0.0	0.4	0.0
August	0.2	0.5	4.0	0.0	0.6	0.1
September	0.4	0.7	4.0	0.0	1.2	0.1
October	0.8	1.6	11.6	0.0	2.0	0.3
November	1.1	2.3	13.5	0.0	3.6	0.3
December	2.4	3.3	29.8	0.1	5.1	0.6
Annual	20.2	20.4	46.7	5.2	25.3	14.2

a/. 75 percent of the recordings did not exceed amounts indicated in this column.
b/. 25 percent of the recordings did not exceed amounts indicated in this column.

iod from November through March and only 22 percent or 2.7 inches occurs during the remaining 7 months. Based on mean data, 71 percent of annual rainfall falls during the period from November through March and only 29 percent or 5.9 inches occurs during the remaining 7 months. During 25 percent of the time, based on the historical recodings, rainfall ranged from zero inches for June and July to 0.8 inches for January. As a miniumum, zero rainfall was recorded for every month except December, for which the minimum recording was 0.1 inches.

Irrigation may not be required during occasional wet periods and supplemental irrigation can be utilized part of the time during winters with normal or above normal rainfall. Supplemental irrigation for months with low median rainfall in the form of occasional showers does not appear to be practical. Because of generally low rainfall and uncertainty of seasonal and annual distribution, it is necessary to depend almost entirely on irrigation water throughout the year. This results in very substantial water use for crop production at Ko Olina.

Irrigation water applied to sugarcane fields west of Kalaeloa Blvd., including the project area, averaged 92.5 acre-inches annually during 1986 and 1987 as determined from Oahu Sugar Company records. Supplemental irrigation water was applied every month of the year, with few exceptions, but only 19 acre-inches or 4.8 acre-inches per month was applied during the 4-month period from December through March and 74 acre-inces, amounting to 9.3 acre-inches per month, was applied during the 8-month period from April through November.

Continual production of truck crops on the same land for an estimated 9-months of the year requires approximately 50-acre inches of water based on gross delivery (5 acre-inches per month for 9 months). It is estimated that rainfall, because of poor distribution, can provide not more than 20 percent of this amount. Thus the net requirement for truck crops is 40 acre-inches annually or 1,086,000 gallons per acre annually. Bananas require a gross delivery of 80.4 acre-inches annuallly (6.7 acre-

inches per month x 12 months). Assuming that 25 percent of this could be provided by natural rainfall, the supplemental irrigation requirement would be 60.3 acre-inches or 1,637,000 gallons per acre annually.

TEMPERATURE, WIND AND MICROCLIMATIC CONDITIONS

The Barbers Point Hawaii Climatology Station recordings are used to approximate temperatures in the project area. Actual temperatures in Ko Olina could be expected to differ less than one degree from the Barbers Point recordings. Table 3 shows recordings in Fahrenheit for the 29-year period from January, 1949, through September, 1987. The average annual temperature is 77 degrees, ranging from 72 degrees in February to 79 degrees in July, August and September. The average annual maximum is 84 degrees, ranging from 79 degrees in January, February and March to 86 degrees in September. The average annual minimum is 68 degrees, ranging from 65 degrees in February to 73 degrees in August. The extreme maximum ranges from 87 degrees in February and March to to 95 degrees in July and August and the extreme minimum ranges from 50 degrees in January to 64 degrees in July.

Temperatures are near optimal for sugarcane, warm climate truck crops, bananas, papayas, tropical and subtropical fruits and pasturelands.

Cloud cover is limited, except during occasional winter periods and light intensity is favorable for crops requiring direct sunlight.

Humidity is fairly high, which tends to promote fungal diseases of fruits, melons and vegetables.

Wind damage from prevailing winds is less serious than for most areas of Oahu. As throughout Oahu, Kona storms are devastating to banana and papaya crops on the average of once every three years. Kona storms are also damaging to vine vegetables and shadehouses for nursery crop production.

RAINFALL AND IRRIGATION REQUIREMENTS

State Weather Station No. 727.00 (Pump 10, Ewa Plantation), which is located near the central-makai border of Ko Olina, provides 72 years of rainfall data applicable to the project. This station, as shown in Table 4, indicates a median annual rainfall of 20.2 inches and mean annual rainfall of 20.4 inches. During 75 percent of the time, annual recordings did not exceed 25.3 inches and only 25 percent of annual recordings were less than 14.2 inches. The annual maximum was 46.7 inches and the annual minimum was 5.2 inches.

Annual data are not appropriate for determining supplemental water requirements in the area, since seasonal distribution is uneven and variation from year to year is extreme. Based on median data, 78 percent of annual rainfall falls during the 5-month per-

Table 3. Temperature Recordings by Hawaii Climatology, Barbers Point, January, 1949, Through September, 1987

Month	Mean Daily	Mean Daily Maximum	Mean Daily Minimum	Highest	Lowest
		degrees F			
January	73	79	66	89	50
February	72	79	65	87	52
March	73	79	66	87	54
April	74	80	68	88	54
May	76	82	69	92	61
June	77	84	71	93	61
July	79	85	72	95	64
August	79	85	73	95	61
September	79	86	72	94	63
October	78	84	71	91	61
November	76	82	70	91	57
December	74	80	67	88	53
Annual	77	84	68	95	50

Table 2. Acreage of Each Land Type, Ko Olina Phase II, LSB Land Capability Classifications

Soil Type	Acreage	Capability Classification Nonirrigated	Irrigated
B63	135	E	B
B16	115	E	B
B75	71	E	B
E112	19	E	E a/
C72	8	E	C
A69	4	E	A
E115	4	E	E a/
A11	3	E	B
A02	2	E	A
Res	2	E	E a/
U	6	E	E a/
Total	373 (372.6)	373	373
Class A & B		0	334
Class C		0	8
Class D & E		373	31

a/ Classified only for nonirrigated because irrigation is infeasible. Thus irrigated is given the same crop productivity rating as nonirrigated.

differences in the number of land capability classifications (A to E for LSB as compared to I to VIII for SCS). Based on this difference, one LSB category includes the equivalent of 1.6 SCS classifications. Thus the B category of LSB could conceivably include the entire SCS II category plus 30 percent of the lower quality of land in group I and 30 percent of the better land in category III. A borderline B category of LSB could contain soils falling mostly in SCS group III.

On-site observations, as previously discussed, indicate a lower capability classification for land type LvB than that provided by SCS (IVS and compared to IIIe). LSB classification B63 includes most of the land area in LvB and thus should be downgraded from B to C. This would increase the acreage in class C from 8 to 143 acres and reduce the A and B acreage from 334 acres to 159 acres.

In summary, SCS soil capability classifications modified by on-site observations are considered to provide a realistic evaluation of the adaptability of project lands to crop production, particularly with respect to sugar. Based on this analysis, 198 acres or 53 percent of the project area (class I and II lands) are well adapted to sugarcane production under irrigation, 102 acres or 30 percent are marginally adaptable to sugar production and the remaining 73 acres or 20 percent are not adaptable to cultivated crop production. An estimated 298 acres or 80 percent of the project area are currently in sugar production. There is no evidence of sugarcane production in the makai pahandle and an estimated 20 acres bordering the highway, including Honokai Hale, are not currently in sugar production.
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Six acres in the northwest section of the project near the urban development is unclassified. SCS classifies part of this land as IIIe and part of it as VIIs.

SUMMARY - SOILS AND TOPOGRAPHY

Crop capability ratings for lands in the project area are summarized in Table 1 for SCS classifications and Table 2 for LSB classifications.

SCS crop capability classifications of lands in the project area range from IVs to VIIIs if nonirrigated because of stoniness, shallowness, unfavorable texture and/or low water holding capacity. The infeasibility for crop production if nonirrigated is also due to a mean annual rainfall of only 20 inches, 85 percent of which occurs during the period from October through March. If irrigated, 198 acres, constituting 53 percent of the project area are upgraded to capability classifications I and II which renders them well adaptable to cultivated crop production. Approximately 163 acres are classified by SCS as class IIIe.These lands have severe limiations, but are marginally adpatable to cultivated crop production. Only 13 acres remain classified as IVs to VIIIs, including areas not available to agriculture because of conversion to other uses.

On-site observations indicate that approximately 60 of the 162 acres classified as III with irrigation are not used for crop production because of poor texture and dense intrustion of rocks. It appears that these areas should retain the nonirrigated classification of IVs since they are nonirrigable in their present state. This modification would decrease SCS class IIIe acreage to 102 acres and increase the area with capability classifications of IVs to VIIIs to 73 acres.

LSB classifies all project lands under crop productivity rating E if nonirrigated, which is comparable to SCSs capability rating of VIII, which indicates that the soils are infeasible for cultivated crop production without irrigation. If irrigated, LSB classifies 6 acres as A, 328 acres as B, 8 acres as C and 31 acres as D and E. Classification by LSB of 334 acres in classes A and only 8 acres in class C as compared with SCS classification of only 198 acres in classes I and II and 162 acres in class III might indicate superficially that there is a discrepancy in classification between the two systems. Some and perhaps a major portion of the apparent discrepancy may be attributed to

Table 1. Acreage of Each Land Type, Ko Olina Phase II, SCS Land Capability Classifications

Soil Type	Acreage	Capability Classification Nonirrigated	Irrigated
LuB	22	IVs	IIIe
LvA	10	IVs	IIIe
LvB	102	IVs	IIIe
LPE	10	VIIs	VIIs a/
EmA	48	IVs	IIs
EmB	14	IVs	IIe
MnC	26	IVs	IIIs
HxA	136	IVc	I
KmaB	2	Vw	IIIw
CR	2	VIIIs	VIIIs a/
rSY	1	VIIs	VIIs a/
Total	373 (372.6)	373	373
Class I & II		0	198
Class III		0	162
Class IV-VIII		373	13

a/ Classified only for nonirrigated because irrigation is infeasible. Thus irrigated is given the same crop productivity rating as nonirrigated.

SALES POTENTIALS

An analysis of sales potentials for the project area is relevant for sugar and for other crops that are ecologically adaptable to the project area in the event that sugar becomes uneconomic.

SCS soil capability classifications indicate that 360 acres in the project are adaptable to cultivated crop production (including 198 acres of class I and II lands and 162 acres of marginal class III lands). LSB classifies 334 acres as adaptable (including 334 acres of class A and B lands and 8 acres of class C land). On-site observations indicate somewhat more limited soil capabilities, with 300 acres considered adaptable to crop production (with 198 acres in classes I and II and 102 acres in class III). Based on this assessment, the market analysis is concerned with sales potentials for 300 acres.

The market for Hawaii sugar is currently assured by the price support provisions of the 1985 Food Security Act through December 1989 assuming that Hawaii sugar production is competitive in the marketplace and that high fructose corn syrup does not displace sucrose by an additional 1,000,000 tons, which is approximately the current amount imported. Beyond that point there will either be need for a quota system for domestic sucrose producers or part of the sales potentials will be lost to the highest cost domestic producers, possibly including Hawaii. If the 1985 support program is not renewed, most domestic producers, including Hawaii, will not be able to compete in the marketplace against surplus sugar that is dumped on the world market at prices far below costs of production.

In the event of the demise of the U.S. sugar industry or if sugar supports are inadequate and Ko Olina lands become uneconomic in sugarcane production, the consideration of sales potentials for alternative crops to sugar becomes relevant.

Ongoing research indicates that sales potentials and comparative costs of production, including transportation, are the major contraints to the production of ecologically adaptable alternatives to sugarcane in Hawaii. Hawaii constitutes a small, pocket market which is readily saturated by ecologically adaptable fruits and vegetables. Because of perishability related to shelf life and high costs of transportation, opportunities for marketing locally produced perishable products outside of Hawaii are extremely limited. Other than sugar, pineapple, macadamias, papayas, coffee, some processed tropical nectars, flowers and foliage and a few other minor products, export opportunities for Hawaii crops are extremely limited.

Because of much lower costs of production in competing areas, numerous fruits and vegetables that are ecologically adaptable to Hawaii can be imported into Hawaii at F.O.B. prices equal to or below wholesale prices of Hawaii produced products. Among these are bananas, dry onions, sweet potatoes, broccoli, sweet corn, cucumbers, green peppers, squash, tomatoes and several minor products.

Probably the best indicator of possible opportunities for expanding marketings of Hawaii crops restricted to the local market is the potential for displacement of inshipments. Table 5 shows the 1987 Hawaii market supply, broken down by Hawaii marketings and inshipments, yield per acre under good management and acreage required to displace imports for selected alternative crops to sugar that are at least marginally adaptable ecologically to the project area. An analysis of the probable opportunity to displace inshipments by Hawaii production and sales potentials as they relate to the project area are as follows:

Historical data indicate no potential for an increase in snap bean production by Hawaii producers. Hawaii production amounted to only 890,000 pounds in 1987 as compared to average annual marketings of 1,228,000 pounds during the previous 10 years. Oahu acreage has continued to decrease, amounting to only 40 acres in 1987 as compared to 90 acres in 1979. Oahu also has a yield disadvantage in relation to neighbor islands, with a decrease from a high of 13,700 pounds per acre in 1981 to 6,300 pounds per acre in 1987. This compares to a 1987 yield of 9,000 pounds per acre on Maui-Molokai.

Hawaii produced 100 percent of the 1,590,000 pounds of fresh sweet corn sold in the Hawaii market in 1978, but the 1987 market supply consisted of only 1,480,000 pounds from Hawaii and 865,000 pounds in inshipments, indicating a very substantial decrease in Hawaii's competitive position. Oahu is the major sweet corn producer in Hawaii, but acreage has stabilized and yields are lower than in competing areas on the neighbor islands. Thus the project area would not be a likely candidate for the 108 acres required to displace 1987 sweet corn imports.

Hawaii marketings as well as imports of cucumbers have increased during the past 10 years, but Hawaii's market share has decreased from 78 percent of a market supply of 5,541,000 pounds in 1978 to 70 percent of 5,692,000 pounds in 1987. The Oahu acreage of cucumbers decreased 100 acres in 1978 to 75 acres in 1987. Oahu also has a yield disadvantage, with an average yield of only 13,900 pounds per acre during the 1982-86 period as compared with

Table 5. Market Supply and Acreage Required to Displace Imports, Selected Fruits and Vegetables, 1987

Crop	Market Supply Hawaii	Market Supply Imports	Yield Per Acre	Acreage Required to Displace Imports
	(1,000 pounds)		(pounds)	(acres)
Beans, snap	890	416	12,000	35
Corn, sweet	1,480	865	8,000	108
Cucumbers	3,960	1,732	20,000	87
Eggplant	1,290	308	30,000	10
Peppers, green	2,300	1,595	20,000	80
Tomatoes	7,000	11,378	35,000	325
Sweet potatoes	1,600	799	20,000	40
Watermelon	13,800	1,104	20,000	55
Bananas	11,400	10,607	30,000	354
TOTAL				1,094

28,140 pounds per acre on Hawaii, primarily under greenhouse production. Assuming that the production potential in the project is representative of that for Oahu, it is not likely that the 87 acres required to displace imports would be produced in the project area.

Hawaii is almost self sufficient in egg plant production and only 10 additional acres would be required to displace 1987 imports of 308,000 pounds. The potential is good for displacing imports, but any additional production would likely take place on small farms rather than on land phased out of sugar.

Hawaii has improved its competitive advantage in green pepper production, from 34 percent of a market supply of 2,415,000 pounds in 1978 to 59 percent of 3,895,000 pounds in 1987. Most of the increase has taken place on Kauai and Maui-Molokai. Oahu acreage has levelled off to 15 acres, representing only 8 percent of the 190 acres statewide. This indicates that the 80 acres required to displace imports will not likely be on Oahu.

Hawaii production of tomatoes has levelled off during the past 10 years at 7,000,000 pounds, whereas imports increased from 7,887,000 pounds in 1978 to 11,378,000 pounds in 1987. This decline in the market share may well indicate an apparent inability to further displace imports under existing technology. Thus, whereas 325 acres would be required to displace 1987 imports, it is not likely that Hawaii producers will be able to take advantage of this opportunity. A further consideration with respect to the project area is that Oahu is a minor producer of tomatoes, with only 17 acres out of a state total of 250 acres in 1987. Major producers are Hawaii and Maui-Molokai, mostly in greenhouses.

Approximately 40 acres of sweetpotatoes would be required to displace 1987 imports, but the capability of displacing does not appear to be promising. Hawaii production has remained at about the same level during the past 10 years, whereas inshipments increased from 533,000 pounds in 1978 to 799,000 pounds in 1987. Local production has shifted to Maui-Molokai, with Oahu plantings declining from 60 acres in 1978 to only 10 acres in 1987 out of a state total of 180 acres. Sweetpotatoes are adaptable to the Ewa Silty Clay Loam soils in the project, but production woul not likely be competitive with lower cost Maui-Molokai production.

Approximately 55 acres would be required to displace 1987 watermelon inshipments and displacement by Hawaii producers appears to be feasible. Most additional acreage would likely occur on Maui-Molokai, where plantings have rapidly expanded to 575 acres

of the state total of 740 acres in 1987. Oahu is the next major producer, with acreage increasing from 70 acres in 1978 to 130 acres in 1987. Watermelon production is labor intensive and it is doubtful that it would be an appropriate crop for Oahu sugarlands, particularly considering the small acreage required to displace inshipments.

Papayas could be grown in the project area, but control of phytophthora root rot would pose a problem and costs of production would not likely be competitive with Puna, which depends largely upon natural rainfall and where labor can be obtained at lower rates. Oahu is a minor papaya producer, with an average of about 70 acres during the past 10 years as compared with 2,200 acres in Puna. A potential for considerable expansion in papaya production in Hawaii is indicated, subject to implementing a satisfactory means of controlling fruit fly egg infestations for outshipments. Based on the competitive situation, this probable expansion would not likely take place on Oahu.

In summary, the market is not currently a limiting factor to sugar production in the project area, but extraneous conditions could reverse this situation. The limited extent of the market and lack of comparative advantage in the marketplace are major and in many instances absolute deterrents to diversified agriculture as an alternative to sugarcane.

LAND REQUIREMENTS IN RELATION TO AVAILABILITY OF AGRICULTURAL LAND ON OAHU

The acreage in cultivated crops on Oahu has steadily declined during the past 10 years from 49,100 acres in 1978 to 41,100 acres in 1987 (6). Most of this decline was in sugarcane, which declined from 34,000 acres in 1978 to 25,700 acres in 1987. The second most important crop, pineapple, increased slightly in acreage from 12,000 acres in 1978 to 12,400 acres in 1987.

The decrease of 8,000 acres in crop production during the 10-year period considerably exceeded the land area converted to other uses. Land zoned agricultural on Oahu by the State Land Use Commission decreased by only 2,838 acres during the same period, from 143,903 acres in 1978 to 141,065 acres in 1987 (3). Land zoned Urban increased only 3,831 acres, from 86,489 acres in 1978 to 90,320 acres in 1987 (3), resulting in a substantial increase in the stockpile of unused land of good quality.

In 1972, LSB classified 53,039 acres of land outside urban areas on Oahu as good agricultural land (A and B), of which 20,583 acres were given crop productivity ratings of A and 32,456 acres were rated as B (10). In addition, 17,837 acres were classified as C, which is marginal for cultivated crop production. These acreages compare to a total of only 41,100 acres in cultivated crop production on Oahu in 1987, of which an undetermined number of acres in production had productivity ratings lower than B under irrigation. The data indicate that the total acreage of good agricultural land (A and B) in 1987 exceeded the total acreage in crop production of all land classes by 11,939 acres. With class C land included, the availability of land adaptable to crop production (A, B and C) exceeded the acreage in cultivated crop production on Oahu by 29,776 acres. Some of the excess good land, however, has been converted to other uses since 1972, which is addressed as follows:

It can be reasonably assumed that all of the 70,876 acres of land given LSB crop capability ratings of A, B and C in 1972 were included in the 148,900 acres zoned agricultural by the State Land Use Commission. In addition, 74,257 acres classified lower than C would have been included in order to arrive at the total of 148,900 acres. The specification of 141,065 acres zoned agricultural in 1987 represents a decrease of 7,835 acres zoned agricultural since LSB acreage determinations by capability class in 1972. Actual data on the 7,835 acres zoned out of the agricultural classification are not available by land class. In 1972, the 53,039 acres of A and B lands constituted only 35.6 percent of the 148,900 acres zoned agricultural. It is reasonable to

assume, however, that A and B lands zoned out of the agricultural classification constituted a higher proportion of the total land area rezoned, since major conversions have taken place on the better lands from Ewa to Mililani. On this basis, it is reasonable to assume that at least 50 percent of the rezoned lands or 3,918 acres consisted of A and B lands. On this basis, the 1972 LSB total of 53,039 acres of A and B lands available for agriculture would have been reduced to 49,121 acres and the excess of A and B lands zoned agricultural over land in crop production would have amounted to 8,021 acres (49,121 minus 41,100). Including class C lands, the excess would have amounted to 21,941 acres under the assumption that the total decrease in lands zoned agricultural consisted of A, B and C classifications (63,041 minus 41,100).

Although the acreage zoned agricultural on Oahu has been slowly declining, the excess over requirements for crop production has also increased because of the continuing decline in crop production. Another consideration is that unused agricultural land is available at lower cost on the neighbor islands. Because of lower cost and lower or no irrigation water cost, the production of several major fruit and truck crops is moving to the neighbor islands at the expense of Oahu. Sugarcane production during the past 10 years has decreased by 25.4 percent on Hawaii and 23.8 percent on Oahu, but only 4.8 percent for Maui and Kauai combined. Only pineapple acreage on Oahu remains at about the same level as 10 years ago.

EFFECTS OF WITHDRAWAL OF PROJECT LANDS ON CROP PRODUCTION

The previous section of the report indicates a considerable excess of prime agricultural land over what is required for agricultural production on Oahu. This excess has increased annually during the past 10 years due to greater decline in crop production on Oahu than in acreage zoned agricultural. Ecologically, the project area is best suited to the production of sugarcane, for which it is currently used or for selected truck crops. The economic viability of sugar is dependent upon the Food Security Act of 1985 which supports domestically grown sugar at a minimum rate of 18 cents per pound for raw cane sugar. Prices are maintained by setting import quotas at a level that minimizes loan forfeitures and permits the program to operate at no cost to the Federal Government (15). Even to survive under this program, Hawaii sugar plantations have realized the need to increase efficiency through increases in sugarcane yields and raw sugar recovery and to implement various price cutting measures, such as periodic shutdowns. The continuing survival of the Hawaii sugar industry will depend upon renewal of the Food Security Act in 1990 at a price support program adequate to ensure economic viability. Substantial research has been conducted by the Hawaiian Sugar Planters Association, the sugar plantations and the College of Tropical Agriculture and Human Resources of the University of Hawaii on alternative crops for sugarlands in the event of decline or demise of the sugar industry. To date, the research has not identified economically viable alternative uses for sugarlands, except for limited acreages, and prospects are not promising. Thus, the only indicated full utilization of project lands is for sugarcane in the event sugar remains economically viable.

EFFECTS OF COMBINED DEVELOPMENTS ON ECONOMIC VIABILITY OF OAHU SUGAR COMPANY

Withdrawal of the estimated 298 acres of Ko Olina Phase II lands planted to sugarcane would have minimal effects on growing and processing operations of Oahu Sugar Company (OSC) as discussed later in this report. The combined effects of sugarland withdrawals for all approved or pending developments plus marginal lands scheduled for fallowing would have a much more serious impact but would not force OSC out of business on the basis of diseconomies of scale.

As of March, 1989, approximately 5,400 acres of land planted to sugarcane were included in approved or pending applications for development 1_/. The use of this figure as a basis for determing effects on economies of scale for OSC is speculataive and should be considered a maximum based on current proposals. Some of the projects may never be developed and others are likely to reach full development over a long period of time, such as 10 years or more. The extreme negative possibility is that withdrawal of the 5,400 acres would isolate other parcels which may then become submarginal and scheduled for withdrawal. Regardless of the time of development, it is likely that pending developments will affect OSC lease negotiations with Campell Estate in 1995 and other lessors in 1996.

Milling capacity of the double mill at OSC is approximately 110,000 tons of raw sugar annually, based on three shifts per day over a 240 day period. Total output of 94,414 tons in 1987 (9) amounted to 86 percent of capacity as compared to 107,150 tons in 1979, which amounted to 97 percent of capacity. This reflects in part a decline in total acreage from 18,271 acres in 1979 to

1_/. Projects and estimated acreages in sugarcane are as follows: Ewa Gentry, 891; Ewa Marina, 410; Kapolei Nolls, 55; Kapolei Town Center, 693; Kapolei Village, 775; Ko Olina Phase II, 298; Kunia Golf Course, 190; Myers Golf Course, 270; Royal Kunia Phases I and II, 1,386; West Lock, 195; Projects to be phased out due to marginality, 240. Total = 5,403.

13,441 acres in 1987. The proportionate decline in economies of scale was less than that for acreage because of an increase in tons of raw sugar per acre from 11.30 in 1979 to 14.06 in 1987.

The important issue with respect to the economic viability of OSC is the extent to which phaseout of approved and pending developments will affect economies of scale. But such an analysis is meaningful only if it is assumed that the Food Security Act of 1985 will be renewed in 1990, with an adequate support price for sucrose. Without such support, the Hawaii sugar industry cannot compete with the world dumping price regardless of increases in efficiency. Without price supports, the industry would thus become demised, leaving a huge stockpile of prime agricultural lands with limited viable alternative uses.

Proceeding under the assumption that the major concern is loss of economies of scale because of developments impacting on OSC, the major issue is level of production in relation to mill capacity, since field operations have greater flexibility in responding to acreage changes. As further withdrawal of sugarcane acreage takes place, percent of operating capacity of the double mill would contine to decline to the point at which one mill is closed and all sugarcane is processed in the remaining mill with a capacity of approximately 70,000 tons.

Withdrawal of the entire 5,400 acres in sugarcane proposed for project developments would reduce OSC sugarcane acreage to 7,600 (13,000 minus 5,400). Based on the previous 10-year average of 48.5 percent of total sugarcane land harvested annually, this would result in a remaining harvested acreage of 3,686 acres. A plateau yield of 15.0 tons of raw sugar per acre harvested is conservatively projected for OSC following a discussion with OSC management. This seems reasonable, since major gains in tonnage may have already been achieved. Per acre yield of raw sugar increased from 11.30 tons in 1979 to 14.20 tons in 1986, but declined to 14.01 tons in 1987 and an estimated 13.90 tons in 1988. At 15.0 tons per acre, the post withdrawal output would amount to 55,290 tons, which is 79 percent of the one mill capacity. It is reasonable to assume that OSC could continue operating at this level, depending, of course, on the price of sugar in relation to input costs. A more optimistic projection of 16.0 tons of raw sugar per acre would provide an annual output of 58,976 tons and the remaining mill could operate at 84 percent of capacity. Since some of the proposed projects will not likely be developed or may be delayed for several years, a more realistic scenario might address an acreage reduction of 3,600 acres of sugarcane, which is equivalent to the acreage of projects approved or partially approved for development. This would reduce total sugarcane acreage to 9,400 acres and harvested acreage to 4,560 acres. This would provide an output of 68,400 tons of raw sugar and the remaining

mill could operate at 98 percent of capacity.

The precise effects of develpment projects on OSC will depend not only on project size, but land quality and the extent to which project parcels will isolate other sugarcane fields and render them uneconomic.

EFFECTS OF KO OLINA PHASE II ON ECONOMIC VIABILITY OF OAHU SUGAR COMPANY

The projected minor effect of Ko Olina Phase II on the economic viability of OSC is detailed below.

An estimated 298 acres or 80 percent of the 372.6-acre project is currently planted to sugarcane. This represents only 2.2 percent of the 13,441 acres of sugarcane reported for OSC in 1987 (9). Thus withdrawal of this parcel, alone, would not be expected to have an adverse effect on sugar production efficiency. Also, the effects of withdrawal of this parcel on net returns might be expected to be somewhat less than the indicated 2.2 percent based on proportion of land area considering (1) somewhat lower quality soils than for the average of the plantation, (2) higher irrigation requirements than for mauka lands, (3) greater distance from the mill than for most parcels and (4) possible conflicts in burning and transporting sugarcane associated with the surrounding urban infringement. Based on these considerations, withdrawal of sugarcane production from the project site might be expected to have a less adverse effect than withdrawal of a more typical similar sized parcel elsewhere in the plantation.

The following estimated effects of the withdrawal of Ko Olina sugarlands on the efficiency of OSC are based on published data (8, 9).

Production data for OSC indicate that a mean of approximately 48.5 percent of the land area in sugarcane was harvested annually during the past 10 years. Application of this percentage to the estimated 298 acres currently planted to sugarcane in the project area indicates an annual harvest of 149 acres, which provides 1987 output of 2,095 tons of raw sugar based on the OSC yield of 14.06 tons per acre. At a gross value of $354.50 per ton for the combined value of raw sugar and by-products reported by HSPA, the value of project tonnage for the project area amounts to $743,000 or 2.2 percent of the gross value for OSC and 0.21 percent of the 1987 gross value of sugar products for the Hawaii sugar industry. The gross value per ton of raw sugar for the project area would, however, differ somewhat from that of the industry as a whole because of different values for molasses and electricity sales in relation to raw sugar sales.

Net return on capital to the Hawaii sugar industry amounted to only 0.2 percent in 1987 as compared to 3.7 percent in 1986 (9). Based on the 1987 return, the loss in net returns attributable to withdrawal of sugarcane from the project area would be of very small magnitude, assuming that the return on capital for OSC is comparable to that for the Hawaii sugar industry as a whole. This does not consider the effect on OSC of reduced economies of scale, which is discussed above.

The Hawaii sugar industry employed 6,230 workers in 1987 for all activities, indluding factory, field, clerical, miscellaneous and supervisors (9). Based on the State of Hawaii Economic Model, with a multiplier of 1.13, the sugar industry would have provided indirect employment to an additional 7,040 workers in 1987. Proportionate employment would have amounted to 601 direct employees and 679 indirect employees for OSC and 13 direct employees amd 15 employees for the project area. Total 1987 wages for the 13 employees who would be displaced by Ko Olina Phase II is estimated at $273,000. Elimininations of this number of jobs would be minor in aggregate. Some employees would likely find comparable jobs at OSC as a result of vacancies due to attrition or at Ko Olina. With essentially no unemployement on Oahu at 2.6 percent, obtaining employment should be no problem.

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APPENDIX B

WEST BEACH PHASE II
BOTANICAL SURVEY

Prepared by: Kenneth M. Nagata
For: Wilson Okamoto & Associates, Inc.
Date: 18 June 1987

INTRODUCTION

The project site occupies approximately 375 acres in the Ewa District on O'ahu. It is bordered on the north by Farrington Highway, on the east by Kalaeloa Blvd., on the south by an old railroad easement and a large piggery, and on the west by the West Beach Phase I development and the Honokai Hale Subdivision. It is surrounded on the east and south by sugar cane fields. The piggery in the southwest corner is situated in a forest of kiawe (Prosopis pallida). Much of the land to the west has been cleared for the West Beach Phase I development and the land across Farrington Highway is occupied largely by scrub kiawe and grasses.

Ripperton and Hosaka (1942) classified the vegetation in the region as xerophytic shrub with trees along the coast (Zone A). The characteristic species of the zone includes kiawe, koa haole (Leucaena leucocephala), swollen finger grass (Chloris inflata), feather fingergrass (C. virgata), pili grass (Heteropogon contortus) and bristly foxtail (Setaria verticillata). More recently, Char and Balakrishnan (1979) made a detailed vegetational study of the entire'Ewa Plains. They recognized 10 natural ecosystems and 10 man-modified ecosystems with numerous subtypes and combinations. The major vegetation type, occuping 36% of the entire 'Ewa Plains, was the sugar cane fields. Various types of cultivated lands, occupied lands, stand, wetland and inland ecosystems were also recognized including several types of kiawe communities.

The present project site was included in the 'Ewa Plains Survey. More than 90% of the site was found to be occupied by sugar cane fields. In the western half of the site the cane fields

were intersected by koa-haole scrubland which were found in the main ravines. A grassland dominated by pitted beardgrass (Andropogon pertusus) was found along Farrington Highway near Honokai Hale Subdivision and below the subdivision a wasteland of mixed herbs and unrecognizable vegetational pattern was located. Three rare and endangered species found in the 'Ewa Plains were documented and mapped during the survey: Abutilon menziesii, Achyranthes rotundata (A. splendens var. rotundata) and Euphorbia skottsbergii var. kalaeloana. None were found in or near the present project site.

RESULTS

The vegetation in the project site was found to be very similar to Char and Balakrishnan's classification of 1979. Most of the site is occupied by sugar cane fields which have been in operation for many decades. The fields in the east portion of the site are continuous but those toward the west are interlaced by gullies and rock and debris piles. Scrub grasslands are found in the extreme west and along Farrington Highway near the Honowai Hale Subdivision. Five vegetation types were recognized.

Sugar Cane Fields (CF). The dominant species in most of the site is sugar cane (Saccharum officinarum). At the time of the survey the fields were recently planted and the sugar cane had not yet formed a complete canopy. Although such an open canopy and bare soil usually presents optimal conditions for invasion by herbaceous weedy species, very few such species were found and in only small numbers. Several narrow dirt roads transect the fields but

these are yet devoid of any significant vegetation. Nut grass (Cyperus rotundus) and castor bean (Ricinus communis) are the most important weeds in the fields.

Koa-Haole - Guinea Grass Wasteland (KGW). This vegetation type occurs in uncultivated areas generally in ravines and where debris and boulders have been piled up. In the major drainages where moisture is readily available guinea grass (Panicum maximum) is dominant but in smaller ravines and on rock and debris piles koa-haole is dominant. Several other species are associated with this vegetation type but generally in small numbers. Of secondary importance and recorded as "occasional" were virgate mimosa (Desmanthus virgatus), castor bean (Ricinus communis) and hi'aloa (Waltheria americana). Just below Honokai Hale Subdivision the narrow band of Koa-Haole - Guinea Grass Wasteland is associated with kiawe. The wasteland vegetation type is identical with Char and Balakrishnan's "Leucaena Scrubland" and its distribution and pattern has changed little since 1979.

Scrub Grassland (SG). In the uncultivated areas in the west and northwest portion of the site and along Farrington Highway the vegetation is dominated by buffelgrass (Cenchrus ciliaris) and guinea grass with occasional emergent koa-haole and kiawe. Many species are associated with the Scrub Grassland but mostly in small numbers. Feather fingergrass and hi'aloa were common and 'ilima (Sida fallax), hoary abutilon (Abutilon incanum), klu (Acacia farnesiana), false mallow (Malvastrum coromandelianum), wild spurge (Euphorbia geniculata) and virgate mimosa were recorded

as "occasional". Seventeen other species were recorded as "uncommon" or "rare".

As a result of recent dry conditons, most of the herbaceous species were in dessicated condition at the time of the survey. Due in part to this and the stony conditon of the land, the vegetation cover varied between 30% and 70%. During wet months the cover in many areas probably approaches 100%. In addition a portion near the Honowai Hale Subdivision appears to have been recently burned.

Most of this vegetation type has evolved from sugar cane fields which have been harvested and fallowed since 1979. Char and Balakrishnan's "Wasteland" zone, characterized by mixed herbs or often unrecognizable vegetational pattern, is included in the present Scrub Grassland. Also included is their "Andropogon Grassland" although the typical species, pitted beardgrass, was not found in the present survey.

Roadway (R). The vegetation along the major roadways generally consists of grasses and other herbaceous species with occasional shrubs. Buffelgrass and bermuda grass (Cynodon dactylon) were found to be the most abundant and koa-haole was regarded as "common". Golden crownbeard (Verbesina encelioides), field bindweed (Convolvulus arvensis) and guinea grass were recorded as "occasional"; 22 other species were regarded as "uncommon" or "rare". Guinea grass and Christmas berry (Schinus terebinthifolius) were locally common especially along the railroad easement.

Cultivated (C). Several ornamental species were found around

the pumphouse. Although probably once cultivated, the area is presently dominated by such common weedy species as guinea grass, koa-haole, feather fingergrass, virgate mimosa, nut grass, and goosegrass (Eleusine indica). Banana (Musa x paradisiaca), mango (Mangifera indica), croton (Codiaeum variegatum var. pictum) and panini'awa'awa or aloe (Aloe vera) are the main cultivated species.

SUMMARY

The vegetation in the study site is dominated by agricultural and weedy species. Only five common native species were found. No endemic or rare and endangered species were found despite a careful search and no native ecosystems will be affected by the proposed project.

LIMITATIONS OF THE SURVEY

Because of recent dry conditions, the vegetation in non-irrigated areas especially in the Scrub Grassland was extremely dessicated. Many of the herbaceous species were barely recognizable and much of the grasses were completely dried. More herbaceous species can probably be found during wet seasons but these are not expected to alter the basic composition of the various vegetation types.

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SPECIES CHECKLIST

Families are arranged alphabetically in two groups - Monocotyledones and Dicotyledones. Genera and species are arranged alphabetically within each family. Taxonomy, common names and the plant status follows that of St. John (1973). The abundance determinations are relative and are dependent on the judgement of the investigator.

EXPLANATION OF SYMBOLS

Species Status:
- I - Indigenous, ie. native to the Hawaiian Islands but also occuring naturally elsewhere.
- X - Exotic, ie. plants introduced after the Western discovery of the islands.

Relative Abundance Ratings:
- A - ABUNDANT, generally the major or dominant species in a given area.
- C - COMMON, generally distributed throughout a given area in large numbers.
- O - OCCASIONAL, generally distributed through a major portion of a given area, but in small numbers.
- U - UNCOMMON, observed uncommonly but more than 10 times in a given area.
- R - RARE, observed 2 to 10 times in a given area.

Vegetation Types:
- C - Cultivated
- R - Roadway
- CF - Sugar Cane Fields
- SG - Scrub Grassland
- KGW - Koa-Haole - Guinea Grass Wasteland

SPECIES CHECK LIST

Scientific Name	Common Name	Relative Abundance/Vegetation Type: Status	C	R	CF	SG	KGW
MONOCOTYLEDONES							
AMARYLLIDACEAE							
Agave sisalana Perrine ex Engelm.	Sisal	X		R			
CYPERACEAE							
Cyperus alternifolius L.	Umbrella plant	X				R	
C. rotundus L.	Nut grass	X	O	U	O		
GRAMINAE							
Brachiaria mutica (Forsk.) Stapf	Paragrass	X					U
Cenchrus ciliaris L.	Buffelgrass	X		A	R	A	U
Chloris inflata Link	Swollen fingergrass	X		R			
Chloris virgata SW.	Feather fingergrass	X	O	R		C	
Cynodon dactylon (L.) Pers.	Bermuda grass	X		A	R		U
Digitaria sanguinalis (L.) Heist.	Large crabgrass	X			R		
Eleusine indica (L.) Gaertn.	Goosegrass	X	O				
Eragrostis tenella (L.) Beauv. ex R. & S.	Japanese lovegrass	X		R			
Panicum maximum Jacq.	Guinea grass	X	O	O	R	A	A
Rhynchelytrum repens (Willd.) C.E. Hubb.	Natal redtop	X	O			U	
Saccharum officinarum L.	Sugarcane	X			A		
LILIACEAE							
Aloe vera L.	Panini'awa'awa	X	R				
MUSACEAE							
Musa x paradisiaca L.	Banana	X	R				

Scientific Name	Common Name	Relative Abundance/Vegetation Type: Status	C	R	CF	SG	KGW
DICOTYLEDONES							
ACANTHACEAE							
Asystasia gangetica (L.) T. Anders.	Asystasia	X	O	R		R	
AMARANTHACEAE							
Amaranthus spinosus L.	Spiny amaranth	X	R	U			
Amaranthus viridis L.	Slender amaranth	X		R			
ANACARDIACEAE							
Mangifera indica L.	Mangos	X	R				
Schinus terebinthifolius Raddi	Christmas berry	X	O	U		R	U
CHENOPODIACEAE							
Atriplex semibaccata R. Br.	Australian salt bush	X		U			
Chenopodium album L.	Pigweed	X		R			
COMPOSITAE							
Bidens pilosa L.	Spanish needle	X	U				
Pluchea indica (L.) Less.	Indian pluchua	X				R	
Pluchea odorata (L.) Cass.	Pluchea	X	U	R		U	R
Sonchus oleraceus L.	Sow thistle	X	O	R			
Tridax procumbens L.	Coat buttons	X	O	R		R	
Verbesina encelioides (Cav.) B. & H. ex Gray	Golden crown-beard	X	O	O			
CONVOLVULACEAE							
Convolvulus arvensis L.	Field bindweed	X		O			R
Ipomoea cairica (L.) Sweet	Koali	I				R	
Ipomoea triloba L.	Little bell	X	O	U			
CUCURBITACEAE							
Momordica charantia var. pavel Crantz	Balsam apple	X		R		R	U
EUPHORBIACEAE							
Codiaeum variegatum var. pictum (Lodd.) Muell.-Arg.	Leaf croton	X	O				
Euphorbia geniculata Ortega	Wild spurge	X	R			O	R
Euphorbia glomerifera (Hillsp.) L.C. Wheeler		X	O	R			

Scientific Name	Common Name	Relative Abundance/Vegetation Type Status	C	R	CF	SG	KGW
EUPHORBIACEAE (Con't)							
Euphorbia heterophylla var. cyathophora (Murr.) Griseb.	Mexican fire plant	X	U	U			
Euphorbia hirta L.	Garden spurge	X	R	R		R	
Euphorbia prostrata Ait.	Prostrate spurge	X		R			
Ricinus communis L.	Castor bean	X		R	O		O
LABIATAE							
Leonotis nepetaefolia (L.) Ait. f.	Lions-ear	X	O	U			R
Ocimum gratissimum L.		X				R	
LEGUMINOSAE							
Acacia farnesiana (L.) Willd.	Klu	X		R		O	R
Crotalaria mucronata Desv.		X	R			R	
Desmanthus virgatus (L.) Willd.	Virgate mimosa	X	O	R		O	O
Indigofera suffruticosa Mill.	Indigo	X				R	
Leucaena leucocephala (Lam.) de Wit	Koa-haole	X	O	C	R	O	A
Phaseolus lathyroides L.	Cow pea	X		R			
Prosopis pallida (Humb. & Bonpl. ex Willd) HBK.	Kiawe	X				U	U
MALVACEAE							
Abutilon grandifolium (Willd) Sweet	Hairy abutilon	X		R		R	
Abutilon incanum (Link) Sweet	Hoary abutilon	I				O	
Malvastrum coromandelianum (L.) Garcke	False Mallow	X	U			O	
Sida fallax Walp.	'Ilima	I				O	R
MORINGACEAE							
Moringa oleifera Lam	Horseradish tree	X				R	
NYCTAGINACEAE							
Boerhavia coccinea Mill.		X				R	
B. diffusa L.	Alena	I				R	
PASSIFLORACEAE							
Passiflora foetida L.	Scarlet-fruited passionflower	X				R	

Scientific Name	Common Name	Relative Abundance/Vegetation type Status	C	R	CF	SG	KGW
POLYGONACEAE							
Antigonon leptopus H. & A.	Mexican creeper	X		R			
SOLANACEAE							
Lycopersicon pimpinellifolium Mill.	Currant tomato	X		R			
Nicotiana glauca Grah.	Tree tobacco	X				R	
STERCULIACEAE							
Waltheria americana L.	Hi'aloa	I	O			C	O

APPENDIX C

PAUL H. ROSENDAHL, Ph.D., Inc.
Consulting Archaeologist

Report 306-060187

July 19, 1987

West Beach Estates
c/o Wilson Okamoto & Associates, Inc.
P.O. Box 3530
Honolulu, Hawaii 96811

Subject: Archaeological Reconnaissance Survey
Ko Olina Resort Phase II Development Site
Honouliuli, Ewa District, Island of Oahu

Gentlemen:

At the request of Mr. Gary Okamoto of Wilson Okamoto & Associates, on behalf of their client, West Beach Estates, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological reconnaissance survey of the approximately 360 acre Ko Olina Resort Phase II Development Site in the Land of Honouliuli, Ewa District, Island of Oahu. The overall objective of this survey was to provide information appropriate to and sufficient for the preparation of a Land Use Boundary Amendment petition to be submitted to the State Land Use Commission.

The goal of the reconnaissance survey was to identify--to discover and locate on available maps--sites and features of potential archaeological significance. A reconnaissance survey comprises the initial level of archaeological investigation. It is extensive rather than intensive in scope, and is conducted basically to determine the presence or absence of archaeological resources within a specified project area. Reconnaissance survey indicates both the general nature and variety of archaeological remains present, and the general distribution and density of such remains. A reconnaissance survey permits a general significance assessment of the archaeological resources, and facilitates formulation of realistic recommendations and estimates for such further work as might be necessary or appropriate. Such work could include intensive survey--data collection involving detailed recording of sites and features, and selected test excavations; and possibly subsequent mitigation--data recovery research excavations, construction monitoring, interpretive planning and development, and/or preservation of sites and features with significant scientific research, interpretive, and/or cultural values.

The specific objectives of the reconnaissance survey of the Ko Olina Resort Phase II Development Site were four-fold: (a) to identify (find and locate) any sites and site complexes present within the project area; (b) to evaluate the potential general significance of any identified archaeological remains; (c) to determine the possible impacts of proposed development upon any identified remains; and (d) to define the general scope of any subsequent data collection and/or mitigation work that might be necessary or appropriate.

The general significance of any archaeological resources identified during the reconnaissance survey were to be evaluated in terms of potential scientific research, interpretative, and/or cultural values. Research value refers to the potential of archaeological resources for

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producing information useful in the understanding of culture history, past lifeways, and cultural processes at the local, regional, and interregional levels of organization. Interpretive value refers to the potential of archaeological resources for public education and recreation. Cultural value, within the framework for significance evaluation used here, refers to the potential of archaeological resources for the preservation and promotion of cultural and ethnic identity and values.

Reconnaissance survey field work was carried out on May 19 and 21, 1987, by PHRI Principal Archaeologist Dr. Paul H. Rosendahl. Approximately five man-hours of labor were expended in carrying out the field work. Field work findings were subsequently discussed with Dr. Joyce Bath, staff archaeologist in the Department of Land and Natural Resources--Historic Sites Section/State Historic Preservation Office. An oral report on the field work findings was given to Mr. Ernest Takahashi of Wilson Okamoto & Associates on May 26, 1987. The present letter report constitutes the final report on the reconnaissance survey.

Based on a preliminary review of available background literature and records, and discussions with Mr. Okamoto and Mr. Takahashi, the following specific tasks were determined to constitute an adequate scope of work for the reconnaissance survey of the Ko Olina Resort Phase II Development Site project area:

1. To review and evaluate available archaeological and historical literature relevant to the immediate project area;

2. To conduct a sample field reconnaissance of the approximately 360 acre project area;

3. To determine the nature of the physical conditions of the project area that would influence the conduct of any subsequent archaeological field work, should any be necessary; and

4. Prepare an appropriate scope of work (including specific field work and other non-field tasks) and accurate man-hour estimates for any subsequent archaeological work that might be necessary.

The Ko Olina Resort Phase II Development Site project area consists of approximately 360 acres located in the Land of Honouliuli, Ewa District, Island of Oahu (see attached map). The project area is bounded by the H-1 Freeway and Honokai Hale Subdivision on the north, Ko Olina Resort (Phase I) and Oahu Sugar Company lands (including a short section of Pump 10 Road) on the west and southwest, the Oahu Railway and Land Company right-of-way (railroad bed) on the south, and Oahu Sugar Company lands adjacent to Kalaeloa Boulevard on the east. The eastern boundary of the project area is situated c. 700-900 ft west of Kalaeloa Boulevard, in cultivated cane land. The entire project area has been extensively modified in recent times, primarily by sugarcane cultivation. Oahu Sugar Company currently cultivates virtually all of the project area, except for small portions immediately adjacent to Honokai Hale Subdivision and the H-1

Freeway where sugarcane was formerly grown. This cultivation involved extensive clearing, as evidenced by several large piles of boulders noted throughout the project area. The vegetation cover ranges from open to dense. Dense areas are comprised of cultivated sugarcane (Saccharum sp.), while former cane lands are characterized by scattered sugarcane, other grasses, and occasional koa-haole (Leucaena glauca [L.] Benth.).

Although no archaeological remains are known to exist within the project area, one previously identified site is immediately adjacent to it. The Oahu Railroad and Land Company right-of-way (railroad bed) bounds the project area on the south side, and is listed on the National Register of Historic Places (Site 50-80-12-9714).

Reconnaissance survey field work conducted on May 19 and 21, 1987 by PHRI consisted limited systematic pedestrian coverage and a combination of vehicular coverage and pedestrian point inspections. Field work was facilitated by black-and-white aerial photo-topographic maps (scale 1"=200'; R.M. Towill, 1969), an aerial photograph of Campbell Estate lands (approx. scale 1"=1,000'; 9/21/82), and a blackline topographic map of the project area (scale 1"=200', 5-ft contours; 3/16/87). Systematic pedestrian coverage concentrated on those very limited portions adjacent to Honokai Hale Subdivision and Pump 10 Road which, on the basis of the aerial photographs and initial field inspection, appeared to have been least modified by sugarcane cultivation and other activities. The combination of vehicular coverage and pedestrian point inspections was used to check accessable locations throughout the project area primarily to verify the almost total modification of the project area in recent times by sugarcane cultivation.

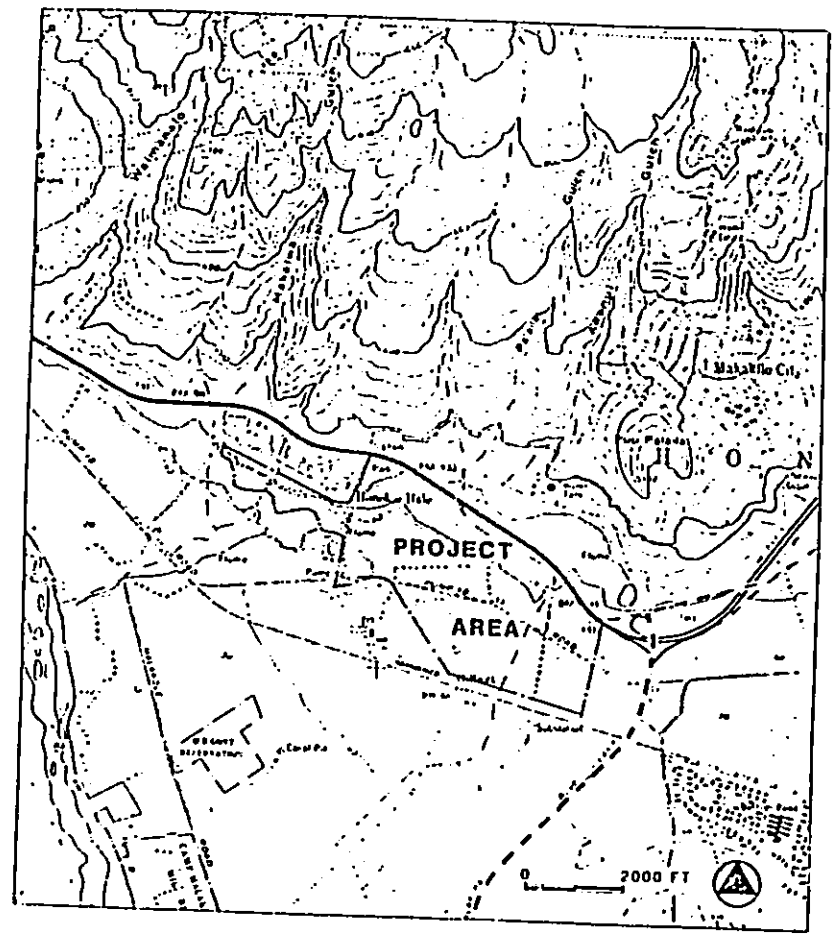
No archaeological sites of any kind were encountered within the project area during the reconnaissance survey of the Ko Olina Resort Phase II Development Site. There is a potential for rockshelter sites along the base of the upraised limestone bluff on the seaward side of Pump 10 Road, but this area is outside the present project area limits. Based on the negative results of the reconnaissance survey, it is concluded that no further archaeological work of any kind is necessary and recommended that full archaeological clearance of the project area be granted. This recommendation is made on the basis of the reconnaissance survey field work, and is given with the general qualification that during any development activity involving the extensive modification of the land surface there is always the possibility--however remote--that previously unknown or unexpected subsurface cultural features or deposits might be encountered. In such a situation, immediate archaeological consultation should be sought.

If you have any questions, please contact me at our Hilo office.

Sincerely yours,

Paul H. Rosendahl, Ph.D.
President and Principal
Archaeologist

Attachment: Project Area Location Map



PROJECT AREA LOCATION MAP

Archaeological Reconnaissance Survey
Ko Olina Resort Phase II Development Site
Land of Honouliuli, Ewa District,

PHRI Project 87-306 May 1987

(Map taken from USGS Quad, Ewa, Hawaii)

PAUL H. ROSENDAHL, Ph.D., Inc.
Consulting Archaeologist

July 23, 1987
87-306

West Beach Estates
c/o Wilson Okamoto & Associates, Inc.
P.O. Box 3530
Honolulu, Hawaii 96811

RECEIVED
WILSON OKAMOTO & ASSOCIATES

Subject: Archaeological Reconnaissance
Ko Olina Resort Phase II Development Site
Honouliuli, Ewa District, Island of Oahu

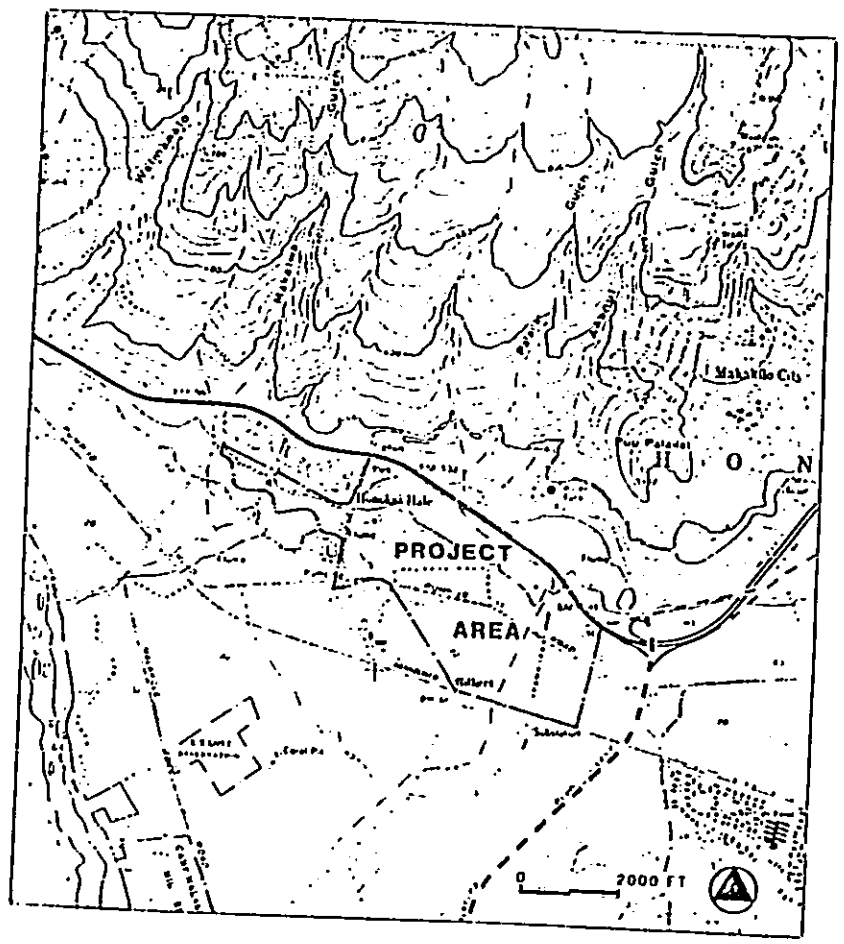
Gentlemen:

Enclosed is replacement page 4, for our Report 306-060187. Please make all necessary changes. Thank you for your prompt attention to this matter.

Sincerely yours

Paul H. Rosendahl, Ph.D.
President and Principal
Archaeologist

305 Mahouli Street • Hilo, Hawaii 96720 • (808) 969-1763 or 966-8038



PROJECT AREA LOCATION MAP

Archaeological Reconnaissance Survey
Ko Olina Resort Phase II Development Site
Land of Honouliuli, Ewa District, Island of Oahu

PHRI Project 87-306 May 1987

(Map taken from USGS Quad, Ewa, Hawaii)

APPENDIX D

Y. Ebisu & Associates
Acoustical and Electronic Engineers
1126 12th Avenue
Room 305
Honolulu, Hawaii 96816
(808) 735-1634

Job #25.012
November 10, 1988

Wilson Okamoto & Associates, Inc.
1150 South King Street, Suite 800
Honolulu, Hawaii 96814

Attention: Mr. Ernest Takahashi

Subject: Noise Study Report: Ko Olina Resort Phase II

Dear Mr. Takahashi:

This letter report presents the results of traffic and noise studies, which were performed in response to the development proposal for Ko Olina Phase II. The development proposal for Ko Olina Phase II does not include noise sensitive parcels, so adverse noise impacts are not expected for this project.

OBJECTIVES: The purpose of this letter report is to present the results of estimates of sound levels which emanate from the off-site motor vehicle traffic and aircraft in the project environs. Because there are no residential uses proposed for this phase of the project, this report is primarily intended to summarize the results of noise predictions and noise contours which were developed in the project environs.

STUDY METHODOLOGY: The following methodology was used in performing the technical portions of this noise study:

State Department of Transportation traffic volume and classification data were used to compute the noise associated with traffic along Farrington Highway in areas fronting the proposed golf course on the project site. The traffic data were obtained at Stations H-10-A and C-10-F during February and September, 1985 by the state.

Using this data, traffic noise levels were calculated on the makai side of the highway for CY 1986 conditions. Noise contours were developed for receptor elevations of +5 and +10 above ground level, using the Federal Highway Administration (FHWA) highway noise model.

Using aircraft operational data contained in the 1984 AICUZ for NAS, Barbers Point and aircraft operational data for Honolulu International Airport, aircraft noise contours over the project site were developed for CY 1985 and CY 2005.

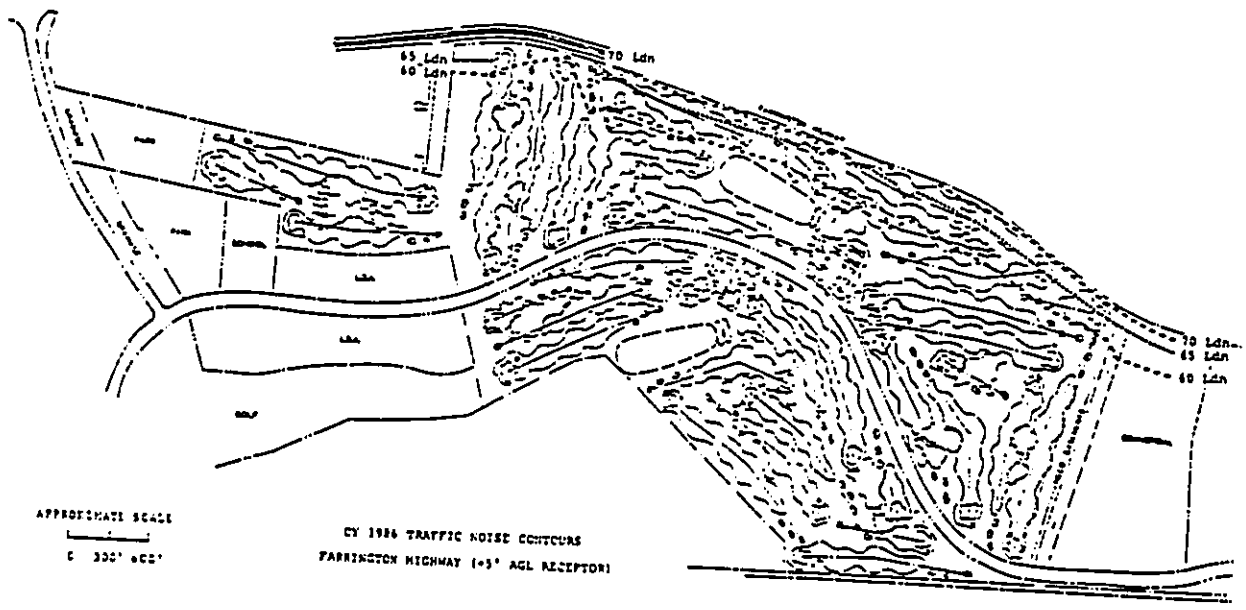
TRAFFIC NOISE LEVELS: Traffic noise contours of 70 to 60 Ld were developed for the Base Year (CY 1986) period along Farrington Highway in the area of the proposed golf course. These traffic noise contours are shown in ENCLOSURES 1 and 2 for receptor elevations of 5 and 10 FT above ground level, respectively. Because the plan for land use along the highway only includes the development of a golf course, which is not considered to be noise sensitive, additional work on updating the traffic noise contours was not considered necessary.

AIRCRAFT NOISE LEVELS: Aircraft noise contours for CY 1985 and CY 2005 were developed over the proposed Phase II development area to identify potential noise complaint and noise impact zones resulting from aircraft operations at NAS, Barbers Point and Honolulu International Airport. The aircraft flight tracks used in developing the noise contours are shown in ENCLOSURE 3, and resulting noise contours over the project site are shown in ENCLOSURES 4 thru 6. The daily operations associated with the flight tracks are shown in ENCLOSURE 7. The proposed Ko Olina Phase II development should be compatible with the level of aircraft noise projected over the project site. These results are consistent with (and actually more conservative than) the recent draft AICUZ noise contour updates for NAS, Barbers Point. For these reasons, risks of adverse impacts from aircraft noise are considered minimal for Phase II.

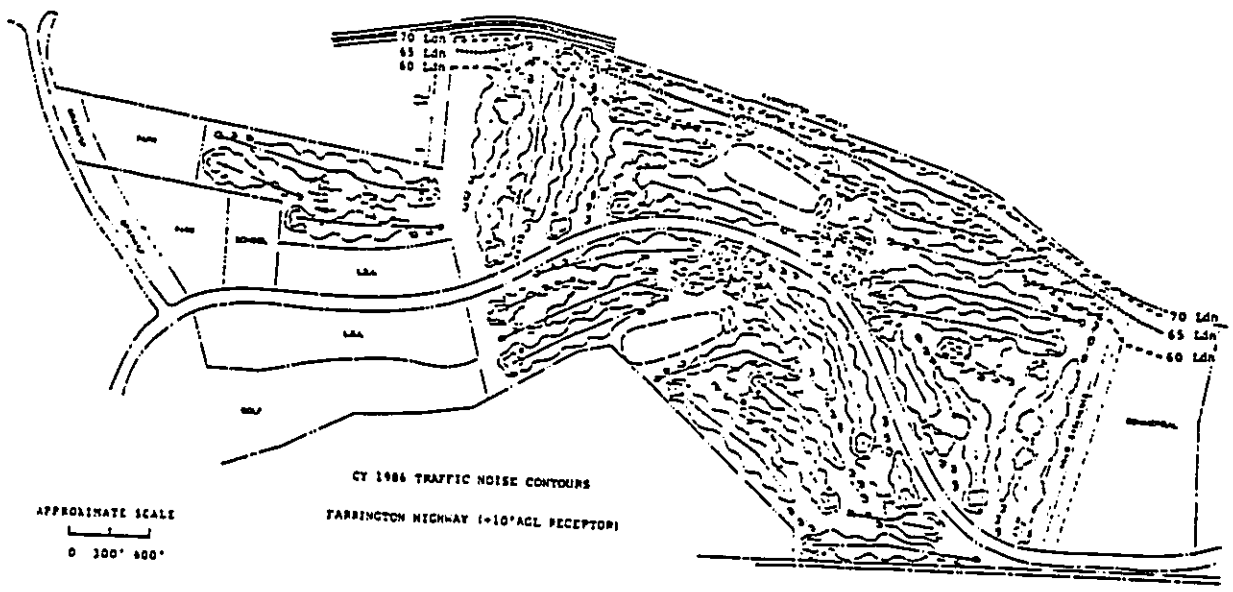
Sincerely,

Yoichi Ebisu, P.E.

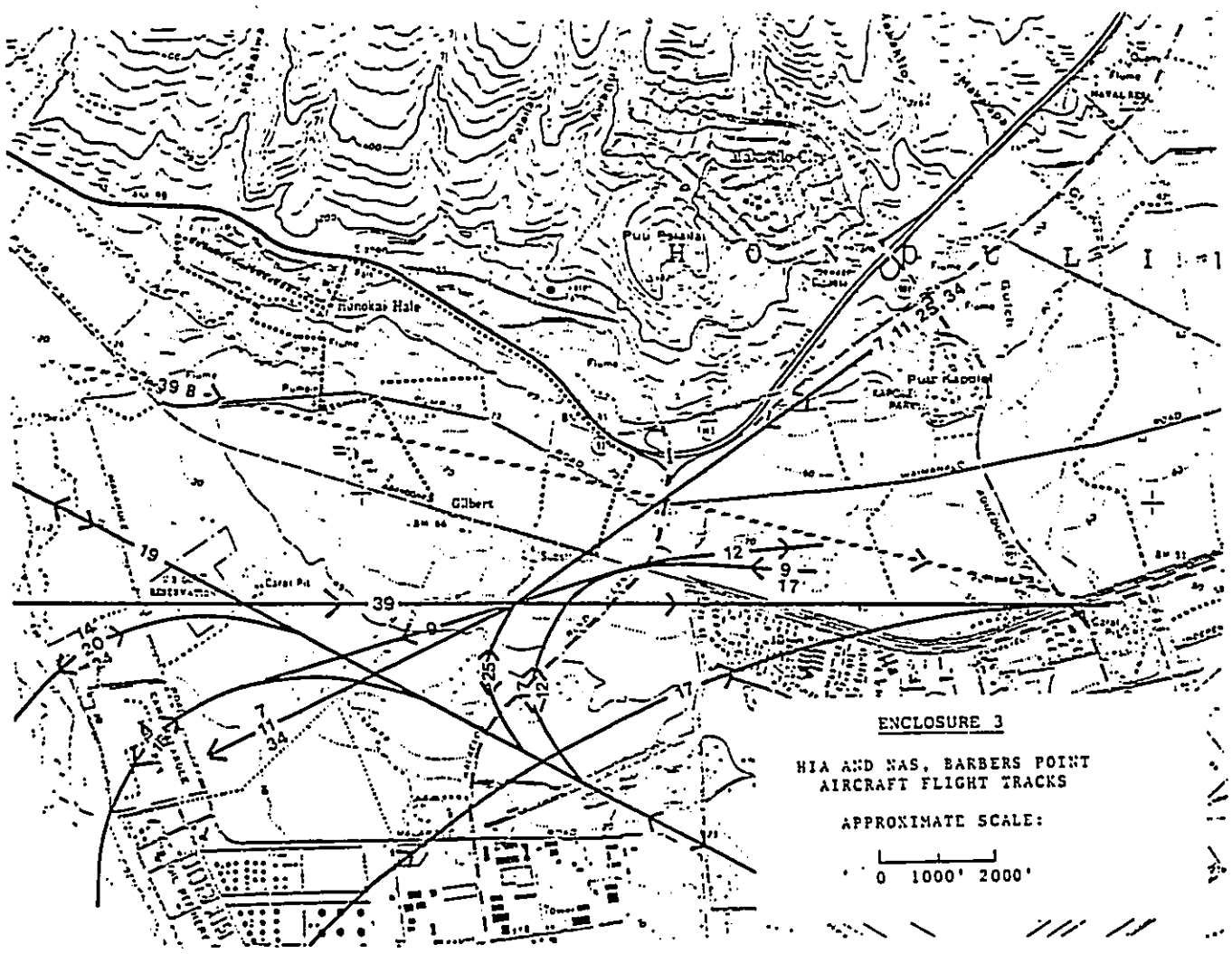
encl.

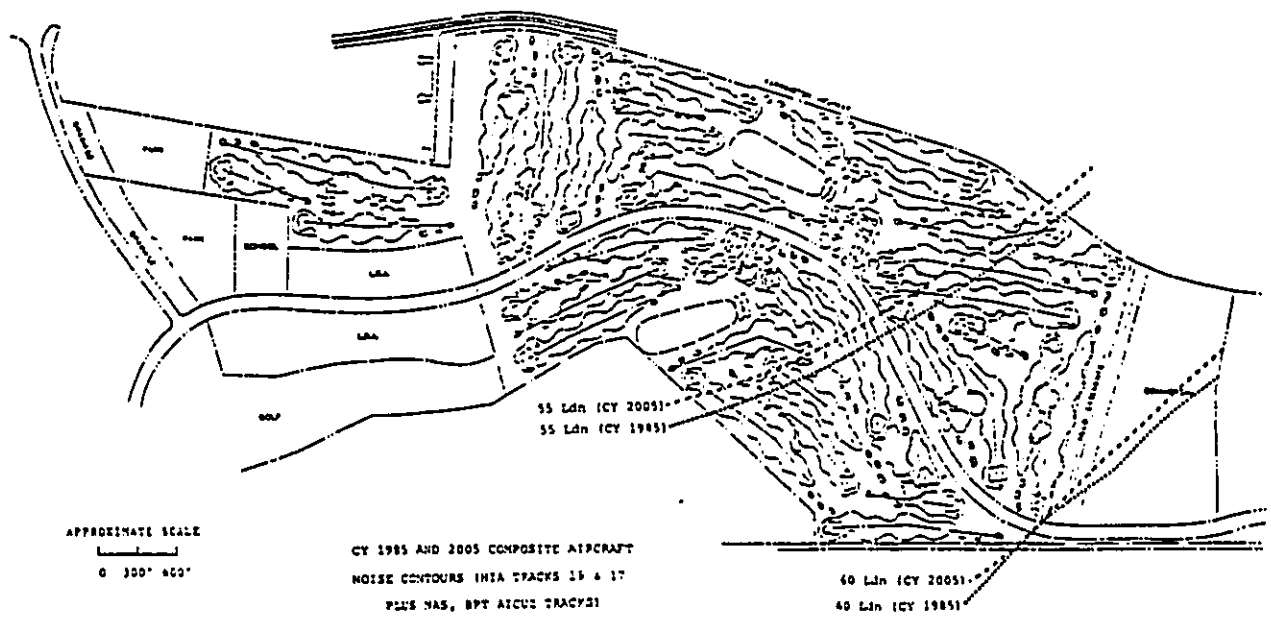


ENCLOSURE 1

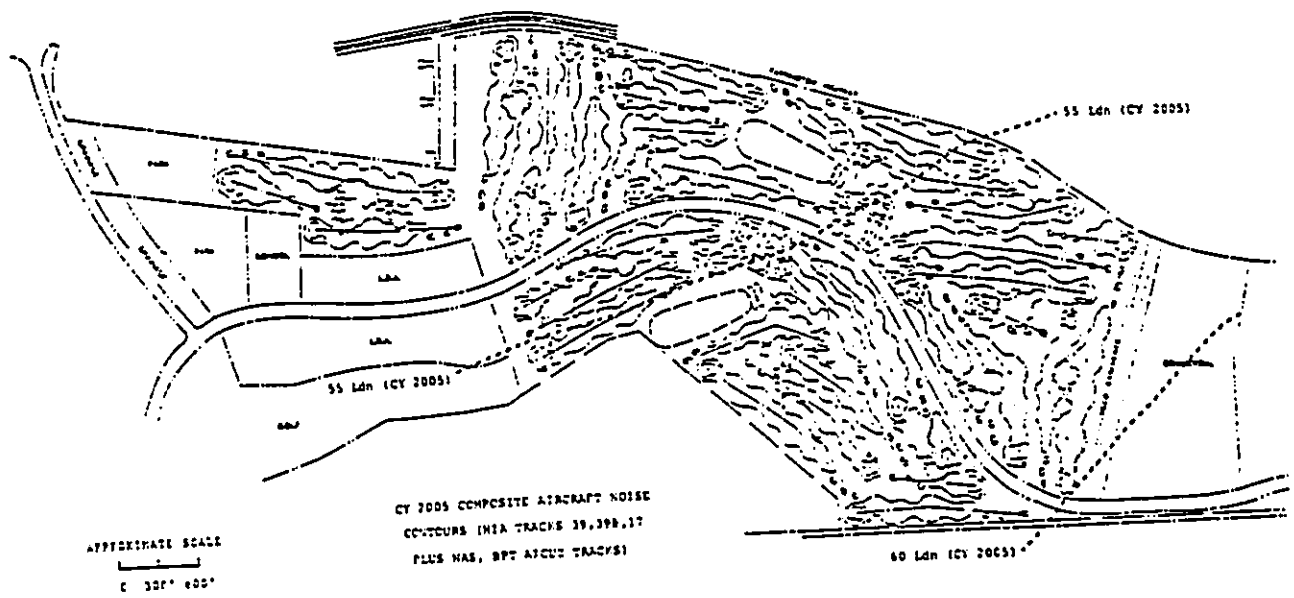


ENCLOSURE 2

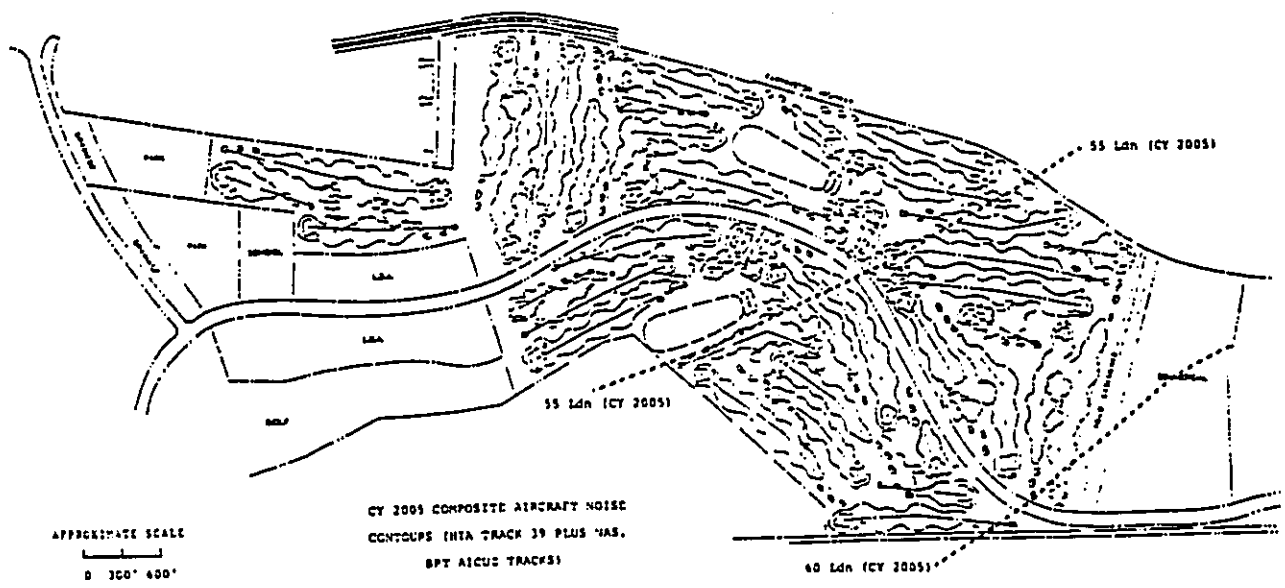

Kunokau Hale
Gilbert
Pua Kapolei
39
19
12
9
17
7
11
34
ENCLOSURE 3
HIA AND NAS, BARBERS POINT
AIRCRAFT FLIGHT TRACKS
APPROXIMATE SCALE:
0 1000' 2000'


55 Ldn (CY 2005)
55 Ldn (CY 1985)
60 Ldn (CY 2005)
60 Ldn (CY 1985)
APPROXIMATE SCALE
0 300' 600'
CY 1985 AND 2005 COMPOSITE AIRCRAFT
NOISE CONTOURS HIA TRACKS 19 & 17
PLUS NAS, BPT AICUZ TRACKS

ENCLOSURE 4



ENCLOSURE 5



ENCLOSURE 6

TOUCH & GO'S	TRACK NUMBERS							
TYPES	#7*	#9*	#11*	#12*	#14*	#16*	#17*	#20*
P-3	20.417		1.134		5.444			1.361
C-130	6.272		0.523		2.509			0.623
C-135					0.438			0.109
DC-9(50)								
C-141								
A-4	0.345		0.047		0.552			0.138
F-4	0.118		0.016		0.187			0.047
T-33	0.216		0.029		0.345			0.087
S-3	0.005		0.002		0.016			0.005
H-52/53	3.643		0.810		1.944			0.485
H-2/3		3.167		1.408		0.352	0.007	-
CH-46/47	0.816		0.183		0.436			0.109
H-1/58	1.622		0.361		0.865			0.216
GA1B	5.952		0.359		1.428			0.476
GA2B	0.581		0.036		0.223			0.061
BEEC45	0.336		0.018		0.149			0.123
TOTALS:	40.319	3.167	3.534	1.408	14.534	0.352	0.007	3.837

DEPARTURES	TRACK NUMBERS					
TYPES	#24 DAY	#24 NITE	#25 DEP DAY	#25 DEP NITE	#19 DEP DAY	#19 DEP NITE
P-3	0.544	0.061			0.136	0.015
C-130	0.323	0.036			0.081	0.009
C-135	0.014				0.004	
DC-9(50)	0.015	0.002			0.005	
C-141	0.006	0.001			0.002	
A-4	0.274				0.068	
F-4	0.064				0.016	
T-33	0.018				0.004	
S-3	0.022				0.005	
H-52/53	0.069		0.068		0.068	
H-2/3	0.105	0.012	0.105	0.012	0.105	0.012
CH-46/47	0.090		0.091		0.090	
H-1/58	0.030		0.029		0.030	
GA1B	0.298		0.298		0.298	
GA2B	0.025				0.006	
BEEC45	0.060				0.015	
TOTALS:	1.957	0.112	0.591	0.012	0.933	0.036

ENCLOSURE 7

APPROACHES	TRACK NUMBERS					
TYPES	#25 APP DAY	#25 APP NITE	#34 DAY	#34 NITE	#19 APP DAY	#19 APP NITE
P-3			0.340	0.038	1.633	0.182
C-130			0.200	0.022	0.968	0.108
C-135					0.076	
DC-9(50)			0.008		0.044	0.005
C-141			0.004		0.016	0.002
A-4			0.067		0.827	
F-4			0.018		0.187	
T-33			0.009		0.085	
S-3			0.004		0.058	
H-52/53	0.242		0.205		0.243	
H-2/3	0.080	0.009	0.316	0.035	0.080	0.009
CH-46/47	0.327		0.271		0.327	
H-1/58	0.109		0.089		0.109	
GA1B	1.072		0.534		1.072	
GA2B			0.022		0.098	
BEEC45			0.031		0.315	
TOTALS:	1.830	0.009	2.118	0.095	6.138	0.306

	HIA (1985)		HIA (2005)	
A/C TYPE	HIA #16 & 19	HIA #17	HIA #16 & 19	HIA #17
C-130	1.120		1.300	
K/C-135	1.950	1.950	2.150	2.150
C-5	1.000	0.900	1.060	0.960
C-141	2.880	2.770	3.250	3.150
A-7	0.630	0.000		
F-4/F-15	9.270	0.000	9.600	
T-33	2.250	0.000		
B-747	7.120	5.630	13.790	10.900
DC-10/L1011	0.750	12.900	1.020	17.470
707/DC-8	0.500	1.480		
727	0.130		22.960	
737	15.540		7.550	
DC-9	3.720		1.480	
DC-9(80)	0.350		15.650	
F-28	3.060		7.730	
YS-11	8.000			
BH7	6.490		18.200	
BH6	1.810		2.970	
TOTALS:	74.570	25.630	110.710	34.630

ENCLOSURE 7 (CONT.)

CORRECTION

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

TOUCH & GO'S TYPES	TRACK NUMBERS #7*	#9*	#11*	#12*	#14*	#16*	#17*	#20*
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DC-9(80)	8.350		15.650	
F-28	3.060		7.730	
YS-11	8.000			
B17	6.490		18.200	
B16	1.810		2.970	
TOTALS:	74.570	25.630	110.710	34.630

ENCLOSURE 7 (CONT.)

APPENDIX E

TRAFFIC IMPACT STUDY

KO OLINA II

Prepared for West Beach Estates

JANUARY 9, 1989

WILBUR SMITH ASSOCIATES

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SUMMARY

A traffic impact study was performed for the second phase of the Ko Olina development (Ko Olina II). The study included:

1. Collection of available traffic and land use data;
2. Review of existing traffic conditions;
3. The generation of site traffic for the Ko Olina II development;
4. The estimation of future traffic volumes with and without the project traffic, using the QRS II microcomputer model for years 1992 and 2005;
5. The capacity analysis of the planned roadways; and
6. The development and analysis of traffic mitigation measures at the key intersections and project driveways.

The proposed development will consist of two 18-hole golf courses, a 200,000 square foot shopping center, and a Garden Office Park with 375,000 square feet of floor area. The golf courses will be opened by 1992; while the commercial development will be phased in over a longer period of time. For the purposes of this impact study, it is assumed that the commercial development will be fully developed by the year 2005.

The planned roadways within the study area include:

- An extension of the Kapolei Parkway referred to herein as Ko Olina Parkway, from Kalaeloa Boulevard west to Farrington Highway.
- Ko Olina Connector, a north-south connector road between Farrington Highway and the Ko Olina Parkway.

- The construction of Kapolei Boulevard, a north-south roadway connecting Farrington Highway to the future Kapolei Parkway on the kokohead side of Kalaeloa Boulevard.
- Access driveways to the golf courses and commercial development.

The proposed development is expected to generate approximately 1,462 vehicle trip ends per day in 1992 and 17,869 vehicle trip ends per day in 2005 when the project is complete.

The planned roadways were analyzed based on the projected land use of proposed development projects within the Ewa area. The estimated future traffic volumes included traffic generated by these proposed development projects as well as the traffic generated by Ko Olina II. The resulting traffic mitigation measures needed to obtain an adequate level of service are due to the traffic generated by these other developments as well as Ko Olina II.

The following mitigation measures are recommended:

<u>Ko Olina Parkway</u>

- Construct Ko Olina Parkway as a four-lane roadway with left-turn lanes as planned.
- The intersection of Ko Olina Connector and Farrington Highway should prohibit left-turns. A diverging lane should be provided for right-turn into the connector and a merge lane should be provided for the right-turn from the Connector to Farrington Highway.
- The intersection of the Ko Olina Connector and Ko Olina Parkway can be stop-controlled initially, but to serve the forecasted volumes may require signalization in the future.

The forecasted volumes also indicate that the Connector should provide separate left-and right-turn lanes. Dual left-turn lanes may also be required on eastbound Ko Olina Parkway to serve the forecasted left-turn traffic volumes onto the Ko Olina Connector.

- The access driveways to the golf courses can also be stop controlled initially. However, increasing traffic volume on Ko Olina Parkway may warrant traffic signals at the driveways in the future.

- The driveway to the Ko Olina II commercial area will require signalization and separate left-and right-turn lanes. This driveway may require dual left-turn lanes for southbound exiting traffic. A right-turn lane on westbound Ko Olina Parkway should be provided to serve the forecasted volumes.

Ko Olina Parkway/Kalaeloa Boulevard Intersection

- The initial construction of the intersection of Ko Olina Parkway and Kalaeloa Boulevard should include two thru lanes and left-turn lanes on the eastbound and westbound approaches.

- The traffic volumes at the Ko Olina Parkway/Kalaeloa Boulevard intersection are expected to increase significantly by 2005 due to other future development and to Ko Olina II. The intersection will likely require dual left-turn lanes on all approaches. Separate right-turn lanes may be required on the north-bound, southbound and westbound approaches. Two through lanes are required on the eastbound and northbound approaches. Three through lanes may be required on the westbound approach. The analysis indicated that the incremental lane improvements to the intersection attributed to the project include a

southbound right-turn lane and an additional eastbound left-turn lane.

Palailai Interchange

- Due to traffic generated from the total proposed land use in the area, the eastbound on-ramp and westbound off-ramp at the Palailai Interchange should be widened to two lanes by 2005.

- A study should be undertaken to determine if the eastbound off-ramp to Farrington Highway should be removed due to high weaving volumes.

INTRODUCTION

Purpose

The purpose of this report is to present the findings and recommendations of a traffic impact study of the proposed second Ko Olina development phase (Ko Olina II). This study included the following tasks:

1. Collection of available information on land use, traffic volumes, roadway characteristics, planned improvements and other proposal developments within the vicinity;

2. The review of the existing traffic conditions;

3. The estimation of the site traffic generated by the proposed site;

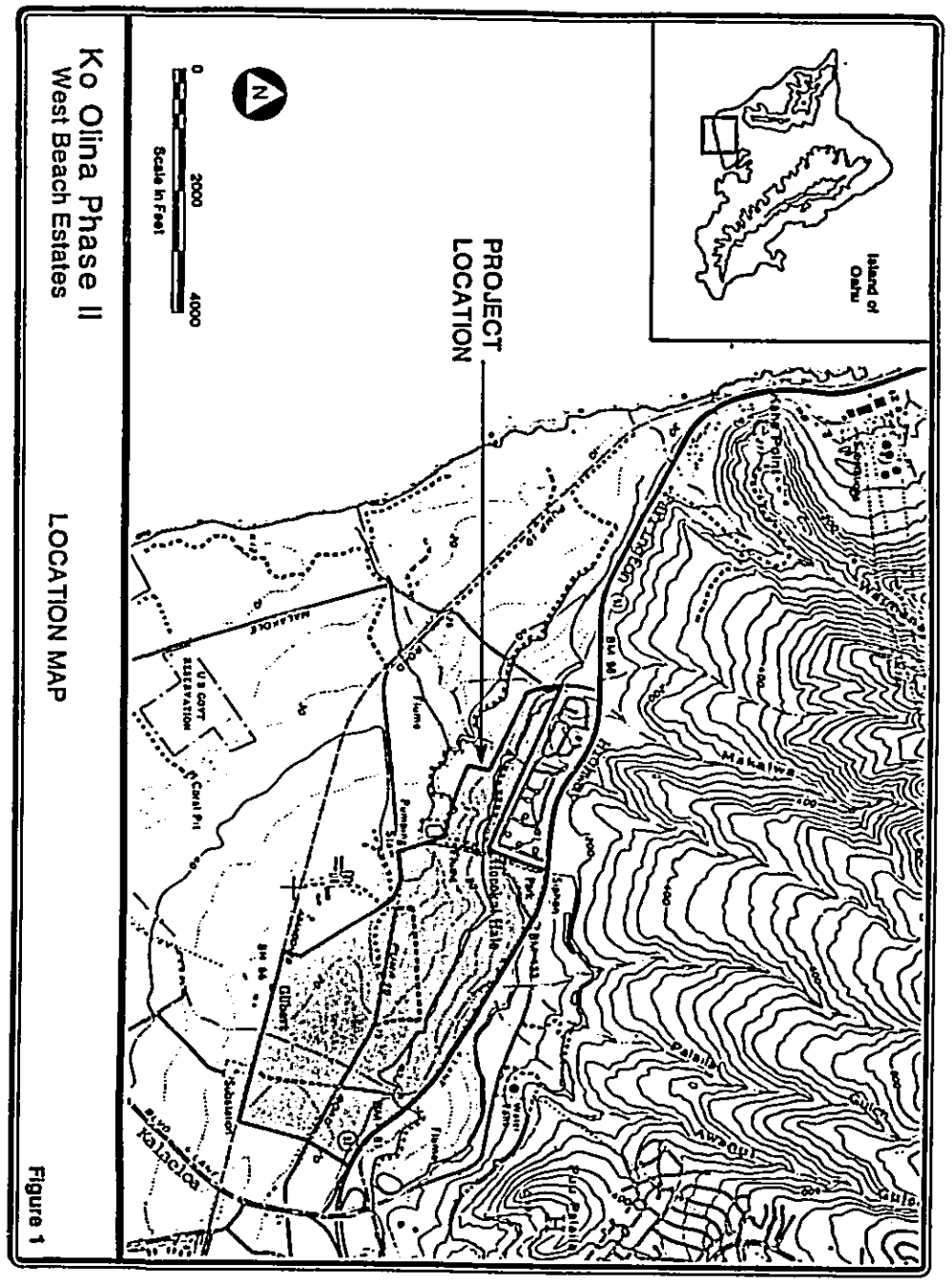
4. The estimation of the future traffic volumes with and without the proposed development; and

5. The analysis of the future traffic conditions and the recommendation of traffic mitigation measures.

Proposed Development

The site of the proposed second Ko Olina development phase is located on the Ewa plain of Oahu as shown in Figure 1. The site is located mauka of the Campbell Industrial area and to the southwest of Hakakilo. The proposed development will be bounded by Farrington Highway on the north, the proposed extension of Kapolei Parkway on the south, Kapolei City to the east, and the Honokai Hale residential area to the west. The first stage of the Ko Olina development which is being developed as a resort area is located southwest of the proposed Ko Olina II development.

The proposed Ko Olina II will include the following land uses.



1. Two eighteen hole golf courses.

2. A 16 acre commercial site for a community shopping center of approximately 200,000 square feet. The center could include a mix of resort-oriented shops, restaurants, convenience store, gas station, supermarket, and cinemas.

3. A Garden Office complex with 375,000 square feet of office space.

The golf courses are anticipated to be opened by the first quarter of 1992. The other elements of the proposed development are anticipated to be "built-out" by the year 2005.

EXISTING CONDITIONS

Existing Land Use

The study area is composed of a mixture of agricultural, residential, resort, industrial, and military uses. The project site is approximately 372.6 acres of land currently in sugar cane cultivation. The Honokai Hale/Nanakai Gardens is an existing residential area located adjacent to and north of the project site. The Campbell Industrial Park, which lays to the south of the site, is an existing large industrial area consisting of light and heavy industrial activities. Barbers Point is a U.S. Naval Air Station located to the southeast of the site. Both the Campbell Industrial Park and the Barbers Point Naval Air Station are existing attractors of traffic into the study area. The Hakakilo area to the northeast of the site is predominantly residential. The remaining areas are currently agricultural lands.

Existing Roadway Conditions

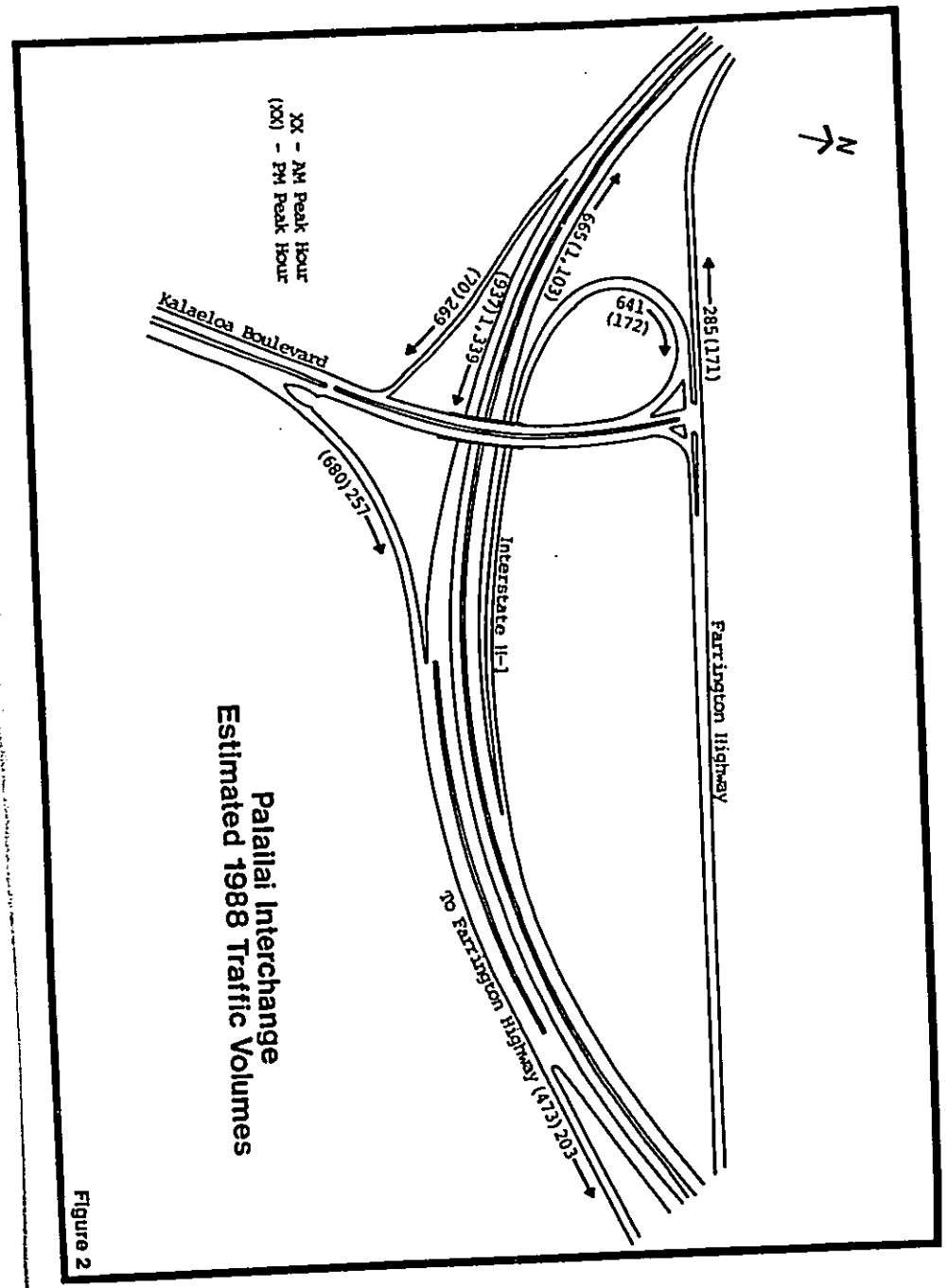
Interstate H-1 and Farrington Highway provide access to the site from the east and west. Interstate H-1 is a four-lane limited access facility running east-west through the study area. East of the Palailai Interchange, Farrington Highway is a two-lane arterial roadway extending from Waipahu to the project area where it merges with the Interstate H-1 facility. Farrington Highway is a four-lane arterial continuation of the H-1 facility west of the Palailai Interchange.

Access from H-1 to the study area is provided by the Palailai and Makakilo Interchanges. The Palailai Interchange shown on Figure 2 includes the following ramps from and to H-1:

1. West and eastbound off-ramps at Kalaeloa Boulevard;

2. Eastbound on-ramp serving traffic from the south at Kalaeloa Boulevard;

3. Eastbound off-ramp to Farrington Highway; and



Palailai Interchange
Estimated 1988 Traffic Volumes

Figure 2

4. Eastbound on-ramp from Farrington Highway.

Kalaeloa Boulevard provides north/south access to and from the Campbell Industrial Park to the south of the Palailai Interchange.

The Makakilo Interchange includes the following ramps at Makakilo Drive:

1. Westbound off-ramps;

2. Eastbound on-ramp serving traffic from the north; and

3. Eastbound on-ramp serving traffic from the south.

Existing Traffic Volumes

As noted above, the Palailai Interchange provides access to the site. The 1988 estimated traffic volumes on the Palailai Interchange are shown on Figure 2. The morning and evening peak-hour volumes on the eastbound on-ramp to H-1 are 257 and 680 vehicles per hour, respectively. The eastbound off-ramp from H-1 has 269 and 70 vehicles per hour, in the morning and evening peak-hours, respectively. The westbound off-ramp has 641 and 172 vehicles per hour in the morning and evening peak-hours. The morning peak-hour volume on the westbound on-ramp at Farrington Highway is 285 vehicles per hour and the evening peak volumes is 171 vehicles per hour.

FUTURE TRAFFIC CONDITIONS

Future traffic generated by development of the area surrounding the Ko Olina site was based on the land use and socioeconomic data for those areas, as projected by Campbell Estates and West Beach Estates. Traffic for the various land uses within the Ko Olina II project site were developed by use of standard trip generation rates. The site traffic estimates and socioeconomic data were input into the Quick Response System II (QRS II) microcomputer model to estimate future volumes. The roadway conditions were analyzed for the years 1992 and 2005.

Future Development Assumptions

The projected future development and socioeconomic data for the study area is shown on Table 1. The land use information for areas other than Ko Olina II was obtained from the following sources: (1) City and County of Honolulu, Department of General Planning data from the Hali 2005 land use projections; and (2) land use forecasts prepared by the Campbell Estates for areas of Ewa outside of the Ko Olina II development. The areas shown on Table 1 are also illustrated on Figure 3. The number of dwelling units within the area by year 2005 is estimated to be 26,898 units. The year 2005 employment in the Ewa area consists of 10,291 retail employees and 38,558 non-retail employees.

The proposed development consists of two 18 hole golf courses, a 200,000 square foot shopping center, and 375,000 square feet of Garden Offices. By 1992, only the two golf courses will be opened and the remaining development is anticipated to be "built-out" between 1992 and 2005.

Planned Roadways

Figure 4 shows the planned roadways within the vicinity of the site. The extension of Kapolei Parkway (Ko Olina Parkway) is planned as a part of the Ko Olina second phase from the Ko Olina I development to Kalaeloa Boulevard. A north-south connecting roadway (Ko Olina Connector) between Farrington

Highway and Ko Olina Parkway will also be constructed. The intersection of the Ko Olina Connector and Farrington Highway will prohibit left turns. The access roads to the two golf courses and commercial parcel are

Table 1

Development Assumptions for 2005 [A]
Ewa Areas Outside of Project

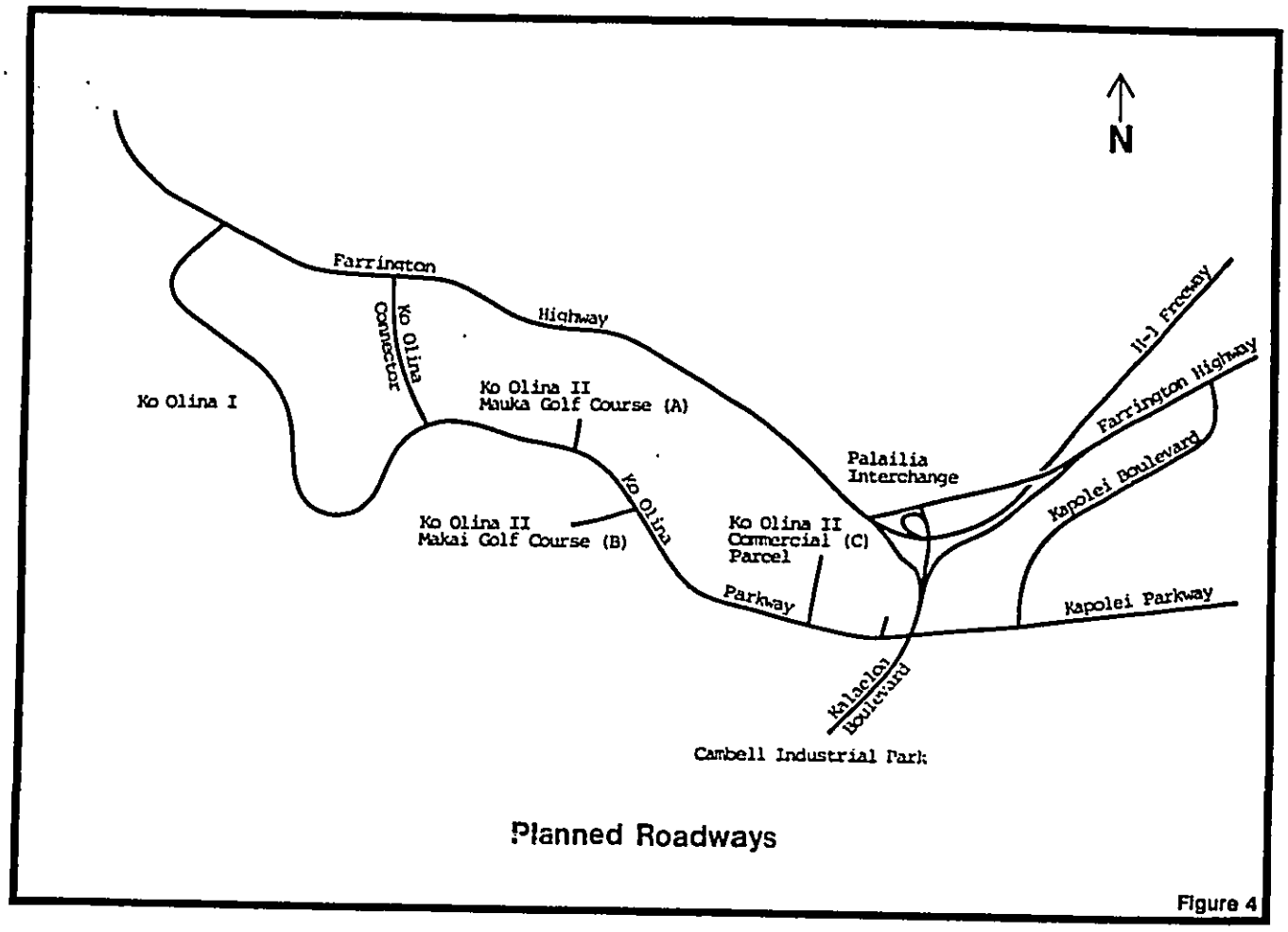
Areas	Dwelling Units	Retail Employment	Non-Retail Employment
D Mixed Use Devel. [B]	104	208	0
E Ko Olina I [C]	4,400	1,630	3,579
F Campbell Ind. Park	0	0	6,861
G Kapolei City	636	3,800	8,016
H Kapolei Village	1,900	438	873
I Honokai Hall/ Nanakai Gardens	500	0	0
J Ewa/Ewa Mill	500	26	27
K Ewa Marina	7,663	3,058	10,758
L Ewa Plantation	3,007	58	869
M Makakilo	7,358	588	2,391
N Barber's Point	830	485	5,184
Totals	26,898	10,291	38,558

NOTE:

A. Source: Except where noted the mid-range scenario from "Projections From Future Employment, Population, and Land Use for the Ewa Town Center," prepared by Kenneth Leventhal & Company March 1986, as adjusted by Wilbur Smith Associates.

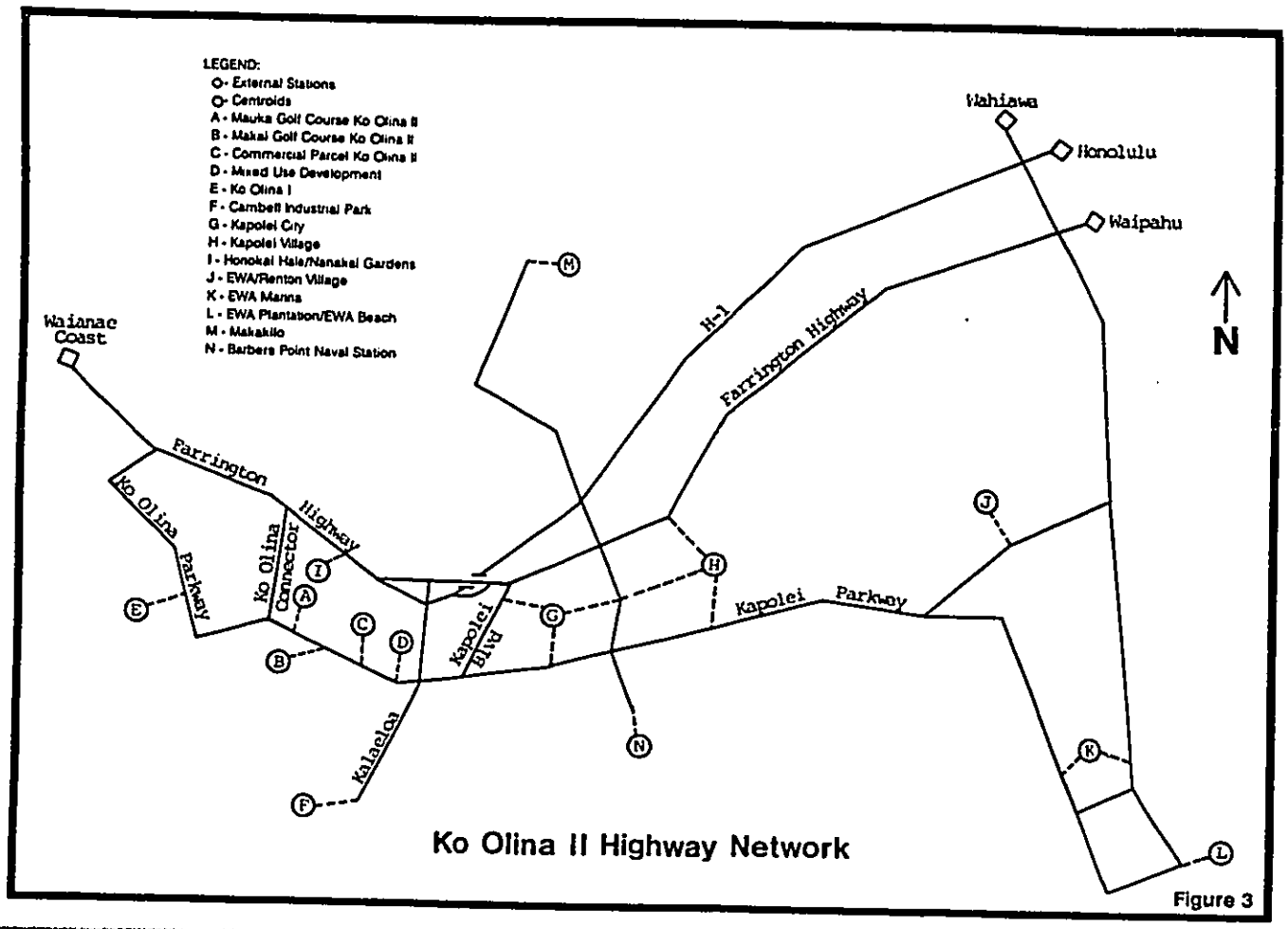
B. Source: Campbell Estates and Wilbur Smith Associates

C. Source: West Beach Estates and Wilbur Smith Associates



Planned Roadways

Figure 4



Ko Olina II Highway Network

Figure 3

also shown in Figure 4. The intersection of Kapolei Parkway and Kalaeloa Boulevard will be constructed as part of the overall development within the area. The construction of the Ko Olina Parkway is anticipated to be completed, including the intersection with Kalaeloa Boulevard, by 1992. The extension of Kapolei Parkway to the east will be phased in after 1992 and is assumed to be completed by the 2005 forecast year.

Forecasting Methodology

The future traffic volumes within the study were estimated using spreadsheet software and the QRS II microcomputer model. The QRS II model is based on techniques set forth in NCHRP 187, Quick-Response Urban Travel Estimation Techniques and Transferable Parameters, 1978.

The methodology for estimating future traffic volumes was as follows:

1. A highway network shown on Figure 4 was developed including the following facilities: (a) H-1; (b) Farrington Highway; (c) Ko Olina Parkway (Extension of Kapolei Parkway); (d) Kalaeloa Boulevard; and (e) Fort Weaver Road.

2. Transportation analysis zones were defined as shown on Figure 3.

3. For transportation analysis zones other than for Ko Olina II, socioeconomic data from the Hali 2005 transportation model were assigned to the transportation analysis zones.

4. The estimated trips generated by the proposed site were assigned to the transportation analysis zones for the site.

5. The QRS II model was run to estimate traffic volumes on the network with and without the proposed development.

6. Traffic volumes were estimated for the year 1992 and 2005.

Projected Site Traffic

The estimated traffic volumes generated by the land uses within the site are shown on Table 2. The proposed site will generate approximately 1,462 trips per day and 17,869 trips per day in the years 1992 and 2005, respectively.

Table 2
Projected Site Traffic in 1992 and 2005
Ko Olina II

Land Use Forecast Year	Average Daily Traffic	Morning Peak Hour To Project	Morning Peak Hour From Project	Afternoon Peak Hour To Project	Afternoon Peak Hour From Project
1992:					
18 Hole Golf Course	731	35	9	20	46
18 Hole Golf Course	731	35	9	20	46
Totals	1,462	70	18	40	92
2005:					
18 Hole Golf Course	731	35	9	20	46
18 Hole Golf Course	731	35	9	20	46
Shopping Center (200,000 S.F.)	11,786	184	80	422	476
Garden Offices (375,000 S.F.)	4,621	698	131	135	690
Totals	17,869	952	229	597	1,258

Future Traffic Volumes Without Project

Morning and evening peak-hour traffic volumes were estimated for the year 2005 without the project traffic. Figure 5 shows 2005 traffic volumes at the intersection of the Ko Olina Parkway and the Ko Olina Connector and at the

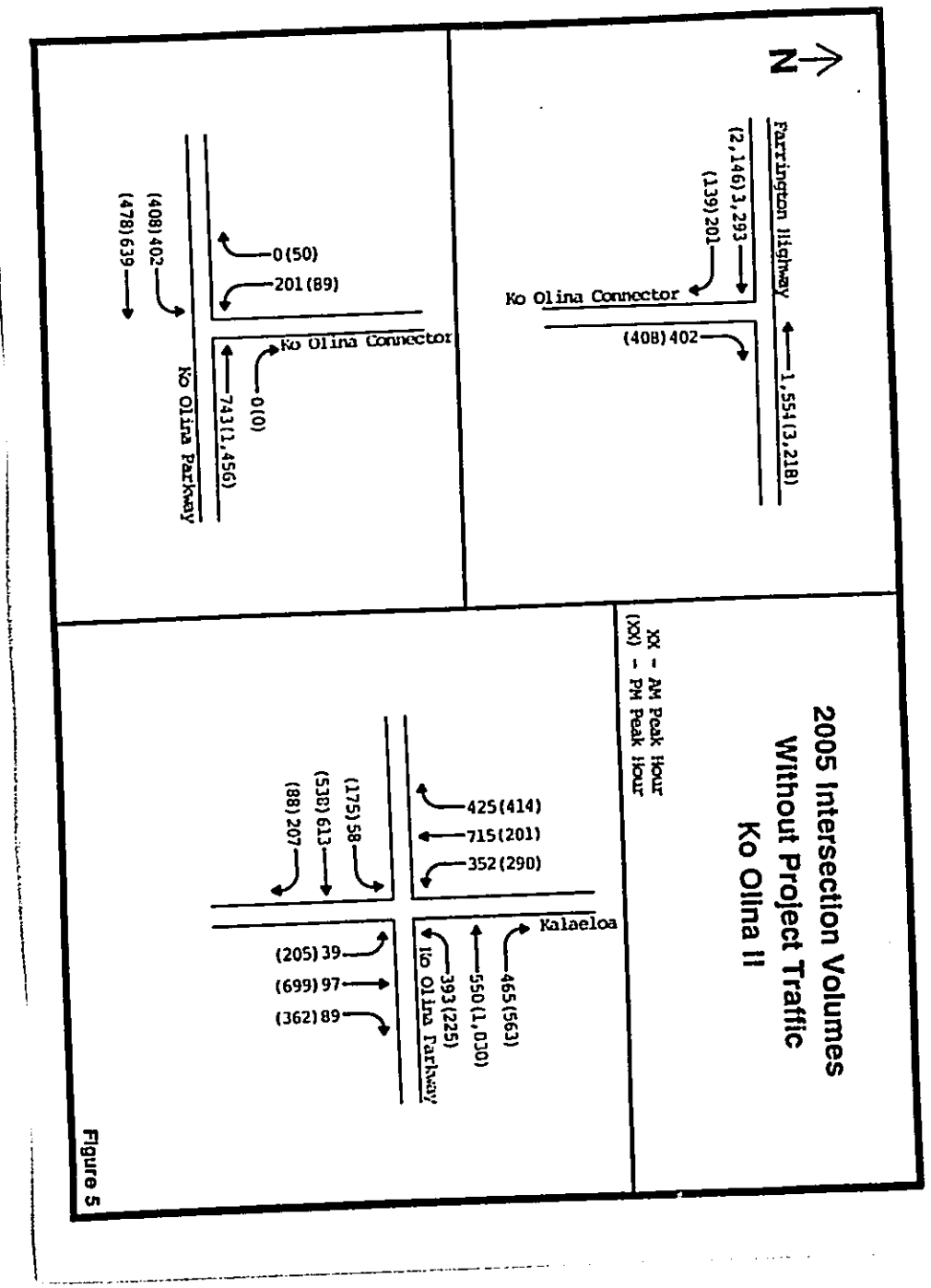


Figure 5

intersection of the Ko Olina Parkway and Kalaeloa Boulevard without project traffic. Figure 6 shows the 2005 traffic volumes on the Palailai Interchange without project traffic.

Future Traffic Volumes With Project Traffic

The 1992 morning and evening peak-hour volumes with project traffic are shown in Figures 7 and 8. The project accounts for a small percentage of the traffic on the Ko Olina Parkway in 1992. For example, the project traffic on westbound Ko Olina Parkway just east of the Hauka Golf Course Driveway is 50 vehicles per hour during the evening peak-hour. This volume accounts for approximately 6 percent of the total westbound traffic at this location.

The year 2005 traffic volumes with the project traffic are shown for the key intersections and driveways on Figures 9 and 10. At the Ko Olina Parkway/Kalaeloa Intersection, the largest difference in traffic volumes with and without the project occurs during the evening peak-hour. Approximately 1,180 more vehicles per hour, or 20 percent more traffic, enter the intersection with the project than without the project. The largest difference in a turning volume at this intersection with and without the project is for the right-turn movement from the north. With the project traffic, the right-turn volume is 886 vehicles per hour during the evening peak-hour compared to 425 vehicles per hour without the project traffic.

A comparison of the volumes shown in Figures 5 and 9 show that approximately 18 percent more traffic enter the Ko Olina Parkway/Ko Olina Connector intersection during the evening peak-hour with the project than without the project.

Figure 11 shows the 2005 traffic volumes with project traffic on the Palailai Interchange. At the interchange, the largest difference in traffic volume with and without the project on the ramps occurs during the morning peak-hour. Approximately 542 more vehicles per hour, or 16 percent more traffic, are estimated to use the interchange ramps with the project than without the project. The largest difference occurs in the morning peak-hour traffic on the westbound off-ramp of the Palailai Interchange. The peak-hour volume is

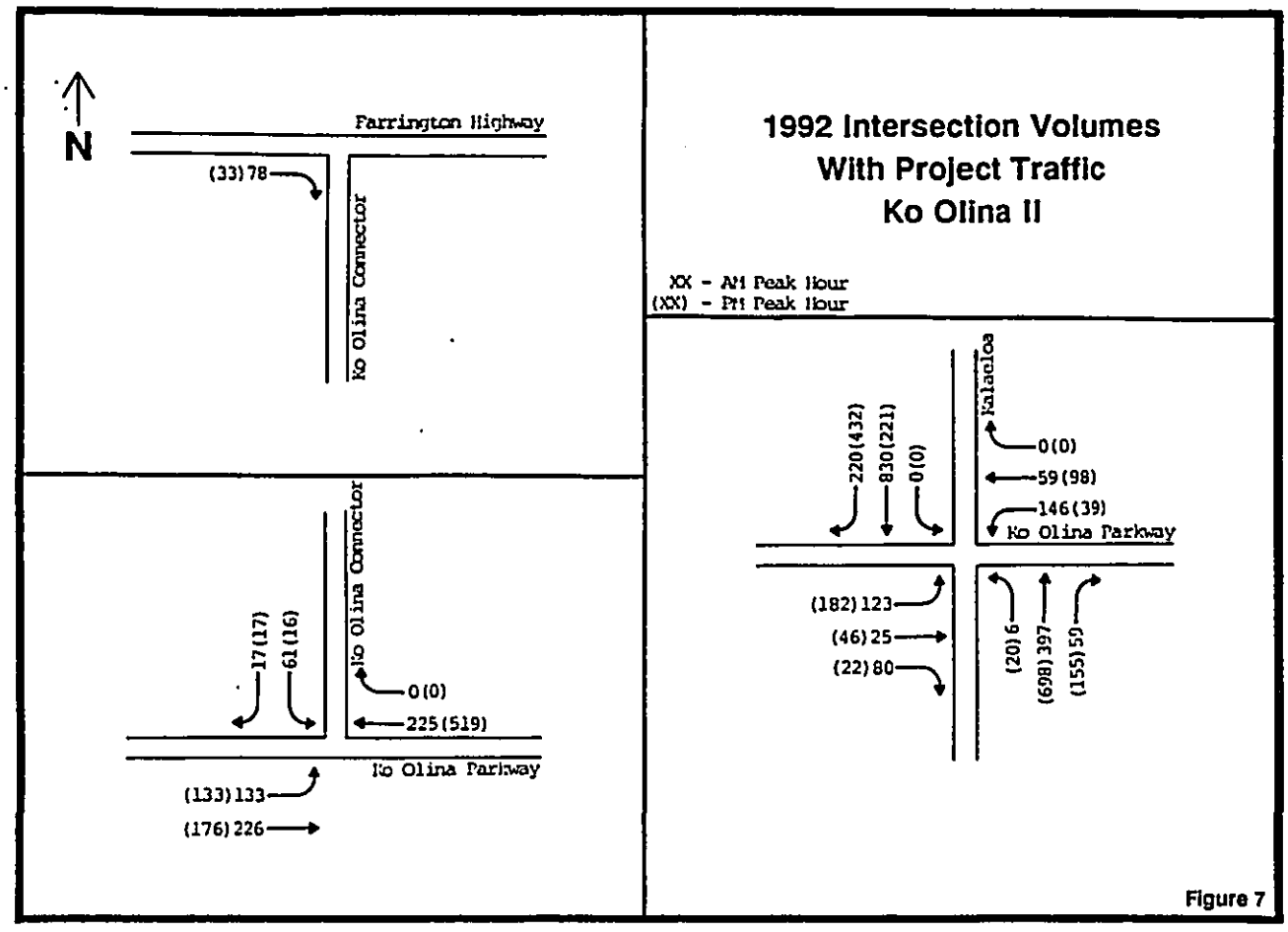


Figure 7

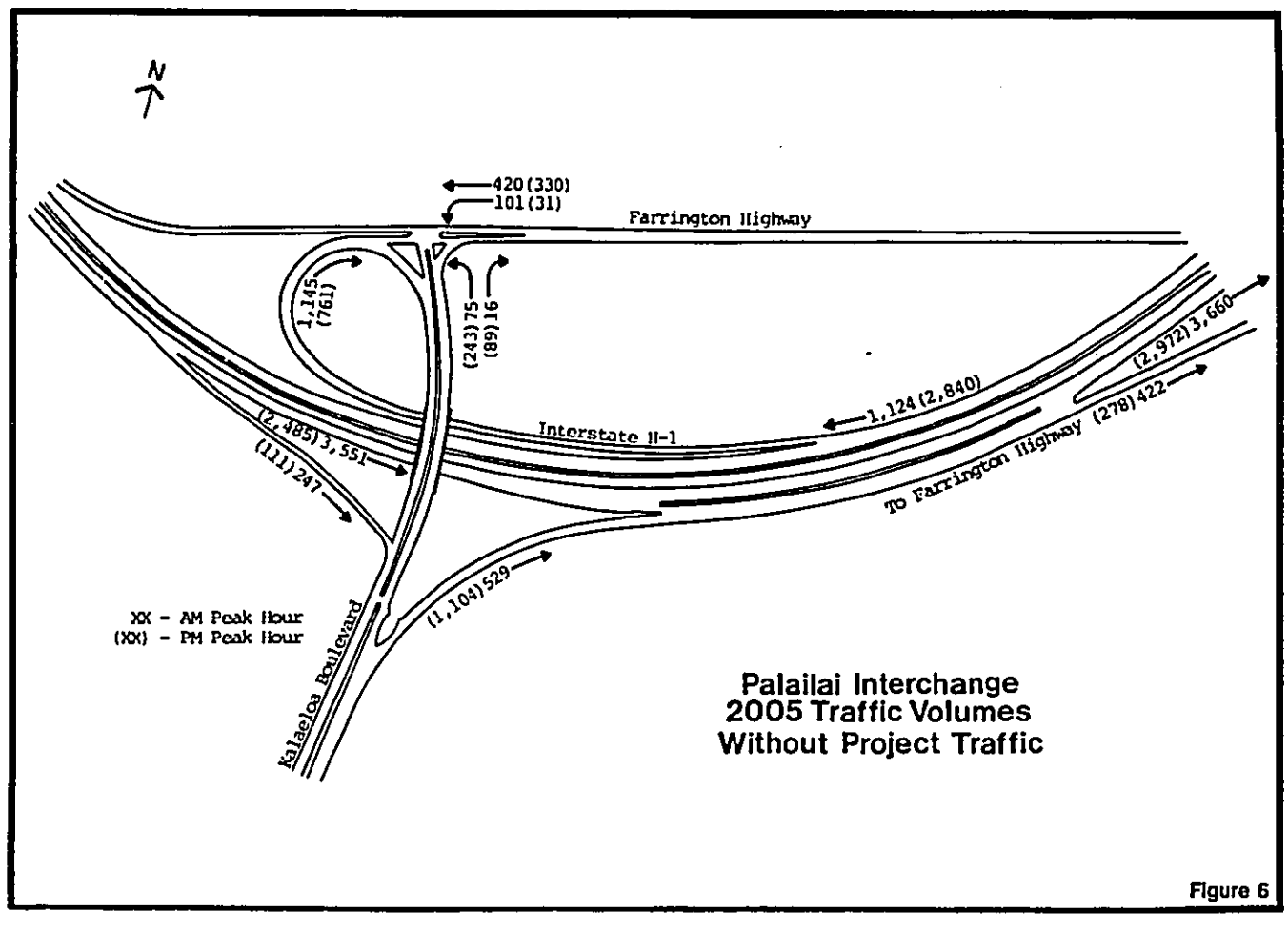


Figure 6

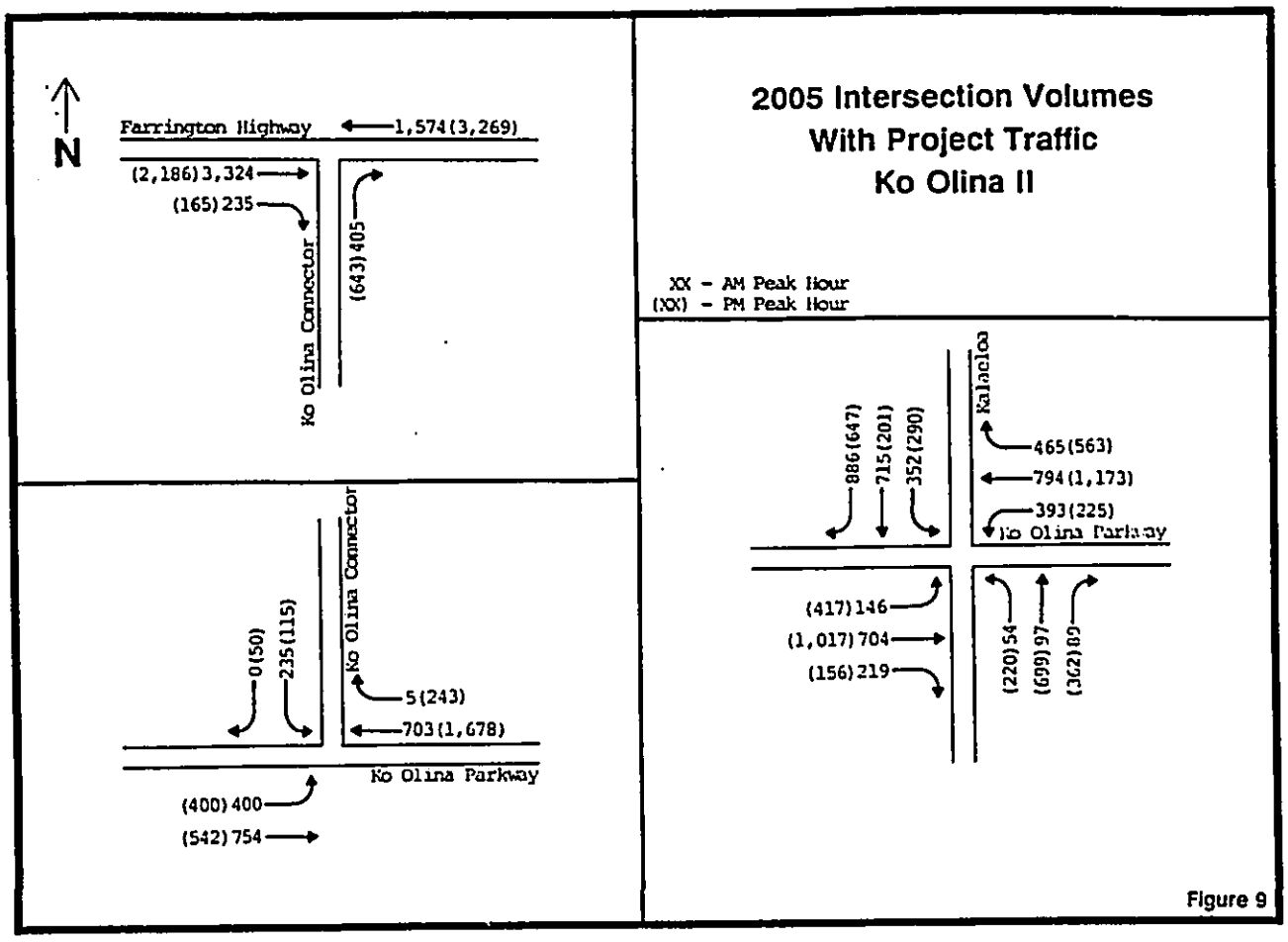


Figure 9

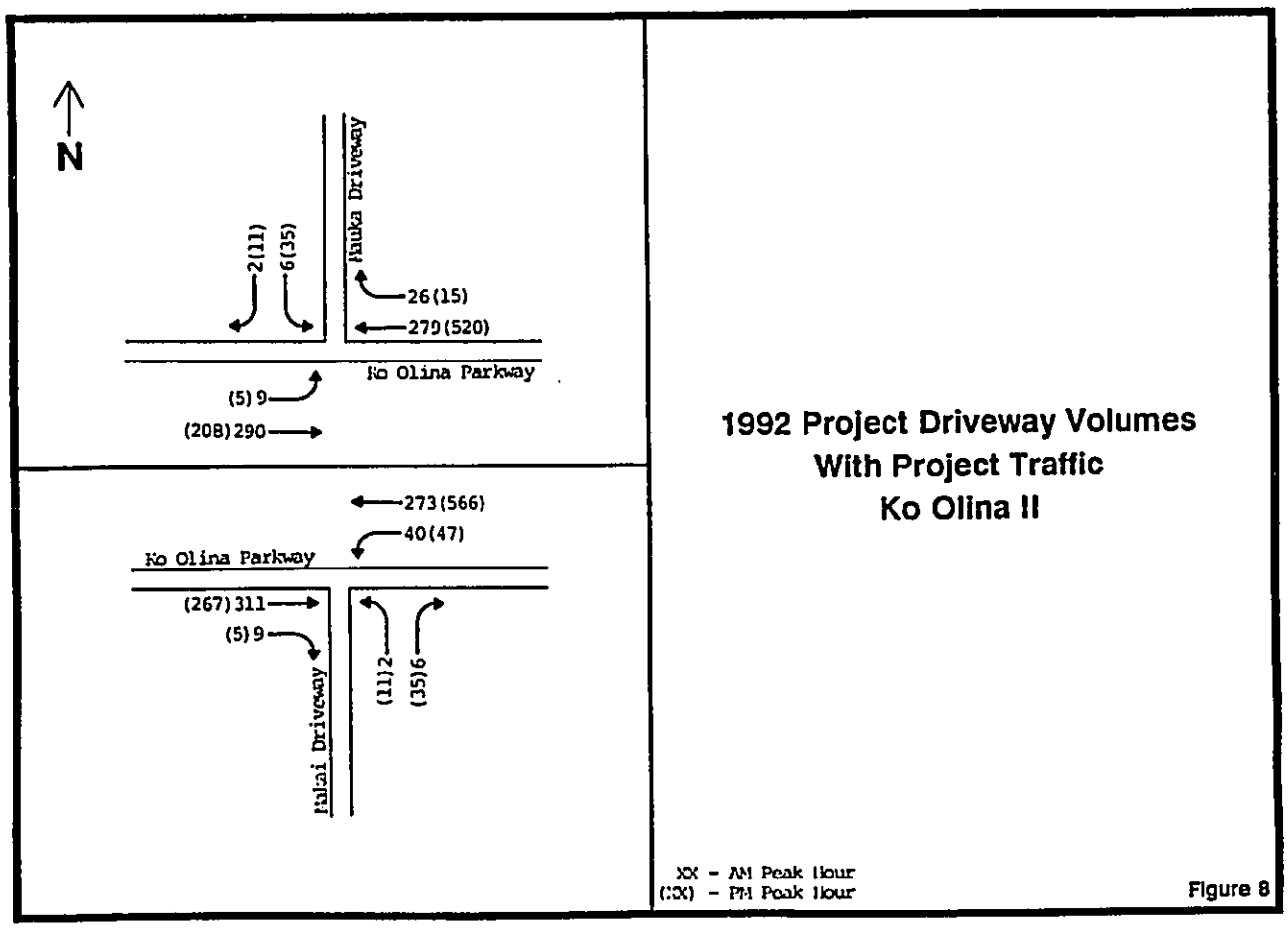


Figure 8

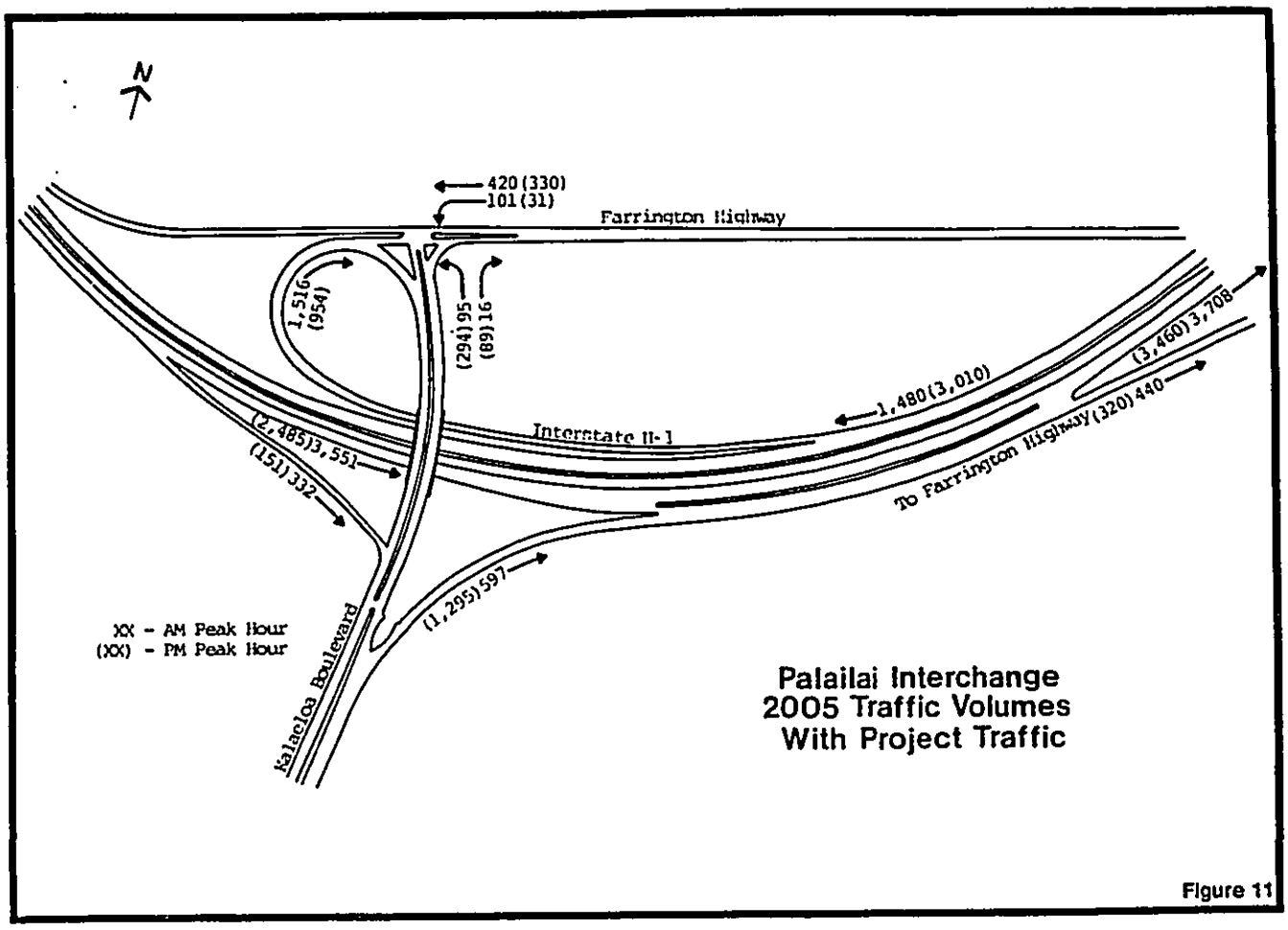


Figure 11

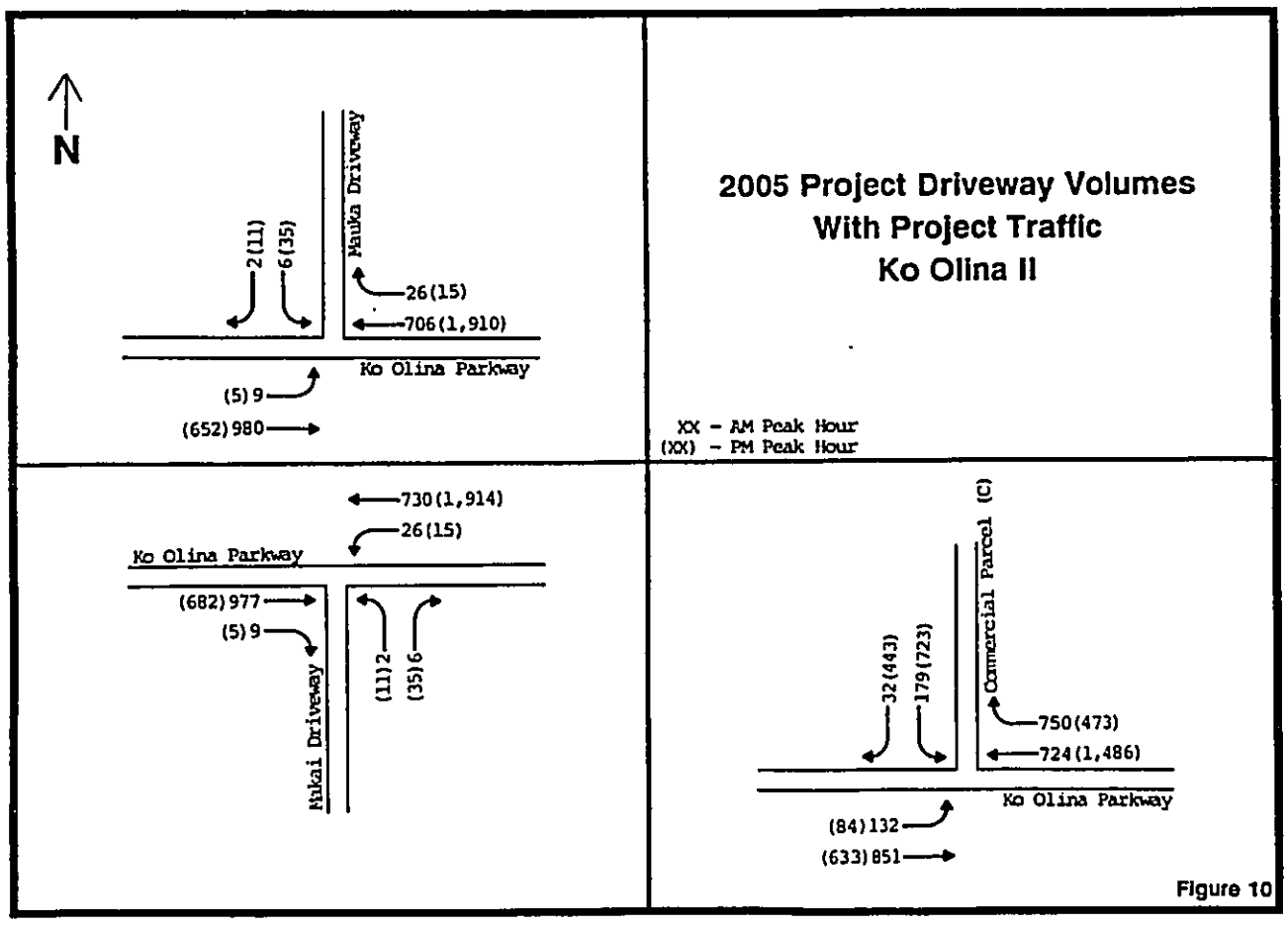


Figure 10

1,145 vehicles per hour without the project traffic and 1,516 vehicles with the project traffic.

Capacity Analysis

The key intersections and project driveways were analyzed using the 1985 Highway Capacity Manual planning analysis method. The capacity analysis is based on the traffic volumes generated by Ko Olina II as well as the other proposed projects within the Ewa area. Table 3 shows a summary of the volume-capacity analysis for roadways with and without the project traffic. The volume-capacity analyses summarized in Table 3 assumes that Ko Olina Parkway has four lanes plus separate left-turn lanes at the intersections and driveways and that all intersections are signalized.

As shown on Table 3, the two golf course driveways will operate at Level of Service C or better with the estimated year 2005 traffic volumes. However, the intersection of the Ko Olina Parkway and the driveway to the Ko Olina II commercial area will operate at Level of Service F. At this intersection, the estimated 2005 traffic volumes indicate that additional improvements are required to obtain a satisfactory level of service.

Based on the travel forecast, the intersection of the Ko Olina Parkway and the Ko Olina Connector will operate at Level of Service D without the project traffic and Level of Service F with the project traffic. Additional lanes are needed at this intersection to improve level of service. Based on the travel forecast, the intersection of the Ko Olina Parkway and Kalaeloa will operate at Level of Service F both without and with the project traffic in the year 2005. Additional lanes would be required at this intersection to improve the level of service given these estimated volumes. The specific mitigation measures which would be required to accommodate the traffic volumes generated by Ko Olina II and other proposed developments are discussed in the next section.

Table 3

2005 Roadway Service Levels
Afternoon Peak Hour
With and Without Project Traffic

Intersection	Without Project V/C	Without Project L.O.S.	With Project V/C	With Project L.O.S.
Ko Olina Pkwy/ Hauka Golf Course Driveway	N.A.		0.72	C
Ko Olina Pkwy/ Makai Golf Course Driveway	N.A.		0.69	B
Ko Olina Pkwy/ Commercial Driveway	N.A.		1.28	F
Ko Olina Pkwy/ Ko Olina Connector	0.88	D	1.05	F
Ko Olina Pkwy/ Kalaeloa Blvd.	1.28	F	1.50	F

V/C = Volume/Capacity
L.O.S. = Level of Service

Assumptions:

1. Four lanes plus left-turn lanes on Ko Olina Parkway and Kalaeloa Boulevard, and signalization of each intersection along Ko Olina Parkway.

2. V/C ratios are based on a capacity (L.O.S. E) of 1,400 vehicles per hour for the sum of the critical lane volumes.

MITIGATION MEASURES

Traffic mitigation measures were developed and analyzed for key intersections and driveways. The need for traffic mitigation measures is due to the combined impact of the various developments within the Ewa area. The Ko Olina II project will contribute to that overall need through the additional increment of traffic that the project would add to the planned roadways. Some mitigation measures, such as those proposed for the Ko Olina Parkway/Kalaeloa Boulevard intersection, will only be necessary if the land use develops as currently proposed. Table 4 summarizes the volume/capacity analysis with the mitigation measures which are discussed below.

Golf Course Driveways

The access driveways to the golf courses should be stop-sign controlled at the intersection with Ko Olina Parkway and allow for separate left- and right-turns from each golf course driveway. The driveways should be monitored in the future to determine if signal installation will be warranted.

Intersection of Commercial Driveway

The intersection of the Ko Olina Parkway and the Commercial Driveway should be signalized with a separate left-turn phase on the eastbound approach of Ko Olina Parkway. The driveway to the commercial area should be four lanes with separate left- and right-turn lanes to the Ko Olina Parkway. The 2005 estimated traffic volumes indicate that a dual left-turn lane exiting the driveway may be required. A right-turn lane on westbound Ko Olina Parkway may also be required to serve the estimated traffic volumes.

Ko Olina Parkway

The Ko Olina Parkway should be constructed as a four-lane roadway with left-turn lanes as currently planned. The 2005 evening peak-hour volume just east of the Ko Olina Connector is 1,931 vehicles per hour eastbound.

Table 4

2005 Roadway Service Levels
Afternoon Peak Hour
With Proposed Mitigation Measures

Intersection	V/C	L.O.S.
Ko Olina Pkwy/ Hauka Driveway	0.72	C
Ko Olina Pkwy/ Hakai Driveway	0.69	C
Ko Olina Pkwy/ Commercial Driveway	0.85	D
Ko Olina Pkwy/ Ko Olina Connector	0.82	D
Ko Olina Pkwy/ Kalaeloa Blvd.	0.85	D

V/C = Volume/Capacity
L.O.S. = Level of Service

V/C ratios are based on a capacity (L.O.S. E) of 1,400 vehicles per hour for the sum of the critical lane volumes.

With the mitigation measures at the intersections discussed below, the Parkway will operate at a level of service between C and D. Since turning lanes may be added along the Parkway to accommodate future volumes, it may be desirable to widen the eastern portion of Ko Olina Parkway to three lanes in each direction in the future to maintain capacity along the Parkway.

Intersections Of Ko Olina Connector

Traffic at the intersection of the Ko Olina Connector and Farrington Highway should be permitted to turn right only into and out of the Connector. A diverging lane should be provided on Farrington Highway for the right-turn into the Connector. The right-turn lane from the Connector should have a merge lane added for eastbound traffic.

The 1992 volumes indicate that the intersection of the Connector and Ko Olina Parkway can be stop-controlled on the Connector approach in 1992. The Connector should provide for separate left- and right-turn lanes at the intersection with the Parkway. The estimated 2005 traffic volumes indicate that the intersection will likely require signalization in the future with a separate left-turn phase for eastbound traffic. Traffic volumes should be monitored periodically to determine when a traffic signal should be installed. A dual left-turn lane on the eastbound approach of the Ko Olina Parkway may be required by 2005.

Intersection Of Kalaeloa Boulevard And Ko Olina Parkway

For initial construction, the eastbound and westbound approaches on the Kalaeloa Boulevard/Ko Olina Parkway intersection should provide two-lanes through plus a left-turn lane. The intersection should be signalized with separate left-turn phases on the eastbound and westbound approaches. Due to large turning volumes generated by traffic both from other development and from Ko Olina II by the year 2005, the following lane configuration would be needed at this intersection:

Ko Olina Parkway/Kalaeloa Boulevard
Suggested Configuration For Estimated 2005 Traffic Volumes

Approach	Left-Turn Lanes	Thru-Lanes	Right-Turn Lanes
Northbound	2	2	1
Southbound	2	2	1
Eastbound	2	2	--
Westbound	2	3	1

With the above intersection approach lanes, the intersection will operate at level of service "D" in the year 2005.

The capacity analysis indicated that the bulk of the above improvements to the intersection would be required to accommodate the year 2005 traffic volumes without the project. The incremental lane improvements attributed to the project include a southbound right-turn lane and an additional eastbound left-turn lane.

Palailai Interchange

The analysis of the interchange indicates that due to the overall future development within the study area, both the eastbound on-ramp and westbound off-ramp at Kalaeloa Boulevard will be congested by the year 2005. The proposed project adds only a small portion of the increased traffic at the interchange. The congested conditions are due to the total accumulated volume generated by all future development.

Both the eastbound on-ramp and westbound off-ramps should be widened to two lanes to accommodate future traffic. Also, the weaving movement is high between the eastbound off-movement to Farrington Highway and the eastbound on-movement from Kalaeloa Boulevard. As volumes increase, this weaving movement should be monitored to determine if the off-bound ramp to Farrington Highway should be closed. The other ramps on the Palailai Interchange should operate at a satisfactory level of service with the forecasted volumes.

APPENDIX F

AIR QUALITY STUDY

FOR THE PROPOSED

KO OLINA RESORT PHASE II

EWA, OAHU, HAWAII

Prepared for:

Wilson Okamoto & Associates

Prepared by:

Barry D. Root & Barry D. Neal

January 1989

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1.0 INTRODUCTION AND PROJECT DESCRIPTION

West Beach Estates is proposing to begin development of Phase II of its Ko Olina Resort located at Ewa, Oahu, Hawaii. Because of the increased projected demand for golf facilities, Phase II plans provide for two 18-hole championship golf courses. It is also being proposed that the existing Kamokila Neighborhood Park be relocated to a larger, more accessible site very near the present location during this stage of the project. Other Phase II plans include a commercial retail village and a low rise office complex. Thus, Phase II will consist of the development of two 18-hole championship golf courses and a commercial center and the relocation of an existing neighborhood park.

Figure 1 is a project location map showing the location of the Ko Olina Resort. The resort is located in the Ewa District inland from the shore nearly one mile and south of the H-1 Freeway near the Palailai Interchange. Other developments in the area include the existing Honokai Hale/Nanakai Gardens and the proposed Kapolei Town Center. As indicated in the master plan shown as Figure 2, the Phase II Ko Olina site will occupy about 373 acres of land. An east-west roadway will divide the two golf courses, and the commercial center will be located along the eastern boundary. Presently, the project site is in active use for sugarcane cultivation. Development of the golf courses is expected to be completed by 1992. Development of the commercial center would be completed at a later date.

The purpose of this study is to describe existing air quality in the project area and to assess the potential short-term and long-term direct and indirect air quality impacts that could result from construction and use of the proposed facilities as planned. Measures to mitigate these impacts are suggested where possible and appropriate.

2.0 AMBIENT AIR QUALITY STANDARDS (AAQS)

National Ambient Air Quality Standards (AAQS) are specified in Section 40, Part 50 of the Code of Federal Regulations (CFR), while State of Hawaii AAQS are defined in Chapter 11-59 of the Hawaii Administrative Rules. Table 1 summarizes both the national and the state AAQS that are specified in the cited documents. As indicated in the table, AAQS have been established for six pollutants: particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone and lead. National AAQS are stated in terms of primary and secondary standards. National primary standards are designed to protect the public health with an "adequate margin of safety". National secondary standards, on the other hand, define levels of air quality necessary to protect the public welfare from "any known or anticipated adverse effects of a pollutant". Secondary public welfare impacts may include such effects as decreased visibility, diminished comfort levels, or other potential injury to the natural or man-made environment, e.g., soiling of materials, damage to vegetation or other economic damage. In contrast to the national AAQS, Hawaii State AAQS are given in terms of a single standard that is designed "to protect public health and welfare and to prevent the significant deterioration of air quality".

Each of the regulated pollutants has the potential to create or exacerbate some form of adverse health effect or to produce environmental degradation when present in sufficiently high concentration for prolonged periods of time. The AAQS specify a maximum allowable concentration for a given pollutant for one or more averaging times to prevent detrimental effects. Averaging times vary from one hour to one year depending on the pollutant and type of exposure necessary to cause adverse effects. In the case of the short-term (i.e., 1- to 24-hour) AAQS, both national and state standards allow one exceedance per year.

State of Hawaii AAQS are in some cases considerably more stringent than comparable national AAQS. In particular, the State of Hawaii 1-hour AAQS for carbon monoxide is four times more stringent than the comparable national limit. While the national AAQS for carbon monoxide is based on health considerations, the respective State of Hawaii carbon monoxide standards are designed primarily to prevent significant deterioration of ambient air quality.

Under the provisions of the Federal Clean Air Act [1], the U.S. Environmental Protection Agency (EPA) is required to periodically review and re-evaluate national AAQS in light of research findings more recent than those which were available at the time the standards were originally set. Occasionally new standards are created as well. Most recently, the national standards for particulate matter were revised to include specific limits for particulates 10 microns or less in diameter (PM-10) [2]. The State of Hawaii has not explicitly addressed the question of whether to set limits for this category of air pollutant, but national AAQS prevail where states have not set their own more stringent levels.

Hawaii AAQS for sulfur dioxide were relaxed in 1986 to make them essentially the same as national limits. It has been proposed in various forums that the state also relax its carbon monoxide standards to the national levels, but at present there are no indications that such a change is being considered.

3.0 PRESENT AIR QUALITY

Present air quality at Ko Olina is likely to be affected by air pollutants from four types of sources: natural, industrial, agricultural, and vehicular. Natural air pollution sources which could affect Ko Olina air quality include the ocean (sea spray), plants (aero-allergens), wind-blown dust, and perhaps distant volcanoes on the Island of Hawaii. Nearby industrial sources of emissions include the Hawaiian Electric Company power plant at Kahe Point and the Campbell Industrial Park. The predominant wind pattern in this area of Oahu carries emissions from these facilities offshore and away from the site, but occasional impacts are probable. The primary source of air pollution in the area related to agriculture is sugar cane harvesting, while any vehicle-related emissions affecting the site mostly come from Farrington Highway and the H-1 Freeway.

The State Department of Health operates an air quality monitoring station in Campbell Industrial Park about one mile southeast of the project site. A summary of measurements from this monitoring station is presented in Table 2. Starting in 1971, total suspended particulate, sulfur dioxide and nitrogen dioxide were all measured over 24-hour sampling periods at the Campbell Industrial Park monitoring station.

In March 1972 the sampling station was moved from the Barbers Point lighthouse to the Chevron oil refinery, about one mile inland, because the particulate concentrations monitored were found to be mostly sea salt from evaporated ocean spray. This is reflected in the comparatively high particulate values that were measured during 1971. Measurements of 24-hour particulate concentrations between 1972 and 1985 generally averaged about 50 ug/m^3 with a range of about 25 to 150 ug/m^3. Occasional exceedances of the AAQS for particulate were recorded during this time. In November 1985 particulate monitoring at the station was changed from total suspended particulate to PM-10. Twenty-four hour average PM-10 concentrations for 1986 and 1987 were only about half as high as the total suspended fraction for preceding years, suggesting that approximately 50 percent of the particulate matter in the air has a particle size that is greater than 10 microns diameter. Measurements of PM-10 for the last two years reported are well within the present national AAQS.

Sulfur dioxide concentrations monitored at the station have been consistently low with annual mean values at or below 5 ug/m^3. The maximum 24-hour average concentration for the entire period of record is 95 ug/m^3. All values measured in recent years have been well within the state and national AAQS.

Nitrogen dioxide concentrations were measured from 1971 through 1976. Annual mean values were found to vary from 11 to 29 ug/m^3, safely inside the state and national AAQS.

Unfortunately, there are no long-term measurements of carbon monoxide, ozone or lead in the immediate vicinity of Ko Olina.

During 1981 the nearest carbon monoxide concentrations were measured at Fort DeRussey in Waikiki (about 19 miles southeast of the project). In 1982-83 the closest carbon monoxide levels were monitored at Leahi Hospital in Kaimuki (about 21 miles east of the project). From 1984 onward the only leeward Oahu carbon monoxide measurements were made at the Department of Health building in downtown Honolulu (about 18 miles east of Ko Olina). In recent years, the average daily maximum 1-hour concentration has been measured at about 2 mg/m^3. During the most recent year reported, 1987, the daily maximum 1-hour concentration ranged from 0.3 to 11.1 mg/m^3; one exceedance of the state AAQS was recorded. During the previous year (1986), three exceedances of the state AAQS were reported.

The nearest available ozone measurements were taken at Sand Island (about 16 miles east of the project site). During 1987 the Sand Island daily maximum 1-hour concentration averaged 38 ug/m^3 and ranged from 4 to 84 ug/m^3, and there were no exceedances of the state AAQS. Maximum 1-hour concentrations during 1986 and 1987 were significantly lower than those measured between 1983 and 1985.

Monitoring for lead was initiated in 1984 at the Department of Health monitoring station in Downtown Honolulu. During the past four years, the annual average quarterly lead concentrations have had a downward trend falling from 0.3 to 0.0 ug/m^3. No exceedances of the state AAQS have ever been recorded.

From the data presented in Tables 2 and 3, it appears that State of Hawaii AAQS for particulates, sulfur dioxide, nitrogen dioxide and lead are currently being met at monitoring stations nearest to

the project site. The ozone AAQS has not been exceeded during the past two years at the Sand Island monitoring station. Carbon monoxide readings from urban Honolulu, which has the only monitoring station on Oahu, indicate that the state AAQS for carbon monoxide may be exceeded at a rate of one to three times per year in traffic congested areas. In the vicinity of the project, traffic congestion is not a problem at the present time.

4.0 SHORT-TERM DIRECT AND INDIRECT IMPACTS OF PROJECT CONSTRUCTION

For a project of this nature, there are two potential sources of air pollution emissions which could directly result in short-term air quality impacts during project construction: (1) fugitive dust from vehicle movement and soil excavation and (2) exhaust emissions from on-site construction equipment. Indirectly, there could also be short-term impacts from slow-moving construction equipment traveling to and from the project site and from a temporary increase in local traffic caused by commuting construction workers.

Fugitive dust emissions may arise from grading and dirt-moving activities within the project site. The emission rate for fugitive dust is nearly impossible to estimate accurately because of its elusive nature and because the potential for its generation varies greatly depending upon the type of soil at the construction site, the amount and type of dirt-disturbing activity taking place, the moisture content of exposed soil in work areas, and the wind speed. The EPA [3] has provided a rough estimate for uncontrolled fugitive dust emissions from construction activity of 1.2 tons per acre per month under conditions of "medium" activity, moderate soil silt content (30%), and semiarid climate (precipitation/evaporation (P/E) index of 50). Soils in the project area are primarily clay soils with fine textured subsoil or underlying material. Local

climate in the Ko Olina vicinity is relatively dry. Thus, uncontrolled fugitive dust emissions from construction sites in the Ko Olina area would probably be somewhat higher than the level suggested above. In any case, State of Hawaii Air Pollution Control Regulations [4] require that visible emissions of fugitive dust from construction activity be essentially nil.

Adequate fugitive dust control can usually be accomplished by establishment of a frequent watering program to keep bare-dirt surfaces in work areas from becoming significant dust generators. Control regulations also require that open-bodied trucks be covered at all times when in motion if they are transporting materials likely to give rise to airborne dust. Paving of parking areas and establishment of landscaping as early in the construction process as possible can also lower the potential for fugitive dust emissions.

On-site mobile and stationary construction equipment will emit some air pollutants in the form of engine exhausts. The largest of this equipment is usually diesel-powered. Nitrogen oxides emissions from diesel engines can be relatively high compared to gasoline-powered equipment, but the standard for nitrogen dioxide is set on an annual basis and is not likely to be violated by short-term construction equipment emissions. Carbon monoxide emissions from diesel engines, on the other hand, are very low and should be relatively insignificant compared to vehicular emissions on nearby roadways.

Indirectly, slow-moving construction vehicles on roadways leading to and from the project site could obstruct the normal flow of traffic to such an extent that overall vehicular emissions are

increased, but this impact can be mitigated by moving heavy construction equipment during periods of low traffic volume. Likewise, the schedules of commuting construction workers can be adjusted to avoid peak hours in the project vicinity. Thus, most potential short-term air quality impacts from project construction can be mitigated.

5.0 LONG-TERM INDIRECT IMPACTS

5.1 Roadway Traffic

By serving as an attraction for increased motor vehicle traffic on nearby roadways, the proposed project must be considered to be a potential indirect air pollution source. Motor vehicles with gasoline-powered engines are significant sources of carbon monoxide. They also emit nitrogen oxides, and those burning leaded gasoline can contribute lead to the atmosphere. The use of leaded gasoline in new automobiles is now prohibited. As older vehicles continue to disappear from the numbers of those currently operating on the state's roadways, lead emissions are approaching zero. Nationally, so few vehicles now require leaded gasoline that the EPA is proposing a total ban on leaded gasoline to take effect immediately. Even without such a ban, reported quarterly averages of lead in air samples collected in urban Honolulu have been near zero since early 1986. Thus, lead in the atmosphere is not considered to be a problem anywhere in the state.

Federal air pollution control regulations also call for increased efficiency in removing carbon monoxide and nitrogen oxides from vehicle exhausts. By the year 1995 carbon monoxide emissions are expected to be about one fourth less than the amounts now emitted. At present, however, no further reductions in vehicular emissions

have been mandated and increases in traffic levels after 1995 will result in directly proportional increases in vehicle-related pollutant emissions.

To evaluate the potential long-term indirect air quality impact of increased roadway traffic associated with a project such as this, it is standard practice to utilize computerized atmospheric dispersion models to estimate ambient carbon monoxide concentrations along roadways leading to and from the project. Carbon monoxide is selected for modeling because it is both the most stable and the most abundant of the motor vehicle generated pollutants. Furthermore, carbon monoxide air pollution is generally considered to be a microscale problem, whereas nitrogen oxides air pollution most often is a regional issue. This is reflected in the fact the AAQS for carbon monoxide are specified on a short-term basis (1-hour and 8-hour averaging times) while the AAQS for nitrogen dioxide is set on an annual basis.

Three scenarios were selected for study: year 1988 with present conditions, year 2005 without the project and year 2005 with the project. To begin the carbon monoxide modeling study, critical receptor areas in the vicinity of the project were identified for analysis. Generally speaking, roadway intersections are the primary concern because of traffic congestion and because of the increase in vehicular emissions associated with traffic cycling: decelerating, stopping, queueing and accelerating.

The traffic impact assessment report for the project [5] describes the present and future conditions and configurations of the roadway system in the vicinity of the Ko Olina Resort. Briefly, Kalaeloa Road running north-south between Farrington Highway/H-1 Freeway and

Campbell Industrial Park and on/off ramps at H-1 and Kalaeloa Road are the only existing roadways that are expected to be significantly impacted by the project. By the year 2005, an east-west roadway (Ko Olina/Kapolei Parkway) will be built that intersects with Kalaeloa Road and provides access to the proposed golf courses and commercial center. This road will also intersect with another new north-south roadway (Ko Olina Connector Road) which will run between Farrington Highway and Ko Olina Parkway on the west side of the golf courses. More detailed descriptions of the Ko Olina roadways are provided in the traffic study cited above.

The main objectives of the modeling study were to estimate both current and projected levels of maximum 1-hour average carbon monoxide concentrations which could be directly compared to the national and state AAQS. The traffic impact assessment report indicates that traffic volumes generally are or will be higher during the afternoon peak hour than during the morning peak period. Worst-case meteorological dispersion conditions usually occur during the early morning hours. Thus, even though afternoon traffic counts may be higher, the morning peak traffic hour usually can be expected to cause the highest air pollution concentrations along roadways. However, due to possible effects from the queuing of vehicles at intersections, both morning and afternoon peak traffic hours were examined to ensure that worst-case concentrations were identified.

The EPA computer model MOBILE3 [6] was used to calculate vehicular carbon monoxide emission estimates for each of the years studied. Based on recent vehicle registration figures, the present and projected vehicle mix in the project area is estimated to be 91.9% light-duty gasoline-powered vehicles, 4.2% light-duty gasoline-powered trucks and vans, 0.5% heavy-duty gasoline-powered vehicles,

1% diesel-powered trucks and buses, and 1% motorcycles. It was assumed that about 21 percent of all vehicles would be operating in the cold-start mode and that about 27 percent would be operating in the hot-start mode. These are standard, default values that are used in calculating cold/hot start emissions. National averages for "mis-fueling" were assumed. Ambient temperatures of 59 and 68 degrees F were used for morning and afternoon peak-hour emission computations, respectively. This is a conservative assumption since ambient temperatures will generally be warmer than this and emission estimates given by MOBILE3 are inversely proportional to the ambient temperature.

After computing vehicular carbon monoxide emissions through the use of MOBILE3, these data were then input to the computer model CALINE4 [7]. CALINE4 was developed by the California Transportation Department and the EPA to simulate vehicular movement and atmospheric dispersion of vehicular emissions. It is designed to predict 1-hour average pollutant concentrations along roadways based on input traffic and emission data, roadway/receptor geometry and meteorological conditions.

Input peak-hour traffic data were obtained from the traffic study cited previously. The traffic volumes given in the traffic study for the future scenarios include project traffic as well as traffic from other growth that is expected to occur in the area by the year 2005.

Model roadways were set up to reflect actual roadway geometry, physical dimensions and operating characteristics. Model receptor sites were located approximately 10 meters from the edge of the

roadways near all roadway intersections at a height of 1.5 meters above grade to simulate levels within the normal human breathing zone.

Input meteorological conditions for this study were defined to provide "worst-case" results. One of the key meteorological inputs is atmospheric stability category. For these analyses, atmospheric stability category 6 was assumed for the morning case and stability category 4 was assumed for the afternoon case. These are the most conservative stability categories that can be used for estimating morning and afternoon pollutant dispersion in model calculations. A surface roughness length of 100 cm was assumed with a mixing height of 500 meters. Worst-case wind conditions were defined as a wind speed of 1 meter per second with a wind direction resulting in the highest predicted concentration.

Existing background concentrations of air pollution in the project vicinity are believed to be low. Hence, background contributions of carbon monoxide from sources or distant roadways not directly considered in the analysis were assumed to be close to zero. A small concentration of 0.1 ppm was added to all predicted concentrations for the 1988 scenario to make allowance for background. For the year 2005 scenarios, a background concentration of 1.0 ppm was assumed.

Table 4 summarizes the final results of the modeling study in the form of the estimated worst-case 1-hour morning and afternoon ambient carbon monoxide concentrations. These results can be compared directly to the state and the national AAQS. Estimated worst-case carbon monoxide concentrations are presented in the table for three scenarios: year 1988 with existing traffic and year

2005 both with and without traffic from the proposed project. The locations of these estimated worst-case 1-hour concentrations all occurred at or very near the indicated intersections.

Insofar as present conditions are concerned, the only existing roadway in the study area is Kalaeloa Road. As indicated in the table, the estimated present (1988) worst-case 1-hour carbon monoxide concentration along Kalaeloa Road near the Palailai Interchange was 4.4 mg/m^3. This occurs near the H-1 eastbound off ramp at Kalaeloa Road during the morning peak traffic hour. Afternoon peak-hour concentrations in the vicinity of the Palailai Interchange were estimated to be about one half the morning values.

In the year 2005 without the proposed project, a worst-case 1-hour concentration of 17.8 mg/m^3 was predicted to occur during the morning peak traffic hour near the intersection of Kalaeloa Road and Kapolei/Ko Olina Parkway. This intersection will have a relatively high traffic volume with much turning movement. Values at the other locations studied for the 2005 without project case were predicted to be less than 10 mg/m^3 during the morning peak hour. Afternoon peak-hour concentrations were estimated to reach about 75 percent of the worst-case values occurring in the morning except at the intersection of Farrington and Kalaeloa where an afternoon traffic queue will likely form.

The estimated worst-case 1-hour concentration for the year 2005 scenario with the proposed project was 19.7 mg/m^3. This would occur near the intersection of Kalaeloa Road and Kapolei/Ko Olina Parkway during the morning, similar to the without project scenario. The predicted worst-case concentrations at other

locations during both morning and afternoon peak traffic hours were generally less than 10 mg/m^3.

Thus, all estimated worst-case 1-hour carbon monoxide levels are well within the national AAQS of 40 mg/m^3. It appears possible, however, that the State of Hawaii 1-hour AAQS of 10 mg/m^3 could be exceeded on occasion near the Kalaeloa Road/Kapolei Parkway intersection either with or without the proposed project in the year 2005. The state AAQS may also be exceeded occasionally during the afternoon peak hour near the intersection of Ko Olina Parkway and the driveway for the proposed commercial center and near the intersection of Farrington and Kalaeloa in the year 2005 with project scenario. Predicted worst-case 1-hour concentrations for the morning peak hour either with or without the proposed project at the Ko Olina Parkway/Ko Olina Connector Road intersection are also very close to the state standard.

Worst-case 8-hour carbon monoxide concentrations were estimated by adjusting the predicted worst-case 1-hour values for both 8-hour traffic demand volume and for meteorological persistance. The ratio of average hourly traffic during the peak 8-hour period to the peak 1-hour traffic volume for the Ko Olina area is conservatively estimated to be 0.8. The meteorological persistence factor for 1-hour to 8-hour conversions is generally taken to be 0.6 [8]. The resulting estimated worst-case 8-hour concentrations are indicated in Table 5. For the 1988 scenario, the estimated worst-case 8-hour carbon monoxide concentration was 2.1 mg/m^3 at the intersection of Kalaeloa Road and the H-1 eastbound off ramp. The predicted maximum values for the year 2005 without and with project scenarios were 8.5 and 9.5 mg/m^3, respectively; both occurred at the Kalaeloa/Kapolei/Ko Olina intersection. All Estimated 8-hour

maximum carbon monoxide concentrations are within the 10 mg/m^3 national AAQS. Predicted present levels are within the State of Hawaii AAQS of 5 mg/m^3, but it appears possible that the future scenarios considered here could result in exceedance of the state 8-hour standard either with or without the proposed project at some locations in the Ko Olina area.

The results of this study reflect several assumptions that must be made concerning traffic movement and worst-case meteorological conditions. One such assumption concerning worst-case meteorological conditions is that a wind speed of 1 meter per second with a steady direction for 1 hour will occur. A steady wind of 1 meter per second blowing from a single direction for an hour is not very likely, and it may occur only once a year or less. With wind speeds of 2 meters per second, for example, computed carbon monoxide concentrations would be only about half the values given above.

5.2 Electrical Generation

The annual electrical demand of the project when fully developed will be relatively minimal. Any air pollution emitted indirectly by electrical generating facilities providing this power will likely be negligible.

5.3 Solid Waste Disposal

Solid waste generated by the project when fully completed is expected to be minimal. Most if not all of this refuse would be hauled away from the project and either landfilled or burned at

another location. Any indirect air pollution emissions are expected to be insignificant.

5.4 Golf Course Pesticide Usage

Once the project is completed and the golf courses are in use, it will be necessary to regularly apply various chemical fertilizers and pesticides to maintain grass quality. AAQS have not been established for any of the pesticides presently in use, although most of them carry warning or caution labels on their containers. The primary purpose of these labels is to provide occupational safety and health guidance regarding proper handling and application. The primary risk of using these chemicals is to the applicator rather than to individuals at possible receptor sites downwind, since these individuals should encounter airborne concentrations of these chemical substances only in greatly diluted form if at all. There are, however, certain precautions that must be followed by pesticide applicators in order to prevent significant downwind drift when spraying. Primary among these are the use of a coarse rather than a fine spray and application under low wind speed conditions when the wind direction will not contribute to drift towards the clubhouse area or to nearby residences. Provided that proper safety precautions are followed, the potential for serious air quality degradation from chemical spraying for golf course maintenance will likely be minimal.

6.0 SUMMARY OF IMPACTS AND MITIGATIVE CONSIDERATIONS

6.1 Impacts Summary

The major short-term air quality impact of the project will be project construction and the potential emission of significant

quantities of fugitive dust. Uncontrolled fugitive dust emissions from construction activities are estimated to amount to about 1.2 tons per acre per month. During construction phases, emissions from engine exhausts (primarily consisting of carbon monoxide and nitrogen oxides) will also occur both from on-site construction equipment and from vehicles used by construction workers traveling to and from the project.

All long-term air quality impacts associated with the proposed project are indirect. The primary long-term air pollution impact from the project will arise from the increased motor vehicle traffic associated with the project. Increased levels of carbon monoxide concentrations along roadways leading to and from the proposed development will be the main problem, especially near the new intersection of Kalaeloa and Kapolei/Ko Olina Parkway. Based on mathematical modeling of projected vehicular traffic and atmospheric dispersion calculations, it is predicted that carbon monoxide concentrations in the vicinity of the project will unavoidably increase by the year 2005 either with or without the project, but the predicted highest concentrations should remain within the national ambient air quality standards set by the U.S. Environmental Protection Agency. However, the more stringent State of Hawaii ambient air quality standards for carbon monoxide may be exceeded. The current state standard is so low, however, it is probably exceeded at nearly any intersection in the state that has even moderate traffic volumes. It is worth noting here that, although the national AAQS allow higher levels of carbon monoxide, the national standards were developed after extensive research with the objective of defining levels of air quality that would protect the public health with an adequate margin of safety.

Other indirect air quality impacts of the project from electrical power demand and from solid waste disposal are expected to be negligible.

Pesticides will be used on the project golf courses to maintain grass quality. If applied during low wind conditions using proper application techniques, contamination of nearby, downwind areas by airborne drift should not be a problem.

6.2 Mitigative Considerations

Strict compliance with State of Hawaii Air Pollution Control Regulations regarding establishment of a regular dust-watering program and covering of dirt-hauling trucks will be required to effectively mitigate fugitive dust emissions from construction activities. Twice daily watering is estimated to reduce dust emissions by up to 50 percent. Paving of parking areas and establishment of landscaping early in the construction schedule will also help to control dust. Increased vehicular emissions due to disruption of traffic by construction equipment and/or commuting construction workers can be alleviated by moving equipment and personnel to the site during off-peak traffic hours.

The long-term projected impacts of carbon monoxide emissions from vehicular traffic associated with the completed development assume that all of the mitigative measures suggested in the traffic impact study will be employed to move traffic efficiently through the project area and adjacent locations. In addition, the results of this air quality modeling study assume that merge lanes will be provided both on Kalaeloa Road and on Ko Olina Parkway to receive right turning vehicles from traffic heading westbound on Kapolei

Parkway and southbound on Kalaeloa Road. A merge lane on Kalaeloa Road near the H-1 eastbound off ramp may also be necessary to receive traffic exiting from the freeway. The modeling results indicated that the heavy right turning traffic at these locations must be kept moving to maintain the national AAQS for carbon monoxide.

Since indirect air quality impacts from project electrical demand and from solid waste disposal are expected to be minimal, no specific mitigative measures are suggested for these two issues. Compliance with existing safety guidelines for the spraying of chemicals for golf course maintenance should mitigate potential air quality impacts from this activity.

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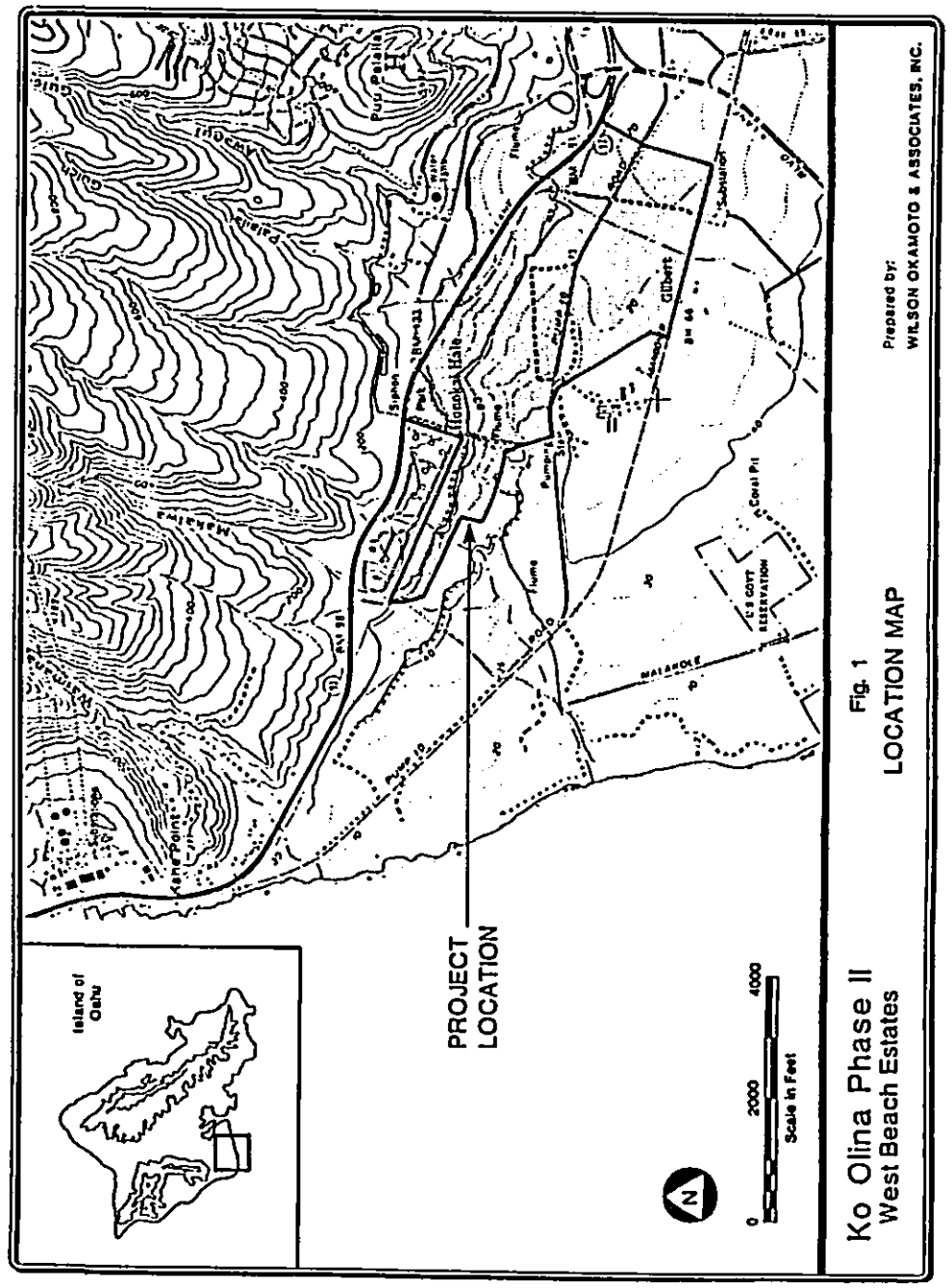

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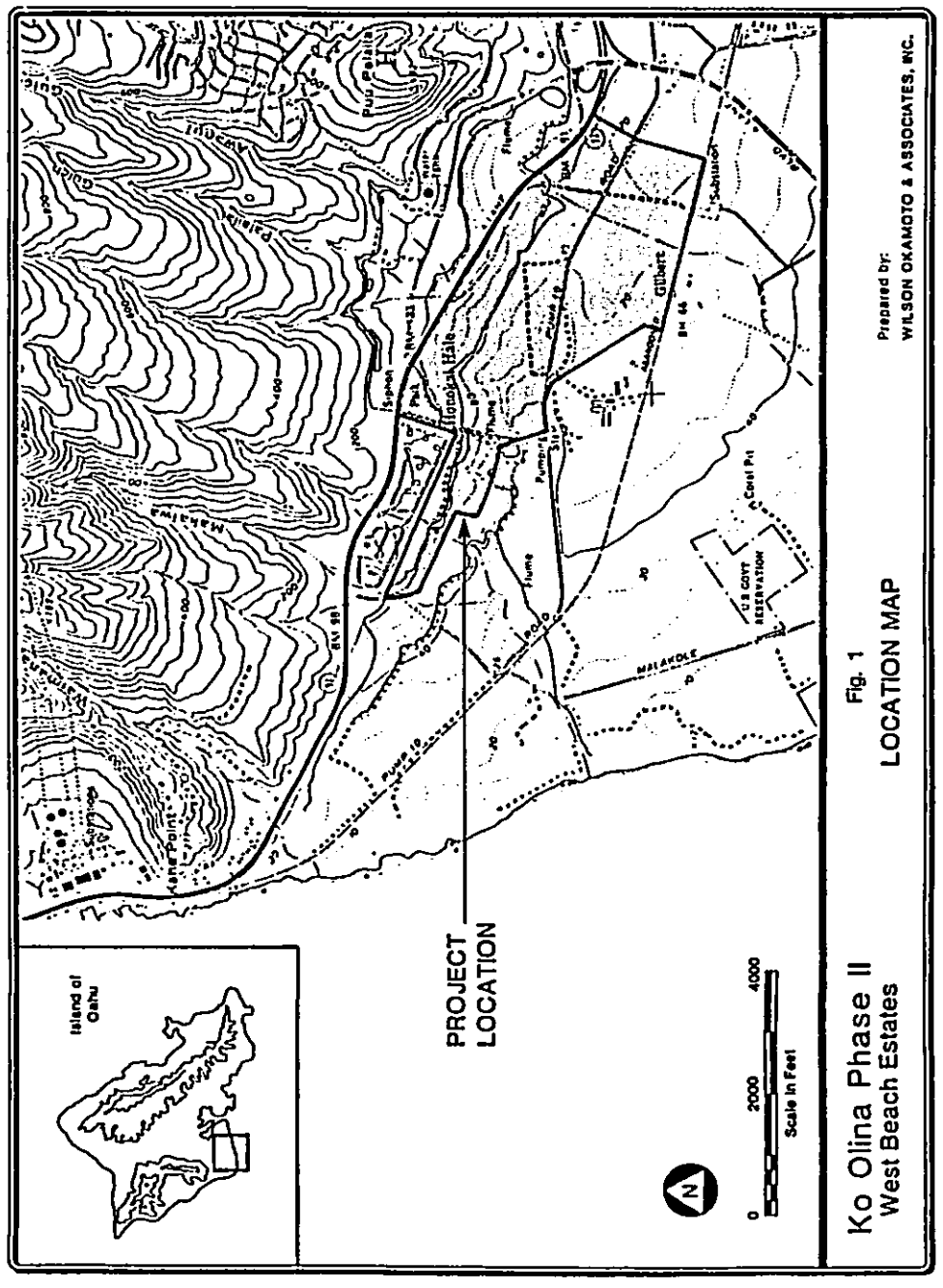

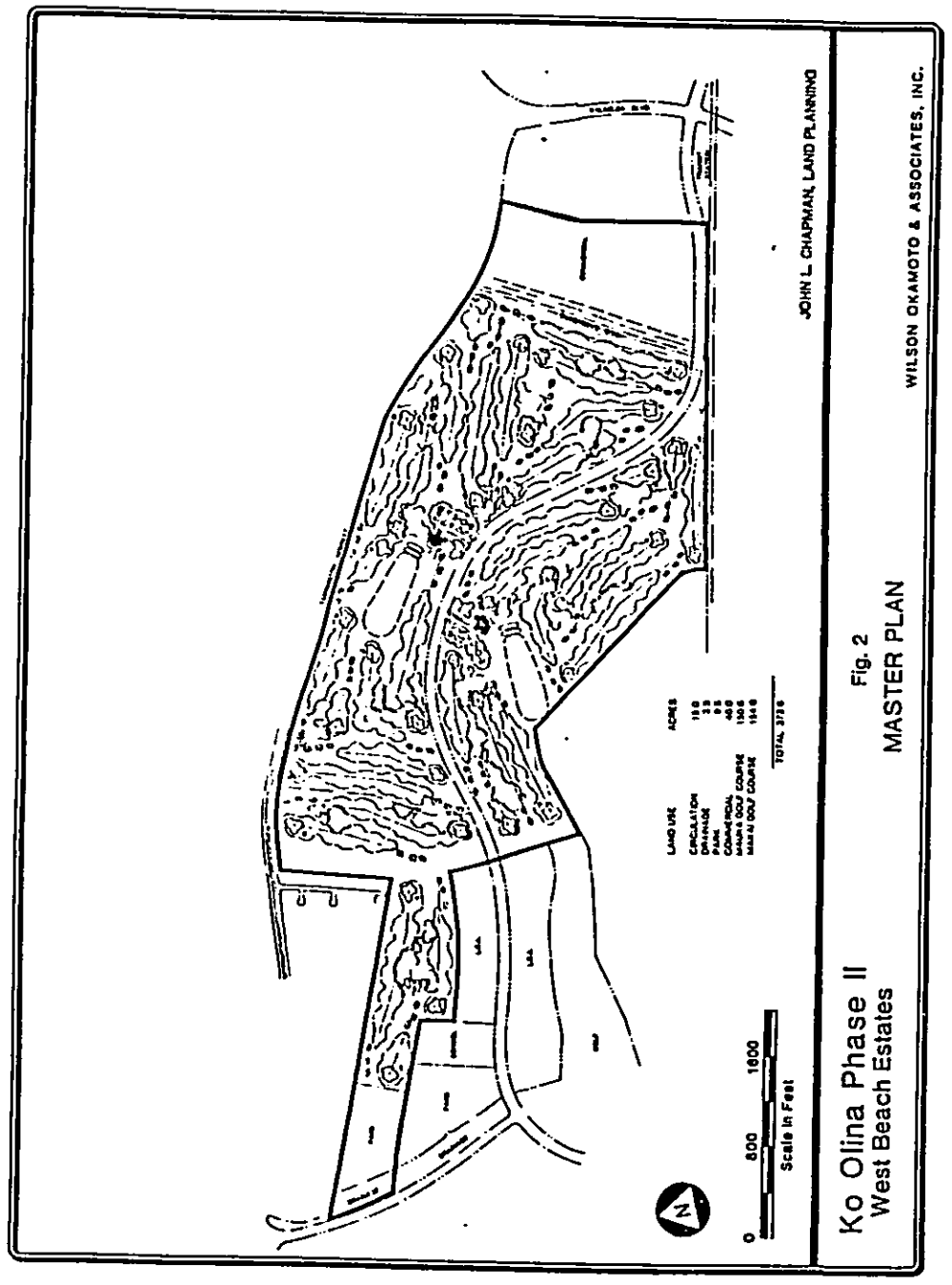

Table 1

SUMMARY OF STATE OF HAWAII AND NATIONAL AMBIENT AIR QUALITY STANDARDS (AAQS)

Pollutant (units)	Averaging Time	Maximum Allowable Concentration: National Primary	National Secondary	State of Hawaii
Suspended Particulate Matter (ug/m^3)	Annual	-	-	60[a]
	24 Hours	-	-	150[b]
Particulate Matter[c] (ug/m^3)	Annual	50	50	-
	24 Hours	150[b]	150[b]	-
Sulfur Dioxide (ug/m^3)	Annual	80	-	80
	24 Hours	365[b]	-	365[b]
	3 Hours	-	1300[b]	1300[b]
Nitrogen Dioxide (ug/m^3)	Annual	100	100	70
Carbon Monoxide (mg/m^3)	8 Hours	10[b]	-	5[b]
	1 Hour	40[b]	-	10[b]
Ozone (ug/m^3)	1 Hour	235[b]	235[b]	100[b]
Lead (ug/m^3)	Calendar Quarter	1.5	1.5	1.5

[a]Geometric mean
[b]Not to be exceeded more than once per year
[c]Particles less than or equal to 10 microns aerodynamic diameter

Table 2

AMBIENT AIR QUALITY MEASUREMENTS
AT CAMPBELL INDUSTRIAL PARK, BARBERS POINT, OAHU[a]
(micrograms per cubic meter)

Year	Particulates		Sulfur Dioxide		Nitrogen Dioxide	
	Range	Mean	Range	Mean	Range	Mean
1971	18-471	125	<5-16	<5	<20-49	29
1972	24-155	55	<5-7	<5	<20-49	21
1973	14-129	50	<5-5	<5	<20-33	<20
1974	23-132	47	<5-10	<5	<20-40	25
1975	13-137	52	<5-11	<5	<5-25	11
1976	12-101	40	<5-7	<5	<5-29	14
1977	25-134	54	<5-18	<5	discontinued	
1978	22-127	48	<5-40	<5		
1979	23-223	76	<5-27	<5		
1980	29-158	53	<5-10	<5		
1981	26-188	51	<5-40	<5		
1982	15-63	41	<5-12	<5		
1983	28-193	54	<5-95	<5		
1984	17-112	50	<5-<5	<5		
1985	24-138	57	<5-25	<5		
1986[b]	7-66	26	<5-10	<5		
1987	10-40	21	<5-13	5		

[a]24-hour averages
[b]Particulate monitoring changed from total suspended particulate to PM-10 in November 1985.

Table 3

COMPOSITE SUMMARY OF AIR QUALITY MEASUREMENTS
FOR CARBON MONOXIDE, OZONE AND LEAD AT
MONITORING STATIONS NEAREST KO OLINA

Parameter/Location	1981	1982	1983	1984	1985	1986	1987
Carbon Monoxide							
Waikiki/Kaiouki/Honolulu (see note)							
No. of Daily Samples	286	311	173	318	342	348	345
Range of Daily Max. 1-Hr Values (ug/m3)	1.2-13.8	0.0-4.6	0.0-8.6	0.6-10.9	0.0-10.4	0.2-13.5	0.3-11.1
Avg. Daily Maximum 1-hr Value (ug/m3)	5.1	1.2	2.3	2.4	1.5	2.2	1.7
No. of State AAQS Exceedances	13	0	0	1	1	3	1
Ozone							
Sand Island							
No. of Daily Samples	314	335	349	296	341	346	342
Range of Daily Max. 1-Hr Values (ug/m3)	10-104	0-151	0-123	0-104	0-148	10-88	4-84
Avg. Daily Maximum 1-hr Value (ug/m3)	37	32	46	44	43	39	38
No. of State AAQS Exceedances	1	2	2	1	3	0	0
Lead							
Honolulu							
No. of 24-Hr Samples	-	-	-	54	58	57	57
Range of 24-Hr Values (ug/m3)				0.0-1.8	0.0-0.3	0.0-0.2	0.0-0.2
Average Quarterly Value (ug/m3)				0.3	0.1	0.0	0.0
No. of State AAQS Exceedances				0	0	0	0

Note: Carbon monoxide measurements for 1981 are from Waikiki; 1982-83 data were measured in Kaimuki; 1984-87 values are from downtown Honolulu.

Source: State of Hawaii Department of Health

Table 4

ESTIMATED WORST-CASE 1-HOUR CARBON MONOXIDE CONCENTRATIONS
ALONG ROADWAYS NEAR KO OLINA PROJECT
(milligrams per cubic meter)

Roadway Intersection	Year/Scenario 1988/ Present	2005/ Without Project	2005/ With Project
Farrington and Kalaeloa	3.2 (1.8)	4.5 (5.8)	5.4 (11.7)
H-1 Eastbound Off Ramp and Kalaeloa	4.4 (1.3)	4.8 (2.9)	5.3 (3.3)
H-1 Eastbound On Ramp and Kalaeloa	2.8 (1.5)	3.9 (3.1)	4.4 (3.9)
Kalaeloa and Kapolei/Ko Olina	-	17.8 (12.5)	19.7 (15.3)
Ko Olina Parkway and Commercial Driveway	-	-	8.6 (11.6)
Ko Olina Parkway and Hauka Golf Driveway	-	-	3.4 (3.4)
Ko Olina Parkway and Hakai Golf Driveway	-	-	3.4 (3.1)
Ko Olina Parkway and Ko Olina Connector	-	9.9 (8.7)	10.2 (8.3)
Ko Olina Connector and Farrington	-	3.6 (2.6)	3.7 (2.8)

Hawaii State AAQS: 10
National AAQS: 40

Note: XXX AM Peak Hour
(XXX) PM Peak Hour

Table 5

ESTIMATED WORST-CASE 8-HOUR CARBON MONOXIDE CONCENTRATIONS
ALONG ROADWAYS NEAR KO OLINA PROJECT
(milligrams per cubic meter)

Roadway Intersection	Year/Scenario 1988/ Present	2005/ Without Project	2005/ With Project
Farrington and Kalaeloa	1.5	2.8	5.6
H-1 Eastbound Off Ramp and Kalaeloa	2.1	2.3	2.5
H-1 Eastbound On Ramp and Kalaeloa	1.3	1.9	2.1
Kalaeloa and Kapolei/Ko Olina	-	8.5	9.5
Ko Olina Parkway and Commercial Driveway	-	-	5.6
Ko Olina Parkway and Hauka Golf Driveway	-	-	1.6
Ko Olina Parkway and Hakai Golf Driveway	-	-	1.6
Ko Olina Parkway and Ko Olina Connector	-	4.8	4.9
Ko Olina Connector and Farrington	-	1.7	1.8

Hawaii State AAQS: 5
National AAQS: 10

APPENDIX G

ENVIRONMENTAL IMPACT OF FERTILIZER AND PESTICIDE USE ON THE PROPOSED KO OLINA GOLF COURSES

A REPORT TO

WILSON OKAMOTO & ASSOCIATES, INC.
DECEMBER 27, 1988

PREPARED BY

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I. INTRODUCTION

Because of concern for potential health effects, federal and state agencies have proposed and established extensive monitoring programs to detect agricultural chemicals in ground water. Agricultural chemicals have been detected in Hawaii's ground water. Most contamination was the result of soil fumigation, incorporation of herbicides, or the result of accidents at pesticide mixing/loading sites.

Movement of chemicals from the application site may occur as the result of runoff during high intensity storms, by leaching through the soil profile, or by drift during or immediately following application.

Ground water contamination occurs when water infiltration exceeds evapotranspiration. Drift occurs whenever sprayed materials are applied during windy conditions. Movement can be mitigated by sound management practices. Presently, about eighty percent of the proposed golf course acreage in Ko Olina is used for sugarcane production, an activity, which like a golf course, requires the use of fertilizers and pesticides (mostly herbicides).

This report describes the potential impact of fertilizers and pesticides on golf courses proposed for Ko Olina Phase II. The assessment is based on (1) an analysis of environmental and geological factors at the site, (2) the types and frequency of chemicals used, and (3) their potential for contaminating ground water or adversely affecting non-target organisms. Lastly, the existing and proposed chemical useage patterns are compared.

II. APPROACH

Information on the area of the proposed Ko Olina golf courses was obtained from several sources. Data on soils, topography, drainage and storm runoff were obtained from Wilson Okamoto & Associates. The site was familiar to one of the authors (Sato). Pesticide data used to estimate the potential for contaminating ground water was obtained from the USDA Soil Conservation Service and The Agrochemicals Handbook. The types of pesticides and their frequency of application was obtained from C. Brewer Company and from reports prepared by Murdoch and Green. The impacts of

proposed pesticide use on fish and other wildlife was estimated from various published reports and from information provided by The Hawaii Department of Land and Natural Resources. The comparison between the proposed pesticide use pattern and the existing sugarcane pesticide use pattern is based on a similar comparison completed by Murdoch and Green.

III. ANALYSIS OF RELEVANT FACTORS WHICH MAY AFFECT CHEMICAL MOVEMENT

A. Site Factors

1. Geology

The geology of the Ewa Plain is an emerged calcareous reef formed during the Pleistocene Period when the ocean level was at a higher elevation. The Plain is basically flat with a few isolated bluffs near Honouliuli which were eroded by Honouliuli stream. The soil material overlies hard but permeable calcareous material.

Caprock at the 100-foot ground elevation serves as a barrier between the brackish water underlying the proposed golf course site and the fresh ground water from the inland basaltic aquifer. Therefore, there is little chance of downward percolation or movement of fertilizers and pesticides into potable water sources of the Pearl Harbor aquifer.

2. Soils

The soils in this area were formed from the alluvium of basic igneous rock. The major soils are the Lualualei and the Honouliuli series which occupy about 73 percent of this area. Other minor soils are the Ewa, Mamala, and Keaau soils. A few acres of coral outcrop and stony land are also included.

The Lualualei and Honouliuli series are well-drained soils more than 60 inches deep over coral limestone. They are dark colored, very sticky and very plastic clays which crack widely upon drying. These soils are characterized by very slow permeability and slow runoff. Their organic carbon content is approximately 0.50 to 1.50 percent, their pH is neutral, and their available water capacity is high. The Keaau series are similar to the Lualualei and Honouliuli soils except that they are poorly drained.

The Ewa series are well-drained soils 20 to 40 inches deep over coral limestone. They have reddish colored silty clay loam textures. These soils are characterized by moderate permeability and very slow runoff. Their organic carbon content is about 1.50 percent and their available water capacity is low to moderate. The Mamala soils are similar to the Ewa soils except that depth to coral limestone is less than 20 inches.

Organic carbon content of the soils in this area is moderate to low. The fine clay textures and moderate organic carbon content enhances sorption of pesticides on the soil and thus reduces leaching or runoff of the chemicals.

Even with a relatively flat terrain, some runoff is expected during high intensity storms due to the slowly permeable soils in this area, i.e. they have nominal leaching potential. However, with very low rainfall in this area, this infrequent occurence will be limited to a few rainy months of the year.

3. Climate and Hydrology

The climate in the Ewa Plains is hot and dry. The average annual rainfall is about 20.4 inches, most of which falls between November and March. Annual rainfall did not exceed 25.3 inches 75 percent of the time. Annual rainfall was less than 14.2 inches only 25 percent of the time. The average annual temperature is 77 degrees F. The average annual maximum is 84 degrees F and the averge annual minimum is 68 degrees F.

A water balance for the caprock area of the Ewa Plains was determined from data presented by Giambelluca (1983). With an average annual rainfall of 20.4 inches, runoff of 5.08 inches and evapotranspiration for irrigated sugarcane of 28.4 inches, the data indicate that without irrigation, there is a net deficit of about 15.5 inches. Unirrigated cropland or grassland areas with a full canopy for evapotranspiration would not significantly contribute to the brackish water aquifer in the Ewa Plains.

B. Management Factors

1. Fertilizers

Fertilizers supply those essential nutrients which are used in large amounts and which are deficient in most soils. Elements which are normally applied in a turfgrass fertilization program are nitrogen (N), phosphorus (P), and potassium (K). Fertilizers are normally applied to only the greens, tees, fairways, and part of the roughs of a golf course. Turfgrasses grown in Hawaii use about twice as much N as K and about 4 times as much N as P. A typical application program for N is given in Table 1.

Table 1. Approximate nitrogen use rates for different areas of a typical golf course in Hawaii (Murdoch and Green).

Type of turf	Area in acres	Fertilizer amt. (lb.N/1000 sq. ft.)	Applic. freq.	Total annual appl.(tons)
Greens	3	0.5	2 wks.	0.85
Tees	3	1.0	3 wks.	1.15
Fairways	50	1.5	8 wks.	10.00
Roughs	30	1.0	3 mos.	2.60
Total	86			14.60

The primary fertilizer elements of concern for contamination of ground and surface waters are nitrogen and phosphorus. Phosphorus is attached very tightly to iron and aluminimum hydroxides which are plentiful in the soil, and any movement would be by erosion or run-off. Ammonium nitrogen (NH_4), like phosphorus, is strongly bound to soils. Since heavy rainfall is infrequent to the proposed site, little fertilizer transport by runoff is expected. Nitrogen applied in the ammonium form is rapidly converted to the nitrate form (NO_3) which is not bound to the soil and moves readily with water. However, because of high N uptake by turfgrasses, nitrogen will be used rapidly after application. If heavy rainfall occurs soon after application of a soluble nitrogen source, excessive loss by surface runoff or by leaching could occur. This nitrogen

movement could be avoided by applying a slow-release nitrogen fertilizer (Murdoch and Green).

2. Pesticides

There are a number of weed, insect and disease pests of turfgrasses in Hawaii which sometimes require application of chemical pesticides. Pesticides are normally applied only in response to outbreaks of pests. There are few instances in which pesticides are applied in a regularly scheduled, preventative program. A typical pesticide program for golf courses in Hawaii is given in Table 2 below. There are several chemicals which may be substituted for certain ones in this suggested program. Pesticides used in turf in Hawaii are given in Appendix I.

Table 2. A typical pesticide program for golf courses in Hawaii. (Modified from Murdoch and Green)

Turfgrass area	Area (acres)	Chemical	Times per yr	Rate/ Applic ai/acre	Annual total lb. ai
I. Herbicides					
Greens	3	MSMA	6	2	36
		bensulide	2	12	72
Tees	3	MSMA	6	2	36
		33 Plus	3	1**	9
		bensulide	2	12	72
Fairways	50	MSMA	6	2	600
		33 Plus	3	1**	152
		metribuzin	2	0.75	75
Perimeter	20	glyphosate	3	1.5	90
II. Insecticides					
Greens	3	chlorpyrifos	As needed	1	18
Tees	3	chlorpyrifos	As needed	1	18
Fairways	*	chlorpyrifos	As needed	1	50
		carbaryl	As needed	1	50
III.Fungicides					
Greens	3	metalaxyl	As needed	1.3	25
		chlorothalonil	As needed	8	72
Tees	3	metalaxyl	As needed	1.3	25
		chlorothalonil	As needed	8	72
Fairways	*	chlorothalonil	As needed	8	250

* Spot Treatment
** Pints/acre (Annual total in pints)

3. Irrigation

Because of low rainfall and uneven distribution throughout the year, the proposed golf courses will be irrigated to supplement rainfall. Ko Olina will have permanent sprinkler irrigation systems with sophisticated controllers. Many are computer controlled so that each sprinkler head on the golf course can be adjusted from a terminal to apply a selected amount of water on each cycle.

Because golf greens are constructed of sand (or mixes dominated by sand), the water holding capacity is less than for other areas which contain more clays. For this reason, golf greens must be watered more frequently than other areas.

Typical evapotranspiration rates for well-watered turf in Ewa is about 0.1 to 0.3 inches per day, depending on temperature, the amount of sunlight, relative humidity, wind speed and the amount of available water in the soil. Soils store approximately 0.5 to 2.5 inches of available water per foot of depth, depending on soil texture. Sands hold less water, clays hold more. (Irrigation should be applied when about one-half the available water has been used.) Since the effective rooting depth for mown turf is approximately one foot, turfgrasses must be watered frequently depending upon the soil type and the water use rates. Amounts of water applied at each irrigation are about 20,000 gal. for greens and 500,000 gal. for fairways.

Irrigation practices may have a large influence on the movement of soluble nitrogen fertilizers in soils. If excessive irrigation water is applied soon after application of soluble nitrogen sources, the chance for runoff or leaching of nitrogen below the root zone is increased. Because of the high cost of irrigation water, there is little incentive to over-water golf courses. As was previously mentioned, golf course irrigation systems are sophisticated, allowing precise control of the amount of water applied.

Atrazine herbicide has been detected in a Barber's Point well and in Ewa Wells 8 and 15. In all, atrazine was found in three wells at the limit of detection, approximately 0.1 ppb. The ground water in this area is brackish and non-potable. It is likely that both nitrogen and

atrazine were leached into ground water as a result of excessive furrow irrigation. However, current practices provide better water control and thus potentially reduced chemical leaching. Drainage from the proposed golf course site will be to the west and away from the West Loch of Pearl Harbor and the Pearl Harbor aquifer.

IV. ENVIRONMENTAL IMPACT OF CHEMICALS APPLIED TO THE PROPOSED GOLF COURSE COMPARED TO THOSE APPLIED TO EXISTING SUGARCANE.

A. Chemicals Used in Sugarcane Cultivation

Sugarcane is presently being grown on the proposed Ko Olina Phase II golf course site. Sugarcane grown in this area is watered and fertilized via drip irrigation. Standard industry practices are to use 300 pounds of N and 400 pounds of K_2O with the bulk of the fertilizer being used during the first year of culture.

Sugarcane cultivation on Oahu utilizes very little insecticides as most pests are kept under control by biological agents. Fungicides are only used for seed piece treatment, and are not applied in the field. Herbicides are applied as surface sprays prior to and during the first six months of growth. Ninety six percent of all the herbicides applied are ametryn, atrazine, diuron or dalapon. Typical quantitites applied are 6 pounds active ingredient per acre per year (Murdoch and Green). Glyphosate is used for spot treatment and for field boundaries, ditch banks and roadsides.

B. Chemicals Used by Proposed Golf Course

Golf courses are managed much more carefully than sugarcane fields. Compared to sugarcane cultivation, golf courses use a higher rate of fertilizer. However, because only a small portion of the area is fertilized, the total fertilizer used by both sugarcane and golf courses is similiar.

The total area of a golf course treated with pesticides is relatively small, with the most heavily treated areas being greens and tees. This situation tends to mitigate the potential problems associated with pesticides that are known to move on or through soils. Of the typical golf course pesticides listed in Appendix I, several have large surface and leaching loss potentials (see Table 3).

Table 3. Golf Course Pesticides that are potential environmental contaminants

Large surface loss potential	Large leaching potential
Benfluralin	Dicamba
Bensulide	Imazaquin
fluazifop-P-butyl	Mecoprop
Glyphosate	Metribuzin
MSMA	Simazine
Oryzalin	Ethoprophos
Oxadiazon	Trichlorfon
Paraquat	
Chlorpyrifos	
Benomyl	
Chlorothalonil	
Mancozeb	
Phosethyl-Al	
Quintozene	

Several factors at Ko Olina will minimize pesticide surface loss. These include soils with slow permeability, high water holding capacity, relatively flat topography and low rainfall. Other factors will minimize pesticide leaching loss. These include a net evapotranspiration deficit, deep soils, and the presence of caprock between this area and the Pearl Harbor aquifer.

The presence of turfgrass will further reduce surface runoff and leaching. Pesticides generally do not penetrate more than 2 to 3 centimeters in the soil, most being confined to the thatch. Microbial degradation occurs more rapidly in the root zone. Since the root mass of turfgrass is larger than that of sugarcane, this situation further minimizes the potential for runoff and leaching.

Some of the pesticides used on golf courses are toxic to wildlife (see Appendix I). Most of these are the organophosphates. Diazinon, which has been implicated in the kill of waterbirds on golf courses in the northeast United States, can no longer be used on golf courses. The use of liquid formulations will minimize the problem of birds picking up granular materials. Neither of the two insecticides (chlorpyrifos and carbaryl)

applied to golf courses in Hawaii have been known to cause adverse effects to birds.

The use of sound management practices should minimize the off site movement of fertilizers and pesticides. Most golf course superintendents have been certified by the Hawaii Department of Agriculture to use or supervise the use of restricted use pesticides such as fenamiphos. Generally, certification occurs after completing both a training course conducted by the University of Hawaii Cooperative Extension Service and taking an examination administered by the Hawaii Department of Agriculture. Factors affecting (and mitigating) pesticide runoff and ground water contamination are addressed during training. Further training for superintendents occurs at regularly scheduled meetings of the Turf Grass Managers Association.

V. SUMMARY AND CONCLUSION

Development of the proposed golf course at Ko Olina and the associated use of chemical fertilizers and pesticides will not pose adverse environmental risks. Over 70 percent of the soils on this relatively flat topography are 60 inches deep and have moderate organic matter content. The site has low rainfall and has a net evapotranspiration deficit. The combination of soil properties, gently sloping topography, and a net evapotranspiration deficit suggests that there will be no recharge of the brackish ground water from rainfall. Runoff should be minimal except during prolonged high intensity storms which are infrequent to the area.

The total amount of nitrogen used in sugarcane production is similar to that which would be used on the proposed golf courses. The presence of caprock between the proposed site and the Pearl Harbor aquifer will serve as an effective barrier between the brackish and potable ground water sources. Therefore, the proposed conversion of land from sugarcane production to golf courses would cause no significant degradation of potable ground water quality.

The pesticides approved for use on golf courses are known to degrade relatively quickly. Although some are potential leachers or can otherwise move off site, the specific site and environmental conditions will minimize movement. Avoidance of over-irrigation and the application of good management practices will further decrease

the likelihood of vertical movement. The presence of turfgrass will further reduce runoff and leaching. Drift can be controlled by using low pressure nozzles, lowering application booms, using drift control agents, selecting proper formulations, observing local weather conditions, and making applications under the direct supervision of certified or properly trained personnel. None of the pesticides used on golf courses in Hawaii have been shown to adversely affect birds or other beneficial wildlife.

The conversion of the proposed area from sugarcane cultivation to a well managed golf course is consistent with the state's goal of preserving and protecting ground water.

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APPENDIX I

These pesticide information sheets were prepared using information from the USDA Soil Conservation Service and the Agrochemicals Handbook (2nd Ed.)

Soil half lives vary by a factor of 3 or more depending upon soil moisture, temperature, oxygen status, soil microbial population and other factors. The numbers given are only relative indicators of persistence. "E" indicates that the value is estimated and is probably in error by a factor of 2 or more. "G" indicates that the value is a guess and could be off by a factor of 3 or more.

Soil sorption index is measured by Koc values. Higher Koc values indicates a stronger attachment to soil organic matter and less tendency to move with water except with eroded materials. The "E" indicates a probable error of 3 to 5 times while "G" indicates a probable error of 10-100 times.

Surface loss potential indicates the tendency of the pesticide to move with sediment in runoff. Leaching potential indicates the tendency of a pesticide to move in solution with water and leach below the root zone into ground water. Both of these movement potentials need to be used in conjunction with the individual soil ranking in relation to surface runoff and leaching properties. The Lualualei and Honouliuli series soils in the proposed golf course site would be classified as nominal for leaching potential. Thus, pesticides with LARGE leaching or surface loss potentials would only have medium overall pesticide losses through leaching or surface loss. Pesticides with a MEDIUM or SMALL leaching or surface loss potential would have a very low overall probability of loss through leaching or surface runoff. Pesticides with a medium overall probability of loss to runoff or leaching can be used without adverse environmental impact by using sound management practices.

Pesticide common name: Benfluralin, benefin

Trade name(s): Balan, Balfin

Manufacturer(s): Elanco

Use: Herbicide

Formulation type(s): Emulsifiable Conc.,Granular, Dispersible Granule

Application mode(s): Soil incorporated, granules in turf

LD-50 mg/kg (rat;oral): > 10,000

Toxicity to wildlife: Low to birds, High to fish

Water solubility (mg/L): 0.1

Soil half-life (days): 30

Soil Sorption index (Koc): 11,000

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Bensulide

Trade name(s): Prefar, Betasau, Betamec

Manufacturer(s): ICI Americas, Stauffer

Use: Herbicide

Formulation type(s): Emulsifiable Conc., Granules

Application mode(s): Soil Spray, Watered in or Soil Incorporated

LD-50 mg/kg (rat;oral): 770

Toxicity to wildlife: Moderate to fish

Water solubility (mg/L): 25

Soil half-life (days): 60

Soil Sorption index (Koc): 10,000

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Bromoxynil

Trade name(s): Buctril

Manufacturer(s): Rhone-Poulenc

Use: Herbicide

Formulation type(s): Emulsifiable Conc.

Application mode(s): Target Plant Foliar Spray

LD-50 mg/kg (rat;oral): 190

Toxicity to wildlife: Moderate to birds and fish

Water solubility (mg/L): 130

Soil half-life (days): 14

Soil Sorption index (Koc): 1,000 E

Surface loss potential: MEDIUM

Leaching potential: SMALL

Pesticide common name: Chlorthal-dimethyl

Trade name(s): Dacthal

Manufacturer(s): SDS Biotech

Use: Herbicide

Formulation type(s): Wettable Powder: Granules: Suspension Conc.

Application mode(s): None

LD-50 mg/kg (rat;oral): > 3,000

Toxicity to wildlife: Non toxic to fish

Water solubility (mg/L): 0.5

Soil half-life (days): not determined

Soil Sorption index (Koc): not determined

Surface loss potential: not determined

Leaching potential: not determined

Pesticide common name: Dicamba

Trade name(s): Banvel, Trooper

Manufacturer(s): Sandoz

Use: Herbicide

Formulation type(s): Aqueous Concentrate

Application mode(s): Soil Surface Spray, Rope Wick, Target Plant Foliar Spray

LD-50 mg/kg (rat;oral): 1707

Toxicity to wildlife: Low to birds, Mod. to fish

Water solubility (mg/L): 6500

Soil half-life (days): 14

Soil Sorption index (Koc): 2

Surface loss potential: SMALL

Leaching potential: LARGE

Pesticide common name: Fluazifop-P-butyl

Trade name(s): Fusilade

Manufacturer(s): ICI Americas

Use: Herbicide

Formulation type(s): Emulsifiable Conc.

Application mode(s): Target Weed Plant Spray

LD-50 mg/kg (rat;oral): 4096

Toxicity to wildlife: Mod. toxicity to fish

Water solubility (mg/L): 2

Soil half-life (days): 20

Soil Sorption index (Koc): 3,000 E

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Glyphosate

Trade name(s): Roundup, Rodeo

Manufacturer(s): Monsanto

Use: Herbicide (terrestrial and aquatic)"

Formulation type(s): Aqueous Concentrate

Application mode(s): Target Plant Foliar Spray, Wiper Application

LD-50 mg/kg (rat;oral): 5600

Toxicity to wildlife: Low to birds and fish

Water solubility (mg/L): 12,000

Soil half-life (days): 30

Soil Sorption index (Koc): 10,000 E

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Imazaquin

Trade name(s): Scepter

Manufacturer(s): American Cyanamid

Use: Herbicide

Formulation type(s): Aqueous Concentrate:

Application mode(s): Target foliar spray, soil incorporated

LD-50 mg/kg (rat;oral): > 5,000

Toxicity to wildlife: Low to birds and fish

Water solubility (mg/L): 60-120

Soil half-life (days): 60

Soil Sorption index (Koc): 20 E

Surface loss potential: SMALL

Leaching potential: LARGE

Pesticide common name: Mecoprop (MCPP)

Trade name(s): 2 Plus (MCPP & 2,4-D amine), Chipco

Manufacturer(s): Fermenta, Rhone-Poulenc

Use: Herbicide

Formulation type(s): Aqueous Solution

Application mode(s): Target Weed Foliar Spray

LD-50 mg/kg (rat;oral): 930

Toxicity to wildlife: Low to fish

Water solubility (mg/L): 620

Soil half-life (days): 21

Soil Sorption index (Koc): 3

Surface loss potential: SMALL

Leaching potential: LARGE

Pesticide common name: Metribuzin

Trade name(s): Sencor, Lexone

Manufacturer(s): Bayer, DuPont

Use: Herbicide

Formulation type(s): Dispersible liquid or granules

Application mode(s): Soil Surface, Chemigation

LD-50 mg/kg (rat;oral): 2200

Toxicity to wildlife: Moderate for birds and fish

Water solubility (mg/L): 1220

Soil half-life (days): 30

Soil Sorption index (Koc): 41

Surface loss potential: MEDIUM

Leaching potential: LARGE

Pesticide common name: MSMA (monosodium methylarsonate)

Trade name(s): Weed-Hoe, Calar

Manufacturer(s): Vineland, Fermenta

Use: Herbicide

Formulation type(s): Aqueous Concentrate

Application mode(s): Target Weed Foliar Spray

LD-50 mg/kg (rat;oral): 900

Toxicity to wildlife: Low to fish

Water solubility (mg/L): 1,400,000

Soil half-life (days): 100

Soil Sorption index (Koc): 10,000E

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Oryzalin

Trade name(s): Surflan

Manufacturer(s): Ciba-Geigy

Use: Herbicide

Formulation type(s): Wettable powder, dispersible liquid

Application mode(s): Soil Surface Spray

LD-50 mg/kg (rat;oral): > 10,000

Toxicity to wildlife: Low to birds, mod to fish

Water solubility (mg/L): 2.5

Soil half-life (days): 60

Soil Sorption index (Koc): 2700

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Oxadiazon

Trade name(s): Ronstar

Manufacturer(s): Rhone-Poulenc

Use: Herbicide

Formulation type(s): Granules, Emulsifiable Conc., Wettable Powder

Application mode(s): Soil Incorporation

LD-50 mg/kg (rat;oral): > 8000

Toxicity to wildlife: Low to birds, High to fish

Water solubility (mg/L): 0.7

Soil half-life (days): 90-180

Soil Sorption index (Koc): 10,000 G

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Paraquat-dichloride

Trade name(s): Gramoxone

Manufacturer(s): ICI Americas

Use: Herbicide

Formulation type(s): Aqueous Concentrated Solution

Application mode(s): Target Weed Foliar Spray

LD-50 mg/kg (rat;oral): 150

Toxicity to wildlife: Mod to birds nd fish

Water solubility (mg/L): 700,000

Soil half-life (days): 3600E

Soil Sorption index (Koc): 100,000 E

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Propyzamide

Trade name(s): Kerb

Manufacturer(s): Rohm & Haas

Use: Herbicide

Formulation type(s): Wettable Powder, Granules, Suspension Conc.

Application mode(s): Soil spray or incorporation

LD-50 mg/kg (rat;oral): 8350

Toxicity to wildlife: Low to birds, Mod to fish

Water solubility (mg/L): 15

Soil half-life (days): 30

Soil Sorption index (Koc): 1,000 G

Surface loss potential: MEDIUM

Leaching potential: SMALL

Pesticide common name: 2,4-D

Trade name(s): Weedone 2,4-dichlorphenoxylacetic acid

Manufacturer(s): Union Carbide

Use: Herbicide

Formulation type(s): Aqueous Solution

Application mode(s): Target Weed Foliar Spray

LD-50 mg/kg (rat;oral): 375-700

Toxicity to wildlife: Low to birds, high to fish

Water solubility (mg/L): 620

Soil half-life (days): 10

Soil Sorption index (Koc): 20

Surface loss potential: SMALL

Leaching potential: MEDIUM

Pesticide common name: Simazine

Trade name(s): Princep

Manufacturer(s): Ciba-Geigy

Use: Herbicide

Formulation type(s): Wettable Powder

Application mode(s): Soil Surface Spray

LD-50 mg/kg (rat;oral): > 5000

Toxicity to wildlife: Low to birds, mod to fish

Water solubility (mg/L): 3.5

Soil half-life (days): 75

Soil Sorption index (Koc): 138

Surface loss potential: MEDIUM

Leaching potential: LARGE

Pesticide common name: Acephate

Trade name(s): Orthene

Manufacturer(s): Chevron

Use: Insecticide

Formulation type(s): Water soluble powder, dust

Application mode(s): Crop foliar spray, spot spray

LD-50 mg/kg (rat;oral): 945

Toxicity to wildlife: Mod to birds, low to fish

Water solubility (mg/L): 790,000

Soil half-life (days): 3

Soil Sorption index (Koc): 100

Surface loss potential: SMALL

Leaching potential: SMALL

Pesticide common name: Bendiocarb

Trade name(s): Ficam

Manufacturer(s): Schering

Use: Insecticide

Formulation type(s): Ganules, Wettable Powder

Application mode(s): Soil Spray or incoporation

LD-50 mg/kg (rat;oral): 40-156

Toxicity to wildlife: Mod to fish

Water solubility (mg/L): 40

Soil half-life (days): 7

Soil Sorption index (Koc): 100 G

Surface loss potential: MEDIUM G

Leaching potential: SMALL G

Pesticide common name: Carbaryl

Trade name(s): Sevin

Manufacturer(s): Rhone-Poulenc

Use: Insecticide

Formulation type(s): Wettable Powder, Oil Suspensions

Application mode(s): Crop Foliar Sprays, Chemigation

LD-50 mg/kg (rat;oral): 850

Toxicity to wildlife: Low to birds, mod to fish

Water solubility (mg/L): 120

Soil half-life (days): 7

Soil Sorption index (Koc): 229

Surface loss potential: MEDIUM

Leaching potential: SMALL

Pesticide common name: Chlorpyrifos

Trade name(s): Lorsban

Manufacturer(s): DOW

Use: Insecticide

Formulation type(s): Emulsifiable Conc., Wettable Powder, Granules

Application mode(s): Soil Incorporation, Crop Foliar Spray, Chemigation

LD-50 mg/kg (rat;oral): 135-163

Toxicity to wildlife: High to birds and fish

Water solubility (mg/L): 2

Soil half-life (days): 30-60

Soil Sorption index (Koc): 6070

Surface loss potential: LARGE SMALL

Leaching potential:

Pesticide common name: Diazinon

Trade name(s): Spectracide

Manufacturer(s): Ciba-Geigy

Use: Insecticide

Formulation type(s): Wettable Powder, Emulsifiable conc., Oil Solution

Application mode(s): Crop Foliar Spray, Soil Drench

LD-50 mg/kg (rat;oral): 240-480

Toxicity to wildlife: High for birds, mod for fish

Water solubility (mg/L): 40

Soil half-life (days): 30

Soil Sorption index (Koc): 85

Surface loss potential: MEDIUM

Leaching potential: LARGE

Pesticide common name: Fenamiphos

Trade name(s): Nemacur

Manufacturer(s): Mobay

Use: Insecticide, Nematicide

Formulation type(s): Emulsifiable Conc., Granules

Application mode(s): Soil Spray or Incorporation

LD-50 mg/kg (rat;oral): 15.3

Toxicity to wildlife: High for birds and fish

Water solubility (mg/L): 700

Soil half-life (days): 20

Soil Sorption index (Koc): 171

Surface loss potential: MEDIUM

Leaching potential: MEDIUM

Pesticide common name: Ethoprophos

Trade name(s): Mocap

Manufacturer(s): Rhone-Poulenc

Use: Insecticide, Nematicide

Formulation type(s): Emulsifiable Conc, Granules

Application mode(s): Water-in or soil incorporation

LD-50 mg/kg (rat;oral): 62

Toxicity to wildlife: High to birds, mod to fish

Water solubility (mg/L): 700

Soil half-life (days): 30

Soil Sorption index (Koc): 120

Surface loss potential: MEDIUM

Leaching potential: LARGE

Pesticide common name: Trichlorfon

Trade name(s): Dylox

Manufacturer(s): Mobay

Use: Insecticide

Formulation type(s): Soluble Powder

Application mode(s): Crop Plant Spray

LD-50 mg/kg (rat;oral): 560

Toxicity to wildlife: high for birds and fish

Water solubility (mg/L): 154,000

Soil half-life (days): 27

Soil Sorption index (Koc): 2

Surface loss potential: SMALL

Leaching potential: LARGE

Pesticide common name: Anilazine

Trade name(s): Dyrene

Manufacturer(s): Mobay

Use: Fungicide

Formulation type(s): Wettable Powder

Application mode(s): Crop foliar spray

LD-50 mg/kg (rat;oral): > 5000

Toxicity to wildlife: Low to birds, high for fish

Water solubility (mg/L): 8

Soil half-life (days): 1

Soil Sorption index (Koc): 3000

Surface loss potential: SMALL

Leaching potential: SMALL

Pesticide common name: Benomyl

Trade name(s): Benlate

Manufacturer(s): DuPont

Use: Fungicide

Formulation type(s): Wettable Powder, Oil Dispersible, Dispersible granules

Application mode(s): Crop foliar spray

LD-50 mg/kg (rat;oral): > 10,000

Toxicity to wildlife: Low to birds, high for fish

Water solubility (mg/L): 2

Soil half-life (days): 100

Soil Sorption index (Koc): 2100

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Chlorothalonil

Trade name(s): Bravo, Daconil

Manufacturer(s): Fermenta

Use: Fungicide

Formulation type(s): Wettable powder, dispersible granules and liquid

Application mode(s): crop foliar spray, chemigation

LD-50 mg/kg (rat;oral): >10,000

Toxicity to wildlife: Low for birds, high for fish

Water solubility (mg/L): 0.6

Soil half-life (days): 20-60

Soil Sorption index (Koc): 1380

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Iprodione

Trade name(s): Rovral

Manufacturer(s): Rhone-Poulenc

Use: Fungicide

Formulation type(s): Wettable Powder

Application mode(s): Crop Plant Spray

LD-50 mg/kg (rat;oral): 3500

Toxicity to wildlife: Mod to birds and fish

Water solubility (mg/L): 13

Soil half-life (days): 20 G

Soil Sorption index (Koc): 500 E

Surface loss potential: MEDIUM

Leaching potential: SMALL

Pesticide common name: Mancozeb

Trade name(s): Dithane, Manzate

Manufacturer(s): Rohm & Haas, DuPont

Use: Fungicide

Formulation type(s): Wettable Powder, Dispersible liquid or granules

Application mode(s): Crop Foliar Spray, Chemigation

LD-50 mg/kg (rat;oral): >8000

Toxicity to wildlife: mod to fish

Water solubility (mg/L): 0.5

Soil half-life (days): 35

Soil Sorption index (Koc): 1000 G

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Metalaxyl

Trade name(s): Ridomil

Manufacturer(s): Ciba-Geigy

Use: Fungicide

Formulation type(s): Wettable Powder, Emulsifiable Conc.

Application mode(s): Soil Surface or Crop Foliar Spray

LD-50 mg/kg (rat;oral): 6 69

Toxicity to wildlife: low to birds and fish

Water solubility (mg/L): 71000

Soil half-life (days): 7

Soil Sorption index (Koc): 16

Surface loss potential: SMALL

Leaching potential: MEDIUM

Pesticide common name: Phosethyl-Al or fosetyl-aluminum

Trade name(s): Aliette

Manufacturer(s): Rhone-Poulenc

Use: Fungicide

Formulation type(s): Wettable powder

Application mode(s): crop plant spray

LD-50 mg/kg (rat;oral): 5800

Toxicity to wildlife: low to birds and fish

Water solubility (mg/L): 120,000

Soil half-life (days): 10G

Soil Sorption index (Koc): 10,000 G

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Quintozene

Trade name(s): Terraclor

Manufacturer(s): Uniroyal

Use: Fungicide

Formulation type(s): Wettable powder, emulsifiable conc.

Application mode(s): Soil Spry

LD-50 mg/kg (rat;oral): > 12,000

Toxicity to wildlife: Low to fish

Water solubility (mg/L): 0.44

Soil half-life (days): 180

Soil Sorption index (Koc): 10,000 G

Surface loss potential: LARGE G

Leaching potential: SMALL G

Pesticide common name: Thiram

Trade name(s): Thiram

Manufacturer(s): Uniroyal, FMC

Use: Fungicide

Formulation type(s): Wettable Powder

Application mode(s): Crop Plant Spray

LD-50 mg/kg (rat;oral): 865

Toxicity to wildlife: High to fish

Water solubility (mg/L): 30

Soil half-life (days): 20 G

Soil Sorption index (Koc): 383

Surface loss potential: MEDIUM

Leaching potential: MEDIUM

Pesticide common name: Thiophanate-methyl

Trade name(s): Topsin Fungo

Manufacturer(s): Pennwalt

Use: Fungicide

Formulation type(s): Wettalbe powder, dispersible liquid

Application mode(s): crop plant spray

LD-50 mg/kg (rat;oral): 7500

Toxicity to wildlife: Low for birds, mod for fish

Water solubility (mg/L): 3.5

Soil half-life (days): <1

Soil Sorption index (Koc): 1000 E

Surface loss potential: SMALL

Leaching potential: MEDIUM

Pesticide common name: Triadimefon

Trade name(s): Bayleton

Manufacturer(s): Mobay

Use: Fungicide

Formulation type(s): Wettable powder, dispersible granules

Application mode(s): crop plant spray

LD-50 mg/kg (rat;oral): 568

Toxicity to wildlife: low to birds, mod to fish

Water solubility (mg/L): 260

Soil half-life (days): 21

Soil Sorption index (Koc): 273

Surface loss potential: MEDIUM

Leaching potential: MEDIUM

Pesticide common name: Metalaxyl

Trade name(s): Ridomil

Manufacturer(s): Ciba-Geigy

Use: Fungicide

Formulation type(s): Wettable Powder, Emulsifiable Conc.

Application mode(s): Soil Surface or Crop Foliar Spray

LD-50 mg/kg (rat;oral): 6 69

Toxicity to wildlife: low to birds and fish

Water solubility (mg/L): 71000

Soil half-life (days): 7

Soil Sorption index (Koc): 16

Surface loss potential: SMALL

Leaching potential: MEDIUM

Pesticide common name: Phosethyl-Al or fosetyl-aluminum

Trade name(s): Aliette

Manufacturer(s): Rhone-Poulenc

Use: Fungicide

Formulation type(s): Wettable powder

Application mode(s): crop plant spray

LD-50 mg/kg (rat;oral): 5800

Toxicity to wildlife: low to birds and fish

Water solubility (mg/L): 120,000

Soil half-life (days): 10G

Soil Sorption index (Koc): 10,000 G

Surface loss potential: LARGE

Leaching potential: SMALL

Pesticide common name: Quintozene

Trade name(s): Terraclor

Manufacturer(s): Uniroyal

Use: Fungicide

Formulation type(s): Wettable powder, emulsifiable conc.

Application mode(s): Soil Spry

LD-50 mg/kg (rat;oral): > 12,000

Toxicity to wildlife: Low to fish

Water solubility (mg/L): 0.44

Soil half-life (days): 180

Soil Sorption index (Koc): 10,000 G

Surface loss potential: LARGE G

Leaching potential: SMALL G

Pesticide common name: Thiram

Trade name(s): Thiram

Manufacturer(s): Uniroyal, FMC

Use: Fungicide

Formulation type(s): Wettable Powder

Application mode(s): Crop Plant Spray

LD-50 mg/kg (rat;oral): 865

Toxicity to wildlife: High to fish

Water solubility (mg/L): 30

Soil half-life (days): 20 G

Soil Sorption index (Koc): 383

Surface loss potential: MEDIUM

Leaching potential: MEDIUM