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89/EIS-2(BWM)

February 22, 1990

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

Dear Dr. Miura:

Final Environmental Impact Statement (EIS)
Bayview Golf Course Expansion
Pacific Atlas (Hawaii) Inc.
Tax Map Keys:

Phase I: 4-5-30: 1, 6, 9, 37, 40, 42,
44, 45, and 46; 4-5-08: 38

Phase II: 4-5-30: 3, 20, 30, por. 36;
4-5-59: 33-36; 4-5-104: 48-54

We are notifying you that the above is an acceptable Final EIS document, pursuant to Chapter 343, HRS, and Title 11, Administrative Rules, Department of Health, Chapter 200, Environmental Impact Statement Rules.

A copy of our acceptance report is attached. If you have any questions, please contact Bennett Mark at 527-5038.

Very truly yours,

Donald Clegg

DONALD A. CLEGG
Director of Land Utilization

DAC:sl
0258N

cc: Tyrone T. Kusao

1990 - Oahu - FEIS -
Bayview Golf

FILE COPY

Final Environmental Impact Statement

BAYVIEW
GOLF COURSE
EXPANSION

Kaneohe, Oahu, Hawaii

PACIFIC ATLAS (HAWAII), INC.

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Final Environmental Impact Statement

BAYVIEW GOLF COURSE EXPANSION

Kaneohe, Oahu, Hawaii

Prepared For:
PACIFIC ATLAS (HAWAII), INC.

Prepared By:
Tyrone T. Kusao, AICP

For Submittal to:
City & County of Honolulu
Department of Land Utilization

January 1990

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Prepared by Y. Ebisu and Associates, June 1989

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Prepared by Cultural Surveys Hawaii, September 1989

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Prepared by Charles L. Murdoch, Ph.D. and Richard E. Green, Ph.D., April 1989

F. BAYVIEW GOLF COURSE: TRAFFIC IMPACT ASSESSMENT REPORT
Prepared by Pacific Planning and Engineering, Inc., April 1989

G. BOTANICAL SURVEY: PROPOSED BAYVIEW GOLF COURSE EXPANSION, KANEOHE, O'AHU
Prepared by Char and Associates, March 1989

H. AIR QUALITY IMPACT REPORT: BAY VIEW GOLF COURSE
Prepared by J. W. Morrow, June 1989

I. PROPOSED BAYVIEW GOLF COURSE EXPANSION IMPACT ON UTILITIES AND SERVICES
Prepared by Hida, Okamoto and Associates, Inc., August 1989

CHAPTER ONE

Introduction And Summary

BAYVIEW GOLF COURSE EXPANSION

FINAL ENVIRONMENTAL IMPACT STATEMENT

1. INTRODUCTION AND SUMMARY

1.1 LOCATION AND OWNERSHIP

Location	Kaneohe, Oahu, Hawaii
Parcels	**Phase 1:** TMK 1-4-5-30: parcels 1, 6, 9, 37, 40, 42, 44, 45 and 46 TMK 1-4-5-08: parcel 38 **Phase 2:** TMK 1-4-5-30: parcels 3, 20, 30, and a portion of 36 TMK 1-4-5-59: parcels 33 through 36 TMK 1-4-5-104: parcels 48 through 54
Size	140 acres
Ownership	All of the Phase 1 lots, which account for 85 percent of the project site, are owned by Pacific Atlas (Hawaii), Inc. The remaining portions of the project site are owned by nine different entities, all of whom have consented to include their lot in the project area for study purposes only.

1.2 PROJECT DESCRIPTION

Project Concept

The applicant proposes to expand the Bayview Golf Course into an 18-hole championship course. The project includes a clubhouse and maintenance shed, recreational facilities and 40 residential units. The residential units are intended primarily for relocation purposes.

Phase 1 includes eleven holes of the proposed course and the clubhouse. The remaining holes and residences will be in Phase 2.

Estimated Cost

The construction cost of the golf course and support facilities is estimated at $20 million. Sitework and construction costs related to the residential component is estimated at $6 million.

1.3 SUMMARY OF IMPACTS

1.3.1 Beneficial Impacts

Environmental

- Physical characteristics, in terms of topography and soils, are suitable for golf course
- Absence of endangered flora and fauna species
- Addition of new habitats for migratory birds
- No significant degradation of air or water quality
- Restoration of Kawa Stream to its original alignment and on-site drainage patterns
- Improvement of current open space nature of the site

Socio-Economic

- Meets recreational need of local residents, as well as visitors
- Employment opportunities generated by golf course construction and operation
- Direct increase in property taxes and indirect increase in general excise tax
- Creation of well-landscaped and permanent open space

Public Facilities

- Public facilities and services are available or can be made available at reasonable costs

1.3.2 Adverse Impacts

Traffic

- Not anticipated to be a major traffic generator; impacts can be mitigated through project design and with City-sponsored improvements which are already planned

Construction

- Clearing and construction work will result in temporary dust, noise and some traffic disruption

- Localized degradation of water quality in on-site streams

Environmental

- Alteration of ecosystem in Waikalua-Loko fishpond and Kawa and Kaneohe Streams, although these have already been highly disturbed

1.4 PROPOSED MITIGATION

Drainage and Grading

- Drainage impacts will be mitigated by routing runoff to ponds within the golf course layout. Short term soil erosion can be mitigated through limiting the grading area in any given time and installing a sedimentation basin at the onset of grading.

Water Quality and Habitats

- Water quality impacts can be mitigated through the use of berms and swales to retain runoff waters. Impacts to the fishponds can be attenuated or mitigated by the provision of a carefully executed water quality and environmental management plan.

Flora and Fauna

- No mitigative action is warranted.

Archaeological Resources

- The only archaeological resources found on the project site are the Waikalua-Loko and Waikalua Fishponds. Pacific Atlas (Hawaii), Inc. proposes to incorporate these fishponds in the golf course design and layout. These fishponds are considered attractive water features which will enhance the proposed championship golf course.

  Further, on-site monitoring during construction will help minimize disruption. The gates and seawalls of the ponds should be restored as much as possible to their earlier functioning condition. The ponds should be maintained free of vegetation and with sufficient water quality to allow flourishing of vertebrate and invertebrate marine life.

Chemical Impacts

- Careful monitoring of fertilizers and pesticides used for the golf course will help preserve the water quality and preserve the ecosystem. The EIS outlines several mitigative measures.

Utilities

- The project includes a water system for potable water and the developer proposes to drill two shallow on-site wells to meet the non-potable water demand. The proposed wastewater system will transmit wastewater to the Kaneohe Sewage Treatment Plant. The developer will maintain contact with the Hawaiian Electric Company and the Hawaiian Telephone Company to assure necessary service levels. All utility lines will be underground to avoid visual impacts.

Traffic

- The proposed project includes on- and off-site roadway improvements to mitigate project impacts.

1.5 ALTERNATIVES CONSIDERED

No Action— The no-action alternative would not require infrastructure improvements and would not generate construction impacts. On the other hand, this alternative would not improve the scenic quality of the area, would not generate additional employment and would not improve the fishponds.

Expansion of Only the Golf Course Facility— This alternative would exclude residential uses, and would not provide for the relocation of on-site residents.

The Proposed Project— This alternative is preferable because it would (1) add to the area's recreational resources; (2) provide for the relocation of on-site residents; (3) consolidate land uses on the site; (4) improve on-site drainage; and (5) improve the area's visual quality.

1.6 UNRESOLVED ISSUES

Issues arising from the implementation and operation of the proposed project can generally be mitigated by measures presented in this EIS. An issue not completely resolved at this time is land control and/or acquisition.

1.7 COMPATIBILITY WITH LAND USE DESIGNATIONS

State Land Use District — The site is designated Urban and Conservation; the proposed project is compatible with these designations.

Koolaupoko Development Plan Land Use — Phase 1 of the project site is designated Preservation and Golf Course. Phase 2 is designated Preservation, Residential and Public Facility.

Public Facilities — A portion of the project site is designated Park. The public facility site is designated for a sewage treatment plant.

Zoning — Phase 1 is zoned P-2, General Preservation District. Zoning in Phase 2 includes P-1, Restricted Preservation District, P-2, General Preservation District, R-10, Residential and I-2 Intensive Industrial District.

List of Approvals Required — Phase 1 requires a Special Management Area Use permit for use as a golf course. Also, a Bridge Permit from the U.S. Coast Guard is required.

Phase 2 requires the following:

- Redesignation on the Koolaupoko Development Plan to Parks and Recreation

- Rezoning to P-2, General Preservation District
- Special Management Area Permit
- Stream Diversion Permit
- Clean Water Act Permit
- Conservation District Use Permit

CHAPTER TWO

STATEMENT OF PURPOSE AND NEED

2. STATEMENT OF PURPOSE AND NEED

Nationally, the sport of golf is experiencing increasing popularity due to continued economic prosperity, as well as the aging of the population.

In Hawaii, golf demand has grown dramatically due to the growth of destination resorts which have fostered a resort golf industry. The same demographic trends which are driving the growth in popularity of golf nationally are at work in Hawaii.

Although Hawaii as a whole ranks favorably in number of golf courses, Oahu lags behind the other islands. As a state, Hawaii compares respectably (ranks #21) with other states in the ratio of golf holes to population. If Oahu was considered alone, however, it would rank 46th. This disparity between Oahu and the other islands is due to the growth of resort golf courses and the increased demand among Oahu visitors for golf.

Local resident golfers are therefore finding themselves facing increasing greens fees and a shortage of starting times. Failure of supply to keep pace with demand is expected to result in a portion of the demand going unsatisfied. This unsatisfied demand is expected to hit the local resident golfer the hardest for two reasons:

- The tourist can "outbid" the resident by paying a higher greens fee.

- The tourist generally has a more flexible schedule which will enable him/her to take advantage of available times.

Thus, a lack of supply can be expected to result in higher fees and limited availability of starting times. At the present time, three new courses are under construction and five are close to construction. Five proposed golf courses need some additional discretionary approval and 14 other proposed golf courses need substantial discretionary approval, or have no official submittals (City and County of Honolulu, July 1989).

The Bayview Golf Course Expansion is designed to meet the local resident demand for golf courses. Local residents are expected to comprise approximately half of the total membership. Membership fees for local residents will be comparable to other private golf clubs on Oahu.

The remaining membership is anticipated to be non-residents. Although mainland and international members will account for 50 percent of the members, it is expected that they will use the facility only 10 percent of the year.

A reasonable amount of playing time will be available for non-member local residents and greens fees are expected to be competitive with rates of other private courses.

CHAPTER THREE

Project Description

3. PROJECT DESCRIPTION

3.1 DESCRIPTION OF THE SUBJECT PROPERTY

The project site is bounded by Kaneohe Bay to the north and Kaneohe Bay Drive to the south. Puohala Elementary School and Playground, as well as the Puohala Subdivision, is to the west, with the Kokokahi YWCA to the east. *Figure A* shows the project location; the project site and existing uses are depicted in *Figure B*.

The total project site encompasses approximately 140 acres. Pacific Atlas (Hawaii), Inc. is the recorded fee owner of approximately 119 acres, or 85 percent of the project site, at this time.

The remaining 21 acres are owned by nine different entities, all of whom have consented to include their properties in this Environmental Impact Statement *for study purposes only*. The following describes actions required to acquire these properties:

1. Eleven acres of the project site are part of a 16-acre parcel owned by the City and County of Honolulu. This parcel contains the Kaneohe Sewage Treatment Plant. The City is currently in the process of relocating the sewage treatment plant and converting this on-site facility to a sewage pump station. This conversion is anticipated for 1994 and will result in surplus lands. The applicant is currently attempting to negotiate the lease or exchange of surplus lands resulting from the conversion.

2. Ten acres are owned by eight landowners. The applicant is currently discussing property acquisition and resident relocation with these parties.

Figure B-1 identifies current ownership of lands.

3.2 DESCRIPTION OF THE PROPOSED PROJECT

3.2.1 Golf Course and Support Facilities

Bayview Golf Course Expansion is envisioned as an 18-hole championship golf course. The conceptual master plan is presented in *Figure C*.

Support facilities include:

Clubhouse— This facility will provide a gathering place for golfers, as well as contain administrative offices necessary to operate the overall facility. The clubhouse will have a dining room, courtyard and meeting rooms.

Other Recreational Amenities— To complement golf facilities, other recreational amenities, such as tennis courts and a swimming pool, will be provided to serve facility users.

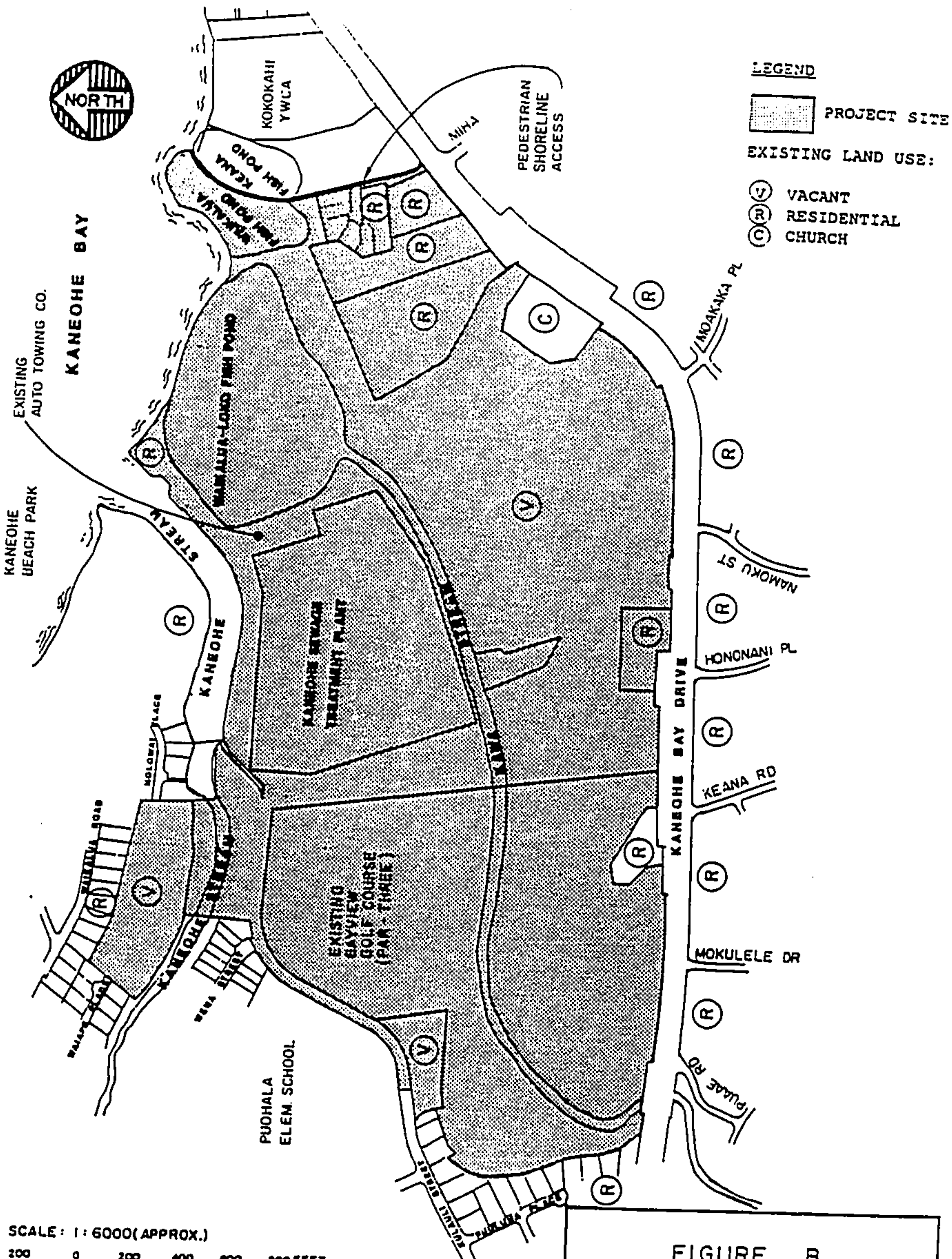
SCALE 1:24000 (APPROX.)

1000 0 1000 2000 3000 4000 5000 FEET

FIGURE A

PROJECT LOCATION

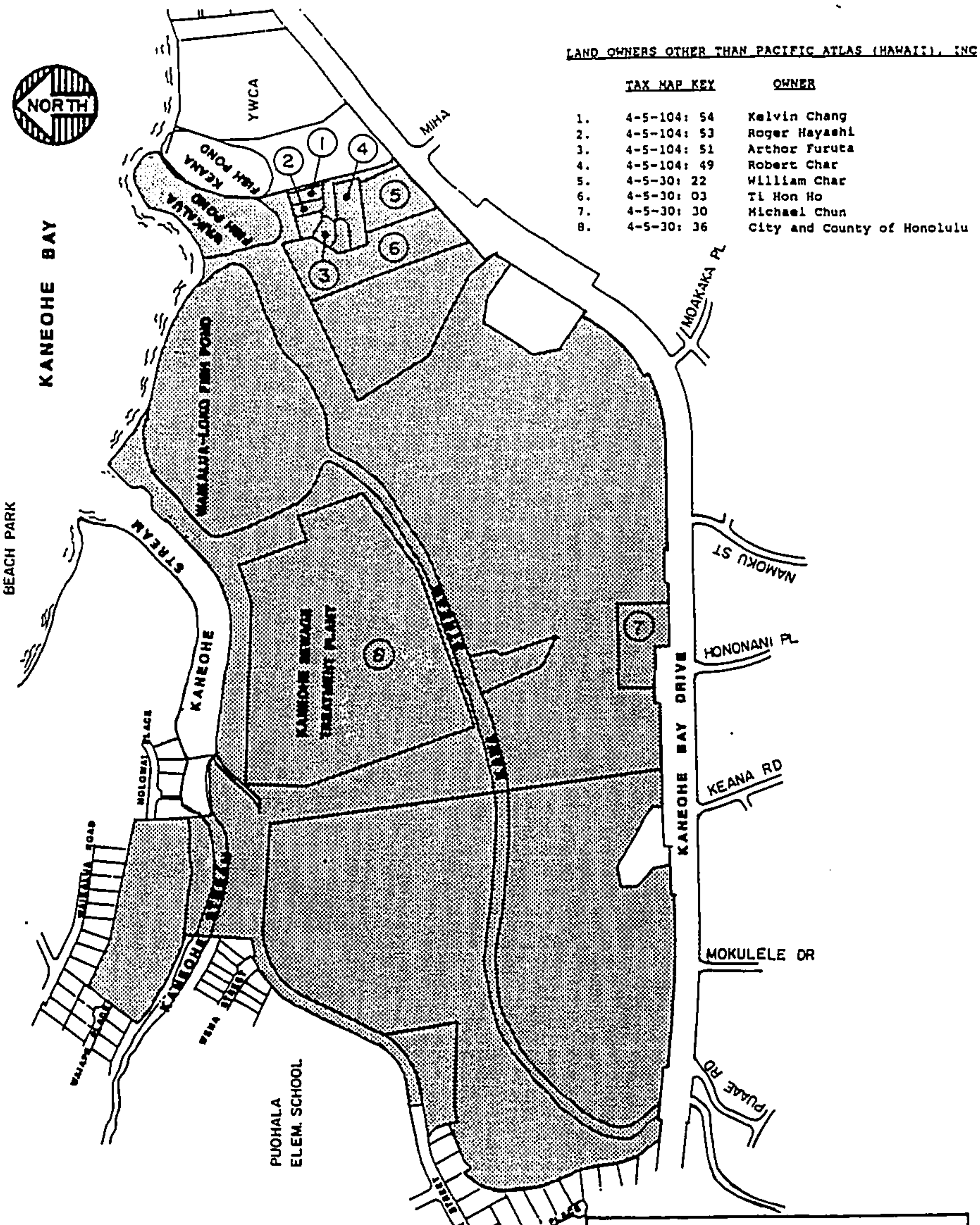
HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

FIGURE B

PROJECT SITE &
EXISTING USES



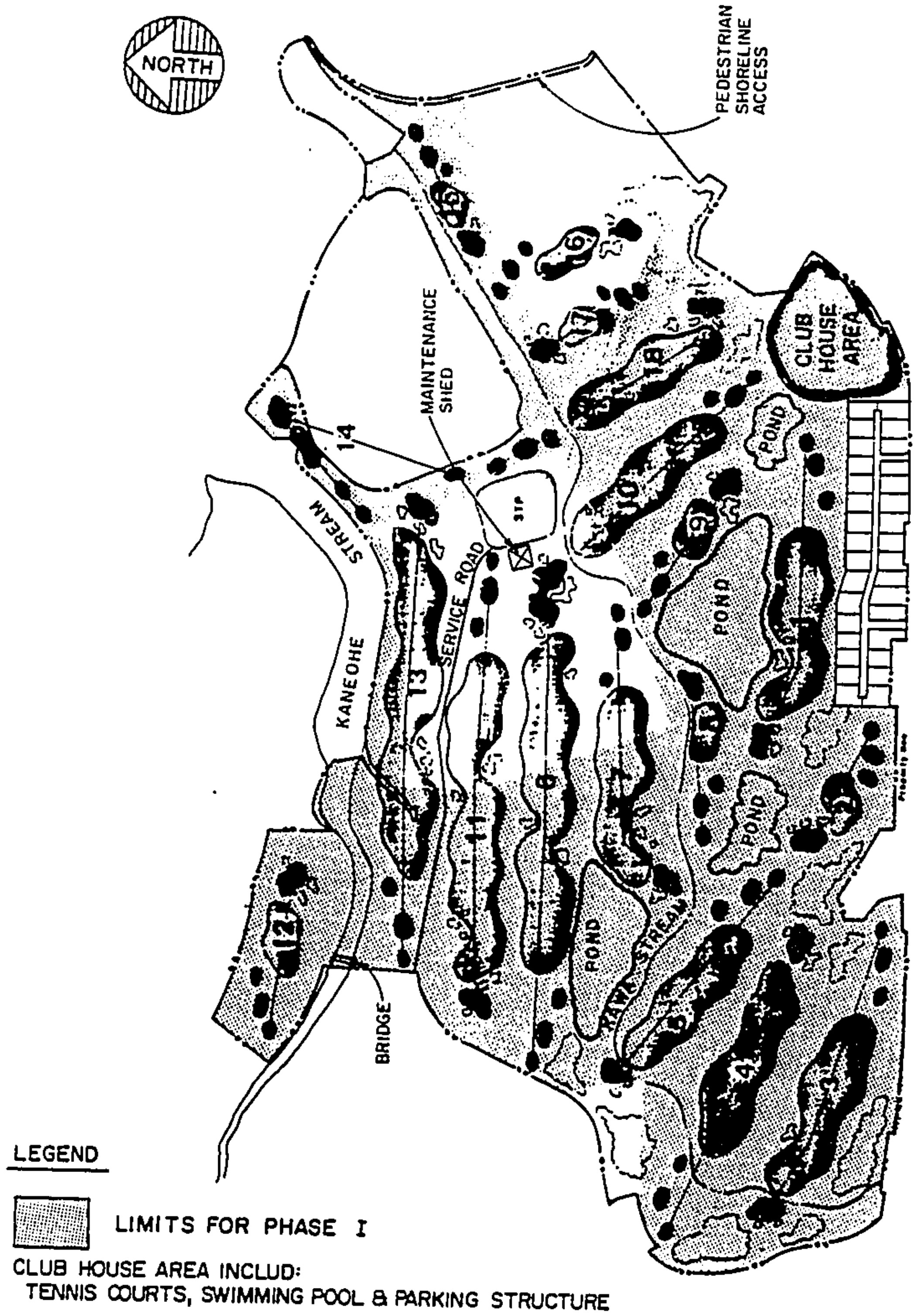
LAND OWNERS OTHER THAN PACIFIC ATLAS (HAWAII), INC.

	TAX MAP KEY	OWNER
1.	4-5-104: 54	Kelvin Chang
2.	4-5-104: 53	Roger Hayashi
3.	4-5-104: 51	Arthor Furuta
4.	4-5-104: 49	Robert Char
5.	4-5-30: 22	William Char
6.	4-5-30: 03	Ti Hon Ho
7.	4-5-30: 30	Michael Chun
8.	4-5-30: 36	City and County of Honolulu

HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

FIGURE B-1

LAND OWNERSHIP



HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

FIGURE C

CONCEPTUAL MASTER PLAN

Maintenance Shed— This is a necessary structure to house maintenance equipment and provide a base for maintenance-related activities.

Parking— A double-deck garage will contain approximately 230 parking stalls.

The proposed golf course will be a privately-owned membership club. Local residents are expected to comprise approximately half of the total membership. Membership fees for local residents will be comparable to other private golf clubs on Oahu.

The remaining membership is anticipated to be non-residents. Although mainland and international members will comprise 50 percent of the members, it is expected that they will use the facility only 10 percent of the year.

A reasonable amount of playing time will be available for non-member local residents and greens fees are expected to be competitive with rates of other private courses.

3.2.2 Proposed Water Features

Pacific Atlas (Hawaii), Inc. will incorporate existing on-site water features, including Waikalua-Loko Fishpond and Kawa Stream, as major features of the golf course design.

In addition, the site includes approximately 6.8 acres of wetlands, as mapped by Elliott and Hall in 1977 and as illustrated in *Appendix G*, "Botanical Survey: Proposed Bayview Golf Course Expansion." The proposed project includes at least partial fill of these lands and project consultants have contacted U.S. Corps of Engineers officials to initiate appropriate discussions. They have indicated that definitive boundaries for on-site wetlands will be determined during the Corps permit process. Hence, the actual acreage of on-site wetlands will be determined at a later date.

Pacific Atlas (Hawaii), Inc. proposes that the majority of the four newly-created water hazards or lakes be designed, constructed and maintained as wetlands, offering significant open water areas, as well as nesting islands. Although the plan is still in design stages, it is anticipated that the total acreage available for lake and wetland construction may exceed seven acres.

These artificial lakes and wetlands will provide a unique wetland resource of substantially greater habitat and wildlife value than the existing wetland. The new water features will be optimal habitats for both resident and migratory species. This can be accomplished by using native wetland plants knows to be utilized by native birds for food, nesting materials and protection from predators.

3.2.3 Residential Component

The residential component of the Bayview Golf Course Expansion comprises 40 lots which would be located on and near Kaneohe Bay Drive.

The lots will be approximately 5,000 to 7,500 square feet. It is anticipated that the residential component will be similar in quality to other residential developments fronting golf courses.

Pacific Atlas (Hawaii), Inc., intends that the bulk of the proposed 40 residential lots be used for relocation of other landowners. The leases between these landowners and their tenants have not been transferred to Pacific (Atlas), Inc. in land transactions. Hence, Pacific Atlas (Hawaii), Inc. does not need to honor these other leases.

Currently, there are 18 residences on eleven lots owned by other landowners. In some cases, owners' family members and relatives reside in more than one house. In current land acquisition transactions, the relocation needs are determined on a case-by-case basis. Most of the executed contracts require the transfer of two or three lots in the proposed project; one requires five lots. The lot assignment is therefore not one-to-one, but is based rather on providing lots which collectively are similar in size to the landowner's current property, and other such preferences. The relocated residents will own the land, and build their own houses.

The company has already completed negotiations with six of these landowners. Already, 20 of the 40 lots have been committed. Pacific Atlas (Hawaii), Inc. anticipates that at least ten more lots may be needed for relocation. Hence, the applicant projects that 30 of the proposed 40 residential units will be used to meet the relocation needs of those property owners displaced by the project.

In terms of affordable housing requirements, only ten residential units will therefore be available to the public. In view of the foregoing, Pacific Atlas (Hawaii), Inc. is of the opinion that the City's ten percent requirement for low/moderate income housing should only apply to those ten units available to the public. Should this approach be acceptable, only one unit (10% X 10 units) will be required to meet the City's requirement. The final decision on this matter will be made by the City Council in conjunction with rezoning of the property for this housing development from its current P-2, General Preservation District, to the proposed R-5, Residential District.

Under the current City's housing policy, it would be possible to make a monetary contribution to the City's Housing Revolving Fund or provide the housing unit at another nearby location in fulfilling the ten percent low/moderate income housing requirement. Concurrence by the City is needed in whatever approach is used.

3.2.4 Site Access and Shoreline Access

Site access will be provided on Kaneohe Bay Drive via one ingress/egress near the proposed clubhouse across from Moakaka Place, and two ingresses/egresses for the residences. The proposed project will have 230 parking stalls to serve members and their guests. A bridge over Kaneohe Stream will provide access for maintenance vehicles and golf carts to the 12th hole.

Pedestrian shoreline access will be provided along the easternmost boundary of the site.

3.2.5 Drainage

The golf course will maintain existing drainage patterns and will utilize overland flow to the existing Kawa Stream. Retention and sediment basins will be incorporated into the golf course design. The avoidance of major topographic changes minimizes the topographical impact of the development. Other mitigating measures will include compliance with the City and County of Honolulu grading ordinances which contain provisions for erosion control during construction.

After construction is completed and activities within the project site are in operation, slight increase in stormwater runoff will occur due to higher runoff coefficients for golf course fairways and green, road, parking areas and other impervious surfaces. However, other features of the golf course such as bunkers, ponds and retention basins will offset the increase in runoff flows. Consequently, the proposed golf course improvements are not expected to create a significant increase in stormwater runoff and would not adversely affect the nearby stream. Earthen berms constructed along Kawa and Kaneohe Streams may create temporary flooding, probably under maximum precipitation conditions.

3.2.6 Utilities

Water supply for the proposed project will be provided in two different systems: the potable water system and the non-potable water system, as illustrated in *Figure D*. The potable water system includes domestic supply to the clubhouse, domestic supply and fire protection for the maintenance building, and domestic supply and fire protection for residential development along Kaneohe Bay Drive. The non-potable water system is for the golf course irrigation.

Hida, Okamoto & Associates, Inc., estimates that the operation of the maintenance building, clubhouse, and residential units will require an additional 28,600 gallons of potable water per day (ppd) (See *Appendix I*). To meet this demand, the proposed potable system will tap off the 12-inch Board of Water Supply (BWS) water line along Kaneohe Bay Drive. A new water line will be installed along the entry road to the clubhouse site. The water line will be private. A new water line loop will be constructed along the new road within the

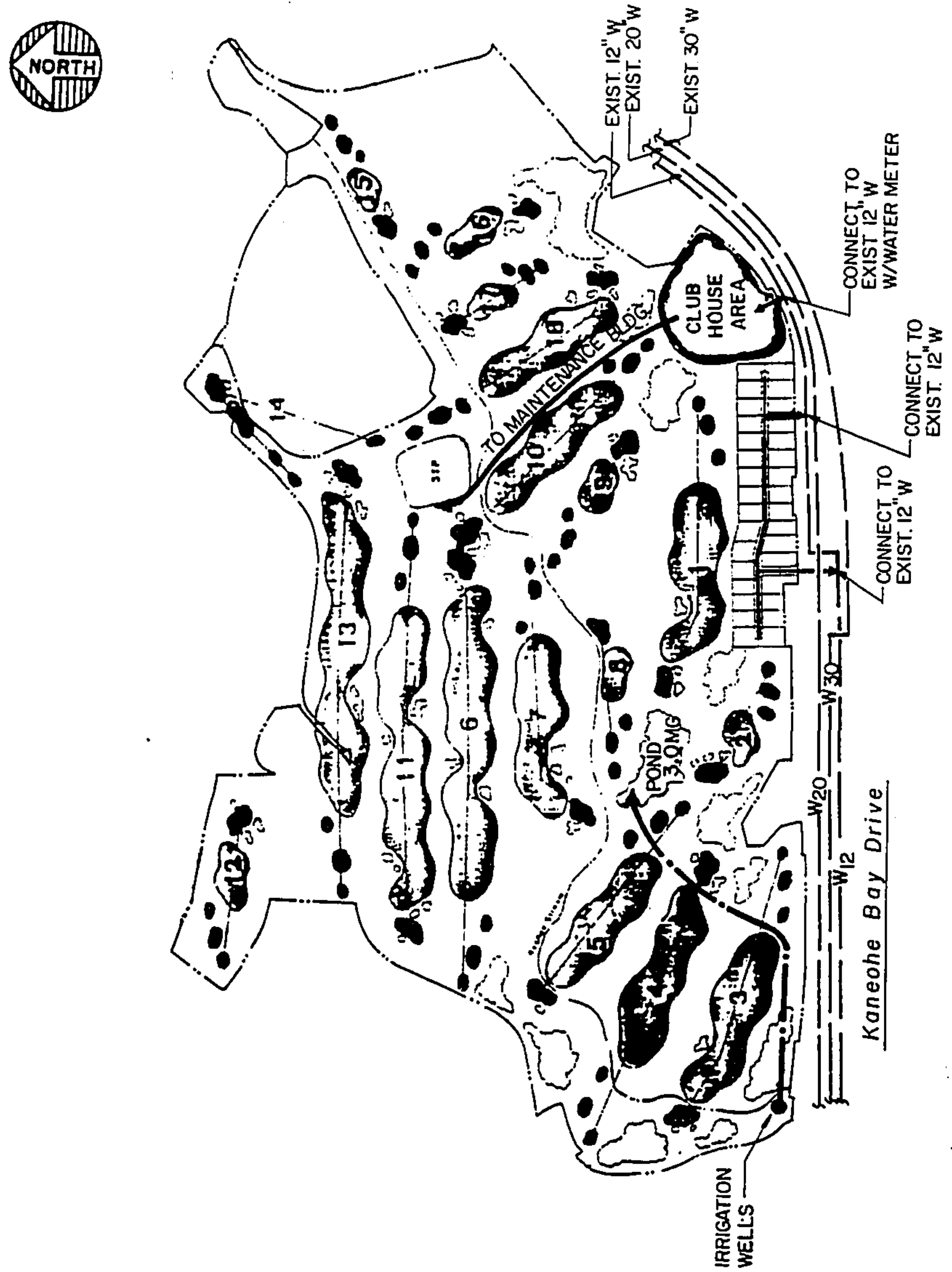


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FIGURE D

PROPOSED WATER SYSTEM

residential development and will be public. The fire hydrants, installed off of the public water line, will provide fire protection for the residential development. A parallel water line will be located within the entry road. The first line, sized to meet fire protection demands, will connect to a fire hydrant near the clubhouse and maintenance building. A second water line will be sized to meet the domestic needs of the clubhouse and maintenance building. The availability of BWS water to meet the additional demand will be determined when building permits are submitted for BWS review and approval.

Water for the non-potable/irrigation system will be supplied by two new shallow wells drilled near Kawa Stream on the property. Each well, located between 20- and 50-foot elevations, is expected to deliver up to 0.8 million gallons per day (MGD). Water from the wells will be pumped to a 2.5 million gallon (MG) irrigation storage pond located north-west of the clubhouse. Pond capacity will be a minimum of three-days' storage for irrigation.

The electrical and telephone improvements necessary to support the project will be served by the existing utility system along Kaneohe Bay Drive. Electricity and telephone lines to the clubhouse, maintenance building and residential development area will be installed underground along the proposed entry road and public road.

Total average wastewater flows are estimated at 32,900 gpd, based on calculations for water use (see *Appendix I*). Wastewater generated from the golf course activities and residential development will be of typical domestic composition. The proposed wastewater collection system for the residential development area (*Figure E*) will be located along the proposed public road. A gravity sewer will convey wastewater to a small sewage pumping station (SPS). Due to site topography, the area requires a SPS for wastewater transport. A force main from this SPS will be connected to the existing sewer manhole at Kaneohe Bay Drive. The sewer manhole will receive wastewater flows from a gravity sewer from the clubhouse area and a force main from the maintenance building site. A gravity sewer will convey wastewater to the proposed wastewater collection system within the residential area and to the Kawa Interceptor Sewer within the project area.

Wastewater generated by the project will be transmitted to and treated at the Kaneohe Sewage Treatment Plan (STP) located within the project area. The City and County of Honolulu plans to consolidate the existing STPs at Kaneohe, Kailua and Ahuimanu so that sewage from Lahikai and Maunawili to Kahaluu feeds into a proposed expanded and upgraded Kailua treatment facility. Currently, construction of a sewage pump at the existing Kaneohe STP is progressing. When upgrading at the Kailua STP is complete, the Kaneohe pump station will simply transmit and allow raw sewage to Kailua STP.

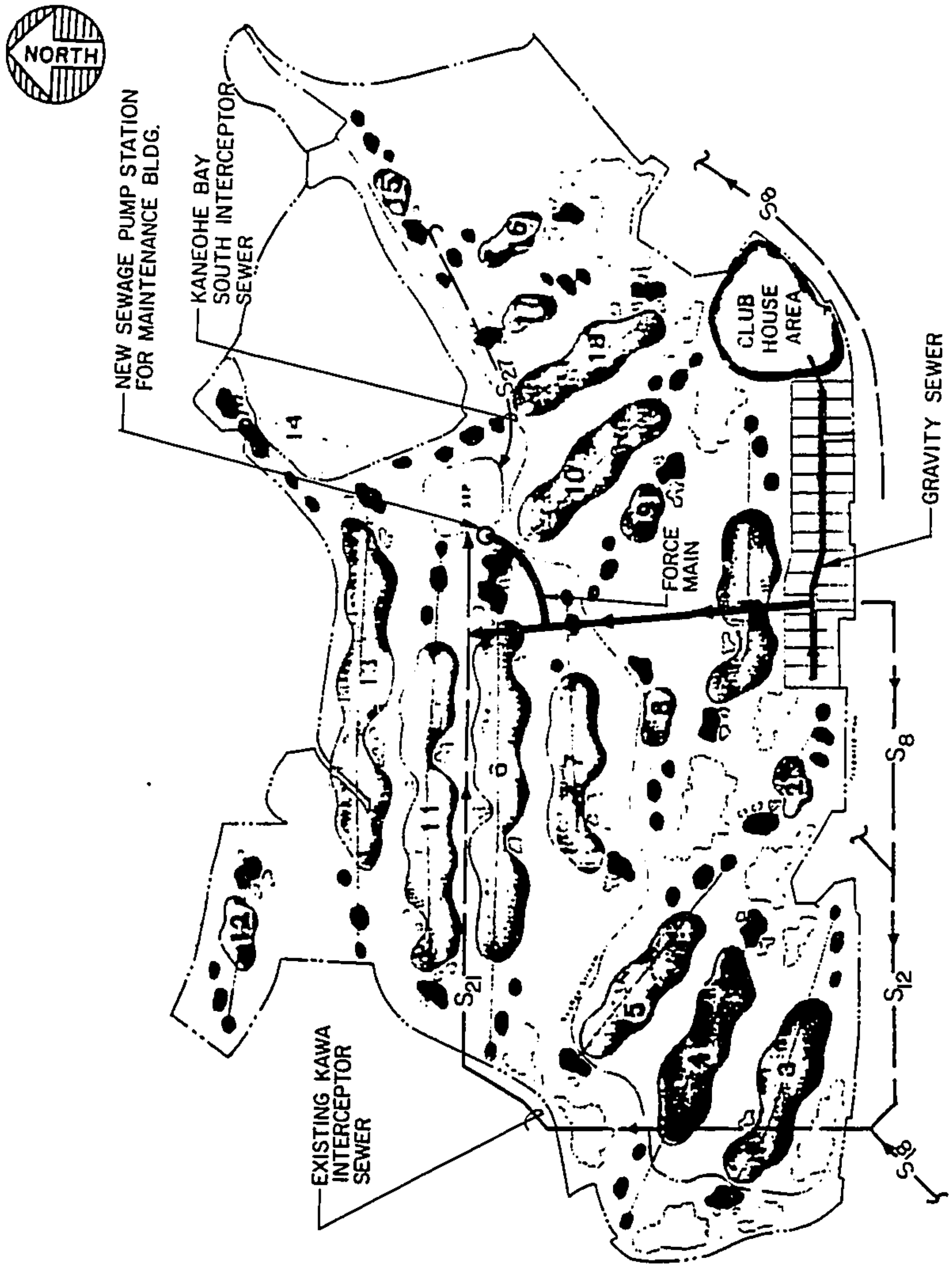

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FIGURE E

PROPOSED WASTEWATER COLLECTION SYSTEM

Solid waste from the clubhouse will be collected by a private refuse collection company and be disposed of at the public windward sanitary landfill. Solid waste generated within the residential development area will be collected by the City and County of Honolulu, Department of Public Works, Refuse Division.

3.2.7 Historical Perspective

The project site is situated within the traditional Hawaiian land unit, the ahupua`a, of Kaneohe. One of the most studied ahupua`a(s), the Kaneohe ahupua`a extends from the windward base of the Koolaus to include most of the Mokapu peninsula. Traditionally, Kaneohe has been viewed as a valuable ahupua`a, in terms of both agricultural and fishery productivity. The traditional accounts do not mention the large fish pond at Waikalua, but they do indicate the high productivity and desirability of the project area.

In the mid-1800s, Kamehameha III inherited Kaneohe, and he retained the bulk of the ahupua`a during the Mahele of 1848. After his death, his wife, Queen Kalama retained Kaneohe. Her award included the Waikalua-Loko Fishpond, but not the majority of the project area. The project site, for the most part, contained small plots of irrigated taro. Approximately 45 Land Commission Awards (LCA) were granted within the project site, and the majority of these LCAs were for less than an acre.

Kaneohe Sugar Plantation, which started around 1865, was on Queen Kalama's land with Charles Coffin Harris as partner and manager. In 1871, Harris purchased these properties from her heirs, and the Waikalua-Loko Fishpond was part of this sale.

By the late 1880s, virtually the entire project area was under rice cultivation by Chinese who rented or leased land from the Hawaiian landowners. By the 1920s, however, rice had gradually declined in importance.

In 1917, Harold K. Castle bought the Kaneohe Ranch Company, which included these lands. During the 1950s and 1960s, the Castle Estate divested itself, through sales and/or leases, of control over most of the project area. These land transactions included the City and County of Honolulu for the Kaneohe Sewage Treatment Plant, Kaneohe Golf Club, Inc., for the Bayview Golf Course and Kaneohe ranch manager Henry Wong. In these transactions, Wong obtained the Waikalua-Loko Fishpond.

Pacific Atlas (Hawaii), Inc. purchased the Bayview Golf Course in late 1988. In addition, eight other parcels in the project site have been acquired by Pacific Atlas, and negotiations for the remaining parcels are currently underway.

3.2.8 Project Objectives

The proposed project is designed to meet local demand for golf courses. The Bayview Golf Course will target local residents for its members. Local residents are expected to comprise approximately half of the total membership. Membership fees for local residents will be comparable to other private golf clubs on Oahu.

The remaining membership is anticipated to be non-residents. Although mainland and international members will comprise 50 percent of the members, however, it is expected that they will use the facility only 10 percent of the year.

A reasonable amount of playing time will be available for non-member local residents and greens fees are expected to be competitive with rates of other Oahu private courses.

The residential component of the proposed project is intended primarily for relocation of current on-site residents.

3.3 USE OF PUBLIC LANDS OR FUNDS

No public lands or funds are required to implement the Bayview Golf Course Expansion.

3.4 DEVELOPMENT SCHEDULE

Phase I of Bayview Golf Course Expansion includes eleven holes of golf, including fairways 1 through 5, 8, 9, 12, 14, 15, and 18, as well as the clubhouse. Phase II includes the remaining holes of the golf course, and the residential units.

Phase I has most of the appropriate land use designations for the proposed project use; it is designated Preservation and Golf Course on the Koolaupoko Development Plan Land Use Map and zoned P-2, General Preservation District. In addition, an application for Special Management Area Use Permit has been submitted. If all approvals are obtained by mid-1990, Phase I will be operational by the latter part of 1991, based on an 18-month construction period.

The applicant intends to seek Development Plan and zoning changes, as well as an SMA permit, for Phase II over the ensuing two years. During that time, property acquisition negotiations are also expected to continue. With an 18-month construction period, Phase II could be operational in 1993.

3.5 PROJECT COSTS

The cost of constructing the proposed golf course and support facilities is estimated at $20 million, $18 million of which will be used for the golf course itself. The other $2 million will be used for the clubhouse.

Sitework and construction of the residential units are estimated at $6 million.

CHAPTER FOUR

Existing Conditions

4. EXISTING CONDITIONS

4.1 CURRENT ON-SITE AND SURROUNDING USES

The project site currently contains the Bayview Golf Course, a par-three course, with a driving range, pro shop and meeting rooms.

Eighteen residences are also located on the project site, seven of which have been acquired by Pacific Atlas (Hawaii), Inc. Negotiations to acquire the other eleven residences are currently underway. A large portion of the project site is unused and heavily-vegetated.

In addition, other landowners have leased portions of their properties for various purposes, including an automobile towing company, residences and animal grazing. Reportedly, most of the residences have been vacated, and the lease to graze animals has been terminated. Remaining leased uses include the automobile towing operation and one residence. These leases have not been transferred to Pacific Atlas (Hawaii), Inc. in land acquisition transactions, and the current lessors are fully responsible for vacating the premises in the event of acquisition.

The project site is not as heavily-used or as dense as its surrounding areas, which include a major roadway (Kaneohe Bay Drive), single-family residences and public facilities. The site's southern edge is bounded mostly by Kaneohe Bay Drive. Southwest of the project site, across Kaneohe Bay Drive, is Castle High School.

On the northern boundary— from west to east— are residences, Kaneohe Stream and Kaneohe Bay. West of the project site are Puohala Elementary School and playground as well as residences which are part of the Puohala Village subdivision. The project site's eastern boundary is fronted by Kokokahi YWCA.

4.2 CLIMATIC CHARACTERISTICS

Median annual rainfall for the area is approximately 1000 millimeters (mm.) [39 inches]. Monthly median rainfall varies from a low of about 50 mm. [2 inches] for the period May through September, to a high of about 150 mm. [6 inches] in December and January (Giambelluca, et al., 1986).

Mean annual pan evaporation for the area is approximately 1,700 to 1,800 mm. [65 to 70 inches] (Edern and Chang, 1985).

4.3 PHYSICAL CHARACTERISTICS

4.3.1 Soils

The United States Department of Agriculture Soil Conservation Survey identifies the following soil classifications on the subject property:

HnA Hanalei silty clay, 0 to 2 percent— Most of the soil in the lower, flat portions of the project site are classified as such. This soil is generally found on stream bottoms and flood plains. In a representative profile of the surface layer which is about ten inches thick, the soil is dark-gray and very dark silty clay that has dark-brown and reddish mottles. The subsurface layer is very dark gray and dark-gray silty clay about three inches thick. Permeability is moderate. Runoff is very slow, and the erosion hazard is no more than slight. The available moisture capacity is about 2.1 inches per foot of soil.

KgB Kaneohe silty clay, 3 to 8 percent slopes— A small area in the southwestern corner of the project site contains this soil, which generally occupies uniform slopes. In a representative profile, the surface layer is dark reddish-brown silty clay about 14 inches thick. The sub-soil, 40 to more than 50 inches thick, is dusky-red and dark-red silty clay that has subangular blocky structure. Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight. The available water capacity is 1.2 inches per foot in the surface layer.

KgC Kaneohe silty clay, 8 to 15 percent slopes— Upper portions of the southwestern and southeastern areas (along Kaneohe Bay Drive) of the project site contain this soil. On this soil, runoff is medium and the erosion hazard is moderate.

AeE Alaeloa silty clay 15 to 35 percent slopes — This soil is also found on Kaneohe Bay Drive, approximately midway along the project's southern boundary. It generally occurs on smooth side slopes and toe slopes in the uplands. In a representative profile the surface layer is dark reddish-brown silty clay about ten inches thick. The sub-soil, about 48 inches thick, is dark-red and red silty clay that has subangular blocky structure. Permeability is moderately rapid. Runoff is medium, and the erosion hazard is moderate. The available water capacity is about 1.2 inches per foot in the surface layer and 1.6 inches per foot in the subsoil.

ALF Alaeloa silty clay, 40 to 70 percent slopes— Found in a portion of the southern boundary, this soil is characterized by rapid to very rapid runoff and the erosion hazard is severe.The project site is divided into two subareas for the purpose of calculating solid erosion potential (See *Figure F*). These subareas represent sites within the project area that vary in soil erosion potential characteristics such as terrain and/or drainage network.

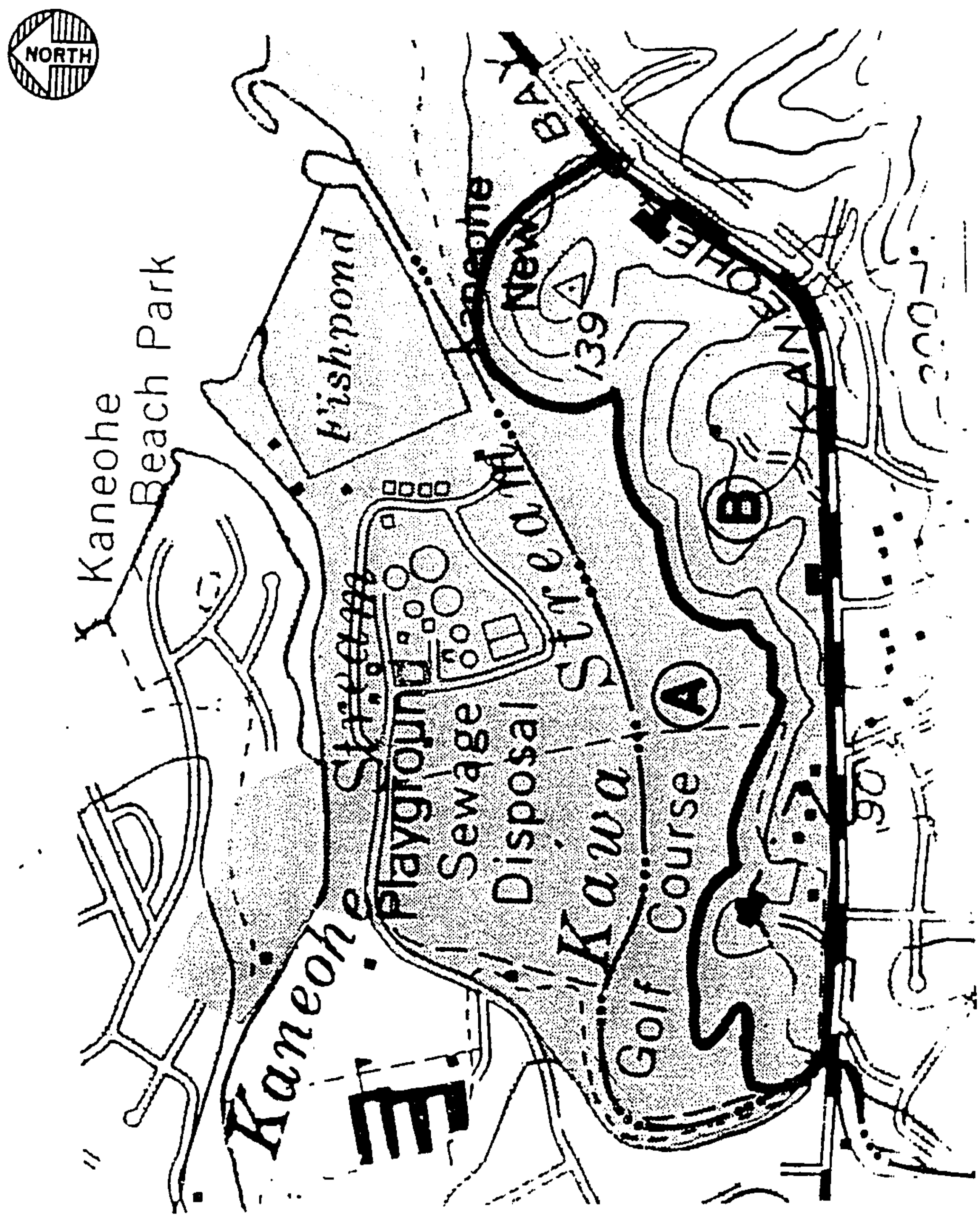

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FIGURE F

SOIL EROSION POTENTIAL

Part of the Kawa Stream drainage basin, Subarea A is located in the central plateau of the project site. This subarea occupies approximately 90 acres and is bounded north, east and west by the project limits and the south by a 15-foot contour line. The entire area of subarea A will be graded for golf course development. The subarea is characterized by the golf course on the west, wetlands adjacent to Kawa Stream on the south, Kaneohe Sewage Treatment Plant on the east toward Kaneohe Bay and Kawa Stream runs through the subarea to Kaneohe Bay.

Subarea B is located south of Kawa Stream and is bounded on south by Kaneohe Bay Drive on the north, and west and east by a 15-foot contour line. Approximately 40 acres are located in the subarea. The subarea is currently a medium-dense woodland area with plateaus bordered by steep slopes ranging from 15 to 40 percent. Approximately two-thirds will be graded for golf course and residential developments.

The existing soil erosion potential for each subarea is listed below and *Appendix I* provides information on how these estimates were derived.

EXISTING SOIL EROSION POTENTIAL

SUBAREA	ACRES	TONS/ACRE/YEAR	TONS/YEAR
A	90	0.3	27
B	40	34.0	1,360

Thus, for the entire project, the existing erosion potential is 1,387 tons per year.

4.3.2 Topography

The site's topography is illustrated in *Figure G*. The southern edge of the project site along Kaneohe Bay Drive is, on the average, at the 95-foot elevation. The portion of the property to be use for golf course is situated 60 to 40 feet lower than Kaneohe Bay Drive. Along the property boundary, the site slopes downward in a northerly direction to an elevation of 6 feet. The site is then relatively flat. Overall slope average is a gentle 0.5 percent measured along west-east axis.

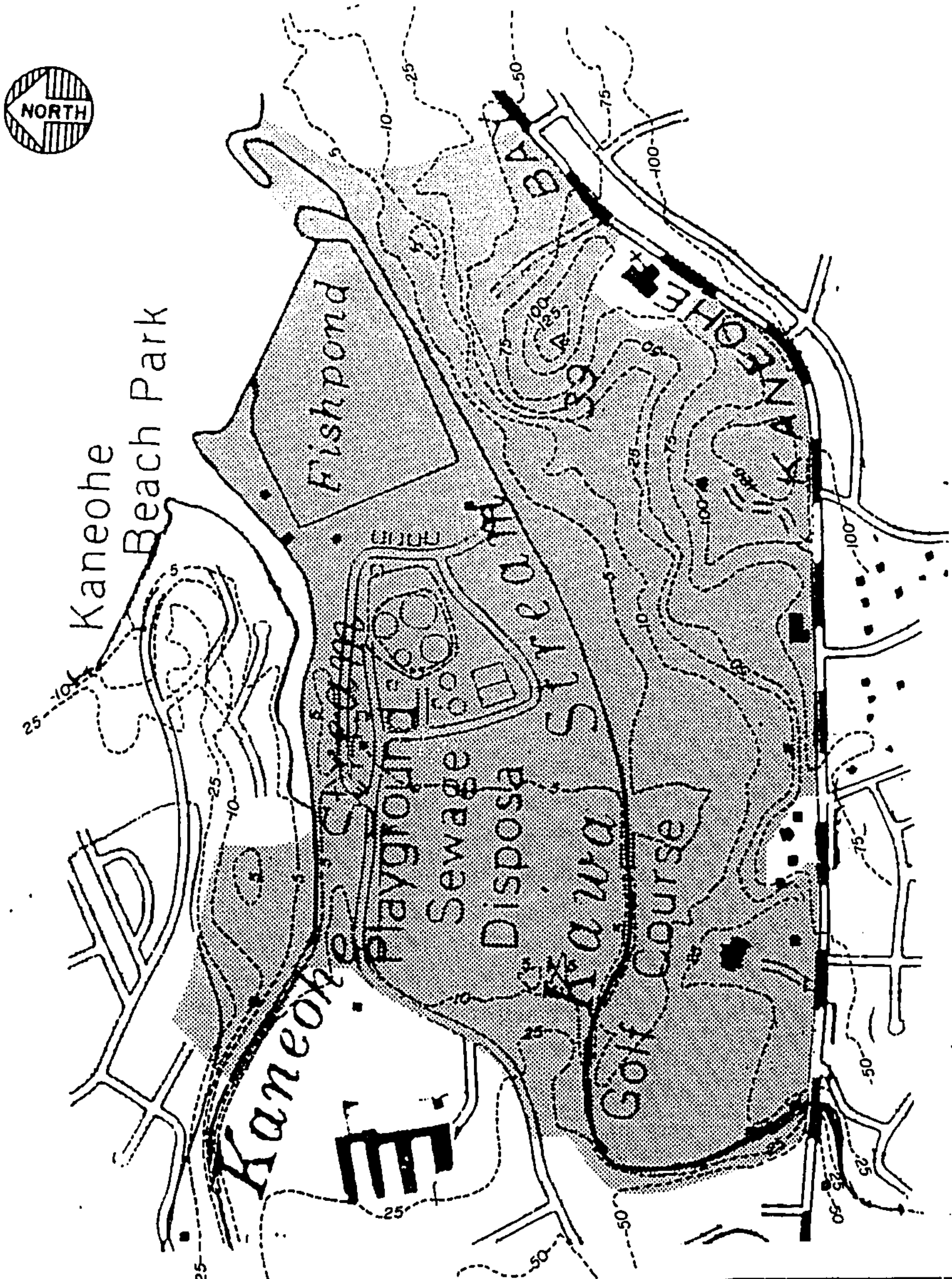

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FIGURE G

TOPOGRAPHY

4.4 HYDROLOGICAL CHARACTERISTICS

4.4.1 Water Features

The prominent natural features of the site are water-related. The site has two streams.

1. Kaneohe Stream crosses the northeast corner of the project site, discharges to a shoreline channel, which is parallel to the north boundary of the site, and empties into Kaneohe Bay.

   The stream drainage basin is located near the southern section of the Kaneohe Bay watershed where considerable urban development has taken place. Urbanization has resulted in encroachment of the stream's flood plain, and construction of a dam affected the Kamooalii and Kuou tributaries of the stream.

   Other forms of channel modification in Kaneohe Stream include concrete-lined channels, realigned channels, vegetation removal, and the presence of an elevated culvert. By 1978, nearly one-fourth of the total channel length had been modified (Norton, etal., 1978).

2. Kawa Stream originates in the vicinity of the Hawaiian Memorial Park Cemetery, at an elevation of about 400 feet. It then flows through the Pikoiloa residential area and Castle High School. Kawa Stream enters the site at or near the southwest corner and runs generally northeast through the site, terminating near the Waikalua-Loko fishpond.

   Urbanization of the watershed has had a major impact on Kawa Stream. The development of upland residential developments necessitated the realignment and reinforcement of the stream for flood protection. The entire stream has been channelized and is periodically dredged and cleared of vegetation.

   The existing Kawa Stream channel fronting the Bayview Golf Center was dredged to its present width around 1958, when the wetlands at the mouth were reclaimed for building the Kaneohe Sewage Treatment Plant. It was subsequently dredged in 1965 to remove accumulated sediment (VTN Pacific, 1977).

   The estuarine segment of Kawa Stream extends from its mouth in Kaneohe Bay about 700 meters inland to the eastern boundary of the existing golf course. The channel is straight and varies in width from about seven to nine meters. Water depths range from one to 1.5 meters.

A portion of Kawa Stream is designated Site #24 on the wetlands map of the Army Corps of Engineers. The topographical survey and botanical study was submitted to the U.S. Corps of Engineers for review of wetlands classification and boundaries.

In addition, the site contains two fishponds which are important archaeological sites. The Waikalua-Loko and Waikalua Fishponds represent significant examples of prehistoric Hawaiian fishponds, despite modern modifications and mangrove disturbance.

1. The Waikalua-Loka Pond is the largest, enclosing over eleven acres of water. Although this pond was modified in the 1930s, the original configuration is still evident. Much of the northwest and south portions of the pond boundary have been modified in modern times, with adjacent coral and earthen fill for flood control. Kawa Stream has been channelized by an artificial bank to flow seaward on the southeastern side of the pond. In spite of these adjacent modifications, the sea wall is still intact and the pond itself is clear of vegetation, except for a growth of mangrove at the southeastern end.

2. The Waikalua Pond shows portion of an intact, but mangrove-covered seawall. The pond outline is still visible, but the interior is filled with dense mangrove.

The Keana Pond is shown on historic maps as a walled-off segment of the Waikalua Pond. It appears that most of this pond is off-site, and situated on the adjacent YWCA property. In any event, this pond was filled in the 1950s, and all traces have been obliterated.

4.4.2 Water Quality

Brewer/Brandman Associates measured the physical-chemical characteristics of (1) Kawa Stream and estuary, (2) Kaneohe Stream and estuary, and (3) Kaneohe Bay waters. *Appendix B* contains the *Baseline Marine, Estuarine and Stream Surveys*, conducted by Brewer/Brandman in May 1989.

Kawa Stream and Estuary

The lower, estuarine, reaches of Kawa Stream extends from the easterly boundary of the golf course to its mouth. Water quality of this estuarine segment is characterized as follows:

- This is a salinity-stratified environment, except during heavy runoff conditions. Surface salinities ranged from 0 to 3.8 parts per thousand (ppt). Bottom water salinities, from about 1.0 to 1.5 meters, ranged from 16.25 to 23.5 ppt.

- Water temperatures in the estuarine segment were variable. Surface temperatures ranged from 23.8 to 24.8° C. Bottom waters ranged from 24.2 to 27.8° C.
- Dissolved oxygen values ranged from 4.17 to 7.8 parts per million (ppm), with surface waters showing levels at 90 percent saturation. Dissolved oxygen values in bottom waters were low.

Water quality conditions in the mauka or golf course portion of Kawa Stream were a function of runoff conditions.

- Temperatures ranged from 23.2 to 27° C.
- Dissolved oxygen values were similarly variable and ranged from 7.31 to 12.48 ppm.
- Turbidity values were variable as a direct function of runoff conditions. These ranged from 3.14 NTU, during low flow conditions, to 66.1 NTU, which corresponded to near flash-flood conditions (VTN Pacific, 1977).

Table 1 provides water quality parameters for Kawa Stream.

Table 1
WATER QUALITY PARAMETERS
KAWA STREAM & ESTUARY

LOCATION/ STATION	DATE	TIME (Hour)	TEMP (°C)	SALINITY (PPT)	D.O. (PPM)	TURBIDITY (NTU)
WWTP BRIDGE,						
Surface	3/31/89	09:30	24.8	3.8	7.44	6.54
Bottom	3/31/89	09:31	27.8	23.5	4.14	
GOLF COURSE, 1	3/31/89	10:15	27.2	0.01	12.48	3.15
GOLF COURSE, 2	3/31/89	10:27	26.9	0.00	10.55	
GOLF COURSE, 3	3/31/89	10:38	26.8	0.00	9.54	3.14
GOLF COURSE, 1	4/1/89	10:41	26.2	0.01	9.23	
GOLF COURSE, 2	4/1/89	10:49	25.8	0.00	8.34	
GOLF COURSE, 3	4/1/89	10:55	25.0	0.00	8.19	
WWTP BRIDGE,						
Surface	4/5/89	15:30	23.8	0.00	7.80	13.50
Bottom	4/5/89	15:30	24.2	16.25	6.42	
GOLF COURSE, 1	4/5/89	15:50	23.4	0.00	7.43	11.00
GOLF COURSE, 2	4/5/89	15:54	23.4	0.00	7.31	
GOLF COURSE, 3	4/5/89	15:59	23.2	0.00	7.67	4.28
WWTP BRIDGE	4/8/89	09:50	(Heavy, sustained rain)			66.10

For most parameters, the quality of Kawa Stream is better than or comparable to other streams in Windward Oahu. Some notable exceptions include:

- the greatest range of temperature and the highest mean temperature of any of the streams, which may be due to the combination of low average flow and concrete channels;
- one of the highest dissolved oxygen concentrations, perhaps due to flourishing filamentous algae; and
- some of the highest concentrations of dissolved organic carbon and total organic carbon (Konno etal., 1976).

Kaneohe Stream And Estuary

Water quality parameters associated with the boulder riprap mouth of Kaneohe Stream were similar to those reported for Kawa Stream, although the lower temperature value is about 0.5° less than the coolest temperature recorded at Kawa Stream. This difference may reflect the higher average discharge volume, larger watershed and higher elevation which characterizes Kaneohe Stream and its major tributaries.

Salinity stratification was not evident in Kaneohe Stream, as the stream mouth is exposed to prevailing winds which provide for a high degree of vertical mixing.

Salinity values ranged from 0.02 to 29.4 ppt. Dissolved oxygen values ranged from 6.9 to 8.29 ppm which suggests that water quality conditions are more stable in Kaneohe Stream than in Kawa Stream.

Existing baseline water turbidity levels are typically high, with an 86.3 NTU reading recorded after a heavy, sustained rain in April 1989.

Table 2 provides water quality parameters for Kaneohe Stream.

Table 2
WATER QUALITY PARAMETERS
KANEOHE STREAM & ESTUARY

LOCATION/ STATION	DATE	TIME (Hour)	TEMP (°C)	SALINITY (PPT)	D.O. (PPM)	TURBIDITY (NTU)
Stream Mouth, 1	3/31/89	10:44	24.2	0.02	7.37	4.12
Stream Mouth, 2	3/31/89	10:58	25.4	2.30	7.15	
Stream Mouth, 3	3/31/89	11:07	26.7	20.45	6.95	
Stream Mouth, 4	3/31/89	11:18	26.6	25.75	7.05	
Stream Mouth, 1	4/1/89	09:55	24.4	0.05	7.95	
Stream Mouth, 2	4/1/89	10:00	24.9	1.50	6.45	
Stream Mouth, 3	4/1/89	10:11	25.4	26.60	7.14	
Stream Mouth, 4	4/1/89	10:20	26.6	29.40	6.90	
Stream Mouth, 1	4/5/89	16:10	22.7	0.52	8.29	49.9
Stream Mouth, 2	4/5/89	16:13	22.7	0.60	8.05	
Stream Mouth, 3	4/5/89	16:18	23.1	1.05	8.16	
Stream Mouth, 4	4/5/89	16:24	23.3	2.56	8.23	
Stream Mouth, 1	4/8/89	09:45	(Heavy, sustained rain)			86.3

Kaneohe Bay Waters

Water quality parameters associated with nearshore waters fronting the mouths of Kaneohe and Kawa Streams are heavily influenced by tidal period, surface runoff, and subtidal and intertidal groundwater discharges. These waters are characterized as follows:

- Salinity varies from near full strength seawater to fresh water. Salinity values ranged from a low of 0.9 ppt. (during low tides and periods of heavy surface runoff) to 31.1 ppt. (high tide periods associated with little surface water runoff).

- Water temperatures also vary widely and ranged from 22.5 to 26.5°. The cooler temperatures are associated with periods of heavy runoff; warmer temperatures coincide with high tide periods.

- Dissolved oxygen levels were high and ranged from 7.04 to 9.90 ppm.

Table 3 summarizes water quality parameters for Kaneohe Bay.

Table 3
WATER QUALITY PARAMETERS
KANEOHE STREAM & ESTUARY

LOCATION/ STATION	DATE	DEPTH (M)	TIME (Hour)	TEMP (°C)	SALINITY (PPT)	D.O. (PPM)
LOW TIDE (-0.5 to -0.2 feet)						
Bay, 1	4/6/89	0.5	10:30	22.5	1.1	8.00
Bay, 1	4/6/89	1.0	10:31	22.8	2.2	7.45
Bay, 2	4/6/89	0.1	10:37	23.0	3.4	7.67
Bay, 2	4/6/89	0.5	10:38	23.1	3.8	7.38
Bay, 3	4/6/89	0.5	10:43	22.7	0.9	8.14
Bay, 3	4/6/89	1.0	10:44	24.3	5.9	7.21
Bay, 4	4/6/89	0.5	10:56	23.3	4.9	7.22
Bay, 4	4/6/89	1.1	10:57	24.4	8.8	7.04
HIGH TIDE (+1.7 to +1.8 feet)						
Bay, 1	4/6/89	0.5	13:10	25.8	23.1	8.90
Bay, 1	4/6/89	1.9	13:11	25.9	30.2	7.80
Bay, 2	4/6/89	0.5	13:15	26.1	26.4	8.85
Bay, 2	4/6/89	1.8	13:15	26.5	30.3	7.24
Bay, 3	4/6/89	0.5	13:22	25.8	20.1	8.32
Bay, 3	4/6/89	1.5	13:23	24.9	29.4	8.00
Bay, 4	4/6/89	0.5	13:33	23.9	19.0	8.13
Bay, 4	4/6/89	1.4	13:34	26.1	31.1	7.59

4.4.3 Drainage

Approximately four-fifths of the property is located within 1,000 acres of the Kawa Stream drainage area and the water shed in the Kaneohe Bay drainage basin. Kawa Stream drainage area extends from sea level at Kaneohe Bay to a maximum elevation of approximately 940 feet. The mountain range on its east side is characterized by an abrupt, steep palis that rapidly merges with a rolling plain that gently slopes towards the coast.

The stream and drainage area, shown in *Figure H*, consists of approximately 1,100 acres. There are presently no continuous gaging facilities located on the stream. Much of the stream bed within the Kawa Stream has only intermittent flow.

Figure H illustrates the Kawa Stream Drainage Basin. Most of the site's surface runoff currently flows into Kawa Stream. Erosion of on-site soil is minimal, except for areas sloping between 40 and 70 percent. These areas are found along the southern boundary and contain soils characterized by rapid to very rapid runoff and the erosion hazard is severe.

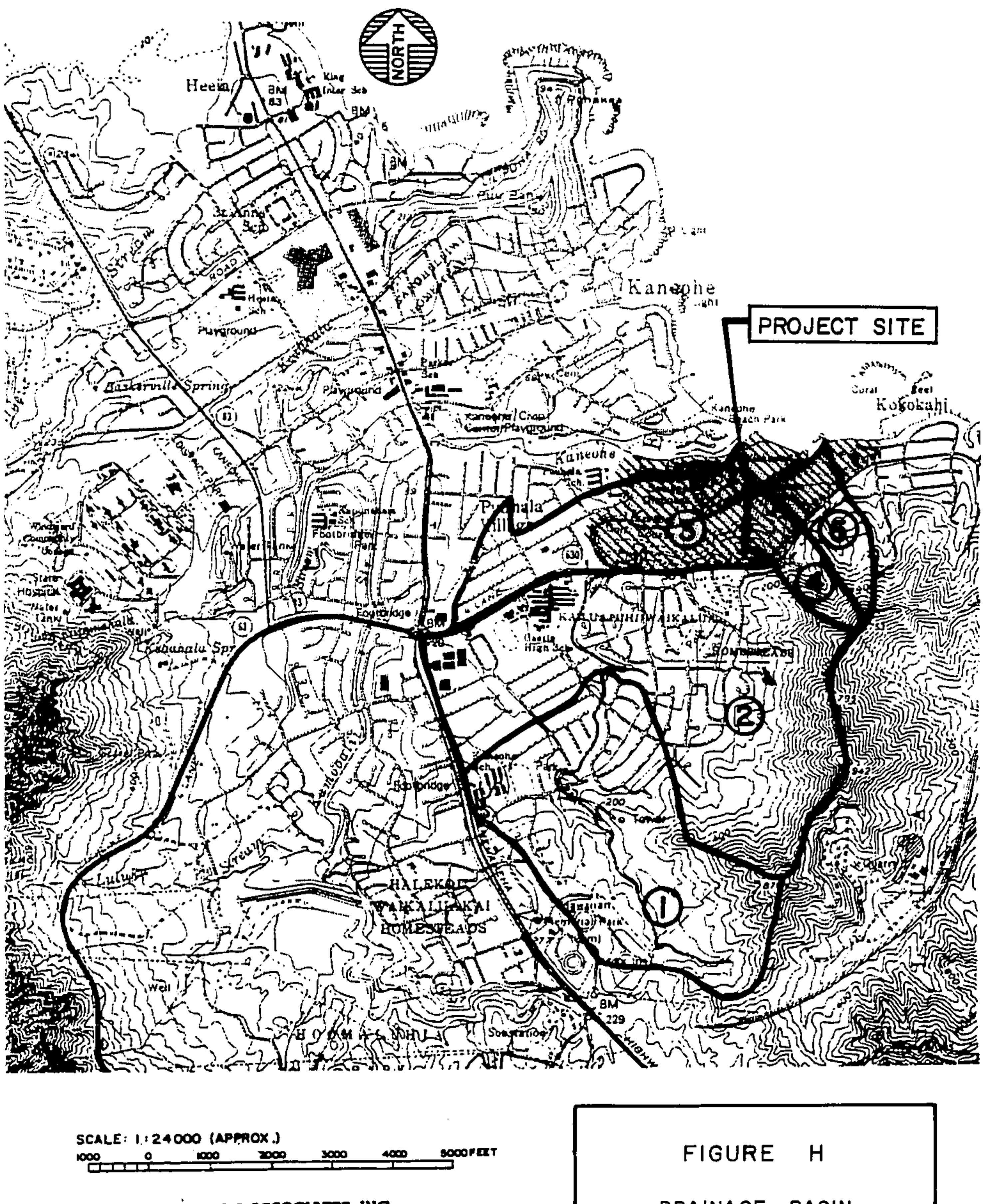

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FIGURE H

DRAINAGE BASIN

As shown on *Figure I*, most of the lower, flat portions of the site are delineated on the Federal Flood Insurance Rate Map (FIRM) as a "special flood hazard area inundated by a 100-year flood." The Zone AE designation indicates that base flood elevations have been determined; the base flood elevation increases from eight to twelve feet in a southwesterly direction.

As the site slopes upward in southerly direction, the designation changes to Zone X, "areas of 500-year flood." This designation occurs on a strip of land extending from the southwestern corner near Kaneohe Bay Drive to the mouth of Kawa Stream.

Except for the southwestern corner of the project site, the upper portions of the site along Kaneohe Bay Drive are outside FIRM designations.

4.4.4 Groundwater

Bayview Golf Course lies at the foot of the dike complex of the Koolau rift zone. In the dike complex, intrusive rocks comprise more than ten percent of the total rock mass. Intrusions are virtually impermeable compared to normal lavas, and the hydrologic environment of the dike complex is therefore unfavorable for the accumulation and movement of groundwater. The aquifer compartments between dikes are small and poorly connected.

In the marginal dike zone the aquifers, termed high level aquifers, can be moderately productive. High level dike aquifers are so named because they are created by fresh water being contained between volcanic dikes. This high level water stands about 800 feet above sea level in the vicinity of the project area.

This type of aquifer occurs at the heads of Koolau and in the lateral ridges between valleys. In general, this water is probably not floating on salt water like a basal lens, but is simply held up by the denser intrusive rock beneath.

Below the poorly developed basal lenses in the lower valleys is a transition zone of brackish water. Because of its generally poor quality, it is used only for irrigation and agricultural purposes.

Below the brackish water is a salt water aquifer, which extends to an unknown depth below sea level. Toward the coast, the fresh water in the marginal dike aquifer may be contaminated with brackish water or salt water that has encroached between the compartments of the dikes.

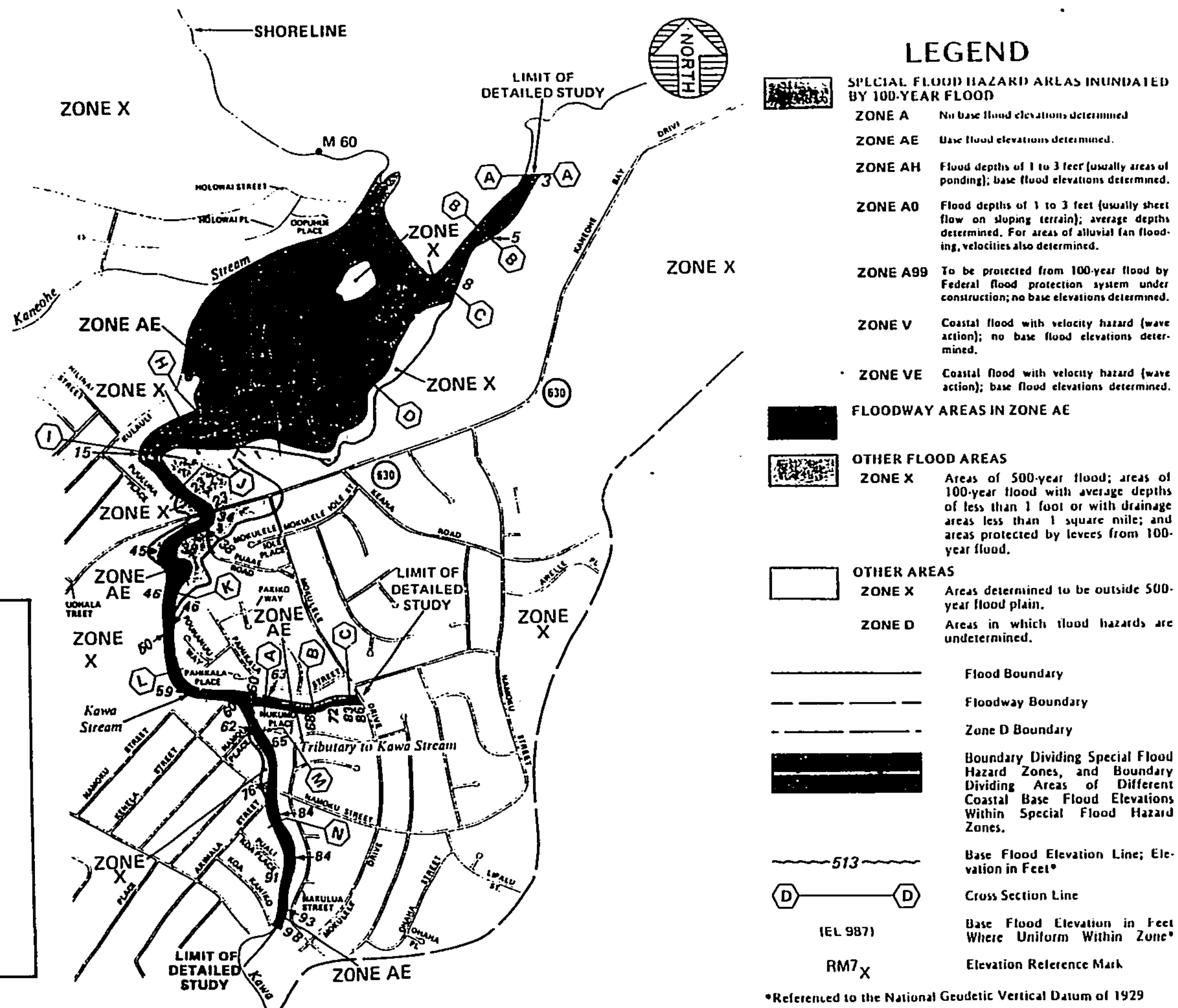


FIGURE I

FLOOD DESIGNATIONS

Figure J is a diagram showing a typical hydrologic cross section in the project area. The only significant groundwater withdrawals near the project area are made by the Board of Water Supply. These withdrawals are from well numbers I and II at Waihee, at about the 195 feet elevation and from the high-level tunnels at Kahaluu, Haiku, and Luluku. Total capacity of these sources is in the range of 10 to 15 mgd. This is compared to total windward Oahu groundwater withdrawals by the Board of Water Supply of about 130 mgd. All present and planned potable water sources in or near the project area are at elevations higher than any inhabited land.

Withdrawals of groundwater by the Board of Water Supply meets water quality standards for drinking water. These withdrawals are all at an elevation above inhabited lands.

At lower elevations in inhabited lands, the Board of Water Supply has established a "no-pass" line for prohibition of sanitary landfills and waste disposal systems. This minimizes any possibility of groundwater contamination of the basal water lens by waste disposal. The no-pass line is shown in *Figure K.* The Bayview Golf Course Expansion project lies entirely within the "pass-zone".

4.5 Water-Based Flora and Fauna

Brewer/Brandman Associates conducted qualitative surveys of nearshore coastal water habitats, intertidal flora and fauna, and biological surveys of the on-site fishpond and existing wetlands. *Appendix B* contains the *Baseline Marine, Estuarine and Stream Surveys,* conducted by Brewer/Brandman in May 1989.

As discussed in *Section 4.4.1*, Kawa and Kaneohe Streams have been highly disturbed. Channelization and lining have essentially eliminated normal stream habitat. Further, the mouths of both streams are subject to flash flooding and associated sediment loads, thereby limiting the habitat for marine and estuarine species.

Kawa Stream and Estuary

The estuarine reaches of Kawa Stream were inhabited by both exotic and indigenous species. Diversity of fishes was low and represented populations were small.

Represented fishes include juvenile barracuda (*Spyhraena barracuda*); jacks (*Caranx melampygus*); tilapia (*Oreochromis mossambicus*); juvenile manini (*Acanthurus triostegus*); and ama`ama (*Mugil cephalus*). The goby (*Psilogobius mainlandi*) was noted in the extreme lower reaches of the estuary. The only species native to Hawaii that were recorded in the estuary was the kuhlid, *Kuhlia sandwicensis* (*aholehole*).

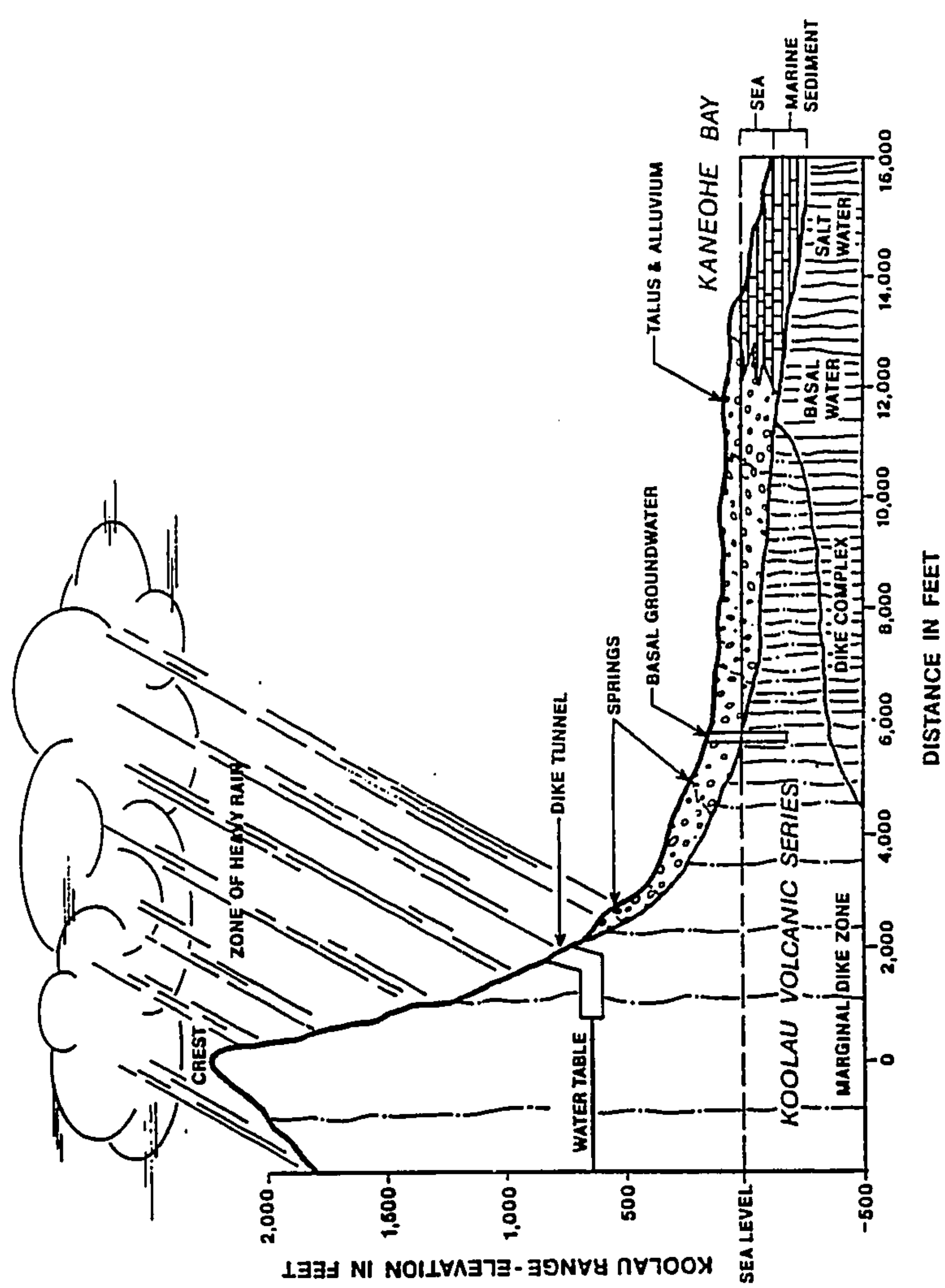


FIGURE J

TYPICAL HYDROLOGIC CROSS

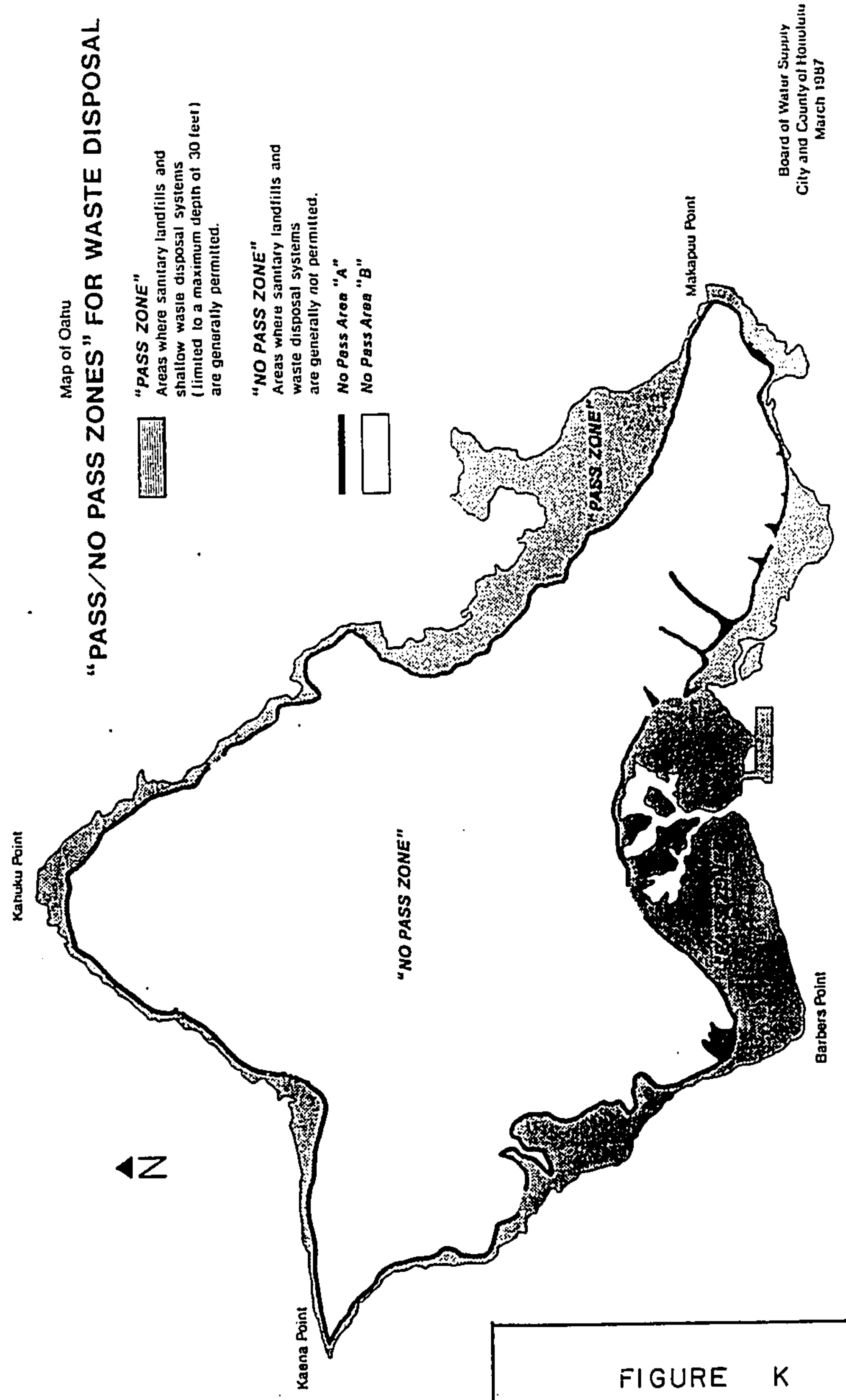


FIGURE K

"NO-PASS" LINE

The macroinvertebrate fauna was dominated by large numbers of living and dead specimens of the rock oyster, *Ostrea sandvichensis* (oyster), and barnacles (*Balanus* sp.). Crabs, namely *Grapsus tenuicrustatus* and *Metopograpsus messor*, were associated with rocky intertidal shorelines, mangrove proproots and the exposed roots of shoreline trees.

Algae were not well-represented and included various unidentified turf-building cyanophytes (blue-green algae).

The lower stream zone was populated only with exotic species, and the biota of this zone is one of low diversity. Literature reviews, combined with the results of the baseline surveys conducted for this project, indicate that no endemic stream fishes, mollusks or crustaceans have been observed in the lower reaches of Kawa Stream for at least the past eleven years. No native fishes were observed. Tilapia (*O. mossambicus*) were the largest species observed, and were extremely abundant along the non-tidal portion of the stream.

Kaneohe Stream And Estuary

The invertebrate fauna of the rock riprap segment of the Kaneohe Stream mouth was limited to a few grapsid crabs, sponges, and few live, though abundant shells of oysters (*O. sandvichensis*).

Waikalua-Loko Fishpond

The Waikalua-Loko fishpond is inhabited by sizeable but unquantified populations of barracuda (*S. barracuda*), jacks (*Caranx* sp.), mullet (*Mugil cephalus*), milkfish (*Chanos chanos*), and tilapia. The only discernible invertebrates associated with the interior of the pond wall and mangrove proproots were rock oysters. This pond was formerly used for an experimental oyster culture operation, but is no longer in commercial production (Devaney, etal, 1976).

Nearshore Reef Flat

This zone is largely a sedimentation basin for Kaneohe Stream, and aerial photographs show a distinct delta created by sediment deposition from both Kawa and Kaneohe Streams. This zone is influenced by subtidal freshwater springs, resulting in cool water temperatures, and appear to be independent of local surface runoff from either stream.

The nearshore reef flat has little discernible permanent habitat for marine or estuarine species and demonstrates extremely low biological diversity. Represented species included heavily-silted orange sponges; the red alga, *Polysiphonia* sp., the bivalves *Ostrea* and *Chama* (mostly dead); and a very modest assortment of fish.

Normal mudflat crustaceans and mollusks were not found during walking surveys on a minus tide. Shells were observed, but live specimen were not seen. These observations suggest that this zone is one of continual sediment deposition, a process that inhibits the development of benthic communities.

Slope Zone

The slope zone, which is seaward of the Kaneohe Stream delta, demonstrated a low diversity of both benthic and pelagic marine organisms, comparable to the impoverished inshore delta community.

Patch Reef Zone

The northeast side of the mouth of Kawa Stream is abutted by a shallow patch reef. Biological surveys showed only moderate amounts of silt and sediment, suggesting that the majority of the reef is outside the influence of sediment-laden runoff waters from Kaneohe and Kawa Streams.

Microalgae were poorly represented. Although numerous small dead corals littered wide areas of the reef flat, live corals were not observed on the reef flat proper.

A total of 34 species of fish representing 21 families were recorded from the patch reef and adjacent slopes. Six species which were listed as abundant included the labrid *Thalassoma duperreyi* (*hinalea lau-wili*); a goby; the acanthurids *A. triostegus* (*manini*) and *A. dussumieri* (*palani*); the jack; and a diverse group of unidentified juvenile parrotfish (*Scarus* sp.).

Fishes recorded in the rare category included the trumpetfish, *Aulostomus chinensis* (*nunu*); the moray eel, *Gymnothorax* sp. (puhi); the Moorish idol, *Zanclus canescens* (*kihikihi*) and unidentified juvenile boxfish; and the eagle ray, *A. narinari*. A single school of juvenile hammerhead sharks, each about 40 centimeters in length, was observed beneath the pier.

4.6 FLORA AND FAUNA

4.6.1 Vegetation

A botanical study of the project site was conducted by Char and Associates. The basic methodology included a literature search and a walk-through survey; this report is presented in *Appendix G*.

Three main vegetation types were recognized on the site:

- **Wetlands,** in which there was some degree of inundation by fresh or saline water;
- **Dry Level Ground,** including moist but non-inundated pasture, lawn areas, and weedy waysides; and
- **Hillsides.**

A total of 212 species of vascular plants were found, of which 94 percent were exotics or Polynesian-introduced species. Only twelve were native or presumed-native species.

No threatened or endangered species, as listed by the U.S. Fish and Wildlife Service or Herbst, were found on the site. Nor were any plants found on the site proposed or candidates for listing. While a number of trees were of sufficient stature to have value in future landscaping, none are listed as exceptional trees by the City and County of Honolulu.

Wetlands

In general the wetlands was found to be little more than a boggy meadow with scarcely any open water. The two sub-types of wetlands vegetation included:

1. Wet Meadow South Of Kawa Stream

The dominant plant was California grass (*Brachiaria mutica*), a common pasturage grass in moist areas. Evenly scattered were clumps of ludwigia (*Ludwigia octovalvis*) and Job's tears (*Coix lachryma-jobi*). Minor, though still widespread, were the dayflower (*Commelina diffusa*) and kyllinga (*Kyllinga brevifolia*), and pluchea (*Pluchea indica* and *P. symphytifolia*) which were common on the slightly more elevated area. Isolated patches or single plants of the following also were found: Chinese taro (*Alocasia cucullata*), `ape (*Alocasia macrorrhiza*), taro (*Colocasia esculenta*), impatiens (*Impatiens wallerana*), duckweed (*Lemna minor*), banana (*Musa* x *paradisiaca*), and hau (*Hibiscus tiliaceus*).

2. Stand Of Mangroves (*Rhizophora mangle*)

While this is one of the few trees to tolerate inundation of roots by seawater, the mangrove is primarily a plant of brackish areas, often forming extensive stands composed almost exclusively of the one species. Its habitat preferences, ability to anchor otherwise-unstable substrate, and extreme productivity make it the basis for many food-chains in the tropics. In addition, it is an effective screen against salt spray, and may be the best means of protecting shoreline from damage due to storm surge and tsunami. On the other hand, its rank growth make it inimical to Hawaiian fish ponds.

All other plants found with the mangroves were relatively minor constituents.

Dry Level Ground

This vegetation type had the greatest diversity of sub-types, and thus species, but the sub-types were also very poorly distinguished from one another, often grading from one into the other. In a very broad interpretation, this vegetation type had three main sub-types:

1. Grassland Or Pasture

   The dominant pasture grass was California grass, though Hilo grass (*Paspalum conjugatum*) was locally dominant. Where the California grass dominated, there was little else. Where the lower-statured Hilo grass predominated, a large variety of wayside weeds were present, usually as minor elements. Pigweeds (*Amaranthus spinosus* and *A. lividus*) and young plants of an apparently large, spiny, unidentified nightshade were especially common. Examples of less common, but still conspicuous, components of this vegetation were the wood fern (*Thelypteris parasitica*), sour grass (*Digitaria insularis*), crab grasses (other *Digitaria* spp.), Guinea grass (*Panicum maximum*) and elephant grass (*Pennisetum purpureum*).

   Some of the taller ornamental plants found in the pasture areas included the coconut (*Cocos nucifera*), African tulip tree (*Spathodea campanulata*), erythrina (*Erythrina variegata*) and monkeypod (*Samanea saman*) These ornamentals were all apparently persisting from previous plantings.

   Where animals have been allowed to overgraze, grasses no longer predominated, and most of the vegetation consisted of ruderal weeds.

2. Mowed Lawns

   Lawn areas were either predominantly Bermuda grass (*Cynodon dactylon*) or Hilo grass, depending on the relative wetness of the soil and frequency of disturbance. Where the grass had been destroyed recently, and had not yet recovered, as well as where the grass was not adequately mowed, ruderal weeds predominated.

3. Weedy Waysides

Ruderal weeds also predominated along roadsides, where vehicular traffic and other factors prevented the establishment of lawn grasses.

The small detached parcel across Kaneohe Stream was a hybrid site. While it was basically dry level ground, the proximity of the stream and the developed slopes above allowed elements of all vegetation types to commingle. Much of the parcel was covered with a forest of koa haole (*Leucaena leucocephala*) and Javaplum trees (*Syzygium cumini*). In these was a dense tangle of vines, such as koali-awahia (*Ipomoea indica*) and maili pilau (*Paederia scandens*), as well as ornamental asparagus (*Asparagus falcatus*) and passion fruit (*Passiflora ligularis*). In the understory were cinnamon (*Cinnamomum burmannii*), `uhaloa (*Waltheria indica*), bananas and castorbean. That part of the parcel not covered with tress was a dense tangle of elephant grass.

Hillside Vegetation

The hillsides below Kaneohe Bay Drive had the most diverse vegetation due to variations in slope, exposure, soil moisture, and human impact. Two basic sub-types of vegetation were identified:

1. Dense Javaplum Forest

Most of the hillside areas was dominated by a tall, closed canopy Javaplum forest with koa haole understory. An old mango (*Mangifera indica*), some stately date palms (*Phoenix dactylifera*), and a large Chinese banyan (*Ficus microcarpa*), added interest. A small cespitose palm, (*Ptychosperma* sp.), not previously reported as naturalized in Hawaii, was very common. An open understory was represented by octopus tree saplings (*Schefflera actinophylla*), heliconia (*Heliconia* sp.), Christmas berry (*Schinus terebinthifolius*) young cinnamon trees, Mickey Mouse plan (*Ochna kirkii*), fern tree (*Filicium decipiens*), and cassia (*Senna surattensis*). Ground cover was generally sparse. One interesting feature was a level terrace where water was impounded and taro and `ape were growing.

2. Exposed Ridgetops

More exposed ridgetops were covered with open, low-stature scrub. The dominant species were either Javaplum-Christmas berry-guava or Christmas berry-guava-octopus tree. The ground beneath the scrub vegetation was covered by a dense growth of grasses and herbs. Two noteworthy plants of the scrub were Koster's curse (*Clidemia hirta*), never before reported from a site so close to the ocean, and u`ulei (*Osteomeles anthyllidifolia*), a remnant of the native lowland scrub vegetation.

A clump of hau was on a boggy level ground at the foot of the slope, and extended up slope a short distance. It had overgrown an old road at the foot of the hillside, and so had evidently begun below and climbed the hill with time, or had begun above and later descended to proliferate below. The clump was too dense to be penetrated beyond the edges.

4.6.2 Birds and Mammals

Andrew J. Berger studied the terrestrial vertebrate animals of the project site and this study is contained in *Appendix D*. The basic methodology included a literature search and a walk-through survey.

1. <u>Birds</u>

None of the introduced birds which may occur at the project site or in this general region are endangered or threatened.

Introduced birds which are found on or near the site include cattle egret (*Bubulcus ibis*), spotted or Chinese dove (*Streptopelia chinensis*), barred or zebra dove (*Geopelia striata*), red-vented bulbul (*Pycnonotus cafer*), Japanese white-eye, or mejiro, (*Zosterops j. japonicus*), the common Indian myna (*Acridotheres tristis*), orange-cheeked waxbill (*Estrilda melpoda*), red avadavat (*Amandava amandava*), nutmeg mannikin or ricebird (*Lonchura punctulata*), Java sparrow (*Padda oryzivora*), house sparrow (*Passer domesticus*), red-crested cardinal (*Paroaria coronata*), northern cardinal (*Cardinalis cardinalis*), and house finch (*Carpodacus mexicanus frontalis*).

Small flocks of pigeons (*Columba livia*) occur sporadically in the area, but it is uncertain if these are feral birds or originate from a nearby pigeon loft. The barn owl (*Tyto alba pratincola*) has been seen on both leeward and windward sides of the island. Although none was spotted during the field survey, it is reasonable to assume that one or more owls forage over the project site for food.

Of the indigenous birds, it is possible that the black-crowned night heron (*Nycticorax n. hoactli*) may occasionally visit the site, although none was found along Kawa Stream during the field survey. The lesser golden plover (*Pluvialis dominica* *fulva*) may also visit the project site. The project region contains no habitats for the indigenous seabirds.

The only endemic bird which may remotely occur on the project site is the endangered Hawaiian owl or Pueo (*Asio flammeus sandwichensis*). It is noted, however, that the Pueo was not observed in this area during this or previous field surveys, nor have there been any published reports of this occurrence.

2. Mammals

It is reasonable to assume that the following rodents occur on the project site: roof rat (*Rattus rattus*), Polynesian rat (*Rattus exulans*), and Norway rat (*Rattus norvegicus*). Further, feral cats and dogs, as well as the diurnal mongoose, would be common on the project site.

4.7 ARCHAEOLOGICAL RESOURCES

An archaeology study was conducted by Cultural Surveys Hawaii and is presented in *Appendix C.* The methods used to conduct this study included background research, a field survey and subsurface testing.

Historical Summary

The historical research on the subject parcel, including examination of the number and kind of Land Court Awards, indicates that the lower floodplain of Kaneohe and Kawa Streams was densely used in prehistoric and historic times for taro cultivation. At one time, three fishponds were located along the shoreline and even the slopes above the plain, near the present Kaneohe Bay Drive, were used for habitation and dryland planting.

The study area may have been one of the most heavily used and most agriculturally productive on Oahu. Approximately 45 separate Land Court Awards were granted within the study area in the mid 1800s. Most of these were *lo`i*, or wetland taro plots, of less than one acre, which were irrigated by a permanent *auwai* system. Because the land was so valuable here, Chiefs and *Konohiki(s)* received plots of land which were generally much larger than those received by commoners.

Following the Mahele and by the 1880s, almost the entire floodplain was given over to rice cultivation. The Kaneohe Rice Mill was built mauka of the project area and rice was mostly cultivated by Chinese farmers. Following the fall in rice prices, taro again flourished and was planted on the floodplain up until the 1950s.

With increased urbanization and associated improvements, the project area has been extensively modified since the 1950s.

Survey Results and Fishpond Significance

Partly as a result of these dramatic modifications of the study area, and in spite of historic evidence for intensive prehistoric and early history use, only two archaeological sites were found on the property. These are the Waikalua-Loko and Waikalua Fishponds. Both of these ponds and their immediate fringes are important archaeological sites.

The Waikalua-Loko Pond has been in continuous productive use to the present time. The pond itself is in good condition. There has been only a small encroachment by mangrove. The pond has been considered significant according to all four of the National Register of Historic Places Criteria which include:

1. Site reflects major trends or events in the history of the state or nation.
2. Site is associated with the lives of person significant in our past.
3. Site is an excellent example of a site type.
4. Site may be likely to yield information important to prehistory or history (Apple and Kikuchi, 1975).

In addition, the site also meets a more recent criteria of having cultural significance, since a fishpond certainly qualifies when the products of the ponds were offered to the gods or eaten by the elite.

Although the walls of the Waikalua Pond are intact, they are heavily overgrown with mangrove with mangrove and, to a lesser extent, hau. The entire interior of the pond is also overgrown.

The original configuration of this pond may be slightly changed with partial filling on the east side; a sewer line passes on the east and south side. Because of the intact seawall, however, the pond is judged to meet all of the criteria mentioned for Waikalua-Loko Pond.

On the western side banked reef deposits contain plentiful marine shells and some possible basalt flakes which may represent early occupation associated with the pond. It is therefore particularly likely that the pond could yield information important to prehistory or history.

Subsurface Testing

Subsurface testing was conducted with use of a backhoe along what was judged to be the least disturbed section of the floodplain. This areas was located along the west boundary of the sewage treatment plant on the north side of Kawa Stream.

The original ponded, gleyed sediments, associated with former taro and rice planting, were encountered at depths varying from 60 to 120 centimeters. These paddy soils have been covered with an extensive layer of imported fill containing broken glass, road tar and other historic trash. If these are representative profiles as they are believed to be, then large areas of the floodplain have been filled in modern times, probably in efforts to reclaim marshlands. This filling would have covered much of the original taro and rice lands, and buried associated terraces and other features. Many of the slopes and level uplands above the streams have been graded and covered as well.

No terracing or buried ancient feature or material was found. Thus, there is an obvious disparity between the abundant historic evidence for intensive prehistoric land use in the project area and the lack of discovery of archaeological features and layers.

4.8 UTILITIES

4.8.1 Water

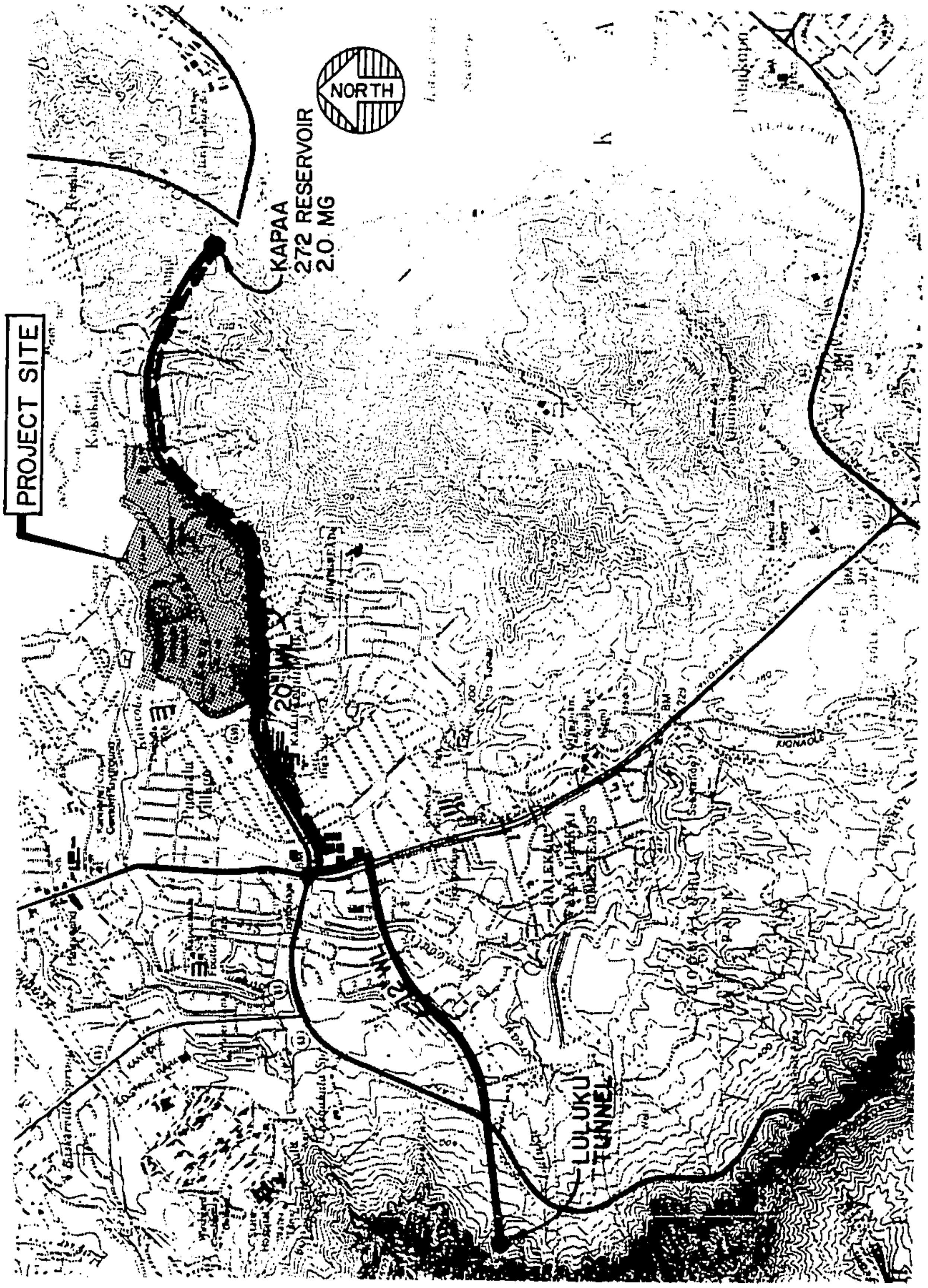
The primary source of water in the vicinity of the project site is Luluku Tunnel. The Board of Water Supply's 272 Kapaa System serves the properties along Kaneohe Bay Drive, with the Kapaa 272 Reservoir nearest to the project site. This reservoir has a 2.0 million gallon capacity. Depicted in *Figure L*, this system includes a 30-inch water transmission line and 12-inch and 20-inch distribution mains along Kaneohe Bay Drive.

4.8.2 Wastewater Facilities

The project site is within the tributary areas of the existing Kaneohe Wastewater Treatment Plant system. Presently, the wastewater generated by the existing houses and clubhouse along Kaneohe Bay Drive is covered by the existing gravity sewer system along Kaneohe Bay Drive. East of the intersection at Kaneohe Bay Drive and Keana Street, an eight-inch Kaneohe Sewers Section 7 gravity sewer system carries wastewater to the 21-inch Kawa Interceptor Sewer for eventual treatment at Kaneohe Wastewater Treatment Plant.

4.8.3 Electrical and Telephone Services

Power and telephone service to the site is currently supplied by an overhead line along Kaneohe Bay Drive. Power to these lines is supplied by the Puohala Substation through Puohala #2 Feeder, which has limited available capacity.



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1000 0 1000 2000 3000 4000 5000 FEET

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FIGURE L

EXISTING WATER SYSTEM

4.8.4 Solid Waste

Presently, solid waste generated within the project area is collected by the City and County of Honolulu, Department of Public Works, Refuse Division. Solid waste generated by the existing on-site clubhouse is collected by a private refuse collection company.

4.9 ROADWAYS AND TRAFFIC

4.9.1 Existing Roadway System

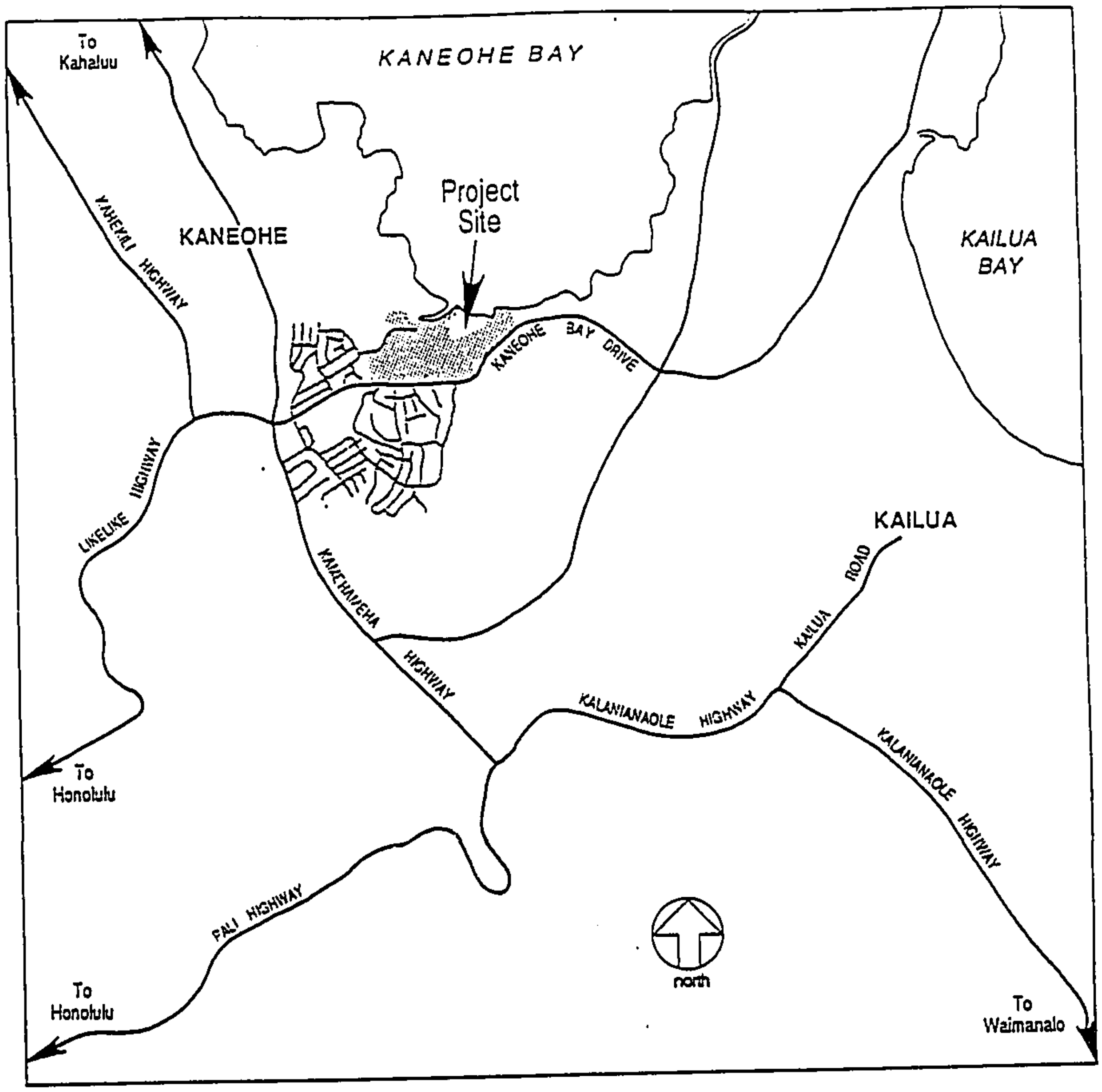
The traffic study for this project was conducted by Pacific Planning and Engineering, Inc., and is presented in *Appendix F.*

Figure M shows existing roadways in the vicinity of the project site. Kaneohe Bay Drive, a two-lane roadway adjacent to the project site, is a Federal Aid Secondary Highway under the jurisdiction of the State Department of Transportation. The posted speed is 35 miles per hour, and the driveways of adjoining land uses connect directly to Kaneohe Bay Drive.

From the project site, Kaneohe Bay Drive leads north to the Mokapu Saddle Road, Kailua, Kaneohe Marine Corps Air Station and the H-3 freeway. To the south, Kaneohe Bay Drive intersects with Mokulele Drive, and, further south, intersects with Kamehameha Highway to the east and Kaneohe to the west. Mokulele Drive also provides access to Kamehameha Highway closer toward the Pali Highway.

In the vicinity of the project site, the Mokulele Drive intersection is the only signalized intersection and the only intersection with exclusive turn lanes. The northbound approach of Kaneohe Bay Drive has an exclusive right turn lane to Mokulele Drive, but the storage and transition length of the right turn lane is too short to be effectively utilized. The southbound approach has two lanes, one for through movements and an exclusive left-turn lane. The Mokulele Drive approach widens sufficiently to provide a right- and left-turn lane.

The other unsignalized intersections along Kaneohe Bay Drive, between Mokulele Drive and Kokokahi Place, do not have exclusive turning lanes. The State Department of Transportation (DOT) has programmed the construction of turning lanes at the Kokokahi Place intersection in 1990. There is a sight distance problem to the south of the Moakaka Place intersection due to a combined horizontal / vertical curve.



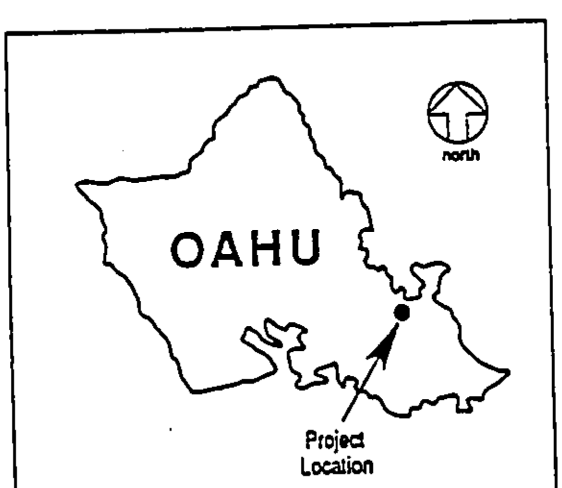


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FIGURE M

EXISTING ROADWAY NETWORK

4.9.2 Existing Traffic Conditions

Traffic counts from the State DOT, Highways Division, provided information on traffic trends. Until 1986, traffic volumes on Kaneohe Bay Drive were increasing at a very modest rate of nine percent at Kamehameha Highway and 1.5 percent at Mokapu Saddle Road. When the H-3 link between Kamehameha Highway and the Kaneohe Marine Corps Air Station was opened in 1986, traffic decreased sharply, by 15 percent at Kamehameha Highway, and has been increasing slowly again. *Figure N* shows the trend in average existing and projected daily traffic volumes on Kaneohe Bay Drive at Mokapu Saddle Road.

Manual traffic counts were taken at several intersections on Kaneohe Bay Drive in March 1989, during the afternoon peak period. *Figure O* shows the results of these counts for the peak hour.

The following table indicates that the number of accidents have been increasing annually, despite a decrease in traffic volumes in 1987. Most of the accidents involved two or more vehicles.

Table 4

**Kaneohe Bay Drive:
Traffic Accident Summary**

MILEPOSTS	GENERAL LOCATION	NUMBER OF ACCIDENTS 1985	1986	1987
.07	Mokulele Drive	6	6	8
.08 to 1.0	to Namoku Street	6	5	9
1.1 to 1.2	to Moakaka Place	4	4	4
1.3 to 1.6	to Kohokahi Place	9	13	13
	TOTAL	25	28	34

SOURCE: State Department of Transportation, Highways Division

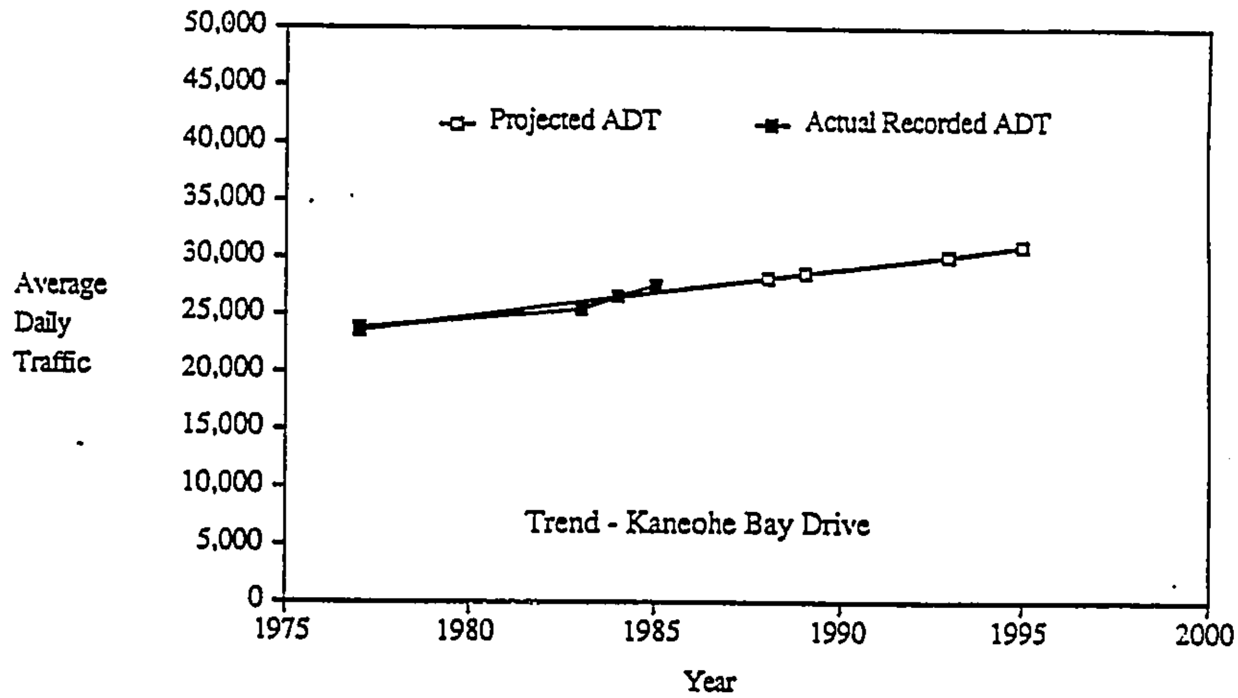


FIGURE N

TREND IN ADT VOLUMES:
KANEOHE BAY DRIVE @
MOKAPU SADDLE ROAD

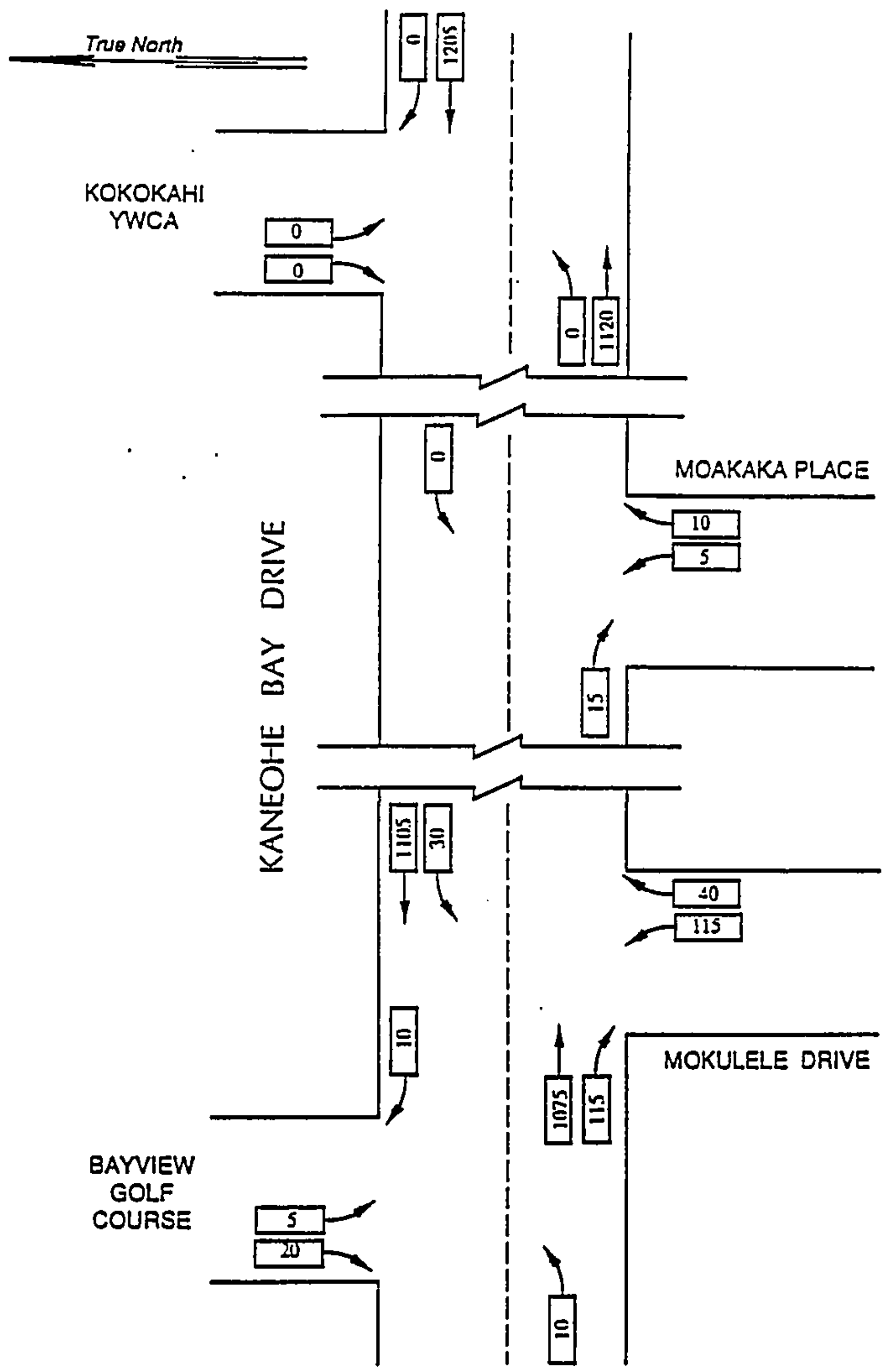


FIGURE O

EXISTING TRAFFIC VOLUMES
AFTERNOON PEAK HOUR

4.10 AIR AND NOISE QUALITY

4.10.1 Air Quality

J. W. Morrow conducted an air quality impact report, as contained in *Appendix H.*

Recent data from the Department of Health and Waimanalo monitoring stations indicates:

- Total suspended particulate (TSP) and sulfur dioxide(SO^2) standards are being met. Much of the time, sulfur dioxide (SO^2) concentrations are below the detectable limit of the measurement method being employed.
- Carbon monoxide (CO) levels are also below State standards most of the time, with only occasional exceedances.
- Generally, airborne lead levels have declined as expected, due to the federal program for gradual phase-out of leaded gasoline.

Particulate lead accumulated over the years in roadside soils and plants, however, will remain indefinitely in the area, and provide inhalation exposure whenever dust is re-entrained in the air as a result of scouring winds or mechanical disturbance due to vehicular motion.

While there are no continuous air monitoring stations in the vicinity of the project site, it is safe to assume that present air quality is good most of the time, since there are no large stationary sources in the vicinity, and the immediate area is not densely populated. The primary source of air pollution is motor vehicle traffic along Kaneohe Bay Drive. The nearest active State Department of Health air monitoring stations are located at Waimanalo and downtown Honolulu, and the data from these stations were presented earlier in this section.

Air sampling was conducted in conjunction with this project. Three sites were sampled during three days in mid-May of this year:

1. Mokulele Drive (150 feet west of the intersection);
2. Midway between Nohonani Place and Namoku Street; and
3. Moakaka Place (100 feet west of the intersection).

On the sampling days, northeast tradewinds prevailed, although on-site velocities were significantly lower than that recorded at the nearby Kaneohe Marine Corps Air Station. *Table 5* presents sampling results.

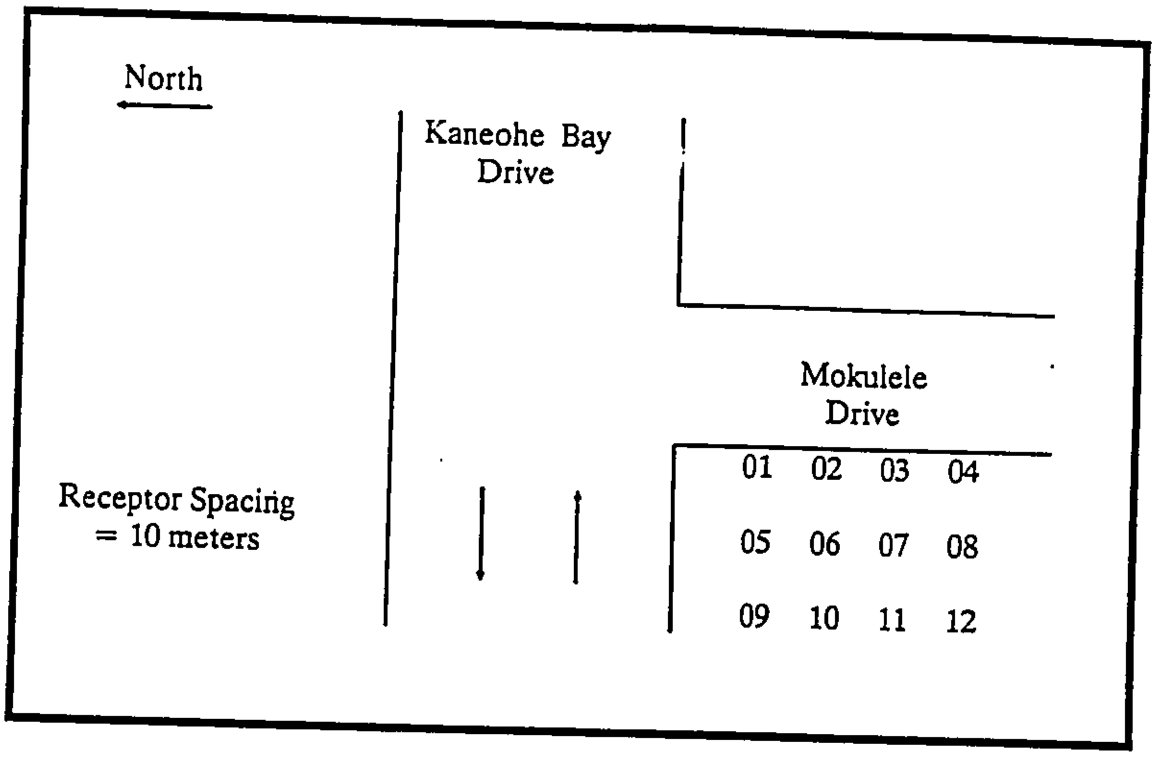
TABLE 5

CARBON MONOXIDE SAMPLING KANEOHE BAY DRIVE IN THE VICINITY OF THE BAYVIEW GOLF COURSE MAY 1989

					ONSITE WEATHER			KANEOHE MCAS WEATHER		
SITE	DATE	TIME	CO CONCENTRTN (mg/m3)	TRAFFIC VOLUME	WIND SPEED (m/s)	WIND DIRECT'N (DEG)	SKY COVER	WIND SPEED (m/s)	WIND DIRECT'N (Deg)	TEMPERA-TURE (Deg F.)
01	May 10, 89	4:15-5:15p	4.9	2,494	< 1-2	00-45	Sct/Bkn	3.6-4.6	40-50	78-80
02	May 11, 89	4:15-5:15p	4.2	2,386	< 1-1	00-90	Sct/Bkn	3.1-3.1	50-70	80-80
03	May 12, 89	4:15-5:15p	4.3	2,311	< 1-1	00-90	Sct	4.6-5.7	30-40	80-81

SITE: *01 - Kaneohe Bay Drive at Mokulele Street*
02 - Kaneohe Bay Drive between Nohonani Place and Nomuku Street
03 - Kaneohe Bay Drive at Moakaka Place

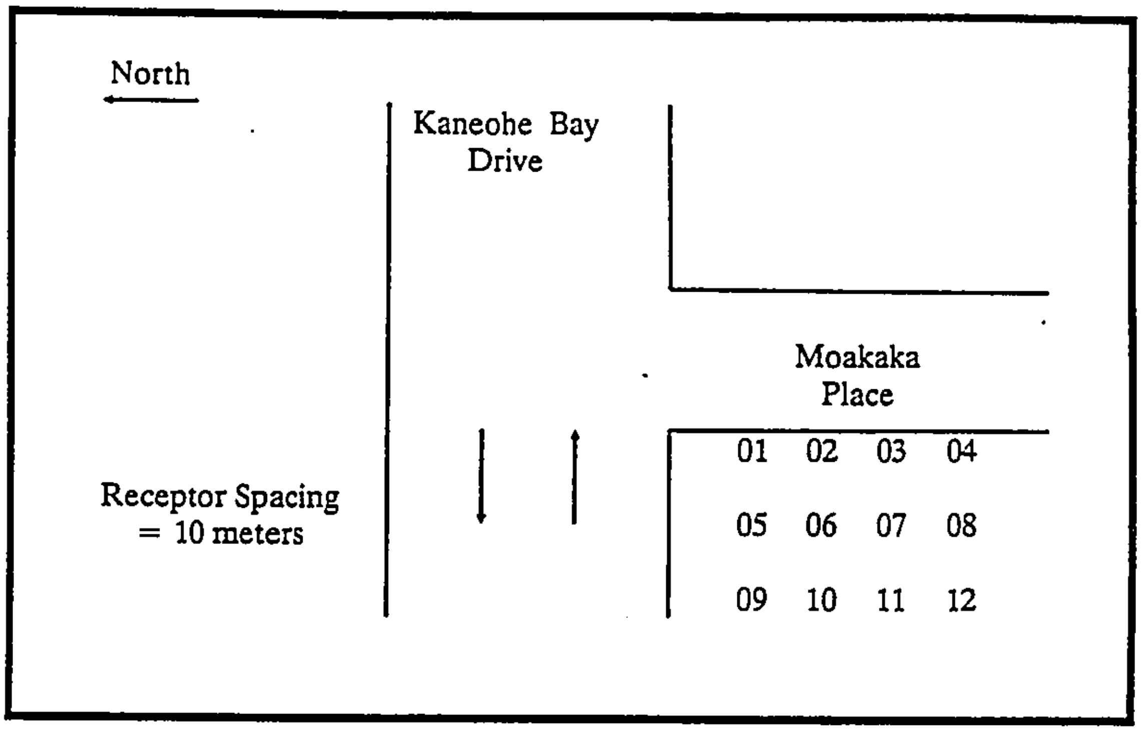
A microscale screening analysis was performed for the Mokulele Drive and Moakaka Place intersections with Kaneohe Bay Drive. Microscale analyses generally involve estimations of concentrations of non-reactive pollutants. For projects involving motor vehicles as the principal air pollution source, carbon monoxide is normally selected for modeling because it has a relatively long half-life in the atmosphere and it comprises the largest fraction of automotive emissions. *Figures P* and *Q* contains the results of this 1989 screening.



Receptor	1989	Concentration (mg/m^3) 1993 w/o Project	1993 w/Project
01	9.7	7.4	7.5
02	10.1	8.0	8.2
03	8.7	7.0	7.2
04	6.7	5.4	5.6
05	9.6	7.4	7.4
06	7.4	5.8	5.8
07	7.0	5.5	5.6
08	6.4	5.1	5.2
09	9.2	8.0	8.0
10	6.5	5.4	5.4
11	5.9	4.8	4.9
12	5.6	4.4	4.6

FIGURE P

ESTIMATED MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS AT THE KANEOHE BAY DRIVE - MOKULELE DRIVE INTERSECTION : P. M. PEAK-HOUR



Receptor	1989	Concentration (mg/m^3) 1993 w/o Project	1993 w/Project
01	3.2	2.6	2.8
02	2.5	2.1	2.2
03	2.2	1.7	1.8
04	1.9	1.6	1.6
05	3.2	2.6	2.7
06	2.4	1.9	2.1
07	2.1	1.7	1.7
08	1.8	1.5	1.6
09	3.2	2.6	2.7
10	2.4	1.9	2.1
11	1.9	1.6	1.7
12	1.7	1.5	1.5

FIGURE Q

ESTIMATED MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS AT THE KANEOHE BAY DRIVE - MOAKAKA PLACE INTERSECTION : P.M. PEAK-HOUR

4.10.2 Noise Quality

The noise study for this project was conducted by Y. Ebisu and Associates and is presented in *Appendix A*.

Existing background ambient noise levels were measured at three locations in the project environs. The following summarizes the characteristics of existing noise levels:

- The existing traffic noise levels at homes fronting Kaneohe Bay Drive in the project environs are high, and in the "Significant Exposure, Normally Unacceptable" category at approximately 65 to 70 Ldn. This condition is typical along highways and roadways of Oahu.

- Traffic noise levels at 100 to 300-foot setback distances from the highway centerline are generally in the "Minimal Exposure, Unconditionally Acceptable" to "Moderate Exposure, Acceptable" categories; noise levels were lowered 5 to 10 Ldn resulting from shielding and distance effects.

4.11 SOCIAL AND ECONOMIC CHARACTERISTICS

The project site lies in the Kaneohe Neighborhood Board No. 30 area. In 1980, the population in this region was 35,553 persons. By 1985, the Kaneohe Neighborhood Board area population increased 8.6 percent to an estimated 38,608 persons. In comparison, the total Oahu population increased 6.7 percent during that five-year period.

The project site is part of two Census Tracts — 106.01 and 107.02. The combined 1980 population for this area was 6,742 persons. The combined 1985 population is estimated at 7,278 persons, which indicates an eight percent increase. This indicates that the project vicinity experienced growth similar to the rest of the Neighborhood Board area.

The project site is in the vicinity of a number of public facilities, including Castle High School, which is across Kaneohe Bay Drive, and Puohala Elementary School and Playground, both of which are across Kulauli Street. The Kokokahi YWCA abuts the project site to the east.

The other predominant use in the immediate vicinity are single family residences which are located all around the project site.

CHAPTER FIVE

Relationship Of The Proposed Action To Land Use Plans, Policies And Controls For The Affected Area

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

5.1 LIST OF NECESSARY APPROVALS

FEDERAL

Type of Approval or Permit	Approving Agency	Status
Federal Register 3305.5 (Permit To Fill Kawa Stream)	U.S. Corps Of Engineers	To Be Filed
Wetlands Permit	U.S. Corps of Engineers	Currently Being Reviewed for Appropriateness
Bridge Permit	U.S. Coast Guard	To Be Filed

STATE

Type of Approval or Permit	Approving Agency	Status
Stream Diversion Permit	Dept. Of Land And Natural Resources	To Be Filed
Conservation District Use Permit	Dept. Of Land And Natural Resources	To Be Filed
Well Permit	Dept. Of Land And Natural Resources	To Be Filed

CITY

Type of Approval or Permit	Approving Agency	Status
Amendment To Koolaupoko Development Plan Land Use Map From Residential And Public Facility To Parks and Recreation	City Council	To Be Filed
Special Management Area Use Permit	Dept. Of Land Utilization	In Process for Phase I portions. To Be Filed for Phase 2 portion

CITY (Continued)

Type of Approval or Permit	Approving Agency	Status
Rezoning From R-10, Residential And I-2, Intensive Industrial District To P-2 General Preservation District	City Council	To Be Filed

5.2 STATE OF HAWAII

5.2.1 Hawaii State Plan

The Hawaii State Plan serves as a guide for the future long-range development of the State. As such, goals, objectives, policies and priorities are set forth to provide a basis for determining priorities and allocating resources.

The proposed Bayview Golf Course Expansion is in conformance with objectives, policies and priority guidelines set forth by the Hawaii State Plan. These are hereby presented with an accompanying discussion.

Section 226-103. Economic priority guidelines

Priority guideline (a)(8) Provide public incentives and encourage private initiative to develop and attract industries which promise long-term growth potentials and which have the following characteristics:

(A) An industry that can take advantage of Hawaii's unique location and available physical and human resources.

(B) A clean industry that would have minimal adverse effects on Hawaii's environment.

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

Priority guideline (b)(4) Encourage visitor industry practices and activities which respect, preserve and enhance Hawaii's significant natural, scenic, historic, and cultural resources.

Comment: The proposed golf course supports the economic health and quality of the visitor industry by providing an additional recreational facility which is in heavy demand by visitors. The course equally supports the recreational needs of Hawaii's resident golfers by providing a new course for play and at the same time reducing the demands on other Oahu courses.

The open space character of a golf course supports the visual and aesthetic qualities of Oahu's natural landscape.

Section 226-16. Objectives and policies for facility systems— Water

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

Comment: The drainage plan for the Bayview Golf Course Expansion proposes to retain storm runoff which will be used for golf course irrigation.

Section 226-23. Objectives and policies for socio-cultural advancement— Leisure

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

Comment: There is a high demand for golf courses and, although numerous proposals have been made, only a few courses are being developed. The Bayview Golf Course Expansion will certainly help meet local golf demand.

5.2.2 Functional Plans

The twelve State Functional Plans manage and coordinate functional area activities and guide resource allocation in decision-making.

The State Recreation Plan is the most relevant to the proposed Bayview Golf Course Expansion:

Policy A (2). Ensure that intended uses for a site respect community values and are compatible with the area's physical resources and recreation potential.

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

Comment: Bayview Golf Course Expansion incorporates the site's natural features in its drainage and grading improvements, and general course layout. Further, the proposed project will expand an already existing golf course which is compatible with the surrounding community. The project will serve as valuable, permanent open space for nearby residences in the Kaneohe area.

5.2.3 Hawaii Coastal Zone Management Program

Hawaii's Coastal Zone Management (CZM) laws contain objectives and policies related to recreation, historic, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards and development management. The impacts of the project, relative to these objectives and policies, are as follows:

Objectives and Policies Related to Recreational Resources.

Objective— Provide coastal recreational opportunities accessible to the public.

Policy (A)— Improve coordination and funding of coastal recreation planning and management

Comment: The portion of Kaneohe Bay fronting the project site is occasionally used for fishing and the gathering of shellfish. As discussed in *Section 4.5*, however, the existing ecosystem does not support significant quantities of marine life.

This area is not used for swimming or other typical shoreline activities. The only recreational use in the vicinity is the off-site launching of catamarans from the adjacent Kokokahi YWCA.

Pacific Atlas (Hawaii), Inc. is including pedestrian shoreline access along the site's easternmost boundary.

Policy (B)— Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by (only relevant policies included):

(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, county planning commissions; and crediting such dedication against the requirements of section 46-6.

Comment: On-site public shoreline access would not appear critical for the project site since the abutting shoreline is not viewed as a recreational resource.

(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect and, where feasible, restore the recreational value of coastal waters;

Comment: As discussed in *Section 6.3.1*, project related impacts to the tidal and non-tidal segments of Kawa Stream are not expected to be significant or long-term. These impacts will entail localized degradation in water quality resulting from earth-moving activities associated with channel realignment and construction of new golf course fairways. Most of these impacts can be ameliorated through the use of berms and swales to retain runoff waters from construction areas generated during periods of heavy rain.

Further, project-related impacts to Kaneohe Stream and estuary are also not anticipated to be significant or long-term in nature and would be limited largely to short-term silt and sediment loading associated with the construction phase of the project.

Landscaping associated with golf course fairways and greens would reduce existing soil erosion potential of the project site. Further, the proposed project would eliminate the existing auto-wrecking yard on the peninsula which may be contributing hydrocarbons and other pollutants to Kaneohe Stream, estuary and nearshore waters.

Regarding public access, pedestrian shoreline access will be provided by the proposed project.

Objectives and Policies Related to Historic Resources.

Objective— Protect, preserve, and, where desirable, restore those natural and man-made historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policy (A)— Identify and analyze significant archaeological resources;

Policy (B)— Maximize information retention through preservation of remains and artifacts or salvage operations; and

Policy (C)— Support State goals for protection, restoration, interpretation, and display of historic resources.

Comment: The only archaeological resources found on the project site are the Waikalua-Loko and Waikalua Fishponds. Pacific Atlas (Hawaii), Inc. proposes to incorporate these fishponds in the golf course design and layout. These fishponds are considered attractive water features which will enhance the proposed championship golf course.

Further, on-site monitoring during construction will help minimize disruption. The gates and seawalls of the ponds should be restored as much as possible to their earlier functioning condition. The ponds should be maintained, free of vegetation and with sufficient water quality to allow flourishing of vertebrate and invertebrate marine life.

Objectives and Policies on Scenic and Open Space Resources.

Objective— Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policy (A)— Identify valued scenic resources in the coastal zone management area;

Policy (B)— Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

Policy (C)— Preserve, maintain, and, where, desirable, improve and restore shoreline open space and scenic resources

Comment: The topographic characteristics of the site are conducive to a good view of the coastline from Kaneohe Bay Drive. Currently, however, a view of the coast is partially prohibited by thick vegetation.

Expansion of the Bay View Golf Course will improve scenic views by, first, clearing of existing vegetation and, second, providing an attractive, maintained landscape which will serve as the foreground for coastal views.

The proposed project would appear to implement, or is at least consistent with the Koolaupoko Development Plan Public Facilities Map which designates a major portion of the site for a park, to be developed in the "beyond six years category." The site was designated as a green belt park to (1) retain open space and (2) minimize increased water runoff into Kaneohe Stream resulting from urban development. From both perspectives, conversion of the area into a golf course would serve the same purposes and will not involve the use of City funds. Note that a portion of the area designated Park is already used for golf course.

Policy (D)— Encourage those developments which are not coastal dependent to locate in inland areas.

Comment: Although the project site extends to the shoreline, structural development will only occur along or near the southern, or mauka, boundary.

Objective and Policies Related to Coastal Ecosystems

Objective — Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

Policy (A) — Improve the technical basis for natural resource management;

Policy (B) — Preserve valuable coastal ecosystems of significant biological or economic importance;

Comment: The project site and abutting shoreline do not contain any valuable ecosystems of significant biological or economic importance.

Policy (C) — Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs;

Comment: Kawa and Kaneohe Streams have been highly disturbed; channelization and lining have essentially eliminated natural stream habitats. Further, the mouths of both streams are subject to flash flooding, thereby limiting the habitat for marine and estuarine species. The proposed project is therefore not expected to significantly impact nor change existing habitats for marine and estuarine species.

The proposed realignment of Kawa Stream would result in the Waikalua-Loko Fish Pond being restored to its former role as a settling basin during periods of heavy runoff.

Further, restoration of the Waikalua-Loko fishpond to its former role as a sedimentation basin will result in a reduction in the present levels of silt and sediment discharged into Kaneohe Bay.

Policy (D) — Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate state water quality standards.

Comment: Typical natural stream habitats in Kawa and Kaneohe Streams have already been virtually eliminated by past channelization and lining activities. The habitats for marine and estuarine species are further limited by the flash flooding that occurs at the mouths of both streams. The proposed project is therefore not expected to significantly impact nor change existing ecosystems.

Also, careful monitoring of fertilizers and pesticides used for the golf course will help preserve the water quality and protect the ecosystem of flora and fauna.

Objectives and Policies Regarding Economic Uses

Objective— Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policy (A)— Concentrate in appropriate areas the location of coastal dependent development necessary to the State's economy.

Comment: The proposed project is not coastal dependent, although the view of the water certainly adds to the value of the proposed golf course and residential units. Because the proposed project is not coastal dependent, every effort will be made to preserve and improve the existing coastline. As noted earlier, structural development will only occur along or near the southern, or mauka, boundary.

Objectives and Policies Regarding Coastal Hazards

Objective— Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion and subsidence.

Policy (B)— Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard.

Policy (C)— Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

Policy (D)— Prevent coastal flooding from inland projects.

Comment: As discussed in *Section 4.4.3*, most of the lower, flat portions of the site is in the 100-year flood zone; a smaller portion is in the 500-year flood zone on the Federal FIRM.

To mitigate the potential increase in off-site discharge of peak runoff generated by the proposed project, runoff will be routed to ponds within the golf course layout. These ponds will serve as detention basins, dampening the peak runoff generated on-site. With these detention basins, no increase of existing conditions is expected.

The applicant will comply with Federal Flood Insurance Program requirements.

5.3 CITY AND COUNTY OF HONOLULU

5.3.1 General Plan

The General Plan for the City and County of Honolulu is the island's statement of long range social, economic, environmental, and design objectives for the general welfare and prosperity of the people of Oahu. This plan is a guide in eleven areas of concern, ranging from population distribution to housing and government operations.

Of the eleven topic areas, three contain objectives and policies most relevant to the proposed project. These are as follows:

Natural Environment

Objective A, Policy 4— Require development projects to give due consideration to natural features such as slope, flood and erosion hazards, water-recharge areas, distinctive land forms and existing vegetation.

Comment: The proposed project will incorporate the site's stream and fishpond in its drainage and grading improvements, and general course layout.

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

Comment: The topographic characteristics of the site are conducive to a good view of the coastline from Kaneohe Bay Drive. Currently, however, a view of the coast is partially prohibited by thick vegetation.

Expansion of the Bay View Golf Course will improve scenic views by, first, clearing of existing vegetation and, second, providing an attractive, maintained landscape which will serve as the foreground for coastal views.

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

Comment: The proposed project will meet a growing demand for additional golf facilities by providing both visitors and residents with increased recreational opportunities. Further, the project site offers views which will enhance its attractiveness as a recreational facility.

Physical Development and Urban Design

Objective D, Policy 8— Preserve and maintain beneficial open space in urban areas.

Comment: The project site will improve the visual character of the area by extending the existing landscaped open space over a larger area. Given the surrounding urban uses, the Bayview Golf Course Expansion will serve as valuable, permanent open space for nearby residences.

Culture and Recreation

Objective D, Policy 10— Encourage the private provision of recreation and leisure-time facilities and services.

Comment: The proposed project will be a privately-owned and managed facility and no significant State or City expenditures are anticipated for infrastructure development, facilities or services in support of the golf course, since these items would be paid by the developer, the operator and users.

The proposed facility will be open for public play during certain designated days.

5.3.2 Koolaupoko Development Plan

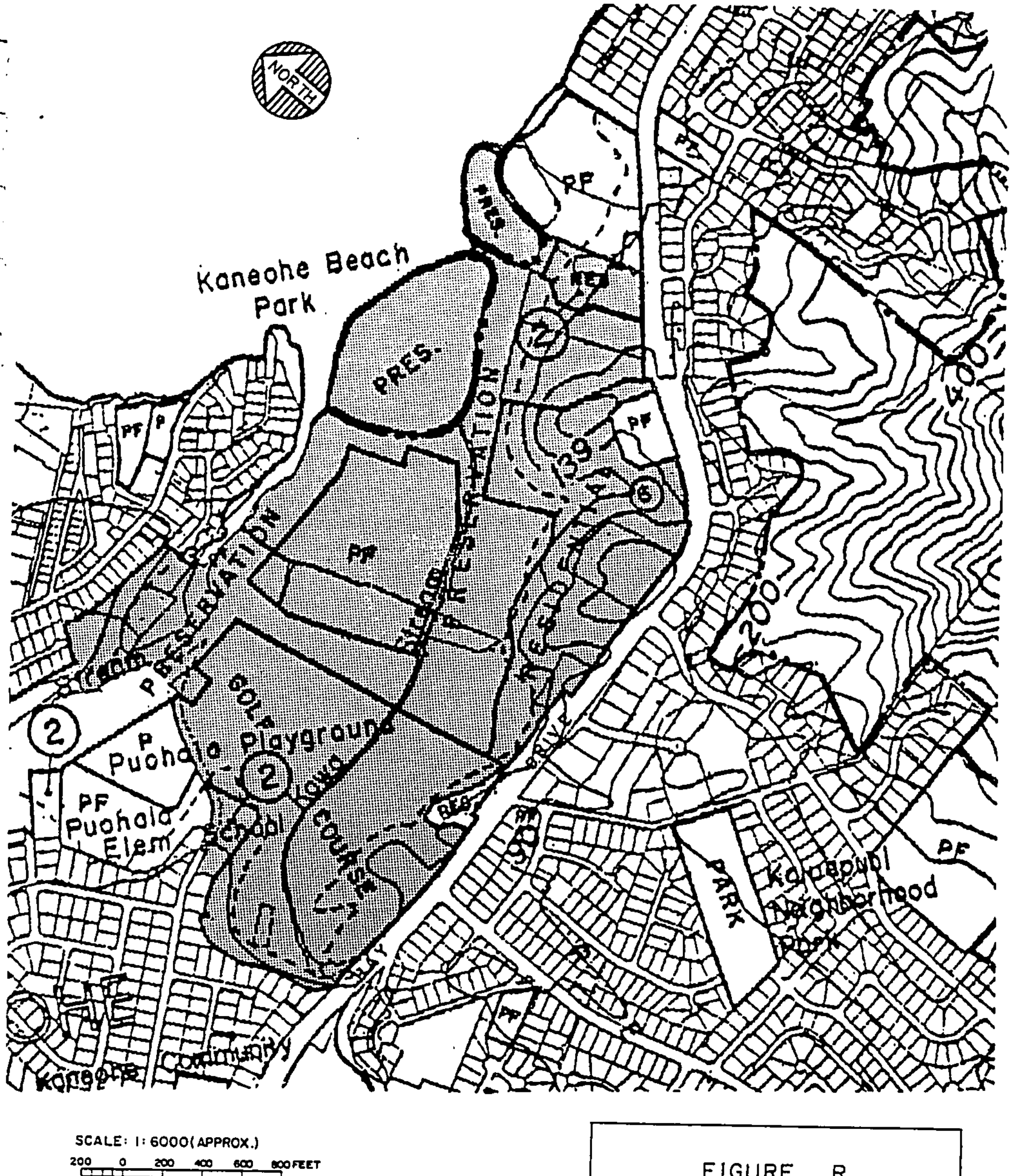
5.3.2.1 Land Use Map

Land use designations of the project site on the Koolaupoko Development Plan are depicted on *Figure R.* Phase 1 of the project site is designated Preservation.

Phase 2 is designated Preservation, Residential and Public Facility. Pacific Atlas (Hawaii), Inc. will apply for re-designation of the Residential and part of the Public Facility lands to Parks and Recreation.

5.3.2.2 Public Facilities

The project site contains two areas designated on the Koolaupoko Development Plan Public Facilities Map. First, the portion of the property containing the sewage treatment plant is designated STP/M, or Sewage Treatment Plant with planned modifications. The time frame for these modifications is within a six-year time frame. The modifications are related to the City's plans to divert the flows from this treatment plant to the Kailua Wastewater Treatment Plant by 1994, resulting in the existing treatment plant being



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CONSULTING ENGINEERS
HONOLULU, HAWAII

FIGURE R

EXISTING DEVELOPMENT PLAN DESIGNATIONS

down-graded to a pump station. When these modifications are completed, the current designation will be amended to reflect implementation of modifications.

Second, a portion of the project site is designated Park for an undetermined site, and to be implemented in the beyond-six-years time frame. It appears that the site was designated as a green belt park to (1) retain open space and (2) minimize increased water runoff into Kaneohe Stream resulting from urban development. From both perspectives, conversion of the area into a golf course would serve the same purposes and will not involve the use of City funds. Note that a portion of the area designated Park is already used for golf course. For these reasons, the proposed project would appear to be consistent with the greenbelt park designation.

5.3.3 Zoning

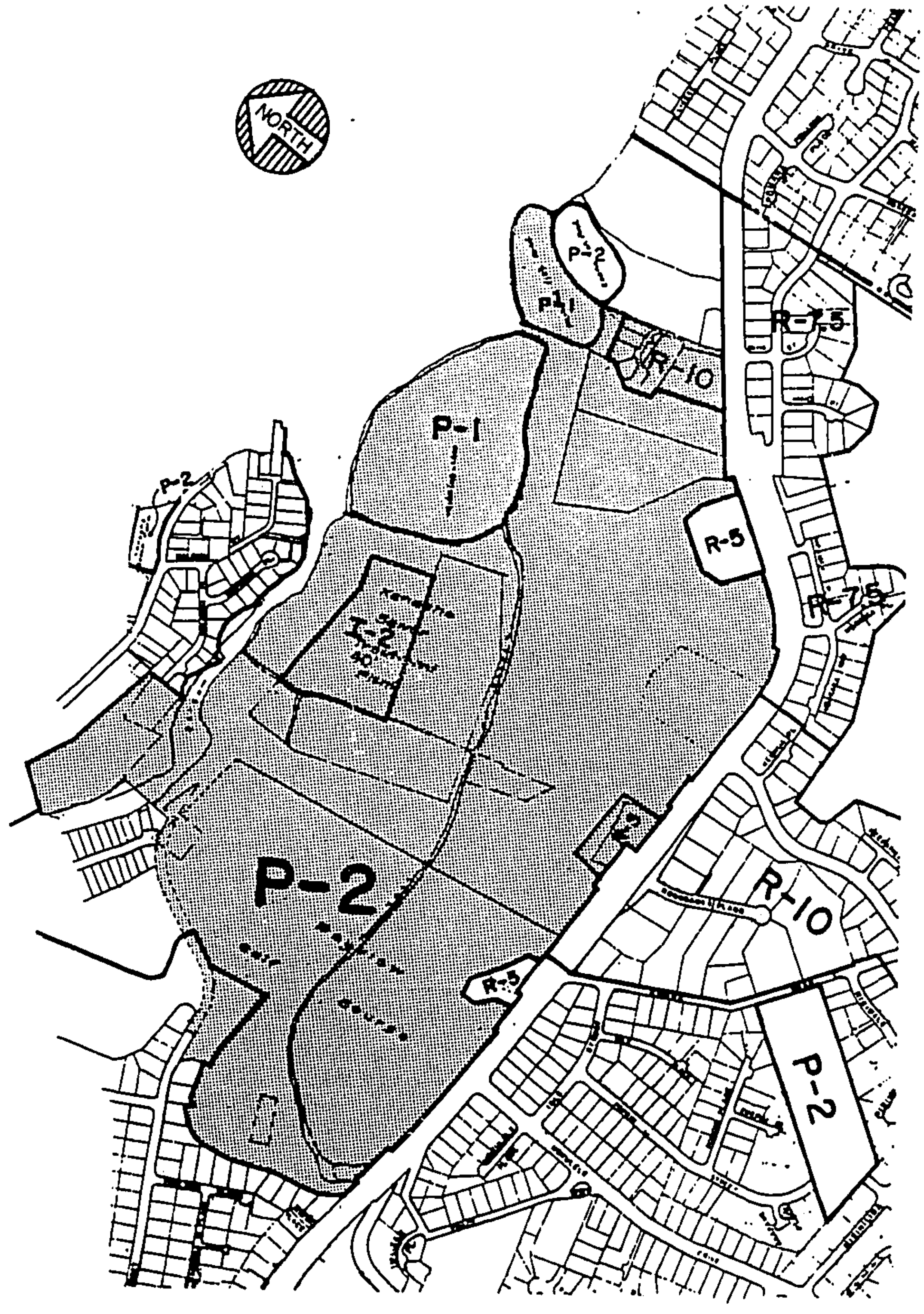
As illustrated in *Figure S*, the Phase I portion project site is zoned P-2, General Preservation District. Zoning in Phase 2 includes P-1, Restricted Preservation District, P-2, General District, R-10 *Residential* and I-2 Intensive Industrial District.

The P-2, General Preservation district, zoning permits golf course as a principal permitted use. The other zoning designations would need to be amended to P-2 to allow the implementation of Phase 2 of the proposed project. For the P-1 District, a Conservation District Use Permit will be required from the State Board of Land and Natural Resources.

5.3.4 Special Management Rules and Regulations

The City and County of Honolulu has established special controls for development within an area along the shoreline to avoid permanent loss of valuable resources and foreclosure of management options. The Special Management Area (SMA) has been established and include lands extending inland from the shoreline, as established by amended City ordinance, and delineated on maps established by the City Council and filed with the Council and appropriate agencies. As noted earlier, the entire project site lies within the SMA.

The following discusses the proposed project, relative to the review guidelines set forth in Chapter 33 of the City Ordinances.



SCALE: 1:6000 (APPROX.)
200 0 200 400 600 800 FEET

FIGURE S

EXISTING ZONING

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Guidelines Related To Public Access and Public Recreation Areas.

These call for "adequate access . . . to publicly-owned beaches, recreation areas, and natural reserves."

The portion of Kaneohe Bay fronting the project site is occasionally used for fishing and the gathering of shellfish. As discussed in *Section 4.5*, however, the existing ecosystem does not support significant quantities of marine life.

This area is not used for swimming or other typical shoreline activities. The only recreational use in the vicinity is the off-site launching of catamarans from the adjacent Kokokahi YWCA.

Pedestrian shoreline access will be provided along the easternmost boundary of the project site.

Guidelines Related to Solid and Liquid Waste Treatment, Disposition and Management.

These guidelines were set forth to minimize adverse effects on SMA resources. The proposed project includes a proposed wastewater collection system which incorporates both a small sewage pumping station and gravity sewer facilities which will be hooked up to the City system.

Solid waste generated by the clubhouse will be continuously collected by private collection companies and disposed of at the City's windward sanitary landfill. Solid waste generated by the residential development will be collected by the City Department of Public Works, Refuse Division.

Guidelines Related to Alterations to Existing Land Forms and Vegetation.

These guidelines were set forth to minimize "adverse effect to water resources and scenic and recreational amenities" and to minimize the "danger of floods, landslides, erosion, siltation, or failure in the event of earthquake."

The proposed project is expected to improve the area's drainage by realigning Kawa Stream to empty into the Waikalua-Loko Fishpond. This diversion of some on-site runoff to the golf course ponds is expected to decrease dampen peak runoff generated on-site.

It is also anticipated that the project will improve the scenic quality of the area by clearing the dense vegetation currently obstructed views and replacing this with a maintained landscape, which will serve as an attractive foreground to views of the shoreline and Kaneohe Bay.

General Guidelines Related to Any Substantial, Adverse Environmental or Ecological Effect.

This EIS summarizes the findings of a thorough investigation of potential project impacts and recommends appropriate mitigation measures.

Guidelines Related To County General Plan, Development Plans, Zoning And Subdivision Codes.

Section 5 contains a thorough discussion of the project's relationship to City and County policies, as well as those of the State, governing land use, development and other relevant issues.

Guidelines Related to Waterways and Water Quality.

These guidelines seeks to minimize "dredging, filling or otherwise altering any bay, estuary, salt marsh, river mouth, slough or lagoon." Further, these guidelines discourage "any development which would reduce or impose restrictions upon public access to tidal and submerged lands, beaches, . . ."

The applicant proposes to alter the alignment of Kawa Stream to re-establish the stream's original alignment. Without this action, the downstream discharge of the on-site runoff has the potential to increase approximately 28 percent for both a 10-year and 50-year storm. However, runoff entering Kawa Stream can remain near levels experienced for existing conditions when mitigating measures are employed. These measures include routing runoff to ponds within the golf course layout. It is intended that the Waikalua-Loko Fishpond serve as a major detention basin, dampening peak runoff generated on-site.

CHAPTER SIX

Potential Impacts

6. POTENTIAL IMPACTS

6.1 DRAINAGE

The proposed project would change the character of approximately 100 acres of the project site. The medium dense vegetative cover currently found on the site would be replaced by a more open, close-cropped landscaping typically associated with golf course developments. Roadways, parking lots, buildings, ponds and other features normally supporting a golf course would further add to the modification of the project.

Appendix I contains the drainage study for this project. As a result of the proposed improvements, peak runoff generated on-site is expected to increase as follows:

Recurrence Interval	Peak Runoff (In Cubic Feet Per Second)
10-year storm	300 cfs
50-year storm	452 cfs

Without mitigation, the downstream discharge of the on-site runoff has the potential to increase approximately 28 percent for both a 10-year and 50-year storm. However, runoff entering Kawa Stream can remain near levels experienced for existing conditions when mitigating measures are employed. These measures include routing runoff to ponds within the golf course layout.

Drainage patterns are expected to remain similar to existing conditions, although diversion of some on-site runoff to the golf course ponds is proposed. It is intended that the ponds serve as detention basins, dampening peak runoff generated on-site. By incorporating these detention basins into the golf course design, the discharge of peak storm runoff from the project site is not expected to increase from existing conditions.

The impacts of the increased on-site peak runoff are minor when compared to the impact of peak runoff generated over the entire drainage basin. The increase in on-site peak runoff represents three percent of the total peak runoff from the drainage basin.

A positive impact of the proposed project is the probable reduction of erosion and sediment transport to Kaneohe Bay. Bare areas currently found would be planted, with the project site as a whole having better control through landscape maintenance.

Construction of the golf course would not affect the 100-year flooding of Kawa Stream, although portions of the golf course may encroach into the flood fringe.

A 200-foot segment of Kawa Stream located near the Waikalua-Loko Fishpond is proposed for realignment. This action will require a Stream Diversion Permit from the Department of Land and Natural Resources.

6.2 SOIL EROSION

As discussed in *Section 4.3.1,* the existing soil erosion potential is 1,387 tons per year.

Construction of the golf course will involve land disturbing activities that result in soil erosion. Such activities include removal of existing vegetation and leveling, and removing and replacing soil. Short term impacts due to construction are estimated to last one year.

Approximately 1,093 tons of soil erosion is estimated for this one-year period. Of this amount, approximately two percent, or 25 tons, will impact Kawa Stream. The basis for these estimates are provided in *Appendix I.*

Mitigation measures can be implemented to reduce short-term soil erosion. One such measure is to limit grading to not more than 15 consecutive acres at a time and installing a sedimentation basin at least 12,000 square feet in size at the onset of grading. Additional measures include:

1. Minimize time of construction;

2. Retain existing ground cover until latest date before construction;

3. Early construction of drainage control features;

4. Use of temporary area sprinklers in non-active construction areas when ground cover is removed;

5. Station water truck on site during construction period for immediate sprinkling;

6. Use temporary berms and cut-off ditches, where needed, for control of erosion;

7. Thorough watering of graded areas after construction activity has ceased for the day and on weekends; and

8. Sod or plant all cut and fill slopes immediately after grading work has been completed.

Long term soil erosion potential at the project site should decrease after development of the golf course. The estimated soil erosion potential after development is 705 tons per year, as compared to the existing potential of 1,387 tons per year.

The erosion potential of subarea A is estimated to decrease seven percent, by 0.02 tons per acre per year, or two tons per year. Thus, sediment transport to Kawa Stream should decrease after development. At 17 tons per acre per year, or 680 tons per year, the erosion potential in subarea B is expected to decrease by 50 percent.

6.3 WATER QUALITY AND HABITATS

6.3.1 Water Quality

1. Kawa Stream and Estuary

   Because of its history of man-induced changes, project related impacts to the tidal and non-tidal segments of Kawa Stream are not expected to be significant or long-term.

   These impacts will entail localized degradation in water quality resulting from earth-moving activities associated with channel realignment and construction of new golf course fairways. Most of these impacts can be ameliorated through the use of berms and swales to retain runoff waters from construction areas generated during periods of heavy rain.

2. Kaneohe Stream and Estuary

   Project-related impacts to Kaneohe Stream and estuary are not anticipated to be significant or long-term in nature and would be limited largely to short-term silt and sediment loading associated with the construction phase of the project.

   The existing baseline water turbidity levels associated with stormwater runoff are typically high in this area. Thus, silt and sediment loading associated with the construction phase of the project are expected to result in conditions already experienced at the mouth of the stream.

   Existing terrain in the estuarine segment of the stream is relatively flat and would not change appreciably with the proposed project.

   Landscaping associated with golf course fairways and greens would reduce existing runoff from the small filled peninsula, which generally lacks vegetative groundcover. This area would not be a significant source of sediment, however, based on observations during periods of heavy rainfall runoff.

   Further, the proposed project would eliminate the existing auto-wrecking yard on the peninsula which may be contributing hydrocarbons and other pollutants to Kaneohe Stream, estuary and nearshore waters.

3. Impacts to Waikalua-Loko Fishpond

Aerial photo maps indicate that Kawa Stream discharged into Waikalua-Loko fishpond prior to 1969. Between 1969 and 1978, Kawa Stream was realigned. Presently, Kawa Stream discharges into Kaneohe Bay on the east side of the pond.

The proposed realignment of Kawa Stream would result in the pond being restored to its former role as a settling basin during periods of heavy runoff. This action would be expected to result in the following consequences:

- increase the rate of pond in filling with terrigenous materials;
- reduce ambient pond salinities during periods of heavy runoff;
- increase the distribution and abundance of *Rhizophora* throughout the pond;
- alter existing flushing and circulation patterns, particularly during periods of heavy runoff; and
- reduce biological productivity of the pond for certain marine and estuarine fishes and invertebrates.

The existing natural, albeit man-induced or accelerated processes, are and will continue to exert many of these same effects through normal coastal ecological succession processes. These would occur with or without the impacts associated with the proposed project.

Many of these impacts can be attenuated or mitigated by the provision of a carefully-executed water quality and environmental management plan for the fishpond. For example, periodic dredging of the pond has the potential to improve the productivity of the now shallow, heavily-silted pond. Control of rapidly-spreading mangroves would maintain the open water habitat of the fishpond, while preserving the structural integrity of the fishpond walls. In the absence of a program to control the spread of mangroves, the fishpond walls will continue to deteriorate.

4. Impacts to Kaneohe Bay Waters

Restoration of the Waikalua-Loko fishpond to its former role as a sedimentation basin will result in a reduction in the present levels of silt and sediment discharged into Kaneohe Bay.

Kawa Stream is one of the smaller perennial streams that discharge into Kaneohe Bay. Its sediment contribution is about three percent of the total amount of stream-generated sediment, reaching the bay annually (VTN Pacific, 1977). This contribution is small in relation to the sediment loading in the bay as a whole, but nonetheless amounts to 320 to 1,210 tons of sediment per year.

Localized improvements in nearshore water quality can be expected. These improvements are likely to include a reduction in storm-generated turbidity levels and a diminution in the quantity of high biological-oxygen-demand (BOD) organic materials that presently discharge into the bay.

6.3.2 Impact on Marine Life, Estuaries and Streams

1. Impacts to Kawa and Kaneohe Streams and Estuaries

   Kawa and Kaneohe Streams have been highly disturbed; channelization and lining have essentially eliminated natural stream habitats. Further, the mouths of both streams are subject to flash flooding, thereby limiting the habitat for marine and estuarine species. The proposed project is therefore not expected to significantly impact nor change existing habitats for marine and estuarine species.

   Because of the domination of the stream by generally undesirable, introduced species, project-related impacts on the biota in the lower reaches of Kawa Stream are insignificant.

   Further, no long-term or significant impacts on estuarine biota are anticipated. Estuarine species are generally adapted to a wide range in turbidity levels, as well as other water quality parameters. Silt and sediment generated by project-related earth-moving and construction activities are likely to produce short-term high turbidity levels in the estuarine segments of the stream, particularly during heavy or sustained rainfall. However, such levels are not expected to significantly exceed baseline turbidity readings except in localized areas immediately adjacent to construction areas.

2. Impacts on Waikalua-Loko Fishpond

   The improvements of Waikalua-Loko fishpond will essentially cause it to be a nutrient sink for organic materials of terrestrial origin.

3. Impacts on Kaneohe Bay Waters

Localized improvements in nearshore water quality can be expected due to proposed improvements to the Waikalua-Loko fishpond, which would cause a diminution in the quantity of high biological-oxygen-demand (BOD) organic materials that presently discharge into the bay.

6.4 BIOLOGICAL RESOURCES

6.4.1 Flora

The site contains no plants of botanical interest on the site, nor any native plant communities in need of protection. None of the native species are of botanical interest in the present context and none warrant mitigative action before the site is developed.

The fresh water-inundated meadow appears to be a very low-grade wetlands. The mangroves seem to have expanded greatly on the site in the last ten years. There is little area left for them to expand into, except to fill the fish pond and clog the stream. They can be controlled by cutting close to the ground with little or no ability to regenerate from the base. However, they germinate their seedlings before dropping them from the fruits, and these seedlings densely carpet the ground beneath the trees. Where there is water beneath the trees, the seedlings are able to float until cast up on solid ground. It is from these seedlings that the trees regenerate after cutting. If allowed to continue to grow here, the mangrove will eventually choke the fish pond and stream. Thus, there is little reason to preserve them, though they may be useful for shoreline protection after development.

6.4.2 Fauna

The proposed project is not expected to significantly impact the birds and animals of this area. None of the introduced birds on the project site or in the general region are endangered. The planned expansion is expected to provide additional habitat for the two species of indigenous birds which may occasionally visit the site. Further, the mammals that occur on the site do not require protection; in fact, most of them are considered destructive to other animals and vegetation.

6.5 CHEMICAL IMPACTS

6.5.1 Management Factors

Fertilizers

Fertilizers are applied to golf courses to supply essential nutrients which are used in large amounts and which are deficient in most soils. The primary fertilizer elements of concerns for contamination of ground and surface waters are nitrogen and phosphorus. Because nitrogen is applied in larger quantities and also because it is the only fertilizer element likely to cause contamination of ground or surface waters, only nitrogen application rates are provided in *Table 6*, which indicates fertilizer use rates for different areas of a typical 18-hole golf course in Hawaii.

Table 6

APPROXIMATE FERTILIZER USE RATES FOR DIFFERENT AREAS OF A TYPICAL 18-HOLE GOLF IN HAWAII

TYPE OF TURF	AREA (Acres)	FERTILIZER AMOUNT (lb.N/1000sq.ft.)	APPLICATION FREQUENCY	TOTAL ANNUAL APPLICATION (Tons N)
Greens	3	0.5	2 Weeks	0.85
Tees	3	1.0	3 Weeks	1.15
Fairways	50	1.5	8 Weeks	10.00
Roughs	30	1.0	3 Months	2.60
TOTAL	86			14.60

Pesticides

Pesticides are normally applied only in response to outbreaks of pests, although there are a few instances in which pesticides are applied in a regularly scheduled preventative program. *Table 7* presents a typical pesticide program for an 18-hole golf course.

Table 7

A TYPICAL PESTICIDE PROGRAM FOR AN 18-HOLE GOLF IN HAWAII

TURF GRASS AREA	AREA (Acres)	CHEMICAL	FREQUENCY	RATE/ APPLICATION	ANNUAL TOTAL
I. HERBICIDES					
A. Greens	3	MSMA	6 times/year	2 lb.ai/acre	36 lb.ai
		bensulide	2 times/year	12 lb.ai/acre	72 lb.ai
B. Tees	3	MSMA	6 times/year	2 lb.ai/acre	36 lb.ai
		33 Plus	3 times/year	1 pint/acre	9 pints
		bensulide	2 times/year	12 lb.ai/acre	72 lb.ai
C. Fairways	50	MSMA	6 times/year	2 lb.ai/acre	600 lb.ai
		33 Plus	3 times/year	1 pint/acre	19 gallons
		metribuzin	2 times/year	0.75 lb.ai/acre	75 lb.ai
D. Perimeter Areas	20	glyphosate	3 times/year	1.5 lb.ai/acre	90 lb.ai.
II. INSECTICIDES					
A. Greens	3	chlorpyrifos	As needed	1 lb.ai/acre	Apprx. 18 lb.ai
B. Tees	3	chlorpyrifos	As needed	1 lb.ai/acre	Apprx. 18 lb.ai
C. Fairways	Spot Treat-ments	chlorpyrifos	As needed	1 lb.ai/acre	Apprx. 50 lb.ai
III. FUNGICIDES					
A. Greens	3	metalaxyl	As needed	1.3 lb.ai/acre	Apprx. 25 lb.ai
		chlorothalonil	As needed	8 lb.ai/acre	Apprx. 72 lb.ai
B. Tees	3	metalaxyl	As needed	1.3 lb.ai/acre	Apprx. 25 lb.ai
		chlorothalonil	As needed	8 lb.ai/acre	Apprx. 72 lb.ai
C. Fairways	Spot treat-ments	chlorothalonil	As needed	8 lb.ai/acre	Apprx. 250 lb.ai

Irrigation

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 chances for runoff or leaching of nitrogen below the root zone is increased.

Typical evapotranspiration rates for well-watered turf in Hawaii range from 0.1 to 0.3 inches per day, depending on temperature, the amount of sunlight, relative humidity, wind speed, the amount of available water in the soil, and so on. Soils store approximately 0.5 to 2.5 inches of available water per foot of depth, depending on soil texture. Amounts of water applied to each irrigation are about 20,000 gallons for greens and 500,000 gallons for fairways.

6.5.2 Surface Waters and Groundwater

Among the fertilizer elements, only nitrogen could diminish water quality, since phosphorus sorption on soils would prevent its movement from the site of application.

Nitrogen fertilizer movement in runoff could conceivably produce undesirable nutrient enrichment of Waikalua-Loko Fishpond waters. Fertilizer nitrogen movement to Kawa Stream and subsequently to the pond can be minimized by constructing berms adjacent to Kawa Stream, with associated temporary retention basins to preclude rapid runoff into the stream.

Use of slow-release nitrogen fertilizer during the rainy season will also assist in reducing nitrogen movement.

Kaneohe Stream will receive minimal runoff from the golf course; that runoff into the stream which does occur will be highly diluted by consistently high water flow in the stream.

Pesticide movement in runoff is not expected because of the sorption of pesticides on turf thatch and soil. Prevention of immediate runoff by retention basins will further reduce movement of pesticides from the treated area.

Leaching of chemicals to groundwater is not a problem, due to the inherent low quality (brackishness) of groundwater at the site.

6.5.3 Migratory Birds and Endangered Hawaiian Waterbirds

The fertilizers, herbicides and fungicides used in golf course maintenance pose little or no hazard to birds frequenting the grassed areas of ponds associated with golf courses. Fertilizers are relatively non-toxic unless ingested in large amounts. All herbicides and fungicides used in golf course maintenance in Hawaii are of low to moderate toxicity.

The only chemicals used in golf course maintenance in Hawaii which are highly toxic to birds are the organic phosphate insecticides, especially chlorpyrifos. Although chlorpyrifos is toxic to birds, it is strongly absorbed on the thatch layer of turf and moves little from the site of application. One reason for its weakness in controlling soil insects is the inability to get the insecticide through the thatch layer to the depth needed to contact these insects. Recent studies have shown that chlorpyrifos applied to turf grasses does not penetrate more than two to three centimeters in the soil. In addition to the resistance to movement in the soil, chlorpyrifos is rapidly degraded in the soil, by both hydrolysis and microbial action.

Because of the absorption of organic phosphate insecticides on organic layers in turf and their rapid break down, there is little change of their movement from grassed areas into possible ponds associated with the proposed golf course. Label instructions for pesticide applications specifically prohibit their direct application to streams and ponds.

The likelihood of bird injury by pesticides used in maintenance of the proposed golf course can be further reduced by proper application of pesticides with reduced toxicity to birds. Such pesticides include carbaryl and trichlorfon, which can be substituted for chlorpyrifos with little loss of effectiveness.

Golf courses are excellent habitats for birds. The study found that there have been no reported incidents of bird kill in Hawaii from chemicals applied in golf course management.

Waterfowl and fish appear to thrive in ponds and water hazards on Hawaii's golf courses. Many golf courses cultivate white amur fish in the ponds to control algae. Mosquito fish are generally stocked to prevent mosquito problems. We are not aware of any incidents of fish or waterfowl injury from chemicals applied to golf courses.

The labeling of herbicides and pesticides from EPA for particular uses enforced by the Hawaii Department of Agriculture is perhaps assurance of protection of humans and wildlife from these hazards. All pesticides must be applied in compliance with federal and state laws regulating their use. Hazards to both humans and wildlife are included in the decision to label a pesticide for specific uses, including use on golf courses, and in developing regulations on allowable application procedures of the pesticide for various uses.

6.5.4 Air Quality

Most herbicides and pesticides used on golf courses are of relatively low mammalian toxicity, ranging from hundreds to several thousand mg/kg body weight. Because they are not highly volatile and are applied in dilute sprays to open areas, there is little likelihood of volatility once the pesticides are applied.

The greatest danger of significant airborne concentrations of pesticides is from aerial application. Golf course pesticides are applied with ground spray equipment. Boom height of spray equipment is less than one meter. Low spray pressures (20 to 40 psi) and coarse spray droplets further reduce the hazard of fine airborne droplets. Droplets larger than 100 micrometers diameter are not subject to drift.

Most of the spray volume from typical flat-fan nozzles used in agricultural spray equipment is from droplets larger than 100 micrometers. At the low concentration used in pesticide application, this would not result in significant quantities of pesticides being carried downwind. High wind speed would increase the likelihood of drift of fine spray droplets, however, because high wind speed distorts spray patterns are results in poor pesticide coverage. Thus, spraying during high winds is uncommon.

To facilitate spray operations and to comply with label instructions of some pesticides, spray applications are only made in later afternoon or early morning hours when golfers are not on the course. This reduces the risk of exposure of people to airborne spray particles. Sufficient buffer space with tall vegetation between the golf course, its support facilities, such as the clubhouse, and housing sites will further reduce the chance of exposure to airborne pesticide particles.

The greatest danger of airborne pesticides is to the pesticide applicators. Mixing of wettable powder formulations and being in close proximity to airborne spray particles, particularly when operating spray equipment in a downwind positions, places spray operators in particularly vulnerable positions.

EPA and OSHA have strict standards which specify that spray operators wear appropriate protective clothing and breathing apparatuses.

6.6 ARCHAEOLOGICAL RESOURCES

The proposed project will include extensive grading of the floodplain slopes and higher elevation lands, particularly at the southern periphery. These activities could potentially expose significant archaeological sites which may now lie buried under fill and alluvium. As an example, in 1986, the Bishop Museum discovered a highly significant prehistoric site under three feet of bulldozed fill just mauka of the project area.

In addition, there are two intact and archaeologically important prehistoric Hawaiian fishponds in the project area.

Pacific Atlas (Hawaii), Inc. proposes to incorporate the existing on-site features, including the fishponds, in the golf course design and layout. It is intended that the Waikalua-Loko Pond serve as a detention basin to mitigate drainage impacts. Further, these fishponds are considered attractive water features which will enhance the proposed championship golf course.

6.7 UTILITIES

6.7.1 Water Supply

Potable Water

The proposed project is estimated to generate a domestic water demand of 42,050 gallons per day. This estimate is based on typical potable requirements for the maintenance building, clubhouse and residential units.

The projected water demand for fire protection is 2,000 gallons per minute over a two-hour duration for the clubhouse and maintenance building.

Figure D illustrates the proposed potable water system. This proposed system would tap off the 12-inch BWS water line along Kaneohe Bay Drive at the proposed access road to the clubhouse. Two new parallel water lines will be located along the proposed access road to the clubhouse and maintenance building site. The water line will be private from meter at Kaneohe Bay Drive and beyond. The first water line, sized to meet fire protection demand, will lead to the clubhouse and maintenance building. A second water line will be sized to meet the domestic needs of the building. A water meter will be installed on the domestic line and detector check meter on the fire line at Kaneohe Bay Drive.

A new water line loop will be constructed along the new road within the residential development. Individual water meters will be located along the new road for hook-up to private water service laterals for each residential lot. Fire protection for the residential development area will be provided by fire hydrants spaced 350 feet apart on the proposed new road. The new water line will be public.

Non-Potable Water

Golf course irrigation of approximately 100 acres will require an estimated 0.6 million gallons per day (MGD). Irrigated areas include greens, tees, fairways and roughs; clubhouse landscaping; and plant nursery. A typical golf course irrigation rate of 1.5 inches per week is assumed.

Drilling of two shallow on-site wells is required to meet the non-potable water demand. The proposed wells, located between the 20- and 50-foot elevation at the southeast corner of the site near Kaneohe Bay Drive at Kawa Stream, are expected to deliver up to 0.8 MGD per well. The well's water will be pumped to a 2.5 million gallon (MG) storage pond located northwest of the clubhouse. The pond will provide a minimum of three days storage for irrigation.

6.7.2 Wastewater Infrastructure

Wastewater flows are anticipated to be generated primarily from clubhouse activities and the residential development. The clubhouse activities include: meal preparation and other related activities; personal hygiene, including toilet and lavatory; showers; and laundry. A small portion of the wastewater flow will be generated from the employee restrooms and service sinks in the maintenance building. Total average wastewater flows are estimated at 32,900 gallons per day.

As illustrated in *Figure E*, the proposed wastewater collection system for the residential development will be located along the proposed public road. A gravity sewer from the maintenance building will convey wastewater to a small sewage pumping station (SPS). Due to topography, this area requires a SPS for wastewater transport. A force main from this SPS will be connected to the sewer manhole at the clubhouse area. The sewer manhole will receive wastewater flows from a gravity sewer from the clubhouse area and a force main from the maintenance building site. A gravity sewer will convey wastewater to the proposed wastewater collection system within the residential area and to the Kawa Interceptor Sewer within the project area.

Wastewater generated by the project will be transmitted to and treated at the Kaneohe Sewage Treatment Plan (STP) located within the project area. The present Kaneohe STP service area covers approximately 3,200 acres. A population of approximately 35,000 is serviced by the collection system which conveys all wastewater to Kaneohe STP.

The City plans to consolidate the existing STPs at Kaneohe, Kailua and Ahuimanu so that the sewage from Lahikai and Maunawili to Kahaluu feeds into a proposed expanded and upgraded Kailua treatment facility. Currently, construction of a sewage pump station at the existing Kaneohe STP is progressing. When upgrading at the Kailua STP is complete, the Kaneohe pump station will simply transmit and allow raw sewage to the Kailua STP.

Currently, a moratorium on new sewer hookups in the Kaneohe area is in progress as a result of these upgrade and consolidation efforts. This moratorium could extend to the end of 1993, at which time the completion of planned improvements is expected.

6.7.3 Electrical and Telephone Services

The assumed average daily power requirement of the proposed project is estimated at 1,000 KVA.

The existing electrical system may need to be upgraded to accommodate the proposed project. Pacific Atlas (Hawaii), Inc. will work closely with Hawaiian Electric Company to ensure timely service and to determine an appropriate on-site location for a substation. The electrical system within the development will be built to City standards. Further, utility lines will be underground to mitigate any visual impacts.

The developer will maintain contact with Hawaiian Telephone Company to assure necessary service levels.

6.7.4 Solid Waste Disposal

At full development, the golf course and residential components of the proposed project will generate a total of 0.6 tons of solid waste each day. Solid waste generated by the clubhouse will be continuously collected by private collection companies and disposed at the City's windward sanitary landfill. Solid waste generated by the residential development will be collected by the City Refuse Division.

The proposed activities within the project site will place additional demand on public waste disposal facilities. It is expected that State and County revenues derived from the completed golf course and residential development will be sufficient to finance the development's fair share of the cost for major capital improvements such as solid waste disposal facilities, and to provide the same level of per-unit services. The City has plans to construct a solid waste transfer station. Solid waste collected at this transfer station will be hauled to either a sanitary landfill site for disposal or to a proposed refuse-to-energy plant.

6.7.5 Police and Fire Protection

The project site would be served by Kaneohe Police Station. Police officials have indicated that they have no objection to the proposed project.

Fire protection services would be provided by the Kaneohe Fire Station. The project is expected to be adequately served by existing services.

6.7.6 Schools and Parks

Since the project's residential component is intended primarily for relocation of on-site residents, the Bayview Golf Course Expansion is not expected to increase residential population. Hence, schools and parks are not expected to be adversely impacted by the proposed project.

6.8 TRAFFIC

6.8.1 Future Conditions Without the Project

Future traffic conditions without the project were forecasted based on trend analysis. The land areas served by Kaneohe Bay Drive is well-developed and major projects other than the proposed project are not expected. Future growth is expected to be primarily from the in filling of vacant lots, which results in a small rate of growth.

Figure T presents projections of ambient traffic without the proposed project. The following are the bases for estimating these projections:

- The analysis of existing traffic volumes indicated a1.5 percent rate of growth on Kaneohe Bay Drive at the Mokapu Saddle Road prior to 1987.
- A six percent growth in through traffic volumes (1.5 percent for four years) at Kokokahi YWCA was assumed.
- The difference between the forecast and existing traffic volumes was 70 vehicles per hour for each direction of travel and was added to the existing through volumes at the remaining intersections.
- Turning movement volumes into and from the side streets were assumed to remain constant.
- The existing land uses which would be relocated or demolished under the proposed project were assumed to remain in place.

6.8.2 Trips Generated by the Proposed Project

Based on trip generation rates from the Institute of Transportation Engineers (ITE), the following are the projected trip generation volumes of the proposed project:

Table 8

TRIP GENERATION SUMMARY

Land Use	Units	ITE Rate	Direction of Travel	Afternoon Peak Hour Trips[1]
Golf Course	230 parking stalls	0.11	Inbound	30
		0.20	Outbound	60
Residential Homes	40 units	0.63	Inbound	20
		0.37	Outbound	15

1 - Afternoon peak hour trips rounded to the nearest five.

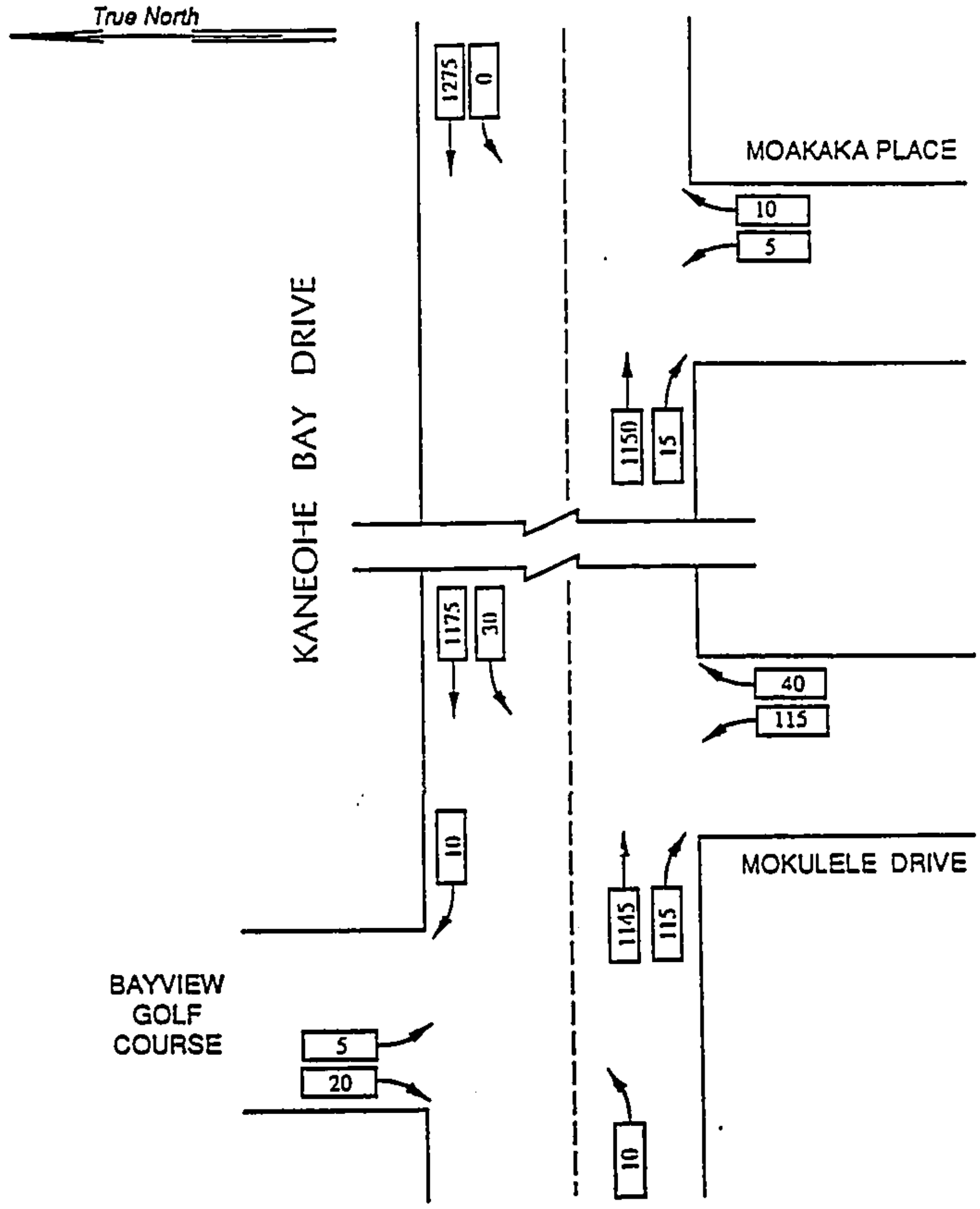

FIGURE T

1993 AMBIENT AFTERNOON PEAK HOUR FORECAST W/OUT PROJECT

Comparison of the derived volumes with actual counts taken at several Oahu golf courses indicate that these counts are on par with public courses but slightly higher than semi-private courses. Use of the derived volumes implies a conservative assumption that overstates the number of trips which would actually be generated.

The distribution and directional assignment of the generated trips were based on the expected market for the golf course. It was assumed that two-thirds of the golf course-generated trips would be to or from the south. One half of these would continue on Kaneohe Bay Drive to Kaneohe or the Likelike Highway. The other half would utilize Mokulele Drive.

The remaining one-third of the golf course-generated trips would be to or from the south.

The residential trips were distributed 75 percent south and 25 percent north, based on the existing travel patterns.

Figure U presents the net volume of traffic which would be generated by the proposed project.

6.8.3 Impacts of the Proposed Project

The proposed project is not expected to have an adverse impact on traffic operations along Kaneohe Bay Drive. The 18-hole golf course and additional residential units will not add a large number of new trips, but will primarily relocate existing trips to new locations on Kaneohe Bay Drive.

Access to the proposed project will be across Moakaka Place. The two major intersections studied at Mokulele Drive and Moakaka Place will continue to operate at acceptable levels of services.

Figure V combines the without-project traffic with the project-generated traffic. It should be noted that both the 1993 ambient and forecast afternoon peak hour traffic volumes are lower than the volumes counted in 1986 before H-3 was opened.

Impacts on Kaneohe Bay Drive traffic resulting from the proposed project were measured by the change in Level-of-Service (LOS) at the study intersections with and without the project for the afternoon peak hour in 1993. A range of LOS from A to F was derived, with F being the worst condition. The following summarizes the projected impacts on nearby roadways:

- The Mokulele Drive intersection is presently operating at an acceptable level of service. The exception is the northbound approach which is operating at LOS D. This rating is considered acceptable but not desirable. The existing under-designed right turn lane is not providing sufficient capacity. Therefore, the two

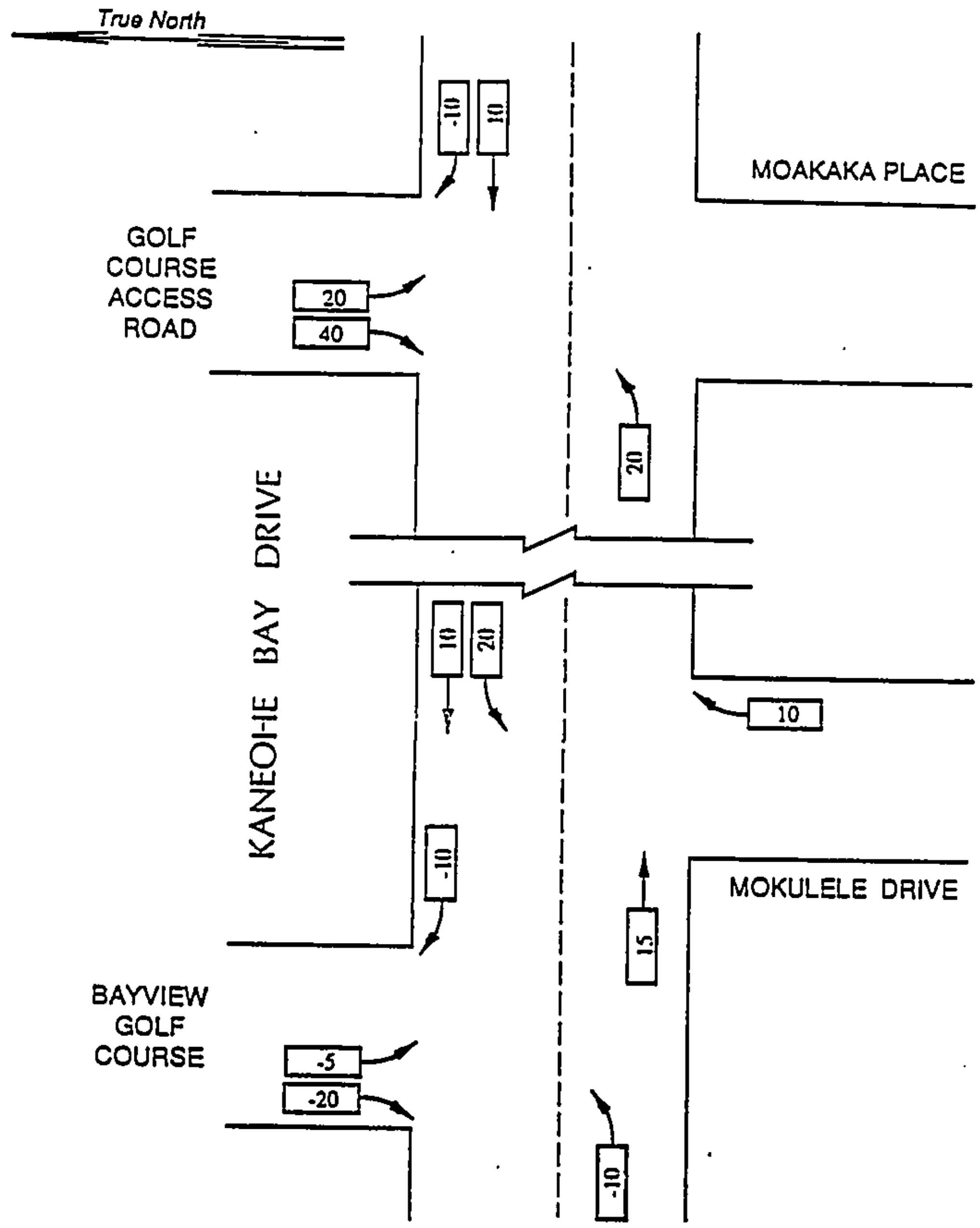

FIGURE U

PROJECT - GENERATED TRAFFIC

HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

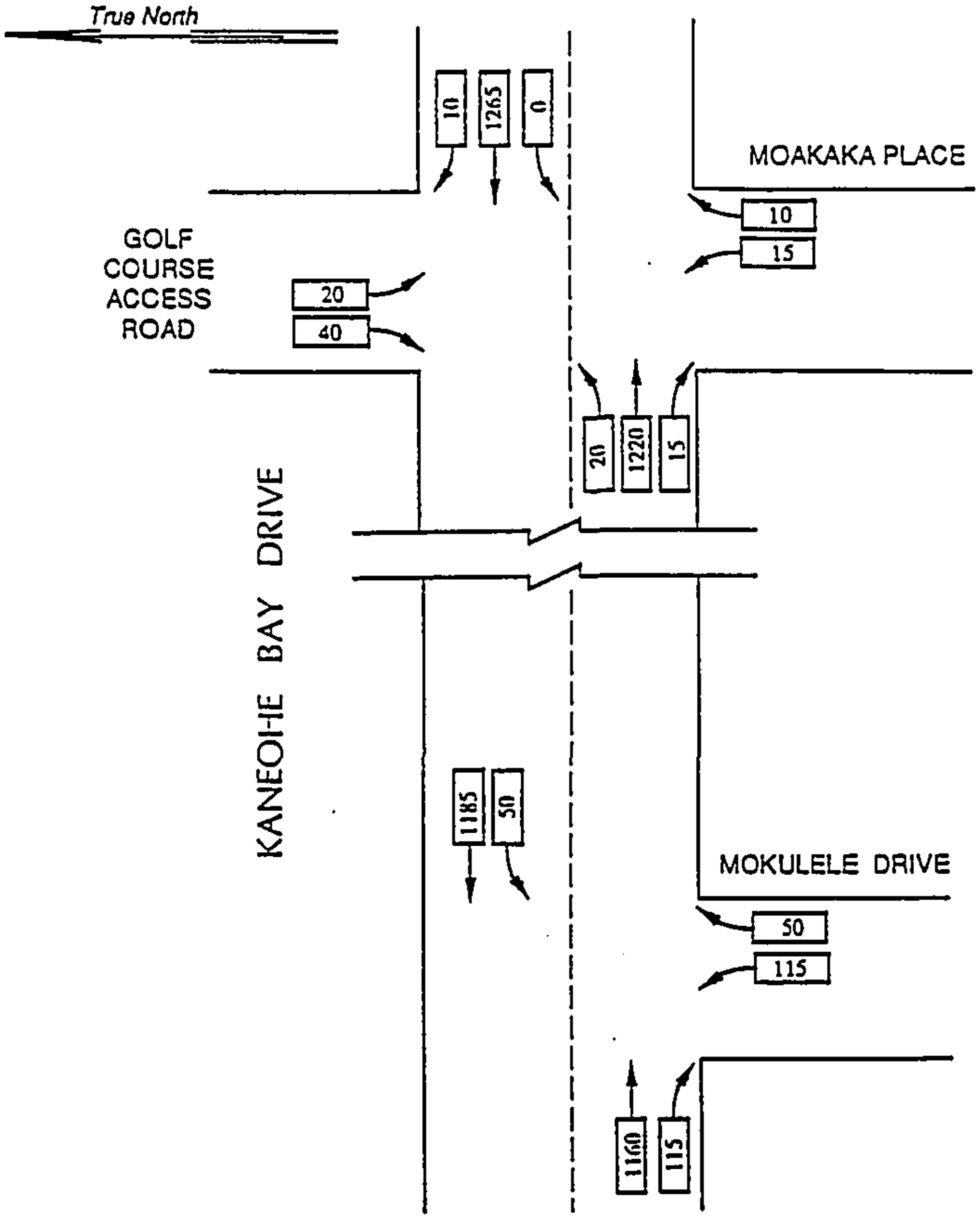

FIGURE V

TOTAL FORECAST AFTERNOON PEAK HOUR VOLUMES future scenarios assumed an improved right turn land would improve future traffic operations to LOS B.

- The other two approaches would continue to operate at LOS C or better, implying desirable levels of service.

- The proposed golf course access road was assumed to be opposite Moakaka Place. Left turns into and right turns out of the access road will be at LOS C and D, respectively, indicating no significant problem. The left turn movement out from the access road will be at LOS E, indicating very long delays. This, however, does not imply that additional intersection improvements are required.

Outbound traffic from the residential cul de sacs will encounter long and very long traffic delays primarily due to the large traffic volumes on Kaneohe Bay Drive. Intersection improvements are not required, but the cul de sacs location should be separated to minimize conflicts with adjacent intersections.

Several mitigating actions are recommended:

- At Mokulele Street, the right-turn lane on the northbound approach of Kaneohe Bay Drive should be improved by providing a longer right-turn lane from the intersection. This will allow the right-turning vehicles to enter the exclusive right-turn lane earlier to avoid some of the delay caused by the through traffic queuing.

- The access road to the proposed golf course should be aligned opposite Moakaka Place to minimize points of conflicts along Bay View Drive and increase turning efficiency of the two minor roadways.

- Separate right- and left-turn lanes should be provided for the golf course access road due to the limited sight distance. To increase the sight distance to the south, the vegetation along the horizontal curve should be cut back so that clear view can be maintained through the turn.

6.9 AIR QUALITY

6.9.1 Impacts During Construction

The principal source of short-terms air quality impact will be construction activity.

1. Construction vehicle activity will increase automotive pollutant concentrations along Kaneohe Bay Drive, as well as in the vicinity of the project site. During off-peak hours, the additional construction vehicle traffic should not exceed road capacities. The presence of large trucks, however, can reduce a roadway's

capacity, as well as lower average travel speeds, thereby contributing to additional air pollution emissions.

2. Site preparation and earth-moving will create particulate emissions, as will building and on-site construction. The movement of construction vehicles on unpaved roads will also generate particulate emissions. During each month of construction activity, approximately 1.2 tons per acre may be expected under conditions of medium activity, moderate soil silt content (30 percent), and a precipitation/evaporation (P/E) index of 50 (U. S. Environmental Protection Agency, 1978).

Fugitive dust is not likely to be a serious concern due to the rainfall in the area and a P/E index in the 60 to 65 range. Dust generation might become a problem during the drier, windier summer months.

During dry periods, dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as 50 percent. Dust barriers near existing dwellings might be considered if problems arise from wind-driven dust.

6.9.2 Microscale Analysis

Figures P and *Q* in *Section 4.10.1* presents estimated maximum one-hour carbon monoxide concentrations on Kaneohe Bay Drive, specifically at the Mokulele Drive and Moakaka Place intersections. The one-hour "worst case" concentration estimates indicate general compliance with federal and State one-hour standards under both current and projected traffic conditions. Only at one receptor location within ten meters of Mokulele Drive did there appear to be a possibility of exceeding the State's one-hour standard under existing conditions.

The 1993 projections suggest a decline in near-roadway CO levels, despite the additional traffic generated by the proposed project, and indicate compliance with State and Federal at all receptor locations. It is also evident that the project's contribution to CO levels is small, at less than two percent, when comparing the "with" and "without project" scenarios.

Compliance with Federal and State eight-hour standards can also be determined by applying an EPA-recommended "persistence" factor (0.6) to the one-hour maximum CO values. In this project area, exceedances may be occurring under existing conditions, but are not projected to occur in 1993, even with the proposed project.

The apparent reduction in ambient CO concentrations despite projected increases in traffic exemplifies the effect of the federal motor vehicle control program. In this instance, the projected rate of reduction in emissions per vehicle over the 1989— 1993 period was greater than the projected rate of increase in traffic volume; thus, a net decrease in cumulative emissions and ambient impact results.

6.10 NOISE QUALITY

6.10.1 Traffic Noise

Table 9 presents estimates of noise levels with the proposed project and non-project traffic for the afternoon peak hour of traffic in 1993. *Table 10* summarizes the predicted increases in setback distances to the 60, 65, and 70 Ldn traffic noise contour lines along the roadways servicing the project and attributable to project and non-project traffic.

Table 9

COMPARISONS OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS ALONG ACCESS ROADS TO PROJECT SITE (50 FEET FROM ROADWAY CENTERLINES)

			HOURLY LEQ IN dB			
LOCATION	SPEED (MPH)	VPH	AUTO	MT	HT	ALL VEH
EXISTING PM PEAK HOUR TRAFFIC:						
Kaneohe Bay Drive (West of Project)	35	2,440	66.4	62.1	65.7	69.9
Kaneohe Bay Drive (Front of Project)	35	2,373	66.2	62.0	65.6	69.8
Kaneohe Bay Drive (East of Project)	35	2,325	66.2	61.9	65.5	69.7
Golf Course Access Road	20	25	37.4	30.0	25.9	38.4
CY 1993 PM PEAK HOUR TRAFFIC:						
Kaneohe Bay Drive (West of Project)	35	2,575	66.6	62.4	66.0	70.1
Kaneohe Bay Drive (Front of Project)	35	2,510	66.5	62.3	65.9	70.0
Kaneohe Bay Drive (East of Project)	35	2,525	66.5	62.3	65.9	70.0
Golf Course Access Road	20	60	41.2	33.8	29.7	42.4

NOTE:
Assumed traffic mix of 95.0% autos, 2.5% medium trucks and 2.5% heavy trucks used for existing and future conditions.

Table 10

EXISTING AND FUTURE DISTANCES TO 60, 65 AND 70 Ldn CONTOURS

STREET SECTION	60 Ldn SETBACK (FT) EXISTING	60 Ldn SETBACK (FT) FUTURE	65 Ldn SETBACK (FT) EXISTING	65 Ldn SETBACK (FT) FUTURE	70 Ldn SETBACK (FT) EXISTING	70 Ldn SETBACK (FT) FUTURE
Kaneohe Bay Drive (West of Project)	228	236	106	110	49	51
Kaneohe Bay Drive (West of Project)	223	232	104	108	48	50
Kaneohe Bay Drive (West of Project)	220	233	102	108	48	50
Golf Course Access Road	2	3	1	2	0	1

NOTES:
1) All Setback distances are from the roadways' centerlines.
2) Ldn assumed to be equal to Peak Hour Leq along all roadways.
3) Setback distances are for unobstructed line-of-sight and soft ground conditions.

The increases in traffic noise levels attributable to the project are predicted to be less than 0.2 dB (or Ldn) along the three roadway sections of Kaneohe Bay Drive which are expected to service the project. An increase in traffic noise of less than 02. dB should not be perceptible and is not considered to be significant.

Risks of adverse noise impacts generated by the proposed project are therefore considered to be low and special traffic noise mitigation measures are unnecessary.

6.10.2 Other Non-Traffic Noise Considerations

Risks of adverse noise impacts from clubhouse activities are low due to the probable use of total closure and air conditioning of the facility. Due to the relatively large buffer distance between the proposed clubhouse and neighboring church property, noise mitigation for the clubhouse will probably be limited to measures such as closure and air conditioning of the clubhouse facility.

Risks of adverse noise impacts from tennis court activities are also low due to the large distances between the courts and the neighboring church, as well as the relatively high level of background traffic noise at the proposed location of the tennis courts.

6.11 IMPACTS ON SURROUNDING COMMUNITY

6.11.1 Regional Community

Social impacts are hereby discussed from both a regional and immediate community perspective. For the purposes of this report, the "regional community" is the Kaneohe Neighborhood Board area. The "immediately-surrounding community" includes the nearby public facilities and residences.

Potential social impacts on the regional community include the following:

1. <u>Addition of a Championship Golf Course</u>

   The proposed project will increase recreational amenities to the area by providing a regulation golf course for resident and visitor use.

2. <u>No Population Increase</u>

   The residential component of the proposed project is intended primarily for relocation of existing on-site residents. The proposed Bayview Golf Course Expansion will therefore neither directly increase nor induce population growth.

3. <u>Maintenance Of Open Space Quality</u>

   The proposed golf course will replace the scattered residences and overgrown vegetation with an consolidated uses and well-maintained open space.

4. <u>Traffic</u>

   As discussed in *Section 6.8*, regional traffic conditions are expected to increase with or without the project. The proposed project will increase traffic, though its impact is minimal when compared to without-the-project scenarios.

6.11.2 Immediate Neighborhood

Potential social impacts on the immediately surrounding neighborhood as follows:

1. <u>Traffic</u>

   The proposed project will cause additional traffic in the immediate vicinity, and measures to mitigate these impacts are proposed in *Sections 6.8* and *10.*

2. Public Safety

   The proposed golf course will be near residents and school children. The golf course architect has designed the course to minimize directional hazards of golf slices and hooks.

3. Improvement Of Visual Quality

   As discussed earlier, the project will improve views of Kaneohe Bay for nearby residents and passersby.

4. Construction Impacts

   The surrounding residents may experience the noise and dust of construction activities associated with the golf course. Other sections in this report present mitigating measures to minimize these impacts.

6.12 ECONOMIC IMPACT

It is anticipated that the proposed golf course and its support facilities will have positive economic impacts by providing an approximate 30 full-time employees.

CHAPTER SEVEN

Relationship Between Short Term Uses Of The Environment And The Maintenance And Enhancement Of Long–term Productivity

7. RELATIONSHIP BETWEEN SHORT TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The proposed project will have the following long-term effects on the natural environment:

- Open space qualities will be maintained.
- The natural environment will not be committed to a more intense urban use, such as resort uses, which has the potential to preclude continuation of green, generally unobstructed open space.
- The proposed golf course will not pose long-term risks to health and safety.

Further, other long range trade-offs generated by uses on this land include the establishment of a permanent recreational facility available for public use, an increase in tax revenues, and the diversification of available employment in the region.

CORRECTION

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

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CHAPTER EIGHT

Irreversible And Irretrievable Commitment Of Resources

8. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

There will be an irreversible commitment of 140 acres of golf course, vacant and residential land for primarily a championship golf course.

It is noted, however, that the proposed golf course will substitute the existing unused open space with another form of open space. Further, the proposed project will improve the visual quality of the area by replacing the overgrown, dense vegetation with attractive, well-maintained permanent open space.

A permanent commitment of private funds and other resources to plan, design and construct the proposed golf course and on- and off-site utilities is expected. Further, commitments to employ workers and operate the facility will be made, which will also result in a commitment to increase tax revenues and diversifying economic activities in the area. A public commitment to maintain the improved infrastructure will be required, and will be somewhat mitigated by Pacific Atlas (Hawaii), Inc. through taxes and user fees.

CHAPTER NINE

Adverse Environmental Impacts Which Cannot Be Avoided

9. ADVERSE ENVIRONMENTAL IMPACTS WHICH CANNOT BE AVOIDED

As previously discussed, there are certain adverse environmental impacts which cannot be avoided, but can be mitigated through recommended measures.

Construction activities will increase noise, air-borne dust and particulate emissions for the surrounding neighborhood. Further, stream water quality may be temporarily affected. None of these impacts are expected to be long-term in nature, however.

The proposed realignment of Kawa Stream to its original alignment would restore the Waikalua-Loko Fishpond to its former role as a settling basin during periods of heavy runoff. The fishpond would subsequently be subject to impacts, such as the increase in the rate of pond in filling with terrigenous materials; the reduction of ambient pond salinities during periods of heavy runoff; and the alteration of existing flushing and circulation patterns. The existing natural, albeit man-induced or accelerated processes are exerting and will continue to exert many of these same effects through normal coastal ecological succession processes. These would occur with or without the impacts associated with the proposed project.

The area's water, sewerage and drainage systems will need to be upgraded, at the developer's expense, to accommodate the proposed project.

The proposed project is not expected to significantly impact nor change existing habitats for marine and estuarine species. There are no plants of botanical interest on the site, nor any native plant communities in need of protection. Further, the mammals that occur on the site do not require protection; in fact, most of them are considered destructive to other animals and vegetation.

Some roadway improvements will be required to handle traffic generated by the project, but the project traffic is insignificant compared to traffic increases without the project.

CHAPTER TEN

Mitigation Measures Proposed To Minimize Impacts

10. MITIGATION MEASURES PROPOSED TO MINIMIZE IMPACTS

10.1 DRAINAGE AND GRADING

Runoff entering Kawa Stream can remain near levels experienced for existing conditions when mitigating measures are employed. These measures include routing runoff to ponds within the golf course layout. Drain patterns are therefore expected to remain similar to existing conditions with diversion of some on-site runoff to the golf course ponds is proposed. It is intended that the ponds serve was detention basins, dampening peak runoff generated on-site. By incorporating these detention basins into the golf course design, the discharge of peak storm runoff from the project site is not expected to increase from existing conditions.

Short term soil erosion can be mitigated by limiting the grading area in any given time, installing a sedimentation basin at the onset of grading, and other measures outlined in *Section 4.7.* Long term soil erosion potential is expected to decrease after development of the golf course.

10.2 WATER QUALITY AND HABITATS

Project-related impacts to Kawa and Kaneohe Streams will entail localized degradation in water quality resulting from earth-moving activities associated with channel realignment and construction of new golf course fairways. Most of these impacts can be ameliorated through the use of berms and swales to retain runoff waters from construction areas generated during periods of heavy rain.

Impacts on the Waikalua-Loko Fishpond can be attenuated or mitigated by the provision of a carefully-executed water quality and environmental management plan. For example, periodic dredging of the pond has the potential to improve the productivity of the now shallow, heavily-silted pond. Control of rapidly-spreading mangroves would maintain the open water habitat of the fishpond, while preserving the structural integrity of the fishpond walls. In the absence of a program to control the spread of mangroves, the fishpond walls will continue to deteriorate.

10.3 FLORA AND FAUNA

None of the native species are of botanical interest in the present context and none warrant mitigative action before the site is developed. Further, the mammals that occur on the site do not require protection.

10.4 ARCHAEOLOGICAL RESOURCES

The only archaeological resources found on the project site are the Waikalua-Loko and Waikalua Fishponds. Pacific Atlas (Hawaii), Inc. proposes to incorporate these fishponds in the golf course design and layout. It is intended that the Waikalua-Loko Pond serve as a detention basin to mitigate drainage impacts. Further, these fishponds are considered attractive water features which will enhance the proposed championship golf course.

The following measures are proposed to mitigate construction impacts:

- An archaeologist will be on-site to monitor initial grubbing and grading for the purpose of identifying and evaluating buried cultural materials which may be uncovered. If significant material is uncovered the State Historic Preservation Office will be consulted to evaluate the findings before construction resumes in that area.
- Both fishponds should be preserved in place. No construction or other modifications should take place on their banks or walls except that which serves to preserve or improve the condition of the sites as functioning Hawaiian fishponds.
- Both ponds should be cleared by hand or other feasible means of existing mangrove, hau and other destructive vegetation.
- Before any dredging or cleaning of the pond takes place, the deposits within the pond should be core-sampled for purposes of stratigraphic study and recovery and dating of organic samples.
- The gates and seawalls of the ponds should be restored as much as possible to their earlier functioning condition.
- The ponds should be maintained, free of vegetation and with sufficient water quality to allow flourishing of vertebrate and invertebrate marine life.
- A modest interpretive program is recommended which would include explanatory signs giving the history and function of the ponds as well as present operation.

10.5 CHEMICAL IMPACTS

Careful monitoring of fertilizers and pesticides used for the golf course will help preserve the water quality and protect the ecosystem of flora and fauna. Specific mitigation measures include:

- Irrigation management is critical and a U. S. Weather Bureau class A evaporation pan is recommended to measure evaporation and schedule irrigation application.
- Where grading is necessary, topsoil should be stockpiled and replaced over the areas to which chemicals will be applied; the high-organic matter containing surface soils will retard pesticide movement.
- Judicious use of fertilizers and pesticides, especially in the early establishment of turf, is essential, since pesticides and nitrogen will be more likely to move before an extensive root system and thatch layer are developed. Use of slow-release nitrogen fertilizer during the rainy season will reduce nitrogen losses to runoff.
- A system of berms and temporary water-retention basin along Kawa Stream will prevent immediate runoff into the stream and eventually into the pond, thus reducing the possible movement of fertilizers and pesticides into Waikalua-Loko Fishpond.
- *Although significant movement* of applied chemicals in either leachate or runoff is not anticipated, a modest monitoring program for nitrogen in Waikalua-Loko Fishpond seems appropriate.
- A qualified Golf Course Superintendent should be given the responsibility of managing the golf course.

10.6 UTILITIES

Water

The proposed water system would tap off the 12-inch BWS water line along Kaneohe Bay Drive at the proposed access road to the clubhouse. Two new parallel water lines will be located along the proposed access road to the clubhouse and maintenance building site. Section 6.7.1 provides more information on the proposed potable water system. Drilling of two shallow on-site wells is required to meet the non-potable water demand.

Wastewater

The proposed wastewater collection system, as described in Section 6.7.2, will transmit wastewater generated by the project to the Kaneohe Sewage Treatment Plan (STP), located within the project area, for treatment.

Electrical and Telephone

The existing electrical system may need to be upgraded to accommodate the proposed project. Pacific Atlas (Hawaii), Inc. will work closely with Hawaii Electric Company to ensure timely service and to determine an appropriate on-site location for a substation. The electrical system within the development will be built to City standards. Further, utility lines will be underground to mitigate any visual impacts. The developer will maintain contact with Hawaiian Telephone Company to assure necessary service levels.

Solid Waste

Solid waste generated by the clubhouse will be continuously collected by private collection companies and disposed at the City's windward sanitary landfill. Solid waste generated by the residential development will be collected by the City Refuse Division.

10.7 TRAFFIC

Several mitigating actions are recommended:

- At Mokulele Street, the right-turn lane on the northbound approach of Kaneohe Bay Drive should be improved by providing a longer right-turn lane from the intersection.
- The access road to the proposed golf course should be aligned opposite Moakaka Place to minimize points of conflicts along Bay View Drive and increase turning efficiency of the two minor roadways.
- Separate right- and left-turn lanes should be provided for the golf course access road due to the limited sight distance.

CHAPTER ELEVEN

Summary of Unresolved Issues

11. SUMMARY OF UNRESOLVED ISSUES

As presented in other sections of this EIS, issues arising from the implementation and operation of the proposed project can generally be mitigated by measures identified in the various project studies.

An issue which is not completely resolved at this time is land control and/or acquisition. Pacific Atlas (Hawaii), Inc. is continuing to discuss possible lease or trade of surplus land around the Kaneohe Sewage Treatment Plant with the City and County of Honolulu. Further, negotiations with landowners of the residential and vacant parcels are continuing.

CHAPTER TWELVE

Alternatives to the Proposed Action

12. ALTERNATIVES TO THE PROPOSED ACTION

Pacific Atlas (Hawaii), Inc. considered three alternatives in developing the project site.

1. NO ACTION

The no-action alternative implies that the existing Bayview Golf Course will continue its pitch-and-putt course, as well as the driving range operations. Further this alternative would mean that the scattered residential uses would continue, and that a large portion of the project site will remain overgrown and dense.

The no-action alternative would not require improvements to the infrastructure and thus not require public maintenance of such improvements. While the potentially negative impacts of construction and golf course operation would not occur, the no-action alternative also would not generate the potentially positive environmental, social and economic impacts.

The area's scenic quality would not be improved, for example. Also, the site's water features would still require improvement and the Waikalua-Loko Fishpond would continue to deteriorate.

2. EXPANSION OF ONLY THE GOLF COURSE FACILITIES

Pacific Atlas (Hawaii), Inc. considered developing only a golf course, without the residential development. In the course of discussion with current landowners, however, it was apparent that on-site owner/occupants preferred relocating in this area. Thus, the no-residential alternative was not selected so as to accommodate on-site residents.

3. THE PROPOSED PROJECT

The proposed project will consolidate land uses on the site. Proposed residential uses on the site, which are designed primarily to be used for relocation, will be only in one area, as will golf course support facilities. The remaining area will be used for a recreational purpose, and will be left in open space.

Further, proposed on-site improvements will improve the site's drainage. Although Kaneohe Stream will remain the same, Kawa Stream will be realigned to its original course. In the process of this alignment, the stream will be improved, and the Waikalua-Loko Fishpond will be restored to its original function as a sediment basin.

The proposed project will also improve the visual quality of the area, by eliminating the overgrown vegetation and providing an attractive foreground to the Kaneohe Bay.

No other alternative uses were considered for this site.

Alternative design decisions are based primarily on topographical considerations, particularly those related to the fishpond and stream areas. The current layout is preliminary, and flexibility of certain elements— such as the exact locations of tees, greens and fairways, as well as the clubhouse and driving range— is imperative until more precise engineering studies have been completed.

CHAPTER THIRTEEN

Consulted Parties And Participants In The Deis Preparation Process

13. CONSULTED PARTIES AND PARTICIPANTS IN THE DEIS PREPARATION PROCESS

13.1 CONSULTED PARTIES

The Environmental Impact Statement Preparation Notice (EISPN) for the proposed Bayview Golf Course was published in the *OEQC Bulletin* of June 23, 1989. The thirty-day review period, announced in the *OEQC Bulletin* ended on July 24, 1989. The EISPN together with the Environmental Assessment report were mailed directly to the agencies and organizations listed below. The list contains parties believed to have an interest in the project or who requested consulted party status.

CITY AGENCIES

Building Department

Fire Department

Board of Water Supply

Police Department

Department of Public Works

Department of Parks & Recreation

Department of General Planning

Department of Housing & Community Development

Department of Transportation Services

Department of Neighborhood Board #30

STATE AGENCIES

Department of Accounting & General Services

Department of Defense

Department of Education

Department of Hawaiian Home Lands

Department of Health

Department of Land & Natural Resources

STATE AGENCIES (Continued)

DLNR State Historic Preservation Officer

Department of Business & Economic Development

Office of State Planning

Housing Finance & Development Corporation

Department of Transportation

Office of Hawaiian Affairs

University of Hawaii, Environmental Center

Hawaii Institute of Marine Biology

FEDERAL AGENCIES

U.S. Army Corps of Engineers

U.S. Fish & Wildlife Services

PRIVATE ORGANIZATIONS

American Lung Association

Outdoor Circle

YWCA Kokokahi Center

Friendship Garden Foundation

YWCA, Executive Office

Ms. Donna Rewick, Kaneohe Neighborhood Board No. 13

Mr. J. Ralston

13.2 PARTICIPANTS IN THE DEIS PREPARATION PROCESS

NAME	POSITION	HIGHEST DEGREE	AREA OF EXPERTISE
Andrew Berger	Retired Professor	Ph.D. Zoology	Terrestrial Vertebrates
William Brewer	Vice President Brewer / Brandman & Assoc.	B.S. Biology & M.S Marine Biology	Marine Biology
Berna Cabacungan	Principal Earthplan	B.A. English	Community Planning/ Social Impact Assessments
Winona Char	President Char & Assoc.	M.S. Botany	Botany
Yoichi Ebisu	President Y. Ebisu & Associates	M.S. Electrical Engineering	Acoustical Consulting
Dick Green	Consultant	Ph.D. Soil Physics	Fertilizer & Pesticide
Hallett Hammat	Owner Cultural Surveys Hawaii	Ph.D. Anthropology	Archaeology
Harvey Hida	President Hida, Okamoto & Associates, Inc.	B.S. Civil Engineering	Civil/ Environmental Engineering
Tyrone Kusao	President T. Kusao, Inc.	M.S. City & Regional Planning	Planning & Zoning Consultant
James Morrow	Environmental Management Consultant J.W. Morrow	M.S. Science	Air Quality
Jonathan Shimada	President Pacific Planning & Engineering	Ph.D. Philosophy & Civil Engineering	Traffic Engineer

CHAPTER FOURTEEN

Comments During The Consultation Period

14. COMMENTS DURING THE CONSULTATION PERIOD

The following pages contain: (1) a copy of DLU's determination letter requiring an EIS, (2) a copy of the Environmental Assessment Report, (3) the project notice in the *OEQC Bulletin* of June 23, 1989, and (4) comments received and follow-up responses.

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU

89/EIS-2(BWM)
89/SMA-52

June 14, 1989

Mr. Tyrone T. Kusao
1188 Bishop Street
Suite 2507
Honolulu, Hawaii 96813

Dear Mr. Kusao:

Environmental Assessment/Determination
Environmental Impact Statement
Preparation Notice (EISPN)
Chapter 33, ROH

Recorded Owner/ Applicant	:	Pacific Atlas (Hawaii), Inc.
Agent	:	Tyrone T. Kusao, Inc.
Location	:	Kaneohe, Oahu
Tax Map Key	:	4-5-30: 1,3,6,9,20,30, por. 36, 37,40,42,44,45,46; 4-5-08: 38; 4-5-59: 33 to 36; 4-5-104: 48 to 54
Request	:	Expansion of Bay View Golf Course into an 18-hole golf course on 140 acres, including a club house and maintenance shed
Determination	:	Environmental Impact Statement (EIS) Required

We have reviewed the EA and have determined that an EIS is required. We have submitted an EISPN to the Office of Environmental Quality Control for publication in the "OEQC Bulletin." A copy of the notice is attached. Also attached is a list of parties to be consulted. You are required to send each a copy of the EISPN and the EA, allowing them 30 days to comment.

If you have any questions, please contact Bennett Mark of our staff at 527-5038.

Very truly yours,

John P. Whalen
JOHN P. WHALEN
Director of Land Utilization

JPW:sl
0335N/5

attachment: EISPN
Parties to be Consulted

DEPARTMENT OF LAND UTILIZATION
89/EIS-2; 89/SMA-52(BWM)
June 14, 1989

Chapter 33, ROH
Environmental Assessment/Determination
Environmental Impact Statement
Preparation Notice (EISPN)

Recorded Owner/ Applicant	:	Pacific Atlas (Hawaii), Inc.
Agent	:	Tyrone T. Kusao, Inc.
Location	:	Kaneohe, Oahu
Tax Map Key	:	4-5-30: 1,3,6,9,20,30, por. 36, 37,40, 42,44,45,46; 4-5-08: 38; 4-5-59: 33 to 36; 4-5-104: 48 to 54
Request	:	Expansion of Bay View Golf Course into an 18-hole golf course on 140 acres, including a club house and maintenance shed
Determination	:	Environmental Impact Statement (EIS) Required

Attached and incorporated by reference is the environmental assessment prepared by the applicant for the project.

On the basis of the environmental assessment, we have determined that an Environmental Impact Statement is required.

APPROVED John P. Whalen
JOHN P. WHALEN
Department of Land Utilization

JPW:sl
0335N/4

Attachment

ENVIRONMENTAL IMPACT STATEMENT PREPARATION NOTICE (EISPN)

BAYVIEW GOLF COURSE

Parties to be Consulted

City Agencies

Building Dept.
Fire Dept.
Board of Water Supply
Police Dept.
Department of Public Works
Dept. of Parks & Recreation
Dept. of General Planning
Dept. of Housing & Community Development
Dept. of Transportation Services
Kaneohe Neighborhood Board #30

STATE AGENCIES

Dept. of Accounting & General Services
Dept. of Defense
Dept. of Education
Dept. of Hawaiian Home Lands
Dept. of Health
Dept. of Land & Natural Resources
DLNR State Historic Preservation Officer
Dept. of Business & Economic Development
Office of State Planning
Housing Finance & Development Corp.
Dept. of Transportation
Office of Hawaiian Affairs

University of Hawaii, Environmental Center
Hawaii Institute of Marine Biology

FEDERAL AGENCIES

U.S. Army Corps of Engineers
U.S. Fish & Wildlife Services

PRIVATE ORGANIZATIONS

American Lung Association
Outdoor Circle
YWCA Kokokahi Center
Kokokahi Community Association
Friendship Garden Foundation

0335N/6

ENVIRONMENTAL ASSESSMENT REPORT

BAYVIEW GOLF COURSE EXPANSION
KANEOHE, OAHU, HAWAII

Submitted By Pacific Atlas (Hawaii)
Agent: Tyrone T. Kusao, Inc.

May 1989

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I GENERAL INFORMATION

Introductory Statement. The Department of Land Utilization publication "*CONTENT GUIDE for Preparing an ENVIRONMENTAL ASSESSMENT Required with an Application for a Special Management Area Use Permit (SMP) Chapter 33, Revised Ordinances of Honolulu, as amended*" was used as the basic guide in the preparation of this report. This was supplemented by discussions with appropriate departmental representatives.

A. APPLICANT. The applicant is *Pacific Atlas (Hawaii) Inc.* Its offices are located at 1441 Kapiolani Boulevard, Ala Moana Building, Suite 1204, Honolulu, Hawaii 96814. Pacific Atlas can be reached at (808) 955-2600.

B. RECORDED FEE OWNER. *Pacific Atlas (Hawaii), Inc.* is the recorded fee owner of 84 percent of the project site at this time. The remaining portions of the project site are owned by ten different entities, all of whom have consented to include their properties in this report *for study purposes only.*

C. AGENT. The agent for this application is *Tyrone T. Kusao, Inc.*, 1188 Bishop Street, Suite 2507, Honolulu, Hawaii 96813. He can be reached at (808) 538-6652.

D. TAX MAP KEY. The project area encompasses the following TMK lots:

Phase 1:

TMK 1-4-5-30: parcels 1, 6, 9, 37, 40, 42, 44, 45, and 46

TMK 1-4-5-08: parcel 38

Phase 2:

TMK 1-4-5-30: parcels 3, 20, 30, and a portion of 36

TMK 1-4-5-59: parcels 33 through 36

TMK 1-4-5-104: parcels 48 through 54

All of the Phase I lots are owned by Pacific Atlas (Hawaii), Inc. Of the eleven Phase II lots, ten are currently owned by other parties. Each party consented to include their lot in the project area *for study purposes only.* Pacific Atlas (Hawaii), Inc. is currently exploring acquisition of these lots.

E. LOT AREA. Subject to acquisition of all parcels, the entire project site will encompass approximately 140 acres. Approximately 119 acres are in Phase 1, with 21 acres in Phase 2.

F. AGENCIES CONSULTED IN MAKING ASSESSMENT. Appropriate agencies will be consulted during the processing of the Environmental Impact Statement (EIS). For the purposes of this assessment, the City Department of Land Utilization was contacted.

2 DESCRIPTION OF THE PROPOSED ACTION

2.1 Introduction and Request

Pacific Atlas (Hawaii) Inc. proposes to expand the **Bayview Golf Course** into an 18-hole championship golf course, in Kaneohe, Oahu, Hawaii. The total project site encompasses 140 acres. The general location of the project site is depicted in Exhibit A, and Exhibit B outlines the project site.

The project includes a clubhouse and maintenance shed, as well as approximately 32 residential units. Exhibit C illustrates the project's conceptual master plan.

SCALE: 1:24000 (APPROX.)
1000 0 1000 2000 3000 4000 5000 FEET

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HONOLULU, HAWAII

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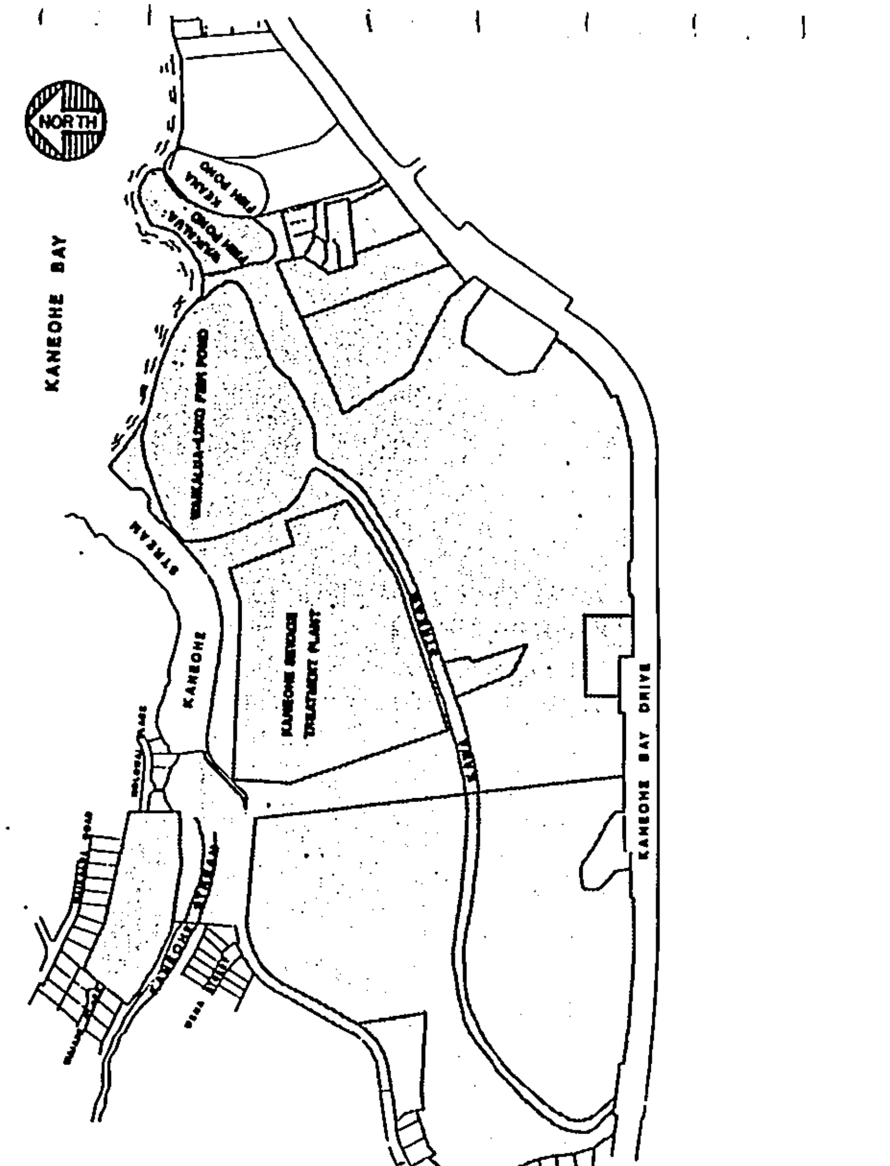
EXHIBIT A
BAYVIEW GOLF COURSE EXPANSION
KANEOHE, OAHU
PROJECT LOCATION MAP



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200 0 200 400 600 800 FEET

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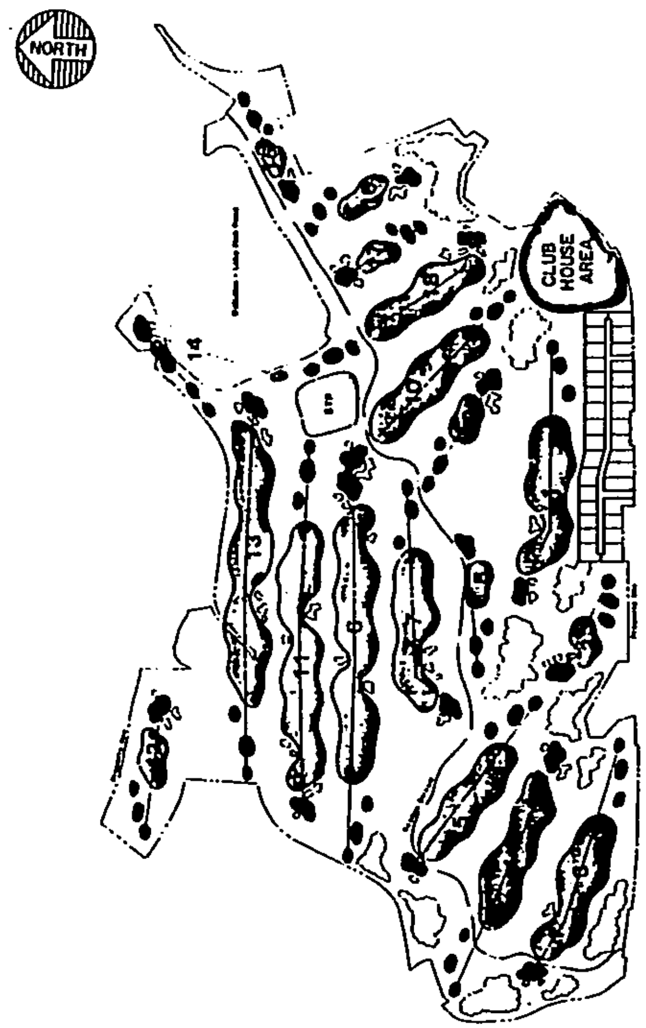
EXHIBIT B
BAYVIEW GOLF COURSE EXPANSION
KANEOHE, OAHU
PROJECT SITE



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HONOLULU, HAWAII

EXHIBIT C
BAYVIEW GOLF COURSE EXPANSION
KANEOHE, OAHU

CONCEPTUAL MASTER PLAN

The project is to be phased as follows:

Phase I includes eleven holes of golf, including fairways 1 through 5, 8, 9, 12, 14, 15, and 18, as well as the clubhouse. Exhibit D delineates Phase I.

Phase II includes the remaining holes of the golf course, and the residential units.

In preliminary discussions between the applicant's agent and DLU representatives, it was agreed that the applicant would proceed with this project as follows:

1. The Special Management Area application, hereby referred to as *SMA application*, is for *Phase I only*, which encompasses an area of approximately 119 acres.

2. Accompanying the SMA application is this Environmental Assessment (EA), which covers *the entire 140-acre project site.*

Hence, all references to *project site* include Phases I and II. All references to the *SMA application area* include only Phase I.

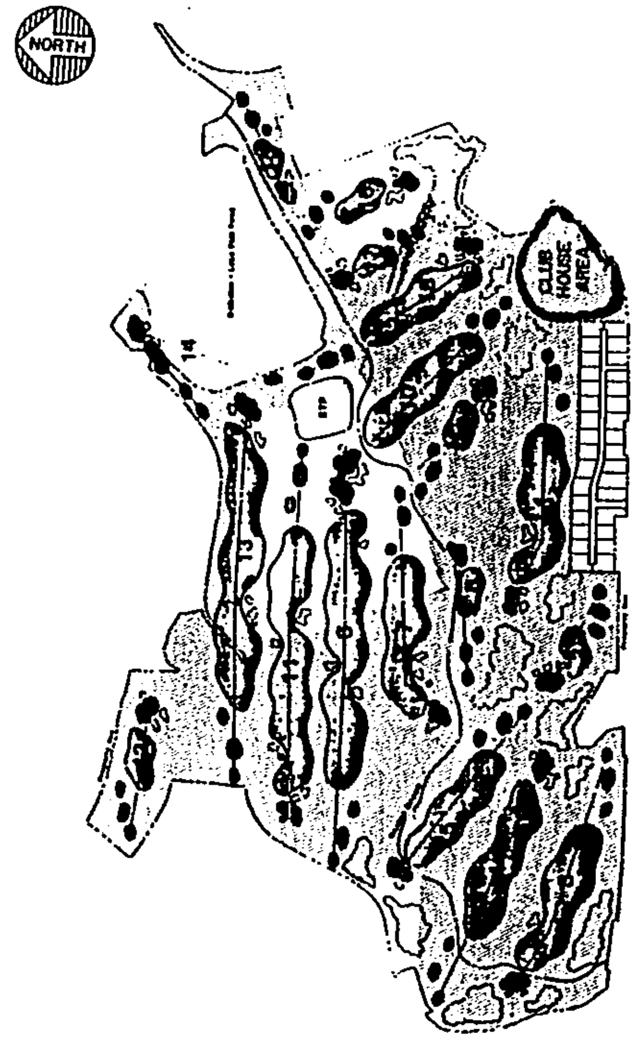

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EXHIBIT D
BAYVIEW GOLF COURSE EXPANSION
KANEOHE, OAHU
PHASE I OF THE PROJECT

3. Due to the project's scope and other considerations, the applicant has already committed to conducting an Environmental Impact Statement (EIS), which will follow this EA pursuant to Chapter 343, Hawaii Revised Statutes. As with the EA, the project site addressed in the EIS is the entire 140-acre site.

4. An SMA application will be submitted for the Phase II portion of the project when appropriate Development Plan and zoning changes are made.

Pacific Atlas (Hawaii) Inc. is presently applying for an SMA for Phase I only for two reasons:

First, the *SMA application area* already has the appropriate land use designations for the proposed use. The *SMA application area* is designated Preservation and Golf Course on the Koolaupoko Development Plan Land Use Map and zoned P-2, General Preservation District.

Second, the applicant is still in the process of assembling portions of the Phase II site.

Almost 16 acres within the project boundaries are owned by the City and County of Honolulu. This site contains the Kulauli Sewage Treatment Plant. The City is currently in the process of relocating the sewage treatment plant and converting this on-site facility to a sewage pump station. This conversion is anticipated for 1994 and will result in excess lands.

The applicant is currently attempting to negotiate acquisition of the excess lands resulting from the conversion and approximately ten acres are included in the golf course design.

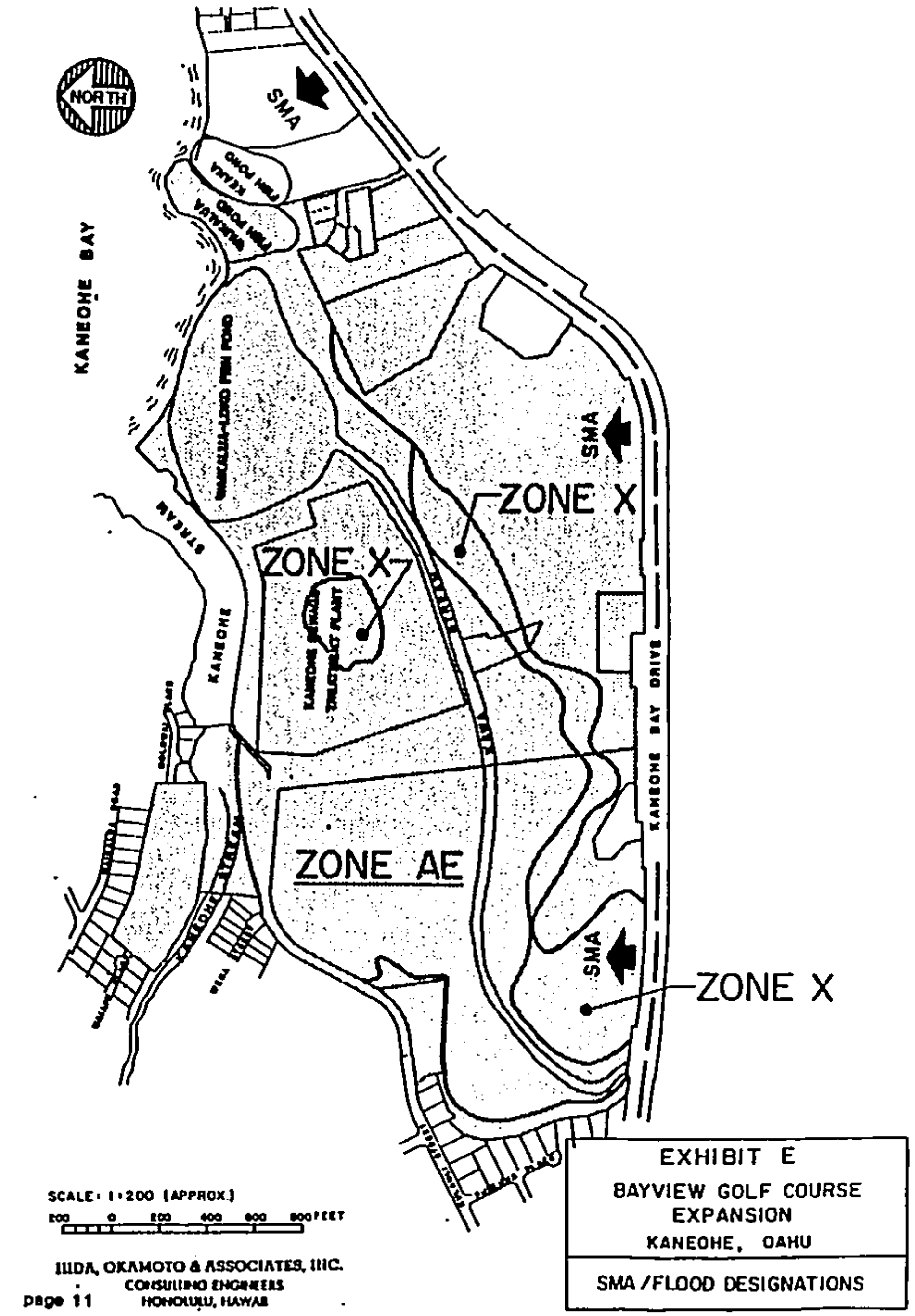
2.2 General Description

2.2.1 Narrative Description

Bayview Golf Course Expansion is envisioned as an 18-hole championship golf course, with residential units fronting the course. The golf course will be privately-owned, and opened to the public during certain days and hours. Supporting the golf course will be a clubhouse containing a restaurant, meeting rooms and administrative offices. A repair and maintenance shed will be located nearby. Two tennis courts and a swimming pool are also proposed as additional amenities for facility users and residents of the proposed residential development. Thirty two residential units will be sold as house-and-lot packages.

2.2.2 Relationship To SMA

The entire project site lies within the Special Management Area, as illustrated in Exhibit E.



2.2.3 **Location Map**

The project site is located in Kaneohe, as illustrated in Exhibit A.

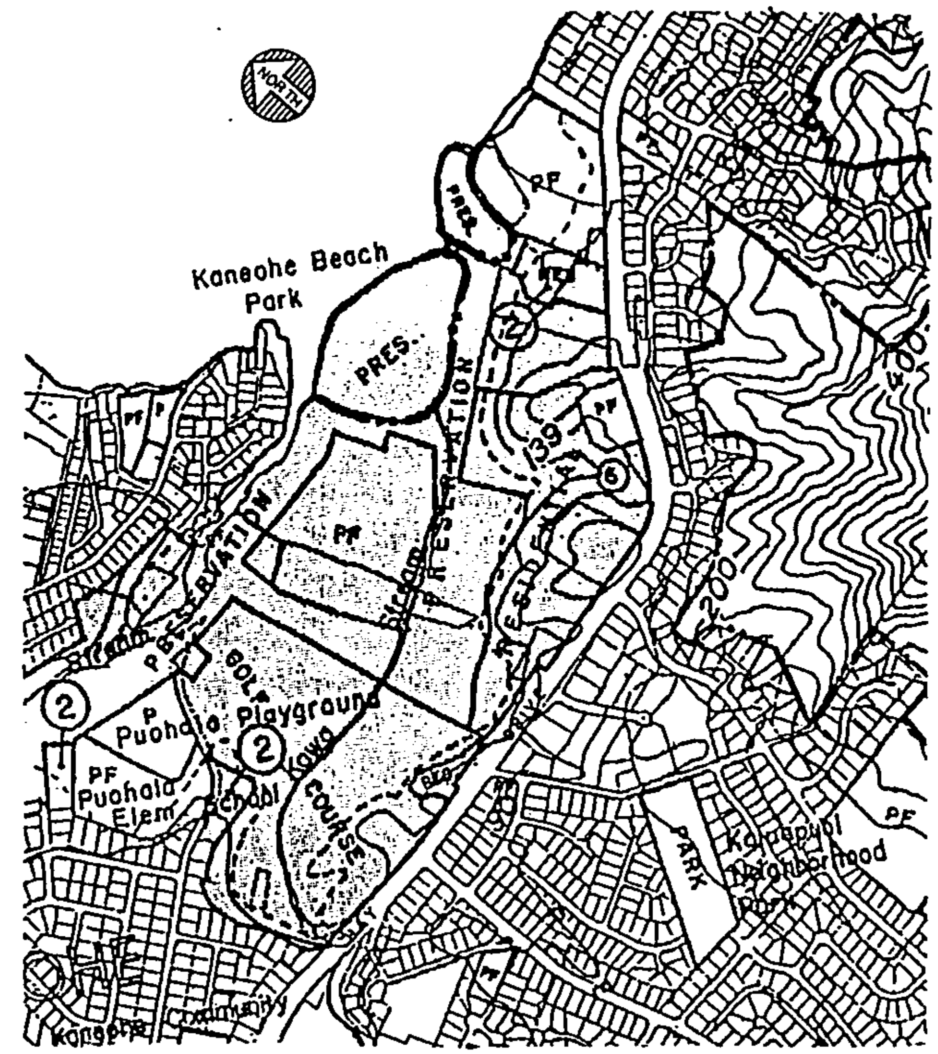
2.2.4 **Land Use Approvals Granted; Approvals Required**

Exhibits F and G show current Development Plan designations and zoning of the project site.

The *SMA application area* is designated Preservation on the Koolaupoko Development Plan Land Use Map and zoned P-2, General Preservation District by the Land Use Ordinance. Phase I, the first eleven holes of the Bayview Golf Course Expansion, is a permitted principal use under these land use designations. To proceed, Phase I requires an SMA permit.

The remaining portions of the project site, or Phase II, are designated Preservation, Residential and Public Facility on the Koolaupoko Development Plan Land Use Map. Zoning in Phase II includes P-1, Restricted Preservation District, P-2, General Preservation District, R-10, Residential, and I-2, Intensive Industrial District.

Implementation of Phase II requires re-designation to Parks and Recreation on the Koolaupoko Development Plan Land Use Map and re-zoning to P-2, General Preservation District. An SMA permit will also be required.



SCALE 1 200 (APPROX.)

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CONSULTING ENGINEERS
HONOLULU, HAWAII

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EXHIBIT F
BAYVIEW GOLF COURSE EXPANSION
KANEOHE, OAHU
KOOLAUPOKO DEVELOPMENT PLAN LAND USE MAP

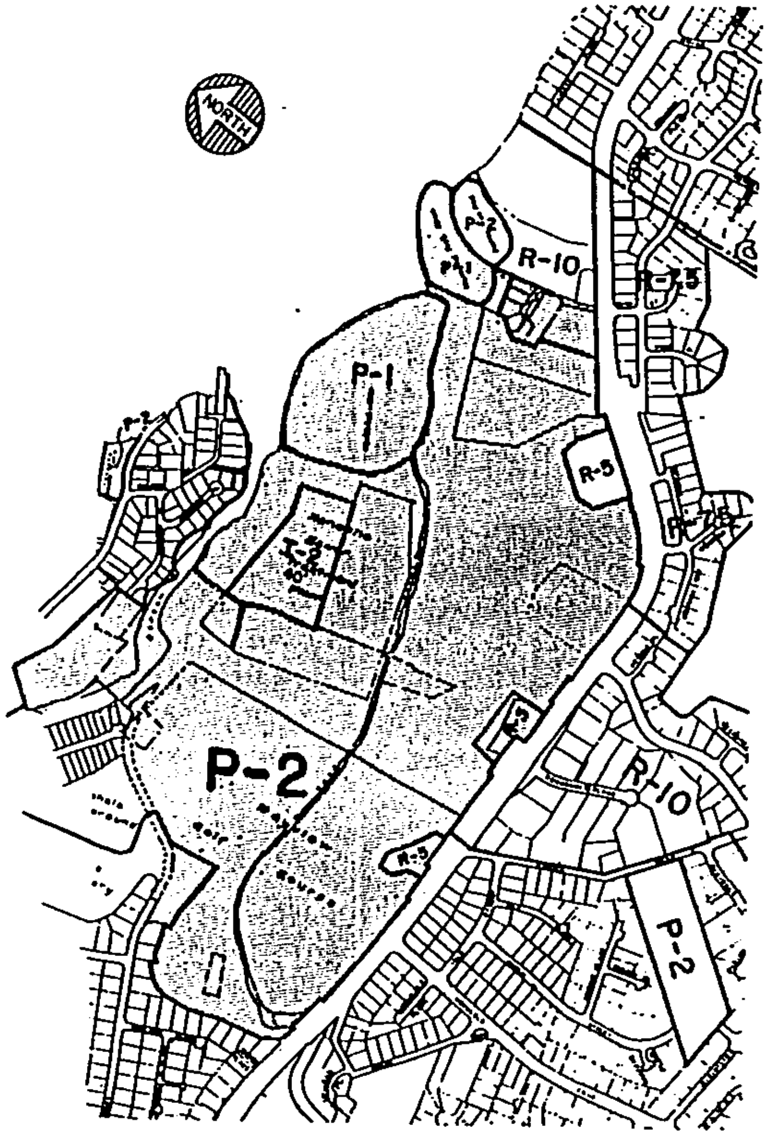

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EXHIBIT G
BAYVIEW GOLF COURSE EXPANSION
KANEOHE, OAHU
ZONING MAP

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In addition, other State and Federal permits related to wetlands and on-site stream may be required. Full disclosure of these permits will be made in the EIS.

2.3 Technical Characteristics

2.3.1 Use Characteristics

The primary feature of the proposed project is an 18-hole championship golf course, which will be supported by typical golf course amenities. Designed to primarily serve the needs of club members, these amenities center around the clubhouse, which would contain dining facilities, meeting rooms and administrative offices. A repair and maintenance shed will be located nearby. The general public will also be able to use the golf course for a fee during certain hours.

Two tennis courts and a swimming pool are also proposed as additional amenities for club members, as well as for residents of the proposed residential development.

The residential component of the proposed project will be similar to other residential developments fronting golf courses. The lots will be relatively large, and the units will be designed to take advantage of views of the golf course and Kaneohe Bay.

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The house-and-lot packages are intended for the upper price range of the housing market. Preliminary plans include reserving some of the residential units for current on-site households; the actual number of units will be determined in land acquisition negotiations between the applicant and other landowners.

2.3.2 Physical Characteristics (Layout Drawing)

A survey of the site's topography is presently underway. A certified shoreline survey map is included as part of the SMA application. These surveys will indicate property lines, lot size, certified shoreline, setback, reference data, ground elevations and existing structures and will be included in the EIS.

2.3.3 Construction Characteristics

All existing structures on the project site will be demolished or removed. The structures include those related to the Bay View Golf Course, and residences. Other construction activities include clearing, grubbing and grading. Additional construction information, including the height and design of the proposed new structures, will be provided in the EIS.

2.3.4 Utility Requirements

Electrical and telephone services are already provided to the site by the Hawaiian Electric Company and the Hawaiian Telephone Company, respectively. It is expected that these services will continue and additional utility requirements will be studied by Hida Okamoto and Associates, Inc., as part of the forthcoming EIS.

2.3.5 Liquid Waste Disposal

The proposed project will be served by the existing municipal sewer system. The project's requirements and impacts on the existing system will be studied by Hida Okamoto and Associates, Inc., as part of the EIS process.

2.3.6 Solid Waste Disposal

Refuse generated by golf course and residential activities will be collected by a private company. Impacts of the project on solid waste disposal systems will be studied by Hida Okamoto and Associates and findings will be presented in the EIS.

2.3.7 Access To Site

Access to the golf course, clubhouse and residences will be via Kaneohe Bay Drive. None of the proposed residential units will be have driveways directly on Kaneohe Bay Drive. Ingress and egress to the residences will be via service roads off Kaneohe Bay Drive. Pacific Planning and Engineering, Inc., will examine potential traffic impacts of the proposed project and findings will be presented in the EIS.

2.4 Economic And Social Characteristics

2.4.1 Estimated Cost And Time; Phasing

The cost of constructing the proposed golf course and support facilities is estimated at $20 million, $18 million of which will be used for the golf course itself. The other $2 million will be used for the clubhouse.

Sitework and construction of the residential units are estimated at $6 million.

It is anticipated that Phase I will require an 18-month construction period. If all approvals are obtained by the end of this year, the Phase I will be operational by in the latter part of 1991.

The applicant intends to seek Development Plan and zoning changes, as well as an SMA permit for Phase II over the ensuing two years. With an 18-month construction period, Phase II could be operational in 1993.

2.4.2 Other Pertinent Information

Other economic and social characteristics of the Bayview Golf Course Expansion will be provided in the EIS.

2.5 Environmental Characteristics

2.5.1 Soils

The United States Department of Agriculture Soil Conservation Survey identifies the following soil classifications on the subject property:

HnA Hanalei silty clay, 0 to 2 percent -- Most of the soil in the lower, flat portions of the project site are classified as such. This soil is generally found on stream bottoms and flood plains. In a representative profile the surface layer, about ten inches thick, the soil is dark-gray and very dark silty clay that has dark-brown and reddish mottles. The subsurface layer is very dark gray and dark-gray silty clay about three inches thick. Permeability is moderate. Runoff is very slow, and the erosion hazard is no more than slight. The available moisture capacity is about 2.1 inches per foot of soil.

KgB Kaneohe silty clay, 3 to 8 percent slopes -- A small area in the southwestern corner of the project site contains this soil, which generally occupies uniform slopes. In a representative profile, the surface layer is dark reddish-brown silty clay about 14 inches thick. The sub-soil, 40 to more than 50 inches thick, is dusky-red and dark-red silty clay that has subangular blocky structure. Permeability is moderately rapid. Runoff is slow to medium, and the erosion hazard is slight. The available water capacity is 1.2 inches per foot in the surface layer.

KgC Kaneohe silty clay, 8 to 15 percent slopes -- Upper portions of the southwestern and southeastern areas (along Kaneohe Bay Drive) of the project site contain this soil. On this soil, runoff is medium and the erosion hazard is moderate.

AeE Alaeloa silty clay 15 to 35 percent slopes -- This soil is also found on Kaneohe Bay Drive, approximately midway along the project's southern boundary. It generally occurs on smooth side slopes and toe slopes in the uplands. In a representative profile the surface layer is dark reddish-brown silty clay about ten inches thick. The sub-soil, about 48 inches thick, is dark-red and red silty clay that has subangular blocky structure. Permeability is moderately rapid. Runoff is medium, and the erosion hazard is moderate. The available water capacity is about 1.2 inches per foot in the surface layer and 1.6 inches per foot in the subsoil.

ALF Alaeloa silty clay, 40 to 70 percent slopes -- Found in a portion of the southern boundary, this soil is characterized by rapid to very rapid runoff and the erosion hazard is severe.

2.5.2 <u>Topography</u>

The southern edge of the project site -- along Kaneohe Bay Drive -- is, on the average, at the 150-foot elevation. At approximately 100 feet from this boundary, the site slopes downward in a northerly direction by 50 percent to an elevation of 15 feet. The site is then relatively flat.

The prominent natural features of the site are water-related. The project site contains three fishponds, one of which has been filled. The larger of the two remaining fishponds is the Waikalua Fishpond.

The site also has two streams. A portion of Kawa Stream is designated Site #24 on the wetlands map of the Army Corps of Engineers. The larger Kaneohe Stream forms part of the project site's northern boundary.

A survey of the site's topography is currently being prepared and will be available in the EIS.

2.5.3 Surface Runoff, Drainage, And Erosion Hazard

Most of the site's surface runoff currently flows into Kawa Stream. Erosion of on-site soil is minimal, except for areas sloping between 40 and 70 percent. These areas are found along the southern boundary and contain soils characterized by rapid to very rapid runoff and the erosion hazard is severe. Hida Okamoto and Associates, Inc., will conduct a drainage study which will be included in the EIS.

2.5.4 Federal Firm Zone, LUO Flood Hazard District, Other Geological Hazards

As shown on Exhibit E, most of the lower, flat portions of the site are delineated on the Federal Flood Insurance Rate Map (FIRM) as a *"special flood hazard area inundated by a 100-year flood."* The Zone AE designation indicates that base flood elevations have been determined; the base flood elevation increases from eight to twelve feet in a southwesterly direction.

As the site slopes upward in a southerly direction, the designation changes to Zone X, *"areas of 500-year flood."* This designation occurs on a strip of land extending from the southwestern corner near Kaneohe Bay Drive to the mouth of Kawa Stream.

Except for the southwestern corner of the project site, the upper portions of the site along Kaneohe Bay Drive are outside FIRM designations. The EIS will contain more detail regarding the flooding potential of the project site.

3 AFFECTED ENVIRONMENT

3.1 Description Of Site And Surrounding Area

The project site currently contains the Bay View Golf Course, a par-three course, with a driving range and clubhouse. A large portion of the project site is unused and heavily vegetated. A few residences are currently located on the project site, and property acquisition and relocation is currently being discussed by the applicant and affected parties.

The project site is not as heavily-used or as dense as its surrounding areas, which include Kaneohe Bay Drive, single-family residences and public facilities. The site's southern edge is bounded mostly by Kaneohe Bay Drive. Southwest of the project site, across Kaneohe Bay Drive, is Castle High School.

On the northern boundary -- from west to east-- are residences, Kaneohe Stream and Kaneohe Bay. West of the project site are Puohala Elementary School and playground and residences which are part of Puohala Village, a subdivision. The project site's eastern boundary is fronted by Kokokahi YWCA.

As discussed in Section 2.1, ten of the 15.89 acres which are owned by the City are included in this EA and in the golf course design for study purposes only.

3.2 Relationship To Recreation, Flora And Fauna, Wetlands, And Fishing

3.2.1 Beaches, Parks And Recreation

The Bayview Golf Course, a pitch and putt course, is the only on-site recreation use. The project will replace this golf course with a regulation, championship golf course and recreation facilities.

The northeasterly portion of the project site fronts Kaneohe Bay and does not appear to be heavily used for ocean recreation. Beach users instead frequent the Kaneohe Beach Park which is less than a mile to the northwest of the project boundaries. The applicant is currently discussing public access possibilities with appropriate agency officials.

The project site abuts the playground of Puohala Elementary School, which is used primarily by students. The nearby Castle High School contains additional recreational facilities which are used primarily by students.

The proposed project is not anticipated to impact off-site recreational activities or facilities. The impact of the project on on-site recreational activities will be explored in the EIS.

3.2.2 Wildlife, Rare And Endangered Species And Their Habitats

The site has been well-used and disturbed by human activity over time. The fishpond areas, in particular, were apparently under cultivation since prehistoric times. It appears that (1) the predominant vegetation was introduced to the area, and (2) project impacts on the flora community will stem from earth-moving and soil erosion due to construction activities. Winona Char will be conducting a flora study for the EIS. Special emphasis will be placed on studying vegetation near stream areas.

As with the site's vegetation, on-site birds appear to have been introduced to the area. A fauna study to be conducted by Andrew Berger will further examine existing land-based fauna and identify project impacts on their habitats.

Aquatic wildlife is also present at the site, though the extent to which it thrives is unknown because of the highly-disturbed condition of on-site streams. Included in the EIS will be the findings of a shoreline, wetlands and stream survey of aquatic biology conducted by Brewer/Brandman and Associates.

3.2.3 Wetlands, Lagoons, Tidal And Submerged Lands

A portion of Kawa Stream is designated as wetlands by the U. S. Army Corps of Engineers. Special attention will be given to this area in the flora, fauna, aquatic biology and water quality studies for the EIS.

At one time, the project site contained three fishponds. Only one of these, Waikalua Fishpond, is prominent at this time. One of the remaining two has been filled, with the other being overgrown and only partially visible.

3.2.4 Fisheries And Fishing Grounds

No fisheries exist on the subject property. The presence of fish and fishing activity at the on-site streams and on the shoreline will be studied by Brewer/Brandman and Associates as part of the EIS process.

3.3 Relation To Historic, Cultural And Archaeological Resources

Preliminary investigations indicate that over 70 land court awards were made involving the subject property during the mid-1900s. This history, as well as the presence of three fishponds, indicates that the project site was probably heavily-populated. Activities occurring at the site were likely agriculture-related, such as taro cultivation.

As yet, there has been no surface indication of archaeological resources. Further work will focus on exploring sub-surface resources, particularly in the vicinity of the thick vegetation, stream banks and fishponds. Findings and recommendations resulting from work performed by Cultural Surveys Hawaii will be presented in the EIS.

3.4 Coastal Views

Coastal views are currently available from the higher elevations of the project site, particularly from Kaneohe Bay Drive near the Bay View Golf Course. From other vantage points at the higher elevations, coastal views are blocked by thick vegetation and residential development. The lower portions of the site are also afforded views of Kaneohe Bay.

Further discussion of existing coastal views and project impacts will be provided in the EIS. Because the project entails clearing of thick vegetation, extensive landscaping, and demolition of existing structures, the Bayview Golf Course Expansion is expected to improve coastal views.

3.5 Water Quality And Sources

Full discussion of the quality of receiving waters and ground water will be provided in the EIS.

3.6 Location And Site Maps

General location, project site and conceptual master plan maps are provided in Exhibits A, B and C, respectively. These maps will be modified as appropriate and presented in the EIS.

4 PROJECT IMPACTS

4.1 Coastal Zone Management

Hawaii's Coastal Zone Management (CZM) laws contain objectives and policies related to recreation, historic, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards and development management. The impacts of the project, relative to these objectives and policies, are as follows:

Objectives and Policies Related to Recreational Resources.

Objective -- Provide coastal recreational opportunities accessible to the public.

Policy (A) -- Improve coordination and funding of coastal recreation planning and management

Comment: The applicant is willing to coordinate on-site coastal recreation resources and public access with appropriate public agencies, and is currently in preliminary discussions with these agencies. The extent of this coordination will be described in the EIS.

Policy (B) -- Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by (only *relevant* policies included):

(iii) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

(viii) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, county planning commissions; and crediting such dedication against the requirements of section 46-6.

Comment: The shoreline fronting the project site's northern boundary is publicly-owned and currently accessible to the public via off-site public accesses. Discussions with public officials regarding public access are currently underway and more information on this topic will be provided in the EIS.

(vi) Adopting water quality standards and regulating point and nonpoint sources of pollution to protect and where feasible, restore the recreational value of coastal waters;

Comment: The impact of the project on water quality will be studied as part of the EIS process. Of concern is the effect of herbicides, pesticides and fertilizers -- typically used in golf course landscaping and maintenance -- on nearby waters, flora and fauna. A full discussion of these impacts will be provided in the EIS, based on a study by Richard E. Green and Charles L. Murdoch.

Objectives and Policies Related to Historic Resources.

Objective -- Protect, preserve, and, where desirable, restore those natural and man-made historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policy (A) -- Identify and analyze significant archaeological resources;

Policy (B) -- Maximize information retention through preservation of remains and artifacts or salvage operations; and

Policy (C) -- Support state goals for protection, restoration, interpretation, and display of historic resources.

Comment: As discussed in Section 3.3, preliminary investigations indicate that over 70 land court awards were made involving the subject property during the mid-1900s. This history, as well as the presence of three fishponds, indicates that the project site was heavily-populated. Further work by Cultural Surveys Hawaii

will focus on exploring sub-surface resources, particularly in the vicinity of the thick vegetation, stream banks and fishponds.

The applicant will work with the State archaeologist to determine how any on-site resources will be handled. The EIS will contain discussion of the findings of the archaeological study, as well as present measures to mitigate project impacts on these resources.

Objectives and Policies on Scenic and Open Space Resources.

Objective -- Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.

Policy (A) -- Identify valued scenic resources in the coastal zone management area;

Policy (B) -- Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

Policy (C) -- Preserve, maintain, and, where, desirable, improve and restore shoreline open space and scenic resources

Comment: The topographic characteristics of the site are conducive to a good view of the coastline from Kaneohe Bay Drive. Currently, however, a view of the coast is partially prohibited by thick vegetation.

Expansion of the Bay View Golf Course will improve scenic views by, first, clearing of existing vegetation and, second, providing an attractive, maintained landscape which will serve as the foreground for coastal views.

Policy (D) -- Encourage those developments which are not coastal dependent to locate in inland areas.

Comment: Although the project site extends to the shoreline, structural development will only occur along or near the southern, or mauka, boundary.

Objective and Policies Related to Coastal Ecosystems.

Objective -- Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

Policy (A) -- Improve the technical basis for natural resource management;

Policy (B) -- Preserve valuable coastal ecosystems of significant biological or economic importance;

Comment: Coastal and on-site ecosystems will be discussed in EIS studies on flora, fauna and aquatic biology. In general, existing species, their habitats will be identified and described. Based on this analysis, the EIS will present measures to preserve ecosystems of significant importance, if any.

Policy (C) -- Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs;

Comment: Two streams run across the project site. The Kaneohe Stream forms part of the project site's northern boundary. Kawa Stream runs through the lower portion of the site. Further, the Waikalua Fishpond is situated near the coastline. The proposed project will feature these water bodies as part of the golf course. Any alterations are expected to restore the quality of these waterways, and appropriate permits will be sought in the approval process.

Policy (D) -- Promote water quantity and quality planning and management practices which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses which violate state water quality standards.

Comment: Green and Murdoch will study the effects of herbicides, pesticides and fertilizers on fresh water and marine ecosystems. Part of their effort includes recommendations on mitigating chemical impacts.

Objectives and Policies Regarding Economic Uses.

Objective -- Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policy (A) -- Concentrate in appropriate areas the location of coastal dependent development necessary to the State's economy.

Comment: The proposed project is not coastal dependent, although the view of the water certainly adds to the value of the proposed golf course and residential units. Because the proposed project is not coastal dependent, every effort will be made to preserve and improve the existing coastline. As noted earlier, structural development will only occur along or near the southern, or mauka, boundary.

Objectives and Policies Regarding Coastal Hazards.

Objective -- Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion and subsidence.

Policy (B) -- Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard.

Policy (C) -- Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

Policy (D) -- Prevent coastal flooding from inland projects.

Comment: As discussed in Section 2.5.4, a large portion of the project site is in the 100-year flood zone; a smaller portion is in the 500-year flood zone on the Federal FIRM.

To reduce hazard to life and property from tsunami, storm waves and stream flooding, structural development will be located away from the shoreline and flood-prone areas.

Further, the applicant will improve drainage on the project site by cleaning the streams and fishponds, both of which will serve as course waterways and drainage.

The applicant will comply with Federal Flood Insurance Program requirements and studies on drainage and flooding will be included in the EIS.

4.2 Special Management Area

The City and County of Honolulu has established special controls on development within an area along the shoreline to avoid permanent loss of valuable resources and foreclosure of management options. The Special Management Area (SMA) has been established and include lands extending inland from the shoreline, as established by amended City ordinance, and delineated on maps established by the City Council and filed with the Council and appropriate agencies. As noted earlier, the entire project site lies within the SMA.

The following discusses the proposed project, relative to the review guidelines set forth in Chapter 33 of the City Ordinances.

Guidelines Related To Public Access and Public Recreation Areas.

These call for "*adequate access . . . to publicly-owned beaches, recreation areas, and natural reserves.*"

The applicant is willing to coordinate on-site coastal recreation resources and public access with appropriate public agencies, and is currently in preliminary discussions with these agencies. The extent of this coordination will be described in the EIS.

Guidelines Related to Solid and Liquid Waste Treatment, Disposition and Managements.

These guidelines were set forth to minimize adverse effects on SMA resources. The EIS will contain studies related to the project's impacts on on-site and nearby water and biological resources, and will take into account solid and wastewater requirements.

Guidelines Related to Alterations to Existing Land Forms and Vegetation.

These guidelines were set forth to minimize "*adverse effect to water resources and scenic and recreational amenities*" and to minimize the "*danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.*"

The proposed project is expected to improve the area's drainage by cleaning the streams and fishponds, both of which will serve as course waterways and ponding areas. It is also anticipated that the project will improve the scenic quality of the area by clearing the dense vegetation currently obstruction views and replacing this with a maintained landscape, which will serve as an attractive foreground to views of the shoreline and Kaneohe Bay.

Potential impacts on water resources and recreational amenities will be fully explored in the EIS.

General Guidelines Related to Any Substantial, Adverse Environmental or Ecological Effect.

As noted in the beginning of this EA, the applicant has agreed to prepare an EIS, which will identify such impacts, if any, and recommend appropriate mitigation measures.

Guidelines Related To County General Plan, Development Plans, Zoning And Subdivision Codes.

The EIS will contain a thorough discussion of the project's relationship to City and County policies, as well as those of the State, governing land use, development and other relevant issues.

Guidelines Related to Waterways and Water Quality.

These guidelines seeks to minimize "*dredging, filling or otherwise altering any bay, estuary, salt marsh, river mouth, slough or lagoon.*" Further, these guidelines discourage "*any development which would reduce or impose restrictions upon public access to tidal and submerged lands, beaches, . . .*"

The applicant does not propose these actions, except as related to cleaning and improving the drainage quality of on-site waterways and fishponds.

5 MITIGATION MEASURES

Anticipated project impacts of the proposed Bay View Golf Course Expansion are related to increased traffic; flora, fauna and aquatic biota; drainage and views.

Note that some of these impacts, such as views and drainage, are expected to result in an overall improvement of existing conditions. Further, the extent of negative effect of other potential impacts is uncertain at this time. Traffic impact, for example, may be minimal in that existing uses may generated comparable amounts of traffic since they are similar to proposed uses.

The EIS, which will follow this EA and application, will identify further impacts, if any, assess the extent of project impacts, and propose mitigation measures to minimize impact.

465 SOUTH KING STREET, KEKUANAOA BUILDING, #104 ; HONOLULU, HAWAII 96813 TELEPHONE (808) 548-6915

OEQC BULLETIN

OFFICE OF ENVIRONMENTAL QUALITY CONTROL

JOHN WAIHEE
GOVERNOR

MARVIN T. MIURA, Ph.D.
DIRECTOR

Volume VI June 23, 1989 No. 12

REGISTER OF CHAPTER 343, HRS DOCUMENTS

BAYVIEW GOLF COURSE EXPANSION, Kaneohe, Oahu; Pacific Atlas (Hawaii) Inc./Dept. of Land Utilization, City & County of Honolulu (TMK: 1-4-5-30: 1,6,9,37,40,42, 44,45,46;1-4-5-8:38;1-4-5-30:3,20,30, por.36;1-4-5-59:33 to 36;1-4-5-104:48 to 54)

Pacific Atlas proposes to expand the Bayview Golf Course into an 18-hole championship golf course, in Kaneohe, Oahu. The total project site encompasses 140 acres.

The project includes a clubhouse and maintenance shed, as well as approximately 32 residential units.

Access to the golf course, clubhouse and residences will be via Kaneohe Bay Drive.

The cost of constructing the proposed golf course and support facilities is estimated at $20 million. Sitework and construction of the residential units are estimated at $6 million.

Contact: Akio Futakawa
1441 Kapiolani Blvd. #1204
Honolulu, Hawaii 96814

Deadline: July 24, 1989

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
DIVISION OF PUBLIC WORKS
P. O. BOX 119, HONOLULU, HAWAII 96810

RUSSEL S. NAGATA
COMPTROLLER
JAMES H. YASUDA
DEPUTY COMPTROLLER

LETTER NO (P)1691.9

AUG 0 1989

Ms. Bernu Cabucangan
Earthplan
81 South Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Subject: Bayview Golf Course Expansion
EIS Preparation Notice

Thank you for the opportunity to review the subject document.

Our concern is for the safety of Puohala students and faculty from golf balls hit into the school and playground.

Should there be any questions, please have your staff contact Mr. Cedric Takamoto of the Planning Branch at 548-7192.

Very truly yours,

TEUANE TOMINAGA
State Public Works Engineer

CT:jk
cc: Mr. Tyrone T. Kusao

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538 6652
RES (808) 395 1330
FAX (808) 521-4232

August 7, 1989

State of Hawaii
Department of Accounting and General Services
Division of Public Works
P.O. Box 119
Honolulu, Hawaii 96810

Attention: Mr. Teuane Tominaga
State Public Works Engineer

Subject: Bayview Golf Course Expansion
EIS Preparation Notice.

Dear Mr. Tominaga:

Thank you for your letter dated July 20, 1989 regarding the EIS preparation notice for the above project.

We have taken note of your concern for the safety of Puohala students and faculty from stray golf balls falling in the school area. We will forward your comments to our golf course architect for his input.

We appreciate you bringing this point to our attention.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.
Hida, Okamoto and Associates, Inc.

BUILDING DEPARTMENT

CITY AND COUNTY OF HONOLULU

HERBERT K. MURAOKA

PB 89-623

July 20, 1989

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Subject: Draft Environmental Impact Statement (DEIS) for Bayview Golf Course Expansion, Kaneohe, Oahu

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

Thank you for the opportunity to review the DEIS.

Very truly yours,

HERBERT K. MURAOKA
Director and Building Superintendent

cc: J. Harada

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

August 3, 1989

Mr. Herbert K. Muraoka
Director and Building Superintendent
Building Department
City and County of Honolulu
650 S. King Street, 2nd Floor
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement (Deis) for Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Mr. Muraoka:

Thank you for your letter of July 20, 1989 in which you note that your agency has no comments to make on the DEIS preparation notice for the project.

Very truly your,

Tyrone T. Kusao

TTK:afk

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

July 21, 1989

Engineering Office

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Ms. Cabucangan:

Bayview Golf Course Expansion
Kaneohe, Oahu, Hawaii

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

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

Sincerely,

Jerry M. Matsuda
Major, Hawaii
Air National Guard
Contracting & Engineering Officer

cc: Dept. of Land Utilization
OEQC

NATIONAL GUARD
Americans At Their Best

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

August 3, 1989

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

Subject: Environmental Impact Statement For Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Major Matsuda:

Thank you for your letter of July 21, 1989 in which you note that your department has no comments to offer at this time regarding this project.

Very truly yours,

Tyrone T. Kusao

TTK:afk

YWCA
Oahu

Executive Office
1040 Richards Street
Honolulu Hawaii 96813
Mailing Address
P O Box 337
Honolulu Hawaii 96809

July 21, 1989

Mr. Tyrone Kusao
Earthplan
81 S. Hotel Street, Room 211
Honolulu, HI 96813

Dear Mr. Kusao:

In response to the EIS preparation notice in the OEQC Bulletin of July 8, 1989 concerning the Bay View Golf Course expansion, we would like to be a consultant party and receive preparatory notice and draft EIS for review.

Mahalo.

Peace,

June Shimokawa

June Shimokawa
Executive Director

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

August 4, 1989

Ms. June Shimokawa
Executive Director
YWCA, Oahu
Executive Office
1040 Richards Street
P.O. Box 337
Honolulu, Hawaii 96809

Subject: Bayview Golf Course Expansion
EIS Preparation Notice

Dear Ms. Shimokawa:

Thank you for your letter of July 21, 1989 in which you state that you would like to be a consulted party on the above project.

Enclosed herein are the following material for your review:

1 - EIS Preparation Notice.

2 - "Environmental Assessment Report, Bayview Golf Course Expansion, Kaneohe, Oahu, Hawaii".

Please note that a copy of the above two items were sent to your Kokokahi Center, YWCA on July 13, 1989 for the attention of Ms. Cynthia Hopkins, Center Director. See copy of letter attached.

Should you have question, please call me or Berna Cabucangan who can be reached at 524-8387.

Very truly yours,

Tyrone T. Kusao

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.
Enc.

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

BUS. (808) 538-6652
RES. (808) 395-1338
FAX (808) 521-4292

July 13, 1989

Ms. Cynthia Hopkins
Center Director
YWCA, Kokokahi Center
45-035 Kaneohe Bay Drive
Kaneohe, Oahu 96744

Subject: Environmental Impact Statement For Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Ms. Hopkings:

Enclosed herein are the following material for your review as a consulted party for the subject EIS:

1 - EIS Preparation Notice.

2 - "Environmental Assessment Report, Bayview Golf Course Expansion, Kaneohe, Oahu, Hawaii".

For your information, the EIS Preparation Notice was published in the June 23, 1989 OEQC Bulletin. Please forward all comments concerning this EIS to:

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Your attention to this matter is sincerely appreciated. Should there be questions, please call me or Berna who can be reached at 524-8387.

Very truly yours,

Tyrone T. Kusao

TTK:afk
Enc.
cc: Earthplan
Department of Land Utilization (no enc.)
Office of Environmental Quality Control (no enc.)

STATE OF HAWAII
DEPARTMENT OF EDUCATION
P. O. BOX 2360
HONOLULU, HAWAII 96804

CHARLES T. TOGUCHI
SUPERINTENDENT

OFFICE OF THE SUPERINTENDENT

July 21, 1989

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

SUBJECT: Environmental Impact Statement for Bayview Golf Course Expansion, Kaneohe, Oahu

Our review of the subject project indicates that it will have no impact to the public schools.

Thank you for the opportunity to comment.

Sincerely,

Charles T. Toguchi

Charles T. Toguchi
Superintendent

CTT:jl

cc: Mr. E. Imai
Mrs. S. Loo

AN AFFIRMATIVE ACTION AND EQUAL OPPORTUNITY EMPLOYER

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538 6652
RES (808) 395 1338
FAX (808) 521 4292

August 3, 1989

The Honorable Charles Toguchi
Superintendent
Department of Education
State of Hawaii
P.O. Box 2360
Honolulu, Hawaii 96804

Subject: Environmental Impact Statement for Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Mr. Toguchi:

Thank you for your letter of July 21, 1989 in which you note that our project will have no impact to the public schools.

Very truly yours,

Tyrone T. Kusao

TTK:afk

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

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

July 21, 1989

Ms. Berna Cabucangan
Earthplan
81 South Hotel Street, Suite 211
Honolulu, Hawaii 96813

RE: Environmental Impact Statement for Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Ms. Cabucangan:

The Department of Business and Economic Development has no comments on this Environmental Impact Statement Notice.

Sincerely,

Roger A. Ulveling

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

August 3, 1989

The Honorable Roger A. Ulveling
Director
Department of Business and Economic Development
State of Hawaii
250 S. King St.,
Honolulu, Hawaii 96813

Subject: Environmental Impact Statement For Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Mr. Ulveling:

Thank you for your letter of July 21, 1989 in which you note that your department has no comments on this Environmental Impact Statement Notice.

Very truly yours,

Tyrone T. Kusao

TTK:afk

OFFICE OF STATE PLANNING
Office of the Governor
STATE CAPITOL HONOLULU HAWAII 96813 TELEPHONE (808) 548-3003

Ref. No. P-9761

July 27, 1989

Ms. Berna Cabucangan
Earthplan
81 South Hotel Street
Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Subject: Environmental Impact Statement for Bayview Golf Course Expansion, Kaneohe, Oahu

We have reviewed the EIS Preparation Notice and Environmental Assessment Report for the Bayview Golf Course Expansion in Kaneohe, Oahu, Hawaii, and have the following comments to offer.

Site Description

The project site is situated at the mouth of Kaneohe Bay and is flanked by Kaneohe Stream to the north and Kaneohe Bay Drive to the south. Kawa Stream traverses the project site, flowing into Waikalua-Loko Fish Pond, which is situated at the northeastern portion of the subject property. Waikalua Fish Pond is located at the easternmost portion of the project site and abuts the Keana Fish Pond, which lies just outside of the subject property on its eastern boundary. All three fish ponds front Kaneohe Bay.

The Kaneohe Sewage Treatment Plant is situated in the central portion of the project site.

Project Description

The applicant, Pacific Atlas (Hawaii), Inc., proposes to expand the Bayview Golf Course into an 18-hole championship golf course. The proposed project includes a clubhouse and maintenance shed, and approximately 32 residential units. The total project site encompasses 140 acres.

Coastal Zone Management Assessment

The comprehensive Coastal Zone Management (CZM) assessment provided is appreciated. Please be advised the CZM Federal consistency approval is required from our office if a Department of the Army Permit from the U.S. Army Corps of Engineers is necessary for any portion of the project.

Ms. Berna Cabucangan
Page 2
July 27, 1989

Historic, Cultural, and Archaeological Resources

Our initial review indicates that there is potential for historic, cultural, and archaeological resources on the project site. We concur with the proposal to conduct further work in assessing these resources.

Endangered Species

According to the Biological Database of Rare Coastal Plants and Animals of the State of Hawaii (The Nature Conservancy, 1988), the project area may provide habitat for one or more of the endangered Hawaiian waterbirds. We concur that studies be conducted to address the presence of waterbirds, their habitat, and potential impacts.

Erosion and Runoff

Kawa Stream and Kaneohe Bay will be the receiving waters for runoff from the development. Significant impacts may occur from increased runoff and sedimentation from erosion if appropriate mitigation is not implemented. In this regard, the proposed drainage study should provide a quantitative analysis of the anticipated increase in storm water runoff including a breakdown of potential sediment and other constituent loads. The erosion potential should also be assessed.

Potential Impacts of Fertilizer, Biocide and Pesticide Use

The use of fertilizers, biocides and pesticides can be expected in the development and maintenance of the proposed golf course expansion, which may directly or indirectly affect the coastal water quality of Kaneohe Bay. Pollutants from golf course use could infiltrate to the groundwater and flow to the shoreline, migrate to the shoreline directly from the project site, and/or flow into the fish ponds located within or near the project site.

The State Department of Health (DOH) is currently developing conditions in regards to groundwater and coastal water contamination that would be applicable to new golf course developments. DOH should be contacted for more detail and discussion.

Thank you for the opportunity to comment. Please feel free to contact our CZM office at 548-5973 if you have any questions.

Sincerely,

Harold S. Masumoto

Harold S. Masumoto
Director

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538-6652
RES (808) 395-1338
FAX (808) 521-4292

August 7, 1989

Mr. Harold Masumoto
Director
Office of State Planning
Office of the Governor
State Capitol,
Honolulu, Hawaii 96813

Subject: Bayview Golf Course Expansion
EIS Preparation Notice

Dear Mr. Masumoto:

Thank you for your letter dated July 27, 1989 regarding the above project.

Your comments and concerns will be considered in the draft EIS, a copy of which will be forwarded to you.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.
Hida, Okamoto and Associates

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

KN-LK

June 27, 1989

Ms. Berna Cabucangan
Earthplan
81 South Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Subject: Environmental Impact Statement For Bayview Golf Course Expansion, Kaneohe, Oahu

We have reviewed the material for the above proposed development and have no objections to the expansion of Bayview Golf Course.

Thank you for the opportunity to comment.

Sincerely,

DOUGLAS G. GIBB
Chief of Police

By [signature]
JOSEPH AVEIRO
Assistant Chief of Police
Support Services Bureau

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

August 3, 1989

The Honorable Douglas G. Gibb
Chief of Police
City and County of Honolulu
1455 South Beretania St.,
Honolulu, Hawaii 96814

Attention: Mr. Joseph Aveiro

Subject: Environmental Impact Statement For Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Chief Gibb:

Thank you for your letter of July 27, 1989 in which you note that your department has no objections to the expansion of Bayview Golf Course.

Very truly yours,

Tyrone T. Kusao

TTK:afk

United States Department of the Interior

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

ES
Room 6307

JUL 28 1989

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Re: Environmental Impact Statement (EIS) Preparation Notice and Environmental Assessment Report for the Proposed Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Ms. Cabucangan:

We have reviewed the referenced reports and offer the following comments for your consideration.

The Draft EIS should describe fish and wildlife resources and their habitats within the project area including wetlands, streams, estuaries and embayments. To the best of our knowledge, no species listed as threatened or endangered, or eligible for listing as threatened or endangered, occur within the project area.

We also suggest that the Draft EIS fully identify the direct, secondary and cumulative environmental consequences of the proposed action on these fish and wildlife resources. This discussion should include the effects of golf course fertilizers and pesticides on aquatic and estuarine food chains of Kawa Stream and southern Kaneohe Bay; realignment of Kawa Stream; and, removal of riparian vegetation. We recommend that impacts to wetland habitats be avoided; however, we suggest that the Draft EIS also identify adequate measures to mitigate any adverse impacts to these resources.

Thank you for providing this opportunity to comment on these documents.

Sincerely,

By Ernest Kosaka
Field Office Supervisor
Environmental Services

cc: Tyrone T. Kusao, Inc.
C&C Honolulu, DLU
OEQC
DLNR (DAR & DOFAW)
WRHC
PODCO-O

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

[illegible] STREET, SUITE [illegible]
HONOLULU, HAWAII [illegible]
[illegible] 538 6652
[illegible] 1338
FAX [illegible] 521 4202

August 7, 1989

United States Department of the Interior
Fish and Wildlife Service
Pacific Islands Office
P.O. Box 50167
Honolulu, Hawaii 96850

Attention: Mr. Ernest Kosaka
Field Office Supervisor
Environmental Services

Subject: Bayview Golf Course Expansion
EIS Preparation Notice.

Dear Mr. Kosaka:

Thank you for your letter dated July 28, 1989 regarding the EIS preparation notice for the above project.

Our consultant will address those issues listed in your letter and your comments and concerns will be considered in the draft EIS.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.
Hida Okamoto and Associates, Inc.

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
HOUSING FINANCE AND DEVELOPMENT CORPORATION
SEVEN WATERFRONT PLAZA, SUITE 300
500 ALA MOANA BOULEVARD
HONOLULU, HAWAII 96813

JOSEPH K. CONANT
EXECUTIVE DIRECTOR

IN REPLY REFER TO:

89:PLNG/2974 JT

July 31, 1989

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Re: EIS Preparation Notice and Environmental Assessment Report for the Proposed Bayview Golf Course Expansion

We have reviewed the subject report and request that the following comments be addressed in the draft EIS.

1. The applicant is proposing to acquire "a few residences" for the golf course expansion. How many existing homes are affected; what types of homes are affected (owner-occupied vs. rental); and what are the plans for relocating affected homeowners and/or renters?

2. Will additional employment stemming from operations of the proposed championship golf course, clubhouse (with restaurant, meeting rooms and offices), repair and maintenance shed, tennis courts and swimming pool generate a demand for housing?

3. What are the proposed sales prices for the thirty two residential units planned for development along the golf course?

4. It is proposed that the golf course will be opened to the public during certain days and hours. Will kamaaina rates be offered?

Thank you for the opportunity to comment.

Sincerely,

JOSEPH K. CONANT
Executive Director

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

BUS (808) 538 6652
RES (808) 395 1330
FAX (808) 521-4292

August 7, 1989

State of Hawaii
Department of Budget and Finance
Housing Finance & Development Corporation
Seven Waterfront Plaza, Suite 300
500 Ala Moana Boulevard.,
Honolulu, Hawaii 96813

Attention: Mr. Joseph K. Conant
Executive Director

Subject: Proposed Bayview Golf Course Expansion
EIS Preparation Notice

Dear Mr. Conant:

Thank you for your letter of July 31, 1989 regarding the above project.

Your comments and concerns will be considered in the draft EIS, a copy of which will be sent to you.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU

REPLY TO ATTENTION OF

August 1, 1989

Planning Branch

Ms. Berna Cabacungan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabacungan:

Thank you for the opportunity to review the Environmental Impact Statement (EIS) Preparation Notice and Environmental Assessment (EA) for the proposed Bayview Golf Course Expansion, Kaneohe, Oahu. The following comments are offered:

a. Wetlands are known to exist on the subject property. A Department of the Army (DA) permit would be required for placement of fill in any wetlands. The owner (or agent) should schedule a preapplication meeting with Operations Branch (telephone 438-9258) to determine DA permit requirements and their effect (if any) on the proposed project.

b. There is a Federally authorized flood control project at the mouth of Kaneohe Stream. The area on the right (south) bank of the stream is not protected by the flood control project. The access right-of-way along the right stream bank must be kept open at all times; this access is shown on property maps. If there are questions concerning the flood control project, please contact Mr. Jim Pennaz, Civil Engineer, at Planning Branch (telephone 438-8599).

c. The flood hazard information presented on page 22 (Section 2.5.4) of the EA is correct.

Sincerely,

Kisuk Cheung
Chief, Engineering Division

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

August 7, 1989

Department of the Army
U.S. Army Engineer District, Honolulu
Building 230
Ft. Shafter, Hawaii 96858-5440

Attention: Mr. Kisuk Cheung
Chief, Engineering Division

Subject: Bayview Golf Course Expansion
EIS Preparation Notice.

Dear Mr. Cheung:

Thank you for your letter dated August 1, 1989 regarding the above project.

We have taken note of your comments and have forwarded a copy of your letter to our consultant engineer. Your concerns will be considered in the Draft EIS. Mr. Harvey Hida of Hida Okamoto and Associates, Inc. will be contacting you to schedule a pre-application meeting in the very near future.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.
Hida, Okamoto and Associates, Inc.

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU

August 1, 1989

Ms. Berna Cabucangan
Earthplan
81 South Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Subject: Environmental Assessment Report
Bayview Golf Course Expansion
Kaneohe, Oahu, Hawaii

We have reviewed the Environmental Assessment Report for the Bayview Golf Course Expansion.

A primary concern of this Department is the availability of housing opportunities to a wide range of income groups, particularly to those households with low and moderate incomes. We recommend that the Environmental Impact Statement for this project contain, in as much detail as possible, a description of the types and price ranges of the housing units proposed for the residential portion of the project and a discussion of the affordability of the units in relation to households of various income groups.

We note that a zone change from P-2 to R-10 is required for the residential portion of the project. The Department's policy for projects involving zone changes is to request that ten percent of the residential units in the proposed project be set-aside for low- and moderate-income households or that the developer contribute in-kind toward the development of such housing. Also, please be advised that the rezoning action would be subject to some kind of requirement under a Bill for a Community Benefit Assessment Ordinance currently before the City Council. 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

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1188 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538-6652
RES (808) 395-1338
FAX (808) 521-4292

August 7, 1989

Department of Housing and Community Development
City and County of Honolulu
650 S. King Street, 5th Floor
Honolulu, Hawaii 96813

Attention: Mr. Michael N. Scarfone
Director

Subject: Bayview Golf Course Expansion
EIS Preparation Notice

Dear Mr. Scarfone:

Thank you for your letter dated August 1, 1989 regarding the above project.

Your comments and concerns will be considered in the draft EIS, a copy of which will be forwarded to you.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii) Inc.

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

IN REPLY REFER TO
ENV 89-136(448)

August 2, 1989

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Subject: Environmental Assessment Report for Bayview Golf Course Expansion
TMK: 4-5-30: 1,3,6,9,20,30, Por. 36, 37,40,42,44,45,46;
4-5-08: 38; 4-5-59: 33 to 36; 4-5-104: 48 to 54

We have reviewed the subject environmental assessment report and have the following comments:

1. The flows from the Kaneohe Wastewater Treatment Plant (WWTP) cannot be diverted to the Kailua WWTP until the secondary treatment units are operational at Kailua. Estimated completion date is early 1994. Also, the following must occur before the land at the Kaneohe WWTP can be purchased:

   a. The Division of Wastewater Management must notify the City Finance Department that the land is surplus.

   b. Finance Department circulates notice to all City agencies of surplus land at Kaneohe.

   c. If no City agency is interested in the surplus land, Finance Department may sell by public auction.

   The purchase of the land will be subject to restrictions such as limited to golf course, but no clubhouse or dwelling unit within surplus property.

2. A drainage report should be submitted to the Drainage Section, Division of Engineering, for review and approval.

Very truly yours,

SAM CALLEJO
Director and Chief Engineer

cc: DLU

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 530-8652
RES (808) 395-1338
FAX (808) 521-4292

August 7, 1989

Mr. Sam Callejo
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 S. King Street,
Honolulu, Hawaii 96813

Subject: Bayview Golf Course Expansion
EIS Preparation Notice

Dear Mr. Callejo:

Thank you for your letter dated August 2, 1989 regarding the above project.

We have taken note of your comments and have forwarded a copy of your letter to our consultant engineer. Your concerns will be considered in the Draft EIS of which you will receive a copy.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.
Hida, Okamoto and Associates

University of Hawaii at Manoa

Environmental Health and Safety Office
2525 Maile Way, Bldg. 2
Honolulu, Hawaii 96822
Telephone (808) 948-8660

August 3, 1989

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, HI 96813

Subject: Environmental Impact Statement for Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Ms. Cabucangan:

I have reviewed the materials sent to me by Tyrone T. Kusao regarding the proposed project. It appears that areas of concern will be addressed in the formal EIS and I look forward to reviewing it.

Thank you for the opportunity to review and comment on this project.

Sincerely,

Roy Y. Takekawa

Roy Y. Takekawa, CIH, MPH
Director

AN EQUAL OPPORTUNITY EMPLOYER

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538-6652
RES (808) 395-1338
FAX (808) 521-4292

August 28, 1989

Mr. Roy Y. Takekawa, CIH, MPH
Director
Environmental Health and Safety Office
University of Hawaii
2525 Maile Way, Bldg. 2
Honolulu, Hawaii 96822

Subject: Environmental Impact Statement For Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Mr. Takekawa:

Thank you for your letter of August 3, 1989 in which you note you will await the formal EIS to address your concerns.

If you have any questions, please do not hesitate to contact me.

Very truly yours,

Tyrone T. Kusao

Tyrone T. Kusao

TTK:afk

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION

EDWARD Y. HIRATA

WREPLY REFER TO
HWY-PS
2.7688

AUG 4 1989

Mr. Tyrone Kusao
Tyrone T. Kusao, Inc.
1188 Bishop Street, Suite 2507
Honolulu, Hawaii 96813

Dear Mr. Kusao:

Environmental Impact Statement (EIS) for
Bayview Golf Course Expansion, Kaneohe, Oahu
TMK: 1-4-5-30: var. parcels; 1-4-5-08: 38;
1-4-5-59: 33-36; 1-4-5-104: 48-54

Thank you for your letter of July 13, 1989 requesting our review of the subject Environmental Assessment Report.

We have the following comments for your consideration:

1. The golf course should be designed to minimize bodily injury and property damage, such as stray golf balls possibly hitting motorists driving along Kaneohe Bay Drive. The design should include a protective fence along the right-of-way to prevent golf balls from straying outside the property line.

2. The accesses to the golf course and the residential development should be checked for proper sight distances and required intersection improvements.

3. The developer will be responsible for the costs of any roadway improvements. All construction plans for work within the State highway right-of-way must be submitted for our review and approval.

Very truly yours,

Edward Y. Hirata
Director of Transportation

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1188 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538-6652
RES (808) 395-1338
FAX (808) 521-4202

August 7, 1989

Mr. Edward Y. Hirata
Director of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Subject: Bayview Golf Course Expansion
EIS Preparation Notice

Dear Mr. Hirata:

Thank you for your letter of August 4, 1989 regarding the above project.

We have taken note of your comments and have forwarded a copy of your letter to our consultant engineers and our golf course architect. Your concerns will be considered in the Draft EIS of which you will receive a copy.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.
Pacific Planning and Engineering Inc.
Hida, Okamoto and Associates, Inc.

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU HAWAII 96843

August 7, 1989

Mr. Tyrone T. Kusao
Tyrone T. Kusao, Inc.
1188 Bishop Street, Suite 2507
Honolulu, Hawaii 96813

Dear Mr. Kusao:

Subject: Your Letter of July 13, 1989 Regarding the Environmental Impact Statement for Bayview Golf Course Expansion, Kaneohe, Oahu

We have the following comments on the proposed project:

1. Irrigation water for the golf course expansion should be obtained from non-potable sources, such as the nearby Kawa Stream. Potable water will be provided for the clubhouse only.

2. The water requirements for the project should be stated. However, water availability will be determined when the construction plans or building permit applications are submitted for our review and approval.

3. The developer shall be required to pay our prevailing Water System Facilities Charges for any additional domestic water from our system.

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

Very truly yours,

KAZU HAYASHIDA
Manager and Chief Engineer

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU HAWAII 96813
BUS (808) 530-6852
RES (808) 395-1336
FAX (808) 521-4292

August 28, 1989

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

Subject: Proposed Bayview Golf Course Expansion
EIS Preparation Notice

Dear Mr. Hayashida:

Thank you for your letter of August 7, 1989 regarding the above dEIS. I have transmitted your comments to our Engineers, Hida, Okamoto and Associates for their review.

If you have further questions, please do not hesitate to call me.

Very truly yours,

Tyrone T. Kusao

TTK:afk

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

DONALD A. CLEGG
CHIEF PLANNING OFFICER

GENE CONNELL
DEPUTY CHIEF PLANNING OFFICER

MH/KK/DGP 7/89-2667

August 10, 1989

Mr. Tyrone T. Kusao
Tyrone Kusao, Inc.
1188 Bishop Street, Suite 2507
Honolulu, Hawaii 96813

Dear Mr. Kusao:

EIS Preparation Notice and Environmental Assessment for Bay View Golf Course Expansion, Kaneohe, Oahu, Tax Map Key: 4-5-30: 1,3,6,9,20,30, por. 36,37,40,42,44,45,46; 4-5-8: 38; 4-5-59: 33 to 36; and 4-5-104: 48 to 54

We have reviewed the EIS Preparation Notice and Environmental Assessment and offer the following comments on the proposed expansion of Bayview Golf Course:

1. The Draft EIS should address the fact that the Development Plan Public Facilities Map shows the planned Kaneohe Green Belt park in the site undetermined beyond six years category, which impacts on portions of the subject site.

2. Since the project may have an impact on Kawa Stream, Kaneohe Stream, Waikalua Fishpond and Kaneohe Bay, the Draft EIS should discuss the projects impact on the water quality and ecosystems of these water features.

3. We are also concerned about the project's impact on coastal views and shoreline access. These issues should be addressed in the Draft EIS.

Thank you for the opportunity to comment on this matter.

Sincerely,

DONALD A. CLEGG
Chief Planning Officer

DAC:ft

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

BUS (808) 538-6652
RES (808) 395-1338
FAX (808) 521-4202

August 28, 1989

Mr. Donald A. Clegg
Chief Planning Officer
Department of General Planning
City and County of Honolulu
650 S. King Street, 8th Floor
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement for Bayview, Golf Course Expansion, Kaneohe, Oahu.

Dear Mr. Clegg:

Thank you for your letter of August 10, 1989 regarding the above project.

Our consultant will address those issues listed in your letter and your comments and concerns will be considered in the draft EIS.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk

JOHN WAIHEE
GOVERNOR OF HAWAII

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

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

In reply, please refer to:
EPHSD

August 15, 1989

Mr. Tyrone T. Kusao
Tyrone T. Kusao, Inc.
1188 Bishop Street, Suite 2507
Honolulu, HI 96813

Dear Mr. Kusao:

Subject: **Request for Comments on Environmental Assessment Report for Bayview Golf Course Expansion, Kaneohe, Oahu, Hawaii**

The Department of Health acknowledges receipt of your letter dated July 13, 1989. Thank you for allowing us to review and comment on the subject environmental assessment.

In preparation of the Environmental Impact Statement (EIS) for the subject project, the following concerns must be addressed:

1. Noise problems are anticipated due to the integration of land use within the proposed development. Noise from golf course related activities, including recreational and ground maintenance types, can have adverse effects, in terms of annoyances, on the proposed residential developments.

2. Construction activities must comply with the provisions of the Administrative Rules, Title 11, Chapter 43, Community Noise Control for Oahu.

   a. The contractor must obtain a noise permit if the noise levels from the construction activities are expected to exceed the allowable levels of the regulations.

   b. Construction equipment and on-site vehicles requiring an exhaust of gas or air must be equipped with mufflers.

   c. The contractor must comply with the requirements specified in the regulations and conditions issued with the permit.

3. Traffic noise from heavy vehicles travelling to and from the construction sites must be minimized near existing residential areas and must comply with the provisions of the Administrative Rules, Title 11, Chapter 42, Vehicular Noise Control for Oahu.

We are also enclosing for your information the Department of Health's "Eight (8) Conditions Applicable to this New Golf Course Development".

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

Sincerely,

BRUCE S. ANDERSON, Ph.D.
Deputy Director for
Environmental Health

AB/rg
Enclosure

April 7, 1989

EIGHT (8) CONDITIONS APPLICABLE TO THIS NEW GOLF COURSE DEVELOPMENT

Conditions:

1. The owner/developer and all subsequent owners shall establish a groundwater monitoring plan and system which shall be presented to the State Department of Health for its approval. The groundwater monitoring plan and system shall minimally describe the following components:

   a. A system of monitoring wells constructed throughout the site. These monitoring wells shall extend approximately ten (10) feet below the water table.

   b. A routine groundwater monitoring schedule of at least once every six (6) months and more frequently, as required by the State Department of Health, in the event that the monitoring data indicates a need for more frequent monitoring.

   c. A list of compounds which shall be tested for as agreed to by the State Department of Health. This list may include, but not be limited to the following: total dissolved solids; chlorides; PH; nitrogen; phosphorus; or any other compounds associated with fertilizers, biocides or effluent irrigation.

2. A baseline groundwater data shall be established as described in this paragraph. Once the test well sites and list of compounds to be monitored for have been determined and approved by the State Department of Health, the owner/developer shall contract with an independent third-party professional (approved by the State Department of Health) to have the groundwater sampled and its data reported to the State Department of Health. Testing of the groundwater shall be done by a certified laboratory.

3. If the data from the monitoring wells indicate the presence of the measured compound and/or the increased level of such compound, the State Department of Health can require the owner/developer or subsequent owner to take immediate mitigating action to stop the cause of the contamination. Subsequently, the developer/owner or subsequent owner shall mitigate any adverse effects caused by the contamination.

4. Owner/developer shall provide sewage disposal by means of connection to the public sewer system; or by means of a wastewater treatment works providing treatment to a secondary level with chlorination. Effluent from this wastewater treatment works may be used for golf course irrigation, <u>subject to Condition #3</u>. The entire system shall be approved by the State Department of Health in conformance with Administrative Rules Title 11, Chapter 62, Wastewater Treatment Systems, effective December 10, 1988.

5. If a wastewater treatment works with effluent reuse becomes the choice of wastewater disposal, then the owner/developer and all subsequent owners shall develop and adhere to a Wastewater Reuse Plan which shall address as a minimum, the following items:

   a. <u>Management Responsibility</u>. The managers of the irrigation system using reclaiming wastewater shall be aware of the possible hazards and shall evaluate their system for public health, safety, and efficiency. They must recognize that contact with the reclaimed wastewater from treated domestic sewage poses potential exposure to pathogenic organisms which commonly cause infectious diseases (bacteria, viruses, protozoa, and helminths or worms).

   b. <u>General Recommendations</u>

      1) Irrigated areas should be no closer than 500 feet from potable water wells and reservoirs.

      2) Irrigated areas should be no closer than 100 feet from any private residence.

      3) Application rates should be controlled to minimize ponding. Excess irrigation tailwater in the reclaimed wastewater irrigation area shall be contained and properly disposed. An assessment should be made of the acceptable time and rate of application based on factors such as type of vegetation, soil, topography, climate and seasonal variations.

      4) Effluent holding/mixing ponds shall be designed to prevent the infiltration of the wastewater into the subsurface. The holding/mixing ponds shall be made impervious.

      5) Irrigation shall be scheduled such that the public is not in the vicinity and the soil is sufficiently dry to accept the irrigation water.

      6) Permanent fencing or barriers shall be erected around polishing or holding ponds to prevent public entry or stray feral and tame animals from gaining access to the ponds.

      7) Adequate irrigation records shall be maintained. Records should include dates when the fields are irrigated, rate of application, total application and climatic conditions. Records should also include any operational problems, diversions to emergency storage or safe disposal and corrective or preventive action taken.

      8) The holding/mixing ponds shall be periodically monitored for the purpose of detecting leakage into the subsuface. If leakage is detected, corrective action shall be immediately taken.

   c. <u>Adequate Notice</u>. Appropriate means of notification shall be provided to inform the employees and public that reclaimed wastewater is being used for irrigation on the site.

1) Posting of conspicuous signs with sufficient letter size for clear visibility with proper wording should be distributed around the use areas.

2) Signs shall be securely fastened. Periodic surveillance shall be conducted to assure permanent posting at all times. Immediate replacements shall be made when necessitated by deterioration, vandalism or misuse.

d. Adequate Employee Education. Employees or users should be cautioned and warned of the potential health hazards associated with the ingestion of reclaimed wastewater being used at the site.

1) Employees should be warned that the ingestion of reclaimed wastewater is unsafe.

2) Employees should be protected from direct contact of the reclaimed wastewater. If necessary, protective clothing should be provided.

3) Employees should be informed of the following:

- The irrigation water is unsafe for drinking or washing.
- Avoid contact of the water or soil with any open cuts or wounds.
- Avoid touching the mouth, nose, ear or eyes with soiled hands, clothes or any other contaminated objects.
- Be aware that inanimate objects such as clothes or tools can transport pathogenic organisms.
- Always wear shoes or boots to protect feet from the pathogenic organisms in the soil or irrigation water.

6. Use of electrical golf carts is recommended. It is recognized that underground storage tank(s) to store gasoline for gas driven golf carts will impose potential risks to the groundwater. If gasoline-driven golf carts are to be utilized, the developer/owner must meet all federal requiren ents in the installation of any underground storage tank.

7. Buildings designated to house the fertilizer and biocides shall be bermed to a height sufficient to contain a catastrophic leak of all fluid containers. It is also recommended that the floor of this room be made waterproof so that all leaks can be contained within the structure for cleanup.

8. A golf course maintenance plan and program will be established based on "Best Management Practices (BMP)" in regards to utilization of fertilizers and biocides as well as the irrigation schedule. BMP's will be revised as an ongoing measure. The golf course maintenance plan will be reviewed by the State Department of Health prior to implementation.

If there are any questions regarding the eight (8) conditions mentioned here, please contact Mr. James K. Ikeda at 548-6455. We ask your cooperation in the protection of Hawaii's valuable groundwater resource.

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1188 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538 6652
RES (808) 395 1330
FAX (808) 521-4292

September 7, 1989

Mr. Bruce S. Anderson, Ph.D.,
Deputy Director for Environmental Health
State of Hawaii
P.O. Box 3378
Honolulu, Hawaii 96801

Subject: EIS Preparation Notice and Environmental Assessment for Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Mr. Anderson:

Thank you for your letter of August 15, 1989, regarding the above project. All of the sub-consultants involved in the areas of concern mentioned in your letter have been apprised of your comments. We will be addressing your concerns in the draft EIS.

Your attention to this matter is sincerely appreciated.

Very truly yours,

Tyrone T. Kusao

TTK:afk

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

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

REF:HP-AL

AUG 17 1989

Tyrone T. Kusao, Inc.
1188 Bishop Street, Suite 2507
Honolulu, Hawaii 96813

Dear Mr. Kusao:

SUBJECT: EIS preparation notice and Environmental Assessment Review
Bayview Golf Course Expansion
Kaneohe, Koolaupoko, Oahu
TMK 4-5-30: various; 4-5-59: 33-36; 4-5-104: 48-54

Thank you for your letter of July 13, 1989, enclosing the subject materials for our review.

As noted in the EA, the project area contains many Land Court Awards and three prehistoric Hawaiian fishponds. One of these is Site 80-10-349, Waikalua-Loko. The two small ones are Waikalua and Keana. All three are zoned preservation.

Your EIS should append the initial archaeological survey, include a section on existing conditions with regard to archaeology and the three extant fishponds, and a section on proposed mitigation detailing how you intend to handle the impact of your project on the archaeology and the fishponds.

As you note in the EA, you should anticipate needing subsurface survey. The subsurface explorations should take place prior to completion of the EIS and the results incorporated into the EIS. Based on results from subsurface survey, you may need subsequent data recovery. In any case, you will need to prepare a fishpond preservation plan for the Historic Sites Section's review and approval.

Very truly yours,

WILLIAM W. PATY
Chairperson and State
Historic Preservation Officer

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1188 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538-6652
RES (808) 395-1330
FAX (808) 521-4202

August 29, 1989

Mr. William W. Paty
Chairperson and State
Historic Preservation Officer
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Subject: Draft Environmental Impact Statement for Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Mr. Paty:

Thank you for your letter of August 17, 1989, regarding the EIS preparation notice for the above project.

We have taken note of your comments and have forwarded a copy of your letter to our consultants Brewer/Brandman and Associates and Mr. Hallett Hammat. Our consultants will address those issues listed in yor letter and your comments and concerns will be considered in the EIS.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk

cc: Brewer/Brandman and Associates
Mr. Hallett Hamat

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

TE-4485
PL1.1696

August 29, 1989

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Subject: Bayview Golf Course Expansion
Environmental Assessment
EIS Preparation Notice

This is in response to a letter of July 13, 1989 from Mr. Tyrone Kusao requesting our review and comments on the subject project.

As stated in the Environmental Assessment, access to the golf course, clubhouse and residential units will be from Kaneohe Bay Drive which is a State facility. They should, therefore, be the primary agency to comment on connections to Kaneohe Bay Drive.

We will provide additional comments on the traffic impact study when it is submitted as part of the EIS.

Should you have further questions, please contact Wayne Nakamoto of my staff at 523-4190.

Very truly yours,

ALFRED J. THIEDE
Director

cc: Dept. of Land Utilization
Tyrone T. Kusao
Office of Environmental
Quality Control

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

September 8, 1989

Mr. Alfred J. Thiede
Director
Department of Transportation Services
City and County of Honolulu
650 S. King Street
Honolulu, Hawaii 96813

Subject: Bayview Golf Course Expansion, Environmental Impact Statement

Dear Mr. Thiede:

Thank you for your letter of August 29, 1989 regarding the above project. We have taken note of your comments and the State Transportation Department was one of those agencies consulted in the dEIS preparation process.

We thank you for your review of the EISPN and your comments thereon. A copy of the draft EIS will be forwarded to your office.

Very truly yours,

Tyrone T. Kusao

TTK:afk

DEPARTMENT OF PARKS AND RECREATION

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

WALTER M. OZAWA
DIRECTOR

HIRUAKI MORITA
DEPUTY DIRECTOR

September 5, 1989

Mr. Tyrone T. Kusao
Tyrone T. Kusao, Inc.
1188 Bishop Street, Suite 2507
Honolulu, Hawaii 96813

Dear ~~Mr. K~~ Ty Kusao:

Subject: EIS for Bay View Golf Course Expansion

The Department of Parks and Recreation has no objections to expansion of Bay View Golf Course. Since public access to the shoreline will be required, please submit plans indicating the access and recreational areas at an appropriate time.

Sincerely,

Walt
WALTER M. OZAWA, Director

WHO:js

cc: Department of Land Utilization

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1188 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

BUS (808) 538-6652
RES (808) 395-1330
FAX (808) 521-4202

September 8, 1989

Mr. Walter M. Ozawa
Director
Department of Parks and Recreation
City and County of Honolulu
650 S. King Street, 9th Floor
Honolulu, Hawaii 96813

Subject: EIS for Bayview Golf Course Expansion

Dear Mr. Ozawa:

Thank you for your letter of September 5, 1989 regarding the above project. We have taken note of your comments regarding submission of plans indicating access and recreational areas at the appropriate time. A copy of your letter has been forwarded to our engineers, Hida, Okamoto and Associates, Inc.

We appreciate your review of the EISPN and your comments thereon.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Hida, Okamoto and Associates, Inc.

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

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

REF:OCEA:SOR

SEP 8 1989

FILE NO.: 90-40
DOC. NO.: 6424E

Mr. Tyrone T. Kusao
Planning and Zoning Consultant
1188 Bishop Street, Suite 2507
Honolulu, Hawaii 96813

Dear Mr. Kusao:

SUBJECT: Environmental Assessment for Bayview Golf Course Expansion, Kaneohe, Oahu

Thank you for submitting the subject for our review. We have the following comments to offer you on the project.

In order to evaluate the project from an aquatic resources standpoint, the forthcoming EIS should describe: 1) the native and exotic fauna/flora in Kawa and Kaneohe Streams and Kaneohe Bay, and the potential impact of construction activities on these organisms; 2) the proposed sewage disposal system proposed for employment and its potential impact; 3) the proposed drainage system for the development; and 4) measures to mitigate the potentially adverse impacts of both short-term (e.g. construction-related) and long-term (e.g. pesticide, herbicide and fertilizer run-off) uses.

A historical site review of the project was previously sent to you and will not be repeated here.

We look forward to the review of your draft environmental impact statement.

Very truly yours,

WILLIAM W. PATY

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1188 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538-6652
RES (808) 395-1330
FAX (808) 521-4292

September 11, 1989

The Honorable William W. Paty
Chairperson
Board of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Subject: EIS For Bayview Golf Course Expansion, Kaneohe, Oahu.

Dear Mr. Paty;

Thank you for your letter of September 8, 1989 (File No:90-40) commenting on our environmental assessment report.

Please be advised that our Draft EIS will address all of the concerns noted in your letter. For your information, we plan to submit our Draft EIS in time for publication in the OEQC Bulletin of September 23, 1989.

We appreciate your assistance in this matter.

Very truly yours,

Tyrone T. Kusao

CHAPTER FIFTEEN

COMMENTS AND RESPONSES DURING THE PREPARATION OF THE FINAL EIS

15. COMMENTS AND RESPONSES DURING PREPARATION OF THE EIS

Sixty (60) copies of the Draft Bayview Golf Course Expansion Environmental Impact Statement (DEIS) were received by the Office of Environmental Quality Control on September 19, 1989. Notice of the DEIS was published in the September 23, 1989 OEQC Bulletin and sixty copies of the report were distributed to interested public agencies, organizations, and individuals. Additionally, five copies of the DEIS were delivered to the accepting agency, the Department of Land Utilization, City and County of Honolulu. A total of 20 comments were received in response to the Draft EIS. All comments were responded to with both comments and responses reprinted on the following pages.

Agencies and organizations submitting comments to the Draft Bayview Golf Course Expansion EIS are as follows:

CITY AGENCIES

Board of Water Supply

Department of General Planning

Department of Housing and Community Development

Department of Land Utilization

Police Department

Department of Public Works

Department of Transportation Services

STATE AGENCIES

Department of Accounting and General Services, Public Works Division

Department of Building and Economic Development

Department of Defense, Office of Adjutant General

Department of Budget and Finance, Housing Finance and Development Corporation

University of Hawaii, Environmental Center

FEDERAL AGENCIES

Department of Agriculture

Department of the Army

Department of the Interior, Fish and Wildlife Service

Department of the Navy

Department of Transportation

PRIVATE ORGANIZATIONS

Bishop Museum

Hawaiian Electric Company

INDIVIDUALS

Mr. Henry J. Ellis, Jr.

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1180 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 530-6652
RES (808) 305-1338
FAX (808) 521-4282

September 19, 1989

Dr. Marvin T. Miura
Director
Office of Environmental Quality Control
State of Hawaii
465 South King Street
Kekuanaoa Building #104
Honolulu, Hawaii 96813

Subject: Draft EIS For Bayview Golf Course
Expansion, Kaneohe, Oahu, Hawaii

Dear Dr. Miura:

On behalf of Pacific Atlas (Hawaii), Inc., I hereby submit sixty copies of the subject Draft EIS for publication in your September 23, 1989 OEQC Bulletin and distribution to those on your mailing list.

Should there be questions, please feel free to contact me. Your assistance in this matter is sincerely appreciated.

Very truly yours,

Tyrone T. Kusao

TTK:afk
Enc.
cc: Pacific Atlas (Hawaii), Inc.

John Waihee

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
465 SOUTH KING STREET, ROOM 104

Dear Reviewer:

Attached for your review is an Environmental Impact Statement (EIS) that was prepared pursuant to Chapter 343, Hawaii Revised Statutes and Chapter 11-200, Administrative Rules, EIS Rules:

TITLE: Bayview Golf Course Expansion Draft Environmental Impact Statement

LOCATION: Kaneohe, Oahu, Hawaii

CLASSIFICATION: Applicant Action

Your comments or acknowledgments of no comments on the EIS are welcomed. Please submit your reply to the accepting authority or approving agency:

Dept. of Land Utilization	Marvin T. Miura, Director Office of Environmental Quality Control
650 S. King St.	465 S. King St., #104
Honolulu, Hawaii 96813	Honolulu, Hawaii 96813

Please send a copy of your reply to the proposing party:

Pacific Atlas (Hawaii) Inc.
Akio Futakawa
1441 Kapiolani Blvd., #1204
Honolulu, Hawaii 96814

Your comments must be received or postmarked by: November 6, 1989

If you have no further use for this EIS, please return it to the Office of Environmental Quality Control.

Thank you for your participation in the EIS process.

DISTRIBUTION LIST

'89 NOV -8 A10:19

( ) E.A.
( ) APPLICANT ACTION
( ) AGENCY ACTION

(x) EIS
(x) APPLICANT ACTION
( ) AGENCY ACTION

Title: Bayview Golf Course Expansion Draft Environmental Impact Statement

Location : Kaneohe, Oahu, Hawaii

Proposing Agency/Applicant: Pacific Atlas (Hawaii) Inc.

Accepting Authority/Approving Agency: Dept. of Land Utilization

Deadline for Comments: November 6, 1989

Date Sent/By: September 23, 1989

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Copy of Distribution List Sent to: Pacific Atlas (Hawaii) Inc.
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Akio Futakawa

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630 So. King Street
Honolulu, Hawaii 96813

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Michael Scarfone, Director
Honolulu Municipal Building
650 So. King Street
Honolulu, Hawaii

Department of General Planning
Donald A. Clegg, Chief Planning Officer
Honolulu Municipal Building
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Douglas G. Gibb, Police Chief
1455 So. Beretania Street
Honolulu, Hawaii 96814

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU

COPY

November 20, 1989

TO: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: KAZU HAYASHIDA, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) FOR BAYVIEW GOLF COURSE EXPANSION

We have no additional comments on the DEIS we received from the State Office of Environmental Quality Control. Our previous comments, which are included in the report, are still valid and applicable to the project.

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

cc: Tyrone K. Kusao, Inc.

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

November 27, 1989

Mr. Kazu Hayashida
Manager and Chief Engineer
Board of Water Supply
630 S. King Street
Honolulu, Hawaii 96813

Subject: Draft Environmental Impact Statement for Bayview Golf Course Expansion

Dear Mr. Hayashida:

Thank you for your letter dated November 20, 1989 to Mr. John P. Whalen, Director, Department of Land Utilization, City and County of Honolulu concerning the above referenced report.

Your letter will be reproduced in the Final EIS together with this response.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Pacific Atlas (Hawaii), Inc.

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

MM/DGP 11/89-4153

November 29, 1989

MEMORANDUM

TO: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: DONALD A. CLEGG, CHIEF PLANNING OFFICER
DEPARTMENT OF GENERAL PLANNING

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE BAYVIEW GOLF COURSE EXPANSION

We have reviewed the Draft EIS and offer the following comments:

1. The residential component of the proposed Bayview Golf Course Expansion should be clarified. There should be a breakdown between units set aside for relocation of existing on-site residents and those meant for market housing. The selling price of residential units should also be estimated.

2. The probable impacts on fishpond areas should be elaborated upon.

3. The Environmental Impact Statement should be more definitive in terms of its plans to provide public access to beach areas.

4. Chemical impacts on Kaneohe Bay should be estimated.

Thank you for the opportunity to comment on this matter.

Donald Clegg
DONALD A. CLEGG
Chief Planning Officer

DAC:ft

cc: ✓Tyrone T. Kusao

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

January 9, 1990

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

Dear Mr. Lee:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

This is in response to your department's 29 November 1989 letter regarding the DEIS on the proposed Bayview Golf Course Expansion.

Residential Component.

To clarify the need for relocation, on page 21 of the DEIS, we differentiate between the owner-occupied residences and rented or subleased units. The leases between other landowners and their tenants have not been transferred to Pacific (Atlas), Inc. in land transactions. Hence, Pacific Atlas (Hawaii), Inc. does not need to honor these other leases.

The proposed 40 residential lots are therefore to be used for relocation of only other landowners and not their current tenants. Currently, there are 18 residences on eleven lots owned by other landowners. In some cases, owners' family members and relatives reside in more than one house.

In these land acquisition transactions, the relocation needs are determined on a case-by-case basis. Most of the executed contracts require the transfer of two or three lots in the proposed project; one requires five lots. The lot assignment is therefore not one-to-one, but is based rather on providing lots which collectively are similar in size to the landowner's current property, or meet other such preferences. The relocated residents will own the land, and build their own houses.

The company has already completed negotiations with six of these landowners. Already 20 of the 40 lots have been committed. Pacific Atlas (Hawaii), Inc. anticipates that at least ten more lots may be needed for relocation.

In addition, the company desires to retain the remaining ten or so lots for contingency purposes, such as housing for company officials. Pacific Atlas has no current plans, however, to develop the lots not committed for relocation purposes. If the company later chooses to sell these residential lots, then the selling price is estimated at $75,000 in current dollars, based on the current market rate of $15 per square foot and an average lot size of 5,000 square feet.

Impacts on Fishponds.

Pages 78 and 79 of the DEIS discusses potential impacts on Waikalua-Loko Fishpond. The proposed alignment of Kawa Stream would result in the pond being restored to its former role as a settling basin during periods of heavy runoff. This action would be expected to result in consequences such as an increase the rate of pond infilling with terrigenous materials and altering existing flushing and circulation patterns, particularly during periods of heavy runoff. The existing natural, albeit man-induced or accelerated processes, are and will continue to exert many of these same effects through normal coastal ecological succession processes. These would occur with or without the impacts associated with the proposed project.

Many of these impacts can be attenuated or mitigated by the provision of a carefully-executed water quality and environmental management plan for the fishpond. For example, periodic dredging of the pond has the potential to improve the productivity of the now shallow, heavily-silted pond. Control of rapidly-spreading mangroves would maintain the open water habitat of the fishpond, while preserving the structural integrity of the fishpond walls. In the absence of a program to control the spread of mangroves, the fishpond walls will continue to deteriorate.

In terms of impacts on marine life in Waikalua-Loko Fishpond, the proposed improvements will essentially cause it to be a nutrient sink for organic materials of terrestrial origin.

Public Access.

Pacific Atlas (Hawaii), Inc. proposes to establish shoreline access along the easternmost boundary of the project site. The Final EIS will include this information.

Chemical Impacts on Kaneohe Bay.

Runoff contamination to Kaneohe Bay from the use of chemicals are not expected to be significant for the following reasons:

1. The total land area to receive chemical treatment is small, compared to the total watershed basin.

2. Absorption of chemicals by soil organic matter in these soils will retard the movement of most chemicals.

3. The few pesticides which are not highly absorbed are readily degraded in the soil and thus are not expected to constitute a source of downstream contamination.

Appendix E of the EIS contains further information on this topic.

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

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

Ronald B. Mun
DEPUTY DIRECTOR

December 5, 1989

MEMORANDUM

TO: John P. Whalen, Director
Department of Land Utilization

ATTENTION: Bennett Mark

FROM: Michael N. Scarfone

SUBJECT: Draft Environmental Impact Statement
Bayview Golf Course Expansion

We have reviewed the subject draft Environmental Impact Statement (EIS). In our response to the EIS preparation notice for this project, the applicant was informed of the Department's policy of recommending that ten percent of the dwellings in a project requiring a zone change be set aside for low- and moderate-income households, or the developer contribute in-kind toward the development of such housing. DHCD will formally make this recommendation when the zone change application is circulated to our Department for review and comment.

Notwithstanding the applicant's stated intention to satisfy its affordable housing set-aside requirement through monetary and in-kind contributions (EIS, Page 13) and that such contributions have been accepted previously for other projects, the ultimate decision regarding the method of satisfying the project's affordable housing requirement rests solely with the City Council.

Thank you very much for the opportunity to review and comment.

MICHAEL N. SCARFONE
Director

cc: Mr. Tyrone Kusao

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

January 9, 1990

Mr. Michael N. Scarfone
Director
Department of Housing and Community Development
650 S. King Street, 5th Floor
Honolulu, Hawaii 96813

Subject: Bayview Golf Course EIS

Dear Mr. Scarfone:

Thank you for your December 5, 1989 response memorandum concerning the subject EIS addressed to the Department of Land Utilization Director.

Our latest position on the 10% low/moderate income housing requirement is as follows:

> Of the 40 residential units proposed, applicant projects that 30 will be used to meet the relocation needs of those property owners displaced by the project. Consequently only 10 units will be available to the public. In view of the foregoing, applicant is of the opinion that the City's 10% requirement for low/moderate income housing should only apply to those 10 units available to the public. Should this approach be acceptable, only one unit (10% x 10 units) will be required to meet the City's requirement. Based on your recommendation, the City Council will make the final decision on this matter in connection with the rezoning application.

We also understand that under the current City's housing policy the applicant can make monetary contribution or provide the unit at another nearby location with the City's concurrence in meeting the 10% requirement.

We hope you concur with our position on this matter.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Department of Land Utilization
Office of Environmental Quality Control

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

BENJAMIN B. LEE
DEPUTY DIRECTOR

89/EIS-2(BWM)
89/SMA-52

November 22, 1989

Mr. Tyrone T. Kusao
Zoning Consultant
1188 Bishop Street #2507
Honolulu, Hawaii 96813

Dear Mr. Kusao:

Draft Environmental Impact Statement (DEIS)
Bay View Golf Course; Kaneohe, Oahu, Hawaii

We have reviewed the DEIS prepared for the Bayview Golf Course Expansion project. We offer the following comments and questions:

1. Figures

The scale given for Figure B, "Project Site," is wrong. The depiction of Kaneohe Stream is incomplete.

Figures C, D, E, H and L are of poor graphic quality and are very difficult to read. They should be improved to at least the quality of Figure B.

The EIS lacks a figure which shows all existing land uses on and around the site. This should be provided; a larger scale than 1" = 500' may be necessary to show the various uses. It should include Puohala School, the YWCA, and Kaneohe Beach Park, as well as all streams, roadways, and other adjacent uses.

The EIS should also provide a figure showing the ownership of lands within the proposed site.

Figure C, "Conceptual Master Plan," should clearly show streams (including proposed diversions), roadways (including service roads), ponds, and other major site features. Where will the maintenance shed, tennis courts, and swimming pool be located?

2. Public Access

Will public access to the shoreline be provided? If so, describe how this access and lateral public access along the shoreline will be provided.

3. Waikalua Loko, Waikalua, and Keana Fish Ponds

Is there any potential for returning Waikalua-Loko and Waikalua Fishponds to active aquaculture use?

Is there a potential for developing the areas at or near these fishponds for passive public recreation, or for the viewing of wildlife?

4. View Analysis

Since single-family residential structures and a clubhouse are proposed along Kaneohe Bay Drive, the view between the roadway and the ocean may be obstructed. A view analysis showing the degree of obstruction should be included in the Final EIS. Provide profiles and elevation drawings.

5. Impact of Fertilizers and Pesticides on Kaneohe Bay Waters

The Draft EIS estimates the tonnage of nitrogen based fertilizers and various pesticides that will be used on the golf course. Where is the summary for phosphorous based fertilizers? What will be the effect of these fertilizers and pesticides on Kaneohe Bay waters? Will there be an increased probability of algal blooms?

6. Impacts of Drainage and Erosion

What are the current and projected estimates of drainage runoff and erosion volumes into Kaneohe Bay? How will this increased "fresh" water and/or sedimentation affect Kaneohe Bay waters? What effects will this have on the coral reefs in the bay?

7. Grading

What is the extent of grading that will be required for this project in terms of the volume of cut and fill required?

At what elevation will the clubhouse facilities and the residential subdivision be constructed? Comparing the "Conceptual Master Plan" and the "Topography" map, there appear to be very large differences in grade across the clubhouse and subdivision sites. How much grading will be needed to construct these portions of the project?

Mr. Tyrone T. Kusao
Page 3

8. Kaneohe Stream

Are any alterations proposed to Kaneohe Stream? Will the project include construction of a bridge across the stream?

9. Wetlands

The EIS should describe and map wetland areas and any proposed fill of wetlands.

Thank you for the opportunity to comment. If you have any questions regarding this letter, please call Bennett Mark at 527-5038.

Very truly yours,

John P. Whalen

JOHN P. WHALEN
Director of Land Utilization

JPW:sl
1954B

cc: OEQC

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

January 11, 1990

Mr. Donald A. Clegg, Director
Department of Land Utilization
City and County of Honolulu
650 S. King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Clegg:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

This is the revised response to your 22 November 1989 letter regarding the DEIS on the proposed Bayview Golf Course Expansion. Please disregard our earlier response letter dated January 9, 1990 as certain revisions have been made to item #3, below.

1. Figures.

We will improve the quality of the figures as you suggested. We will also add Figure B-1 to show ownership of lands within the site. Finally, we will indicate the location of structures and recreational amenities on Figure C.

2. Public Access.

Pacific Atlas (Hawaii), Inc. proposes to establish shoreline access along the eastern most boundary of the project site. The DEIS will be revised to include this information.

3. Waikalua-Loko, Waikalua and Keana Fishponds.

Active aquacultural use:

With regard to the potential for developing Waikalua Fishpond for aquacultural use, we find that the pond has been filled with sedimentation over the years and is completely overgrown with mangrove. The pond bed is dry and does not support any marine life of which we are aware. Consequently, we feel that its potential for aquacultural use is practically nill.

Waikalua-Loko Fishpond, on the other hand, is still in active use, although a portion has been encroached upon by mangrove and siltation build-up which has occurred over the years. It appears that there is potential for returning this pond, or a portion of it, to active aquacultural use. However, due to the existence of the sewer treatment plant and storage area for abandoned vehicles nearby there may be some question regarding the suitability of the pond for active aquacultural use.

<u>Passive recreation or viewing area</u> - Due to the tightness of the area proposed for the golf course, the development of the area for passive public recreation has to be carefully evaluated. In this instance, the size of such a facility would be of concern to the applicant.

With respect to the wildlife viewing area, we feel that such a facility could be viable provided its development is in conjunction with the beach public access which may be required along the easterly boundary of the golf course and does not occupy too much space. Further, such an area must be compatible with golf course activities, particularly from the standpoint of safety.

As suggested by your staff, we have written to the following agencies requesting their views concerning return of the fishponds to aquacultural use and setting aside an area for passive recreation or for wildlife viewing purposes: (1) City Department of Parks and Recreation; (2) State Department of of Agriculture; (3) State Department of Land and Natural Resources; and (4) U.S. Department of the Interior. All agencies were requested to respond to your agency directly with a copy to us.

4. View Analysis.

The series of photographs provided as an attachment to this letter were taken from Kaneohe Bay Drive proceeding towards Kaneohe Marine Corps Air Station. The attached "Photo Index Map" depicts the positions from which photographs were taken.

As is evident, there is presently no view of the ocean from the highway due to ground togography and thick vegetation, including trees. On the other hand, clearing of vegetation in connection with the project

could result in some views toward the ocean from the highway. These views will actually be glimpses between the proposed houses particularly where low-lying lands (gulch) approach the highway.

We examined the <u>Coastal View Study</u> produced by the Department of Land Utilization in 1987. Kaneohe Bay Drive adjacent to the project site is categorized as "Coastal Roadway" on Exhibit 10, Kaneohe Bay Viewshed. The discussion under Section 7.1 Kaneohe Bay Viewshed confirms our field trip findings as follows:

> "Other important coastal roads include Lilipuna and Kaneohe Bay Dirve. <u>Although these roads follow the coastline, surprisingly few views can be found except from public parks and occasional glimpses through breaks in the vegetation</u> (Emphasis added). The most dramatic views of Kaneohe Bay occur from the H-3 which falls outside the SMA boundary."

5. Impact of Fertilizers and Pesticides on Kaneohe Bay Waters.

Concerning phosphorous as a contaminant of water, consultant Dr. Richard Green notes that their report states that "The primary fertilizer elements of concern for contamination of ground and surface waters are nitrogen and phosphorous. Phosphorous is attached very tightly to soil clays and moves little if any from the site of application (page 3 of Appendix E). The study concludes that "only nitrogen could diminish water quality, since phosphorous sorption on soils would prevent its movement from the site of application" (Ibid., page10).

Regarding the effect of fertilizers and pesticides on Kaneohe Bay waters, Sections IV.A and V (items 1 and 2) of Appendix E discuss the potential impacts on surface waters, including Kaneohe Bay waters. The report notes that

> "A negative impact of chemical constituents in runoff and drainage from the golf course on shallow waters is not likely. These waters are presently contaminated by urban runoff and sediment, thus we do not expect runoff from the golf course to significantly alter the nature of these waters. The considerable volume of flow in Kaneohe Stream prior to reaching the development site will also serve to dilute the small amount of runoff entering the stream channel from the golf course" (Ibid., page 5).

6. **Impacts of Drainage and Erosion.**

The proposed project is not expected to affect Kaneohe Bay waters or the coral reefs in the bay.

The proposed project will essentially divert drainage runoff by realigning Kawa Stream to empty into Waikalua-Loko Fishpond. As presented in Section 3.2 and 3.4 of DEIS Appendix I, current and projected estimates of drainage runoff into Kawa Stream are as follows:

Storm Recurrence <u>Interval (Year)</u>	Current <u>Peak Runoff</u>	Estimated Peak <u>Runoff</u>(with project)
10	234 cfs	300 cfs
50	352 cfs	452 cfs

On page 75 of the DEIS, we note that the downstream discharge could potentially increase 28 percent <u>without mitigation</u>. However, runoff entering Kawa Stream could remain near existing levels when mitigating measures, such as routing runoff to ponds within the golf course layout.

It is stressed that the impacts of the increased on-site peak runoff are minor when compared to the peak runoff generated over the entire drainage basin. The estimated project increase represents three percent of the total peak runoff from the drainage basin.

In terms of soil erosion volumes, the existing soil erosion potential is 1,387 tons per year, as presented in Section 4.3.1 of the DEIS. Because the project would actually <u>reduce</u> soil erosion by establishing Waikalua-Loko Fishpond and other water features as detention basins, the project would only cause a short-term increase in soil erosion. Approximately 1,093 tons of soil erosion is estimated for the one-year period during which land-disturbing construction activities will occur. Page 76 of the DEIS lists mitigation measures which will be taken to minimize this short-term impact.

7. **Grading.**

It is estimated that the required volume of cut and fill is approximately 240,000 cubic yards.

The clubhouse facilities and residential subdivision will be at an elevation of 75 feet above mean sea level.

The applicant anticipates that extensive grading will be required to implement the proposed project. Detailed grading information will be provided in the application for a grading permit.

8. **Kaneohe Stream.**

No realignment is proposed for Kaneohe Stream. The project will include a bridge over the stream. To provide access for maintenance vehicles and golf carts to the 12th hole, this bridge will be designed to meet Coast Guard requirements regarding navigable waters.

9. **Wetlands.**

The DEIS Appendix G, "Botanical Survey: Proposed Bayview Golf Course Expansion," presents a map depicting on-site wetlands. The proposed project includes at least partial fill of these lands and we have contacted U.S. Corps of Engineers officials to initiate appropriate discussions. They have indicated that definitive boundaries for on-site wetlands will be determined during the Corps permit process. We will keep your department apprised of boundary definition and other pertinent information as the permit process progresses.

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

Attachment

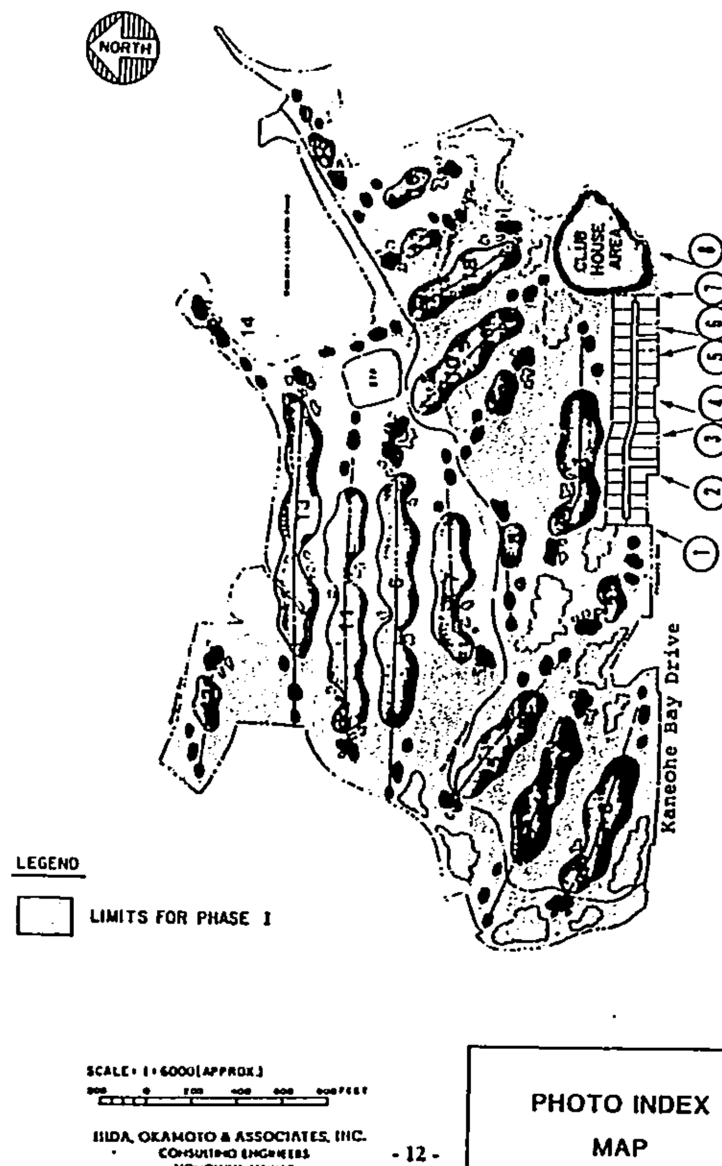

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PHOTO INDEX
MAP

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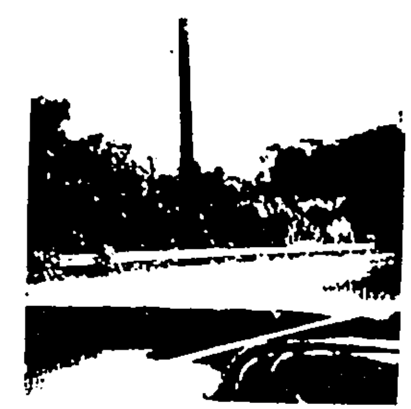

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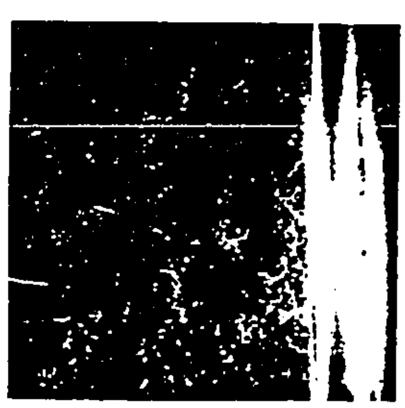

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7

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POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

FRANK F. FASI, MAYOR

DOUGLAS G. GIBB, CHIEF

WARREN FERREIRA, DEPUTY CHIEF

OUR REFERENCE KN-LK

November 21, 1989

TO: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTENTION: BENNETT MARK
ENVIRONMENTAL AFFAIRS BRANCH

FROM: DOUGLAS G. GIBB, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT
FOR THE BAYVIEW GOLF COURSE EXPANSION

We have reviewed the draft environmental impact statement for the proposed golf course expansion and have nothing to add to our June 27, 1989 response at this time.

Thank you for the opportunity to comment.

DOUGLAS G. GIBB
Chief of Police

By JOSEPH AVEIRO
Assistant Chief of Police
Support Services Bureau

cc: Tyrone K. Kusao, Inc.

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

November 27, 1989

Mr. Douglas G. Gibb
Chief of Police
City and County of Honolulu
1455 S. Beretania St.,
Honolulu, Hawaii 96814

Subject: Draft Environmental Impact Statement
for Bayview Golf Course Expansion

Dear Chief Gibb:

Thank you for your letter dated November 21, 1989 to Mr. John P. Whalen, Director, Department of Land Utilization, City and County of Honolulu concerning the above referenced report.

Your letter will be reproduced in the Final EIS together with this response.

Very truly yours,

Tyrone T. Kusao

TTK:afk

cc: Pacific Atlas (Hawaii), Inc.

LU 11/89 7360

DEPARTMENT OF PUBLIC WORKS

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

'89 NOV 16 PM 3 33

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

SAM CALLEJO
DIRECTOR AND CHIEF ENGINEER

In reply refer to:
ENV 89-217(449)

November 16, 1989

MEMORANDUM

TO: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTENTION: BENNETT MARK

FROM: SAM CALLEJO, DIRECTOR AND CHIEF ENGINEER

SUBJECT: DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)
BAYVIEW GOLF COURSE EXPANSION

We have reviewed the subject DEIS and wish to reinstate our comments made during the EA reviewing period (see attached copy of letter dated August 2, 1989, Reference No. ENV 89-136).

SAM CALLEJO
Director and Chief Engineer

Attach.

'89 NOV 16 PM 3 33

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

In reply refer to:
ENV 89-136(448)

August 2, 1989

Ms. Berna Cabucangan
Earthplan
81 S. Hotel Street, Suite 211
Honolulu, Hawaii 96813

Dear Ms. Cabucangan:

Subject: Environmental Assessment Report for Bayview Golf Course Expansion
TMK: 4-5-30: 1,3,6,9,20,30, Por. 36, 37,40,42,44,45,46;
4-5-08: 38; 4-5-59: 33 to 36; 4-5-104: 48 to 54

We have reviewed the subject environmental assessment report and have the following comments:

1. The flows from the Kaneohe Wastewater Treatment Plant (WWTP) cannot be diverted to the Kailua WWTP until the secondary treatment units are operational at Kailua. Estimated completion date is early 1994. Also, the following must occur before the land at the Kaneohe WWTP can be purchased:

   a. The Division of Wastewater Management must notify the City Finance Department that the land is surplus.

   b. Finance Department circulates notice to all City agencies of surplus land at Kaneohe.

   c. If no City agency is interested in the surplus land, Finance Department may sell by public auction.

   The purchase of the land will be subject to restrictions such as limited to golf course, but no clubhouse or dwelling unit within surplus property.

2. A drainage report should be submitted to the Drainage Section, Division of Engineering, for review and approval.

Very truly yours,

SAM CALLEJO
Director and Chief Engineer

cc: DLU

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1180 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

BUS (808) 538-6652
RES (808) 395-1330
FAX (808) 521-4292

November 27, 1989

Mr. Sam Callejo
Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 S. King Street,
Honolulu, Hawaii 96813

Subject: Draft Environmantal Impact Statement
for Bayview Golf Course Expansion

Dear Mr. Callejo:

Thank you for your letter dated November 21, 1989 to Mr. John P. Whalen, Director, Department of Land Utilization, City and County of Honolulu regarding the above referenced report.

Your letter will be reproduced in the Final EIS together with this response.

Very truly yours,

Tyrone T. Kusao

TTK:afk

cc: Pacific Atlas (Hawaii), Inc.

DEPARTMENT OF TRANSPORTATION SERVICES

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

FRANK F. FASI
MAYOR

ALFRED J. THIEDE
DIRECTOR

JOSEPH M. MAGALDI, JR.
DEPUTY DIRECTOR

TE-7222
PL1.1850

December 7, 1989

MEMORANDUM

TO: JOHN P. WHALEN, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTENTION: BENNETT MARK

FROM: ALFRED J. THIEDE, DIRECTOR

SUBJECT: REVIEW AND COMMENTS ON DRAFT EIS
BAYVIEW GOLF COURSE EXPANSION
TMK: 4-5-30: 45, 46, PORTION 1, 42, AND 44

This is in response to a letter from Dr. Marvin T. Miura, Director of the Office of Environmental Quality Control, dated November 14, 1989 requesting our review and comments on the above subject.

We have the following traffic concerns that should be included in the final EIS:

1. Will the internal roadway system be dedicated to the City? If it is, it should be designed to City standards, and construction plans should be submitted to our office for review.

2. Off-street parking should be provided in accordance with the Land Use Ordinance.

Should you have any questions, please contact Wayne Nakamoto of my staff at Local 4190.

(for) ALFRED J. THIEDE

cc: Tyrone K. Kusao
Marvin T. Miura, Ph.D.

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

(808) 538-6652
(808) 395-1330
FAX (808) 521-4202

January 4, 1990

Mr. Alfred Thiede, Director
Department of Transportation Services
City and County of Honolulu
Honolulu Municipal Building
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Thiede:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

This is in response to your 7 December 1989 comments on the above project.

Per your question on the possible dedication of internal roadways, Pacific Atlas (Hawaii), Inc. intends to retain ownership of these roads. Improvements will be designed to City standards.

Further, as you have indicated, off-street parking will be provided in accordance with the requirements of the Land Use Ordinance.

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

SEP 28 1989

(P)1958.9

received
SEP 29 1989

Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96814

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

Gentlemen:

Subject: Bayview Golf Course Expansion
Draft Environmental Impact Statement

Thank you for the opportunity to review the subject document.

Our primary concern about the proposed development is the hazard from golf balls landing in Puohala School and the adjacent playground. We note that the following proposed changes will probably increase this hazard:

1. The section of Kulauli Street which currently separates the school and playground from the golf course will be used as part of the golf course. Thus, the golf course boundary will abut the school/park boundary.

2. The configuration of the fairways will be changed. Hole No. 11 will point toward the school and park.

3. The golf course will change from a Par-3 to a regular stroke course. We believe the use of longer-hitting clubs will increase the problem of errant golf balls.

Based on the above, we would like to be informed of the measures that will be taken to minimize the hazard of errant golf balls on the people in the school and park.

Should there be any questions, please contact Mr. Cedric Takamoto of the Planning Branch at 548-7192.

Very truly yours,

T. Tominaga

TEUANE TOMINAGA
State Public Works Engineer

CT:em
cc: Mr. Eugene Imai
Ms. Akio Futakawa

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538-6652
RES (808) 395-1330
FAX (808) 521-4292

December 18, 1989

Mr. Teuane Tominaga
State Public Works Engineer
Public Works Division
State Department of Accounting and General Services
1151 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Tominaga:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

This is in response to your 28 September 1989 letter on the above project.

Your primary concern about the proposed project is the hazard from golf balls on people in the nearby school and park. Our golf course architect, Mr. Robin Nelson of Nelson & Wright, indicates that the maintenance area for the golf course is to be located to serve as a buffer between the golf course and Puohala School.

In general, no golf holes play alongside the school. The holes either play toward or away from the property. Golf holes which play toward the school have been designed to provide more than an appropriate safety distance between golf course and school, and shall be landscaped to provide further buffer. The golf holes which play away from Puohala School provide maximum protection to the school in that no golf balls will be struck toward the property.

In specific reference to hole #11, Mr. Nelson indicates that this hole plays toward the school, and an appropriate safety distance has been designed into the layout of this hole. Although there are no laws which govern the exact distance that shall separate any golf hole from other adjacent property, golf course architects generally accept that 150 feet from the centerline of a hole to any property line is considered reasonably safe.

Mr. Nelson refers you to Golf Course Developments, by Rees Jones, ASGCA and Guy L. Rando, published in the Urban Land Institute in 1974. On pages eight and nine of that publication, there is mention made of "a minimum distance of 150 feet from center line to boundary on both sides is necessary." The article does not mention any distance behind the hole. Please note that hole #11 shows an approximate distance of at least 150 feet to the property line. Also, this plan is conceptual in nature and subject to modification; any modification will strictly adhere to the 150-foot setback guideline.

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

DEPARTMENT OF BUSINESS AND ECONOMIC DEVELOPMENT

September 25, 1989

received SEP 27 1989

Mr. Marvin T. Miura, Director
Office of Environmental Quality Control
465 S. King St., #104
Honolulu, Hawaii 96813

Dear Mr. Miura:

Subject: Bayview Golf Course Expansion Draft Environmental Impact Statement, Kaneohe, Oahu, Hawaii

In response to your request for comments regarding the subject Environmental Impact Statement, please be advised that we have none to offer.

Also, as requested, we are returning the EIS to you as we have no further use for it.

Thank you for the opportunity to review the document.

Sincerely,

Maurice H. Kaya
Energy Program Administrator

MHK:lf

cc: Pacific Atlas (Hawaii) Inc.

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

November 15, 1989

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

Subject: Bayview Golf Course Expansion
Draft Environmental Impact Statement

Dear Mr. Kaya:

Thank you for your letter dated September 25, 1989 to Mr. Marvin T. Miura Director, Office of Environmental Quality Control concerning the above-referenced report.

Your letter will be reproduced in the Final EIS together with this response.

Very truly yours,

Tyrone T. Kusao

TTK:afk

cc: Department of Land Utilization
Pacific Atlas (Hawaii), Inc.

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

September 26, 1989

Engineering Office

received
SEP 28 1989

Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813

Gentlemen:

Bayview Golf Course Expansion
Draft Environmental Impact Statement
Kaneohe, Oahu, Hawaii

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

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

Sincerely,

Jerry M. Matsuda
Jerry M. Matsuda
Lieutenant Colonel
Hawaii Air National Guard
Contracting & Engineering Officer

cc: Dr. Marvin T. Miura, Director
Office of Environmental Quality Control
✓Mr. Akio Futakawa
Pacific Atlas (Hawaii) Inc.

NATIONAL GUARD
Americans At Their Best

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

November 15, 1989

Lieutenant Colonel Matsuda
Hawaii Air National Guard
Department of Defense
State of Hawaii
3949 Diamond Head Road
Honolulu, Hawaii 96816-4495

Subject: Bayview Golf Course Expansion
Draft Environmental Impact Statement

Dear Lieutenant Colonel Matsuda:

Thank you for your letter dated September 26, 1989 to the Department of Land Utilization, City and County of Honolulu concerning the above referenced report.

Your letter will be reproduced in the Final EIS together with this response.

Very truly yours,

Tyrone T. Kusao
Tyrone T. Kusao

TTK:afk
cc: Department of Land Utilization
Pacific Atlas (Hawaii), Inc.

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

received

89:PLNG/4563 jt

November 13, 1989

MEMORANDUM

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

FROM: Joseph K. Conant

SUBJECT: Draft Environmental Impact Statement (DEIS) for the Proposed Bayview Golf Course Expansion

We have reviewed the subject DEIS and offer the following comments.

While the applicant has somewhat addressed our concerns in the DEIS, further clarification is needed. For example, we previously inquired about the number of families and types of existing homes (owner-occupied vs. rental) that will be affected, as well as the plans for relocating affected homeowners and/or renters. From information contained in the DEIS, it appears that the development of 40 residential lots are intended to provide relocation sites for existing on-site residents. Page 9 of the report adds that "ten acres are owned by eight landowners" and that "the applicant is currently discussing property acquisition and resident relocation with these parties." While it appears that the applicant is planning to provide relocation assistance to displacees, it would be beneficial to have a relocation plan which includes such information as the number of families subject to displacement; whether these families would require housing for sale or rental; and the measures that will be taken to assist the displaced families.

Thank you for the opportunity to comment.

JOSEPH K. CONANT
Executive Director

cc: Pacific Atlas Hawaii, Inc.

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

December 18, 1989

Mr. Joseph K. Conant, Executive Director
Housing Finance and Development Corporation
State Department of Budget and Finance
Seven Waterfront Plaza, Suite 300
900 Ala Moana Boulevard
Honolulu, Hawaii 96813

Dear Mr. Conant:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

This is in response to your 13 November 1989 comment on the above project.

To clarify the need for relocation, on page 21 of the DEIS, we differentiate between the owner-occupied residences and rented or subleased units. The leases between other landowners and their tenants have not been transferred to Pacific (Atlas), Inc. in land transactions. Hence, Pacific Atlas (Hawaii), Inc. does not need to honor these other leases.

The proposed 40 residential lots are therefore to be used for relocation of only other landowners and not their current tenants. Currently, there are 18 residences on eleven lots owned by other landowners. In some cases, owners' family members and relatives reside in more than one house.

In these land acquisition transactions, the relocation needs are determined on a case-by-case basis. Most of the executed contracts require the transfer of two or three lots in the proposed project; one requires five lots. The lot assignment is therefore not one-to-one, but is based rather on providing lots which collectively are similar in size to the landowner's current property, or meet other such preferences. The relocated residents will own the land, and build their own houses.

The company has already completed negotiations with six of these landowners. Already 20 of the 40 lots have been committed. Pacific Atlas (Hawaii), Inc. anticipates that at least ten more lots may be needed for relocation.

In addition, the company desires to retain the remaining ten or so lots for contingency purposes, such as housing for company officials. Pacific Atlas has no current plans, however, to develop the lots not committed for relocation purposes. If the company later chooses to sell these residential lots, then the selling price is estimated at $75,000 in current dollars, based on the current market rate of $15 per square foot and an average lot size of 5,000 square feet.

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

University of Hawaii at Manoa

received NOV 1989

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

November 6, 1989
RE:0540

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

Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Gentlemen:

Draft Environmental Impact Statement
Bayview Golf Course Expansion
Kaneohe, Oahu

The proposed project involves the expansion of the Bayview Golf course into an 18-hole championship course with clubhouse and maintenance shed, recreational facilities, and 40 residential units. Two prehistoric fishponds are located within the site. Kawa stream will be realigned to a former location and the fishpond gates and seawalls will be restored as much as possible to their earlier functioning condition.

The Environmental Center has reviewed the above referenced document with the assistance of Frank Peterson, Geology and Geophysics; Terry Hunt, Anthropology; David Callies, Law; Pauline King, History; Nicholas Ordway, Real Estate Research and Education; and Carolyn D. Cook, Environmental Center.

The following comments have been offered by our reviewers for your consideration.

Social - Economic Impacts

Bayview Golf Course Expansion plans include land currently zoned for P-1, Restricted Preservation district; P-2, General Preservation District; R-10, Residential; and I-2 Intensive Industrial District. Because zoning changes will be required which will redesignate land from preservation, housing, and industry zones to Parks and Recreation, thus decreasing lands

A Unit of Water Resources Research Center

AN EQUAL OPPORTUNITY EMPLOYER

Office of Environmental Quality Control
and Department of Land Utilization
November 6, 1989
Page 2

available for much needed housing, it is important that the economic the viability of the project be fully evaluated prior to committment of the required zoning changes.

It has been estimated that over 40 new golf courses exist in various stages of planning or development on Oahu. The proposed course will be in direct competition with these. No assessment is provided of the impact of this course on the market. It should be observed that the existing course is directed to a very broad local market. The proposed substitute course deals with a narrow and untested market. A more detailed discussion of marketing issues should be included in the Final EIS.

Our reviewers have expressed concern that the proposed expansion of Bayview Golf Course will increase golfing fees, thereby decreasing its accessability to the local people. Page 18 indicates "A reasonable amount of playing time will be available for non-member local residents and green fees are expected to be competitive with rates of other Oahu private courses." The word "reasonable" is difficult to measure and the greens fee could be as much as $150 per round. A Kamaaina rate should be specified or a dollar range might be indicated. Again, because the development will involve a loss of land previously zoned to meet the needs of the community, economic impacts of the development should be fully evaluated prior to the commitment of the required changes in zoning.

The City and County Department of Housing and Community Development requests that ten percent of the residential units in the proposed project be set aside for low- and moderate-income households or that the developer contribute in kind toward the development of such housing. The document does not clarify what type of "monetary and in-kind contributions" are planned as a substitute to meet the affordable housing requirement.

The Residential component of the Draft EIS (3.2.2, p. 13) states that 40 lots will provide relocation for existing on-site residents, but according to 4.1, p. 21, 18 residential units are now located on the project site. Most of the residences have been vacated and only one residence and an automobile towing operation remain. Therefore, contrary to the information in the paragraph cited, apparently, more than half of the new housing will not be for relocation. The impact on housing that will be created as a result of the new jobs in the expanded operation of the course should be addressed in the Final EIS.

Archaeology

The background, field survey, and subsurface testing as described in the archaeological report (Appendix C) appear to be complete and well-executed. The protection and preservation of the two fishponds is important. Monitoring during any and all earthwork on the site must be carried out as a

Office of Environmental Quality Control
and Department of Land Utilization
November 6, 1989
Page 3

mitigative step to avoid any adverse impact to buried archaeological resources in the area. The periodic dredging of Waikalua-Loko Fishpond will require close observation regarding the content of extracted materials. An unusual amount of rocks could indicate that previously undetected structures are underwater and buried in the sediments.

Hydrology and Soil Erosion

It would be helpful to add a reference note to Appendix I in the text of the Draft EIS on pages 24 and 76-77 where quantitative estimates of soil erosion are presented. In the text they are presented without any indication of methods, references, etc. used to determine the values. Values for peak runoff are given on page 75. Here, again, a reference to Appendix I is needed. On page 76 there is a list of soil erosion mitigation measures that can be used. Will they be used?

A question has been raised in regards to the non-potable water sources: Is the local groundwater suitable for irrigation?

In accordance with Section 226-16 of Hawaii State Plan for development which encourages productive use of runoff water, the Bayview Golf Course Expansion plans propose to retain runoff for irrigation (p. 61). It is not clear how this runoff gets into the irrigation system. Elsewhere in the text, for example page 14, the source for irrigation water is always described as coming from two shallow wells drilled near Kawa Stream. Water from the wells will be pumped to an irrigation storage pond. Is this the same storage pond which is expected to hold a three-day supply of irrigation water also the receptacle for the runoff? Will water be pumped from other small ponds? Is there a plan for such infrastructure?

As noted above, the text in several places indicates that two shallow wells will be the source of nonpotable water, but in Appendix I: p. 12, three wells are cited as this source. Does this include one that is already in place?

There appears to be a discrepancy between the text (p. 87, and Appendix I, p. 14) and the map (p. 13, figure D and Appendix I, p. 15, figure F) as to the location of the two shallow non-potable water wells. They are described as being located southeast of the clubhouse, but the map shows them as being southwest.

Permits

The proposed potable water supply will come from the 12 inch Board of Water Supply (BSW) line along Kaneohe Bay Drive. However, BSW has not determined whether they will be able to provide the amount of water requested by the project for the needs of the clubhouse.

Office of Environmental Quality Control
and Department of Land Utilization
November 6, 1989
Page 4

Wastewater (p. 87) is to be transmitted to and treated at the Kaneohe Sewage Treatment Plant (STP). Bayview Phase II is expected to be operational in 1993; however, a letter from the City and County Department of Public Works states that the Kaneohe Wastewater Treatment Plant will not be able to receive additional wastewater flows until secondary treatment units are operational at Kailua. Estimated completion date is early 1994. How will the disposal of wastewater be resolved prior to completion of the Kailua/Kaneohe Wastewater Treatment systems?

Thank you for the opportunity to comment on this Draft EIS. We hope that our comments will be helpful in preparing the final document.

Yours truly,

Jacquelin N. Miller

Jacquelin N. Miller
Associate Environmental Coordinator

cc: Pacific Atlas (Hawaii) Inc.
L. Stephen Lau
Frank Peterson
Terry Hunt
David Callies
Pauline King
Nicholas Ordway
Carolyn Cook

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1188 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813

BUS (808) 538-6652
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FAX (808) 521-4282

January 4, 1990

Ms. Jacquelin N. Miller
Associate Environmental Coordinator
Environmental Center
University of Hawaii at Manoa
Crawford 317
2550 Campus Road
Honolulu, Hawaii 96822

Dear Ms. Miller:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

The following responds to comments in your 6 November 1989 letter to the Office of Environmental Quality Control and the City and County of Honolulu Department of Land Utilization:

Social - Economic Impacts.

1. You commented that we will decrease lands available for much needed housing. As presented on pages 70 and 71, the bulk of our lands are zoned for General and Restricted Preservation. Currently, 5.48 acres of the project site are residentially-zoned lands and these include 2.65 acres zoned R-5 Residential and 2.83 acres zoned R-10 Residential.

   The Bayview Golf Course Expansion proposes to consolidate these lands into one area, as shown in the conceptual master plan. This proposed residential area encompasses 8.24 acres, thereby causing an actual 2.76-acre increase of residentially-zoned land.

2. Your request for more marketing information is noted. First, the proposed project is unique among the 40 new golf courses in that Pacific Atlas (Hawaii) is proposing to expand an already-existing facility.

   Second, the expanded golf course is expected to be a profitable venture because of its proposed membership structure. Long-term members, some of whom are expected to be from abroad, will sustain the economic viability of the proposed project.

   Third, Pacific Atlas (Hawaii) intends to retain local accessibility to the Bayview Golf Course. Based on recently-approved golf courses and on Bill 152 (1989) which is currently being considered by the City Council, the project will need to include playing time for non-member local residents; this will be specified in our deliberations with public agencies and City Council. Further, your apprehension that the new fees could be "as much as $150" is unfounded. The Turtle Bay golf course charges a weekend fee of $90 for non-resident, non-guest golfers, based on the City's report Golf Course Development on Oahu (1989). This is currently Oahu's highest green fees, and non-resort courses charge considerably lower fees. The expanded Bayview Golf Course will have fees similar to the non-resort courses, such as the Mililani, Olomana and Hawaii Kai Championship Golf Courses. These courses currently charge between $30 and $45 for weekend play.

3. To clarify the need for relocation, on page 21 of the DEIS, we differentiate between the owner-occupied residences and rented or subleased units. The vacated residences to which you refer are in the paragraph referring to sublessees and renters. The leases between these landowners and their tenants have not been transferred to Pacific (Atlas), Inc. in land transactions. Hence, Pacific Atlas (Hawaii), Inc. does not need to honor these other leases.

   Pacific Atlas (Hawaii), Inc., intends that the bulk of the proposed 40 residential lots to be used for relocation of only other landowners and not their current tenants. Currently, there are 18 residences on eleven lots owned by other landowners. In some cases, owners' family members and relatives reside in more than one house.

   In these land acquisition transactions, the relocation needs are determined on a case-by-case basis. Most of the executed contracts require the transfer of two or three lots in the proposed project; one requires five lots. The lot assignment is therefore not one-to-one, but is based rather on providing lots which collectively are similar in size to the landowner's current property, and other such preferences. The relocated residents will own the land, and build their own houses.

The company has already completed negotiations with six of these landowners. Already, 20 of the 40 lots have been committed. Pacific Atlas (Hawaii), Inc. anticipates that <u>at least</u> ten more lots may be needed for relocation. Hence, the applicant projects that 30 of the proposed 40 residential units will be used to meet the relocation needs of those property owners displaced by the project.

In terms of affordable housing requirements, only ten residential units will therefore be available to the public. In view of the foregoing, Pacific Atlas (Hawaii), Inc. is of the opinion that the City's ten percent requirement for low/moderate income housing should only apply to those ten units available to the public. Should this approach be acceptable, only one unit (10% X 10 units) will be required to meet the City's requirement. The final decision on this matter will be made by the City Council in conjunction with rezoning of the property for this housing development from its current P-2, General Preservation District, to the proposed R-5, Residential District.

Under the current City's housing policy, it would be possible to make a monetary contribution to the City's Housing Revolving Fund or provide the housing unit at another nearby location in fulfilling the ten percent low/moderate income housing requirement. Needless to say, concurrence by the City is needed in whatever approach is used.

We will edit appropriate sections in the Final EIS to clarify the information.

Archaeology.

We concur with your comments on protecting the two on-site fishponds. Cultural Surveys Hawaii recommends the protection and preservation of the two fishponds, as well as of the grubbing and grading in the area. Hallett Hammatt, Ph.D., of Cultural Surveys Hawaii indicates that periodic dredging of the sediments within Waikalua-Loko Fishpond would need to be proceeded by sediment coring of the pond to recover datable organic samples and other organic materials, such as pollen, within a stratigraphic context. In addition, the dredging should be monitored by an archaeologist and all of these actions would be coordinated through the Historic Sites Section of the State Department of Land and Natural Resources.

Hydrology and Soil Erosion.

1. As you suggested, we will add a reference note to Appendix I on pages 24 and 76-77 where quantitative estimates of soil erosion are presented. Also a reference note will be made where values for peak runoff are presented.

2. The applicant intends to undertake all of the measures listed on page 76 needed to minimize the potential impacts of soil erosion during the construction phase.

3. Regarding the use of local groundwater for irrigation, the chloride content of the local groundwater is uncertain and difficult to assess at the present time. Preliminary salinity tests will be conducted during a drilling of the test wells. Chloride content will be monitored to insure that the brackish water is not drawn.

4. On the drainage runoff for irrigation, the project system will be designed to retain storm water on site as much as possible by incorporating retention ponds and detention features into the golf course design. The detailed design of the irrigation system will be provided when the project reaches the appropriate design phase. The golf course development is currently at the schematic and preliminary regulatory approval stage.

5. A correction will be made in regards to the three wells mentioned in Appendix I. The non-potable water sources will be two shallow wells drilled near Kawa Stream.

6. We agree that two shallow wells for non-potable water sources will be located southwest of the clubhouse. A correction will be made.

Permits.

1. We understand the preliminary nature of any comments on the availability of domestic water for the clubhouse need at this time. The application for a service connection and a water master plan with calculations and specifications of the pipe lines will be submitted to the Board of Water Supply at the appropriate stage in the golf course development.

2. Regarding your question on how wastewater will be disposed, Phase 2 of the proposed project will be concurrent with the completion of the Kailua/Kaneohe Wastewater Treatment systems.

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

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

November 6, 1989

Mr. Marvin T. Miura, Director
Office of Environmental Quality Control
465 South King Street, #104
Honolulu, HI 96813

RECEIVED

Dear Mr. Miura:

Subject: Draft Environmental Impact Statement (DEIS) - Bayview Golf Course Expansion, Kaneohe, Hawaii

We have reviewed the above-mentioned document as requested and offer the following comments:

It is our feeling that the erosion and sedimentation aspects of this proposal will have adverse effects and that these effects on Kawa Stream and the surrounding area have not been adequately addressed.

A more detailed analysis of the erosion and resultant sedimentation and their effect on the water quality of Kawa Stream, the fish pond, and Kaneohe Beach Park should be included in the final EIS.

The final report should also address the specific steps that will be taken to minimize these effects.

We would appreciate an opportunity to review the final EIS.

Sincerely,

Warren M Lee

WARREN M. LEE
State Conservationist

cc:
Department of Land Utilization, City and County of Honolulu, 650 South King Street, Honolulu, HI 96813
Akio Futakawa, Pacific Atlas (Hawaii) Inc., 1441 Kapiolani Boulevard, #1204 Honolulu, HI 96814

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

January 9, 1990

Mr. Warren Lee, State Conservationist
Soil Conservation Service
P. O. Box 50004
Honolulu, Hawaii 96850

Dear Mr. Lee:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

This is in response to your department's 6 November 1989 letter regarding the DEIS on the proposed Bayview Golf Course Expansion.

Some erosion and sedimentation impacts may occur during the grading and construction period, since construction of the golf course will involve land-disturbing activities that result in soil erosion.

Mitigation measures will be implemented to minimize these short term erosion impacts. Limiting grading to not more than 50 contiguous acres at a time will not necessarily extend the construction period. The method to be used will leave a strip of land between two or more graded areas, making simultaneous grading of more than one 15 acre portion possible. A sedimentation basin will be used during construction to minimize the potential for adverse impacts on Kawa Stream and Kaneohe Bay.

After the golf course is developed, it is anticipated that long-term erosion and sedimentation impacts on Kawa Stream will be reduced. It is also anticipated that better grounds management and landscaping, with proper planting and maintenance of stream edge vegetation, will reduce off-site runoff and erosion.

We believe that a more detailed analysis of erosion and sedimentation is not needed, since sediment loads are expected to decrease due to the proposed project.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

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

REPLY TO ATTENTION OF:

October 6, 1989

Planning Branch

received OCT 1989

Mr. John P. Whalen, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Whalen:

Thank you for the opportunity to review the Draft Environmental Impact Statement (EIS) for the Bayview Golf Course Expansion, Kaneohe, Oahu, Hawaii. The following comments are offered:

a. As stated in our letter of August 1, 1989, a Department of the Army (DA) permit will be required for the proposed project. The applicant's agent, Harvey Hida, is aware of permit requirements and will submit an application at a later date.

b. The flood zone designation information presented on page 33 EIS is correct, as is the Flood Insurance Rate Map shown on page 34.

Sincerely,

Clarence Fujii
Acting Chief
Engineering Division

Copy Furnished:

Mr. Marvin T. Miura, Director
Office of Environmental Quality Control
465 S. King St., #104
Honolulu, HI 96813

✓Pacific Atlas (Hawaii) Inc.
Akio Futakawa
1441 Kapiolani Blvd., #1204
Honolulu, HI 96814

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

December 18, 1989

Clarence Fujii, Acting Chief
Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Building 230
Fort Shafter, Hawaii 96858-5440

Dear Mr. Fujii:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion. As you have stated, Mr. Harvey Hida, our agent in Army permit requirements, will be submitting an appropriate application for the proposed actions at a later date.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

United States Department of the Interior

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

'89 NOV 8 PM 2 28

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

NOV 07 1989

Mr. John Whalen, Director
Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813

Re: Draft Environmental Impact Statement, Bayview Golf Course Expansion, Kaneohe, Oahu

Dear Mr. Whalen:

The U.S. Fish and Wildlife Service (Service) has reviewed the referenced Draft Environmental Impact Statement (EIS) and offers the following comments for your consideration.

General Comments

The applicant proposes to expand the existing 18-hole Bayview Golf Course into an 18-hole championship golf course. The proposed expansion would include grading and filling a wetland that lies immediately east of the existing golf course. The Service's primary concern with the proposed development of a golf course at this site is the direct loss of wetland habitat, and indirect impacts to water quality within Kaneohe Bay.

Specific Comments

Wetland Resources

In historical times, the project area was characterized by wetlands and wetland agriculture. By the mid-1800's, the project area was dominated by wetland taro cultivation. Through the period from about 1880 - 1920, taro cultivation was replaced with extensive rice farming in the project area. By the 1920's, however, rice farming gradually declined in importance. Limited taro and rice farming continued in the project area until the middle or late 1950's. The above information on wetland agriculture within the project area was based on the Archaeological Survey and Assessment of a 90-Acre Parcel for the Proposed Expansion of Bayview Golf Course (Cultural Surveys Hawaii, September 1989).

In modern times, dumping of imported top soil and construction fill appears to have been widespread throughout the project area (Cultural Surveys Hawaii, 1989). Also, around 1958, the wetlands at the mouth of Kawa Stream were filled in for the construction of the Kaneohe Sewage Treatment Plant (Draft EIS for Bayview Golf Course Expansion, September 1989). The project site has since been overgrown with California grass (Brachiaria mutica) and other wetland vegetation, and has been used as a cattle pasture.

Biologists from the Service and Department of Land and Natural Resources (DLNR) conducted a site survey of the existing wetland on October 25, 1989. The wetland site was dominated by California grass, a facultative wetland plant. Other wetland plants present in the wetland were dayflower (Commelina diffusa), primrose willow (Ludwigia octovalvis), and Job's tears (Coix lachryma-jobi). Standing water was present throughout the wetland. Wetland vegetation and standing water have been noted at this wetland by other investigators (Botanical Survey of the Proposed Bayview Golf Course Expansion, Kaneohe, Oahu. Char and Associates, March 1989; Wetlands and Wetland Vegetation of Hawaii. H.E. Elliot and E.M. Hall, 1977; and An Ornithological Survey of Hawaiian Wetlands. Ahuimanu Productions, December 1977). The soils within this wetland were mapped as Hanalei silty clays, a soil type that contains hydric soil inclusions (Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii. Soil Conservation Service, 1972).

Endangered and Migratory Waterbirds

Endangered and migratory waterbirds have not been observed at this wetland in recent times (Ahuimanu Productions, 1977; Terrestrial Vertebrate Animals of the Bayview Golf Course Expansion, Kaneohe Bay Drive, Kaneohe. J.A. Berger, March 1989). No endangered waterbirds were observed during the joint-agency site inspection on October 25, 1989. However, a determination on the biological value of this wetland for endangered and migratory waterbirds should be evaluated in light of the past and potential uses of this wetland by these species, and the cumulative losses of wetland resources throughout the State.

Taro fields provide valuable habitat for the four species of endangered waterbirds (Hawaiian Waterbirds Recovery Plan, U.S. Fish and Wildlife Service, 1985), and for migratory waterfowl and shorebirds. For example, at the Hanalei National Wildlife Refuge on Kauai, the endangered Hawaiian Coot (Fulica americana alai); Hawaiian Moorhen (Gallinula chloropus sandvicensis); Hawaiian Stilt (Himantopus mexicanus knudseni); and Hawaiian Duck (Anas wyvilliana) use the taro fields for loafing, roosting, and feeding (Master Plan for the Hawaiian Wetlands National Wildlife Refuge Complex, U.S. Fish and Wildlife Service, December 1985). The Hawaiian Moorhen, Hawaiian Stilt, and Hawaiian Duck also use the taro fields at Hanalei for nesting. Migratory waterfowl, such as the Northern pintail (Anas acuta) and Northern shoveler (Anas clypeata), and shorebirds, such as the Pacific golden plover (Pluvialis dominica) and Wandering Tattler (Heteroscelus incanus), also use the taro fields for feeding, roosting, and loafing habitat at the Hanalei refuge (U.S. Fish and Wildlife Service, December 1985). Rice fields have also provided wetland habitat for endangered and migratory waterbirds in Hawaii. Therefore, it is likely that the wetlands along the lower reaches of Kawa Stream, including the subject wetland, provided important habitat for endangered and migratory waterbirds until the middle to late 1950's.

Under proper management, this wetland could provide habitat for endangered and migratory waterbirds. For example, reducing the dense stands of California grass and other wetland vegetation would create open-water habitat that would be used by these endangered waterbirds. Likewise, the return to wetland agriculture at this site would improve the value of the wetland for endangered and migratory waterbirds.

The loss and degradation of wetland habitats is the primary cause for the decline of these four species of endemic Hawaiian waterbirds (U.S. Fish and Wildlife Service, 1985). Many productive wetlands have been converted into housing tracts, resorts, golf courses, and other urban developments. Within the project site, the historical wetland has been reduced in size by filling for the existing golf course and the sewage treatment plant. Only a portion of this former wetland remains.

Water Quality

This wetland may also function as a sediment basin for upland stormwater run-off. The retention of stormwater flows and capture of sediments by the wetland may protect water quality and coral reef habitats within the adjoining Kaneohe Bay. Alteration of the transport and storage capacity of this wetland may reduce water quality in Kaneohe Bay. However, we note that the retention capacity of this wetland is small relative to the surrounding watershed area.

Summary Comments

The Service is guided by regional and national policies regarding wetland development. Based on the past and potential use of this wetland by endangered and migratory waterbirds, and this site's potential role in the recovery of these endangered species, we recommend no-net loss of habitat for this wetland. Under the Service's regional wetland protection policy, development proposals adversely impacting wetlands will generally be discouraged unconditionally by our office. Therefore, we recommend that the proposed golf course be redesigned to avoid placing fill material into the wetland. We recommend that less-damaging alternatives that avoid placing fill material into the wetland be rigorously examined by the applicant.

The proposed project will likely require a Department of Army permit under Section 404 of the Clean Water Act. We recommend that the applicant contact the U.S. Army Corps of Engineers for information on wetland delineation, permit conditions, and inter-agency consultation.

We appreciate the opportunity to comment.

Sincerely,

Ernest Kosaka

Ernest Kosaka
Field Office Supervisor
Pacific Islands Office

cc: RD, FWS, Portland, OR (AFWE)
DE, USAED, Fort Shafter, HI
EPA, San Francisco
DLNR, DOFAW
OEQC

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

January 9, 1990

Mr. Ernest Kosaka
Field Office Supervisor
Pacific Islands Office
U.S. Fish and Wildlife Service
United States Department of the Interior
P.O. Box 50167
Honolulu, Hawaii 96850

Subject: Draft EIS, Bayview Golf Course Expansion, Kaneohe, Hawaii; Your comment letter dated November 7, 1989.

Dear Mr. Kosaka:

Your letter on the status of wetlands within the boundary of the proposed Bayview Golf Course Expansion, as well as the status of endangered waterbirds on a statewide basis is appreciated.

Pacific Atlas (Hawaii), Inc. will incorporate existing on-site water features, including Waikalua-Loko Fishpond and Kawa Stream, as major features of the golf course design.

In addition, the site includes approximately 6.8 acres of wetlands, as mapped by Elliott and Hall in 1977 and as illustrated in Appendix C, "Botanical Survey: Proposed Bayview Golf Course Expansion." The proposed project includes at least partial fill of these lands and project consultants have contacted U.S. Corps of Engineers officials to initiate appropriate discussions. They have indicated that definitive boundaries for on-site wetlands will be determined during the Corps permit process. Hence, the actual acreage of on-site wetlands will be determined at a later date.

Pacific Atlas (Hawaii), Inc. proposes that the majority of the four newly-created water hazards or lakes be designed, constructed and maintained as wetlands, offering significant open water areas, as well as nesting islands. Although the plan is still in design stages, it is anticipated that the total acreage available for lake and wetland construction may exceed seven acres. These artificial lakes and wetlands will provide a unique wetland resource of substantially greater habitat and wildlife value than the existing wetland. The new water features will be optimal habitats for both resident and migratory species. This can be accomplished by using native wetland plants known to be utilized by native birds for food, nesting materials and protection from predators.

We anticipate that our proposed water feature plans will be consistent with the national "no net loss" policy. We look forward to working with you to this end.

Very truly yours,

Tyrone T. Kusao

TTK:afk
cc: Mr. Bennett Mark, DLU
Office of Environmental Quality Control

DEPARTMENT OF THE NAVY
COMMANDER
NAVAL BASE PEARL HARBOR
BOX 110
PEARL HARBOR, HAWAII 96860-5020

IN REPLY REFER TO

5090 (171B)
Ser 032/2416
25 Sep 1989

received
SEP 26 1989

Department of Land Utilization
650 S. King St.
Honolulu, HI 96813

Gentlemen:

BAYVIEW GOLF COURSE EXPANSION DEIS

The Draft Environmental Impact Statement (DEIS) for Bayview Golf Course Expansion has been reviewed, and we have no comments to offer. Since we have no further use for the DEIS, it is being returned to the Office of Environmental Quality Control.

Thank you for the opportunity to review the draft.

Sincerely,

W.K. Liu

W. K. LIU
Assistant Base Civil Engineer
By direction of
the Commander

Copy to:
Pacific Atlas (Hawaii) Inc.
OEQC (w/DEIS)

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

1100 BISHOP STREET, SUITE 2507
HONOLULU, HAWAII 96813
BUS (808) 538-6652
RES (808) 395-1330
FAX (808) 521-4252

November 15, 1989

Mr. W. K. Liu
Assistant Base Civil Engineer
Department of the Navy
Naval Base Pearl Harbor
Box 110
Pearl Harbor, Hawaii 96860-5020

Subject: Bayview Golf Course Expansion
Draft Environmental Impact Statement

Dear Mr. Liu:

Thank you for your letter dated September 25, 1989 to the Department of Land Utilization, City and County of Honolulu concerning the above-referenced report.

Your letter will be reproduced in the Final EIS together with this response.

Very truly yours,

Tyrone T. Kusao

Tyrone T. Kusao

TTK:afk

cc: Dept. of Land Utilization
Pacific Atlas (Hawaii), Inc.

US Department of Transportation

United States Coast Guard

Commander (dpl)
Fourteenth CG District

PJKK Federal Building
300 Ala Moana Blvd.
Honolulu, Hawaii 9850
Phone: (808) 541-2126
FTS: 551-2126

SEP 22 '89

RECEIVED

5000
21 September 1989

Dear Mr. Miura:

Thank you for giving us the opportunity to review the EIS on the Bayview Golf Course expansion.

The Coast Guard has no comment on this matter.

Sincerely,

M. R. ADAMS
Commander, U. S. Coast Guard
Planning Officer
Fourteenth Coast Guard District

copy:
Pacific Atlas (Hawaii) Inc.
Akio Futakawa
1441 Kapiolani Blvd., #1204
Honolulu, Hawaii 96814

MI 9/26/89

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

December 18, 1989

M. R. Adams
Commander, U.S. Coast Guard
Planning Officer
Fourteenth Coast Guard District
PJKK Federal Building
300 Ala Moana Boulevard
Honolulu, Hawaii 96850

Dear Commander Adams:

Subject: DEIS for Proposed Bayview Golf Course Expansion
<u>Response to Comments</u>

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion. We note that Pacific Atlas (Hawaii), Inc. may need a Coast Guard permit related to the proposed construction of a bridge over Kaneohe Stream. We will contact you as we proceed in our permit process.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

BISHOP MUSEUM

October 6, 1989

RECEIVED OCT 16 '89

Mr. Akio Futukawa
President
Pacific Atlas (Hawaii), Inc.
Ala Moana Building Suite 1212
Honolulu, Hawaii 96814

Dear Mr. Futukawa,

On June 28, 1989 archaeologists from the Museum's Applied Research Group visited Haikalua Fishpond for the purpose of updating inventory information concerning the pond. This work was done under contract to the State of Hawaii, Department of Land an Natural Resources and the Office of State Planning, Hawaii Coastal Zone Management Program.

Enclosed is a portion of our report including the general inventory for the island of O'ahu and specific information about Haikalua Fishpond. The complete report will be available at the Bishop Museum Library and the Hamilton Library on the University of Hawaii Manoa Campus.

We thank you for your cooperation. If you have any questions or comments please call me or Aki Sinoto at 848-4189.

Sincerely,

Mary F. Riford

Mary F. Riford
Applied Research Group

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

November 22, 1989

Ms. Mary F. Riford
Applied Research Group
Bishop Museum
1525 Bernice Street
P.O. Box 19000-A
Honolulu, Hawaii 96817-0916

Subject: Bayview Golf Course Expansion
Draft Environmental Impact Statement

Dear Ms Riford:

Thank you for your letter dated October 6, 1989 to Mr. Akio Futukawa, President, Pacific Atlas (Hawaii), Inc. concerning the above referenced report.

We appreciate the time you took to forward a portion of your study which proved most hepful for our purpose.

Very truly yours,

Tyrone T. Kusao

TTK:afk

Hawaiian Electric Company, Inc. • PO Box 2750 • Honolulu, HI 96840 0001

William A. Bonnet
Manager
Environmental Department

October 18, 1989

ENV 2-1
JA/G

RECEIVED
OCT 21 '89

Marvin T. Miura, Ph.D., Director
Office of Environmental Quality Control
465 South King Street, #104
Honolulu, Hawaii 96813

Dear Dr. Miura:

Subject: Draft Environmental Impact Statement (DEIS) for Bayview Golf Course Expansion, Kaneohe, Oahu, Hawaii

The attached map that depicts the proposed expansion of the Bayview Golf Course shows the approximate location of HECO's existing overhead distribution lines and underground service cables within the project area. If these lines are to remain during the construction of the project, the following comments should be included in the project drawings:

1. The Contractor is to exercise extreme caution when the excavation and construction cross or are in proximity to HECO overhead lines and is to maintain a minimum 13'-0" clearance for his equipment while working close to and/or under the overhead facilities.

2. The Contractor is to comply with the directions of the State of Hawaii's Occupational Safety and Health Law (DOSH).

3. When trench excavation is adjacent to or beneath our existing HECO structures or facilities, the Contractor is responsible for:

    a. Sheeting and bracing the excavation to prevent slides, cave-ins and settlements, and

    b. Protecting existing structures or facilities with beams, struts, or under-pinning.

4. If the Contractor requires pole bracing instructions, he should call the HECO District Construction Superintendent at HECO's Koolau office at 261-4084 a minimum of 72 hours in advance.

An HEI Company

5. For verification of underground lines or for assistance in supporting and protecting these lines, the Contractor shall call HECO's Underground Division at 543-7345 a minimum of 72 hours in advance.

6. Any work required to relocate HECO facilities shall be done by HECO. The Contractor shall be responsible for all costs and coordination. In addition, should it become necessary for the Contractor to temporarily relocate any HECO facilities, these temporary locations will be done by HECO or by the Contractor under HECO supervision and all costs will be born by the Contractor.

7. Any damage to HECO's facilities will be reported immediately to HECO's Trouble Dispatcher at 543-7874. The Contractor shall be liable for any damages to HECO's facilities.

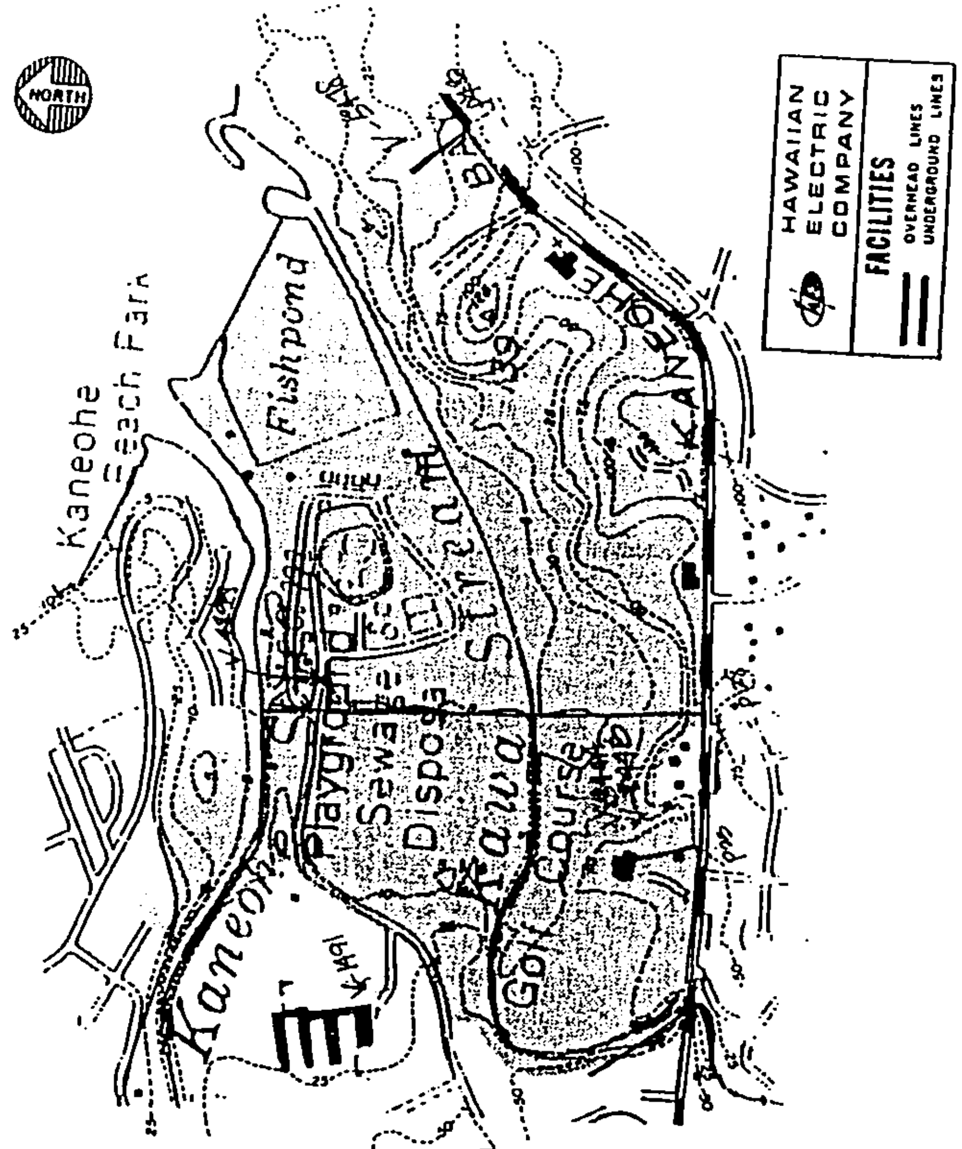
Sincerely,

William A. Bonnet

Attachment

cc: Dept. of Land Utilization

Pacific Atlas (Hawaii) Inc.



SCALE: 1:6000 (APPROX.)

HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

-25-

FIGURE G

TOPOGRAPHY

TYRONE T. KUSAO, INC.
Planning and Zoning Consultant

December 18, 1989

Mr. William Bonnett, Manager
Environmental Department
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawaii 96840

Dear Mr. Bonnett:

Subject: DEIS for Proposed Bayview Golf Course Expansion
<u>Response to Comments</u>

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion.

We note that your comments are primarily related to specific construction activities which will be more fully addressed subsequent to our current approval stage. As we prepare the construction drawings for proposed project, we plan to coordinate our actions with HECO in a timely fashion.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

November 3, 1989

Tyrone T. Kusao
Tyrone T. Kusao, Inc.
Planning and Zoning Consultant
1188 Bishop Street
Suite 2507
Honolulu, Hawaii 96813

Dear Mr. Kusao,

Thank you for your letter of October 25th and the copy of the draft EIS for the Bayview Golf Course expansion. Enclosed, for your information, is a copy of my comments on the draft EIS.

I wish you smooth sailing with the project.

Aloha,

Henry J. Ellis, Jr.

November 3, 1989

Office of Environmental Quality Control
Marvin T. Miura
Director
465 S. King St., #104
Honolulu, Hawaii 96813

Department of Land Utilization
650 S. King St.
Honolulu, Hawaii 96813

Dear Sirs:

Attached are my comments on the Bayview Gold Course Expansion Draft Environmental Impact Statement for Kaneohe, Oahu, Hawaii.

I own my home and residence at 45-076 Waiape Place, which is one house away from the proposed 12th hole of the course. My property is bordered to the south by Kaneohe Stream which I use frequently for recreational purposes. I am especially concerned that my sailboat access to Kaneohe Bay using the tidewaters of Kaneohe Stream is maintained. Since the developer must build a bridge across the stream, its appropriate design is critical to my continued access.

While I would prefer that the land proposed for the 12th hole and that other land bordering Kaneohe Stream be left in a wild state, I do not object to a golf course provided that it does not intrude significantly on the rural residential nature of the neighborhood and the stream.

My comments on the draft EIS follow on the attached pages.

Thank you for the opportunity to comment on the proposal.

Aloha nui,

Henry J. Ellis, Jr.
45-076 Waiape Place
Kaneohe, Hawaii 96744

cc: Pacific Atlas (Hawaii) Inc.
Akio Futakawa
1441 Kapiolani Blvd., #1204
Honolulu, Hawaii 96814

GENERAL COMMENTS

The Expansion of the Bay View Golf Course into an 18 hole championship course has the potential to improve the surrounding environment if the developer is sensitive to the beauty and fragility of nature, respects the rights and feelings of the residential neighborhoods surrounding the course, and preserves the aina - the great Hawaiian culture and spirit surrounding the land, fishponds, and streams in the project area.

I have lived in Hawaii since 1986, and my wife was born and raised here. We live with our two sons less than 150 feet from where the developer would place the tee for the 12th hole. Our residence is separated from that hole by one house lot, that is, our bedroom window is 65 feet from the northwest edge of the proposed course. Our lot borders Kaneohe stream which we use frequently for recreational purposes.

INSURE CONTINUED RECREATIONAL USE OF THE KANEOHE STREAM TIDEWATERS

One of these purposes is to use the tidewaters of Kaneohe stream as boat access to Kaneohe Bay. We both row and sail boats between Kaneohe Bay and the stream bank bordering our property. We are most concerned that our access to the Bay via the Stream is not impeded by whatever bridge the developer might construct to cross Kaneohe Stream.

The maps which show Kaneohe Stream in the draft EIS do not show the borders of the stream between the Eastern edge of TMK 4-5-08: parcel 38 and the stream banks about 250 feet downstream (by the Kaneohé Sewage Treatment Plant). The missing stream banks should be drawn in all applicable maps.

As that portion of Kaneohe Stream which borders TMK 4-5-08: parcel 38 is subject to the tides it is tidal water. It is also navigable water as we, and others, use it for small boat recreational purposes. As such the developer must obtain Coast Guard approval for any bridge which would cross Kaneohe Stream. No mention of this requirement is made in the draft EIS.

To better evaluate the effect of a bridge on Kaneohe Stream, and those who use it, the developer should include a discussion of the basic parameters to be used in the design and construction of the bridge. The developer should include a conceptual drawing of the bridge and its surrounding area.

INSULATE BORDERING RESIDENCES FROM THE ACTIVITIES ON THE COURSE

The proposed 12th hole is bordered on three sides by single family residences. No mention is made in the draft EIS of how the developer proposes to insulate these residences from the activities on the course. No discussion is included in the draft EIS of the impact of the course on these households. Both of these areas should be addressed.

PRESERVE THE LARGE TREES ON THE PROPERTY

There are several large trees near the northwest border of TMK 4-5-08: parcel 38. These trees are over thirty years old and are approximately fifty feet high. The developer should insure that no harm will come to these trees.

From an economic viewpoint they greatly enhance the natural beauty of the course and thus make it more attractive to the golfers playing on it. This helps to maximize the value of the property.

PRESERVE THE NATIVE HAWAIIAN AND OTHER WILD VEGETATION STILL BORDERING KANEOHE STREAM

Portions of the banks of Kaneohe Stream bordering TMK 4-5-08: parcel 38 are covered with wild native Hawaiian vegetation. The draft EIS mentions that much of the stream's banks have been disturbed. This leaves the reader with the impression that any additional disturbance would have minimal impact. Such is not the case. The stream bank in question is quite beautiful in its wild state. To ruin this remaining natural beauty would be a shame.

It should be possible for the developer to easily construct a beautiful 12th hole without disturbing the remaining wild banks of Kaneohe Stream. The EIS should contain a discussion by the developer of how he proposes to maintain the existing wild state found on the banks of Kaneohe Stream.

DO NOT ALLOW HEAVY CONSTRUCTION VEHICLES ON WAIAPE PLACE

The residential neighborhoods which borders TMK 4-5-08: parcel 38 (the 12th hole) consist of a portion of Waikalua Road and a portion of Waiape Place. Waiape Place is a small, quiet, two lane dead end street which is two blocks long and which connects to Waikalua Road by way of Waikalua Place. 15 houses lie along the path from the northwest side of the proposed 12th hole to Waikalua Road. More than half of these houses are inhabited by children under the age of thirteen. The entire area surrounding Waiape Place and Waikalua Place is heavily populated with small children. Indeed, Waikalua Road also has a sizable resident population of children and passes Benjamin Parker Elementary School.

The nature of the neighborhood and the high concentration of small children dictate that the developer must take special care during construction of the 12th hole.

It would appear that the best access to the 12th hole during construction would be though that portion of TMK 4-5-08: parcel 38 which directly connects to Waikalua Road and is bordered by parcels 43 and 44. The developer should address how he expects to access the 12th hole during its construction, and what the impact will be on the surrounding neighborhood. The access to Waikalua Road is not shown on any of the draft EIS maps of the 12th hole, but such access is shown on a tax map of the area dated October 1, 1987.

DETAILED COMMENTS

REFERENCE - PAGE 11:

1. Figure B of the Project Site contains a map of TMK 1-4-5-08: parcel 38 (The north west corner which is planned to become the 12th hole) which does not show a small lot of about 6,000 square feet between parcels 43 and 44 of TMK 1-4-5-08.

   No mention is made in the draft EIS of what is to become of this small lot. If the lot is to be used as access to the 12th hole or another part of the course it should be discussed in the EIS.

2. Figure B does not fully show the boundaries of Kaneohe Stream. The stream is shown to begin on the northwest edge of the map, proceeds to the east for about 600 feet, then there is a break in the stream boundaries of about 200 feet after which the boundaries resume and proceed to Kaneohe Bay. This deficiency should be corrected as the stream bed in this area is well defined and contains significant scenic beauty. See the general comments above.

3. The shading of Figure B suggests that the developer "owns" a portion of Kaneohe Stream, Kawa Stream, and the two depicted Waikalua Fishponds. Clearly he does not own Kaneohe Stream - these are navigable tidewaters. I do not know the status of the other water areas, but they should be accurately depicted.

REFERENCE - PAGE 12:

1. Figure C does not show Kaneohe Stream bisecting the course between the 12th and 13th holes. The developer makes no mention of covering the stream in his draft EIS so the public is given the impression that the stream will not be altered. If Kaneohe Stream is to remain in its present natur3al state then figure C should show its boundaries correctly.

2. Figure C does not show a bridge over Kaneohe Stream which would be necessary to connect the 12th hole with the rest of the course. As the placement and design of this bridge has a significant impact on the use of the stream it should be shown on the Figure.

REFERENCE - PAGE 14:

The draft EIS states "Earthen berms constructed along Kawa and Kaneohe Streams may create temporary flooding....", but there is no description of the design or placement of the berms in the draft EIS. As the maps of the project do not depict about 200 feet of the stream banks of Kaneohe Stream, let alone where the berms will be located in relation to the existing bank, it is impossible for the public to determine the impact of the berms on Kaneohe Stream.

REFERENCE - PAGE 38:

1. The description of the wildlife in and around Kaneohe Stream is inadequate. No mention is made of the plentiful tilapia which inhabit the stream. The stream also provides habitat to catfish, turtles, crayfish, prawns, koi, and ducks. I have observed most of the above in the stream with varying population levels and other residents have told me of the existence of the others.

2. The description of Waikalua-Loko Fishpond does not mention a sizable population of Samoan crabs which inhabit the area.

REFERENCE - PAGE 59:

In the list of necessary approvals the draft EIS makes no mention of the fact that the developer must obtain approval from the Coast Guard to construct a bridge over the tidewaters of Kaneohe Stream. As these tidewaters extend inland past the boundaries of the proposed golf course the developer has no practical option to a bridge if he wishes to connect the proposed 12th hole with the rest of the course.

As of October 18, 1989, the Coast Guard had not been contacted regarding the building of a bridge over Kaneohe Stream.

REFERENCE - PAGE 62:

Regarding the section which seeks to address Hawaii's Coastal Zone Management (CMZ) law's objective "Provide coastal recreational opportunities accessible to the public" -

1. The draft EIS states that "the existing ecosystem does not support significant quantities of marine life." I disagree. While the area encompasses by Kaneohe Stream may not contain vast schools of ulua, it does contain a multitude of species and large quantities of several of these species. Local residents regularly make use of Kaneohe Stream and the nearby area for recreational fishing and other marine gathering activities.

2. This draft EIS also states that "This area is not used for swimming or other typical shoreline activities." Again I disagree. As I live on the shores of Kaneohe Stream I can assure you that the local residents do use the tidewaters of Kaneohe Stream for both swimming and boating, myself and my family included.

3. For many years the public has made use of the vacant land which comprises TMK 4-5-08: parcel 38 for recreational activities which include, but are not limited to shoreline activities.

4. The public also uses the tidewaters of Kaneohe Stream for small boat recreational activities. Specifically, row boats and small sail boats enjoy access to Kaneohe Bay by way of Kaneohe Stream

REFERENCE - PAGE 63:

1. The Draft EIS comments: "On-site public shoreline access would not appear critical for the project site since the abutting shoreline is not viewed as a recreational resource." On the contrary, shoreline access is of concern to the the public. See my comments above regarding recreational use of the area. As the draft EIS is incomplete in its description of the boundaries of Kaneohe Stream, or the proposed construction surrounding the stream, it is not possible to adequately evaluate the impact of the project on the public's access to the tidewaters and stream banks of Kaneohe Stream.

2. I agree whole heartedly with the suggestion in the Draft EIS that the environment would be improved by the elimination of the auto-wreaking yard from the peninsula. Needless to say the developer should conduct the appropriate testing to identify any contaminated soil which must be removed to an approved hazardous waste storage site.

REFERENCE - PAGE 70:

The Draft EIS discusses the fact that "a portion of the project is designated Park..." and maintains that its use as a golf course would serve the same aims. While this is partly true, with respect to green space and water runoff, it is not true with regard to public access. City parks are freely available to all for their enjoyment. The proposed golf course would not be available to those who are not willing to pay a fee. This is a major distinction which should be addressed by the EIS.

REFERENCE - PAGE 72:

1. In addressing the City and County of Honolulu Special Management Area (SMA) guidelines which call for "adequate access...to public-owned beaches, recreation areas, and nature reserves" the Draft EIS again indicates that the project site area "is not used for swimming or other typical shoreline activities." As mentioned above, I beg to differ. The area around by Kaneohe Stream is used for such activities.

2. The Draft EIS also proposes "that the project will improve the scenic quality of the area by clearing the dense vegetation ..." Whether this is an improvement is a matter of taste and preference. I would strongly disagree with the premise that clearing the wild vegetation along the banks of Kaneohe Stream would improve its scenic quality. In my opinion the natural diversity and the wild state presently found in the still undeveloped banks of Kaneohe Stream are quite beautiful and are an inspiration from nature. I would suggest that leaving these banks in their present wild state would serve as an aesthetically pleasing juxtaposition to the highly designed nature of the golf course fairways, greens, etc.

REFERENCE - PAGE 73:

Under the section entitled "Guidelines Related to Waterways and Water Quality" the Draft EIS is silent with respect to Kaneohe Stream. The reader is thus given the impression that there would be no "dredging, filling or otherwise altering any bay, estuary, salt march, river mouth, slough or lagoon..." and that there would be no "development which would reduce or impose restrictions upon public access to tidal and submerged lands, beaches, ...". Given the necessity of the construction of a bridge over Kaneohe Stream, the EIS should address how such actions, or other actions contemplated, would affect the concerns delineated in the guidelines quoted above.

REFERENCE - PAGE 91:

This part of the Draft EIS addresses vehicular access to the project site from Kaneohe Bay Drive. I agree with the discussion that the impact on Kaneohe Bay Drive traffic would not be significant in comparison to the existing traffic patterns.

The Draft EIS is silent, however, regarding access to the golf course from either Waiape Place or Waikalua Road. The reader is left with the impression that there would be no access to the course from either of these two thoroughfares. The EIS should specifically identify the developer's plans regarding such access both during construction and eventual ongoing operations of the course.

In this regard the EIS should note that both Waiape Place and Waikalua Road are old, quite, residential neighborhoods. Waiape Place in particular is two blocks long with dead ends at either end (access in in the middle via Waikalua Place, another dead end street) and with a very high concentration of children. Any significant increase in traffic on Waiape Place would greatly increase the potential safety hazard to children in the area when compared to the existing situation.

I am particularly concerned about the impact of heavy construction vehicle activity during the construction phase of the project. Access to the 12th hole via Waiape Place is especially troublesome. Access via Waikalua Road creates less of a hazard, but the EIS should nevertheless point out that travel along Waikalua Road will entail passing Benjamin Parker Elementary School.

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January 8, 1990

Mr. Henry J. Ellis, Jr.
45-076 Waiape Place
Kaneohe, Hawaii 96744

Dear Mr. Ellis:

Subject: DEIS for Proposed Bayview Golf Course Expansion
Response to Comments

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion. The following responds to comments in your 3 November 1989 letter to the City and County of Honolulu Department of Land Utilization:

GENERAL COMMENTS.

We believe that the proposed project will improve the subject site and the on-site natural and cultural resources. Pacific Atlas (Hawaii), Inc. intends to incorporate Kawa Stream, Waikalua-Loko Fishpond and Waikalua Fishpond in the design of the golf course. In doing so, the company will improve the natural habitats of these resources by cleaning the waterway and fishponds and providing attractive buffers around these for preservation of water quality. Pacific Atlas (Hawaii), Inc. is also sensitive to the nearby community and will make every effort to be a good neighbor.

Recreational Use of the Kaneohe Stream Tidewaters.

We agree that the proposed project will require a Coast Guard permit. In a 21 September 1989 response from M. R. Adams, the Planning Officer for the Fourteenth Coast Guard District, the Coast Guard did not indicate this requirement. We intend, however, to pursue this item further.

Regarding the bridge construction, the bridge is designed to clearly meet Coast Guard requirements over navigable waters. Detailed design of the bridge will be completed only after discussions with and review by Coast Guard officials. The golf course development is currently at the schematic and preliminary regulatory approval stage.

As you suggested, a revision will be made on our maps regarding Kaneohe Stream banks.

Impact on Nearby Residences from Golf Course Activities.

You raised two concerns in this section. First, you expressed a concern about the protection of nearby residences from golf course activities. Second, you suggest that the general impacts of the proposed project on nearby communities be discussed in the EIS.

Regarding your first point, at hole #12, golfers would tee away from houses on Waiape Place. Our golf course architect indicates that an appropriate safety distance has been designed into the layout of this hole. Although there are no laws which govern the exact distance that shall separate any golf hole from other adjacent property, golf course architects generally accept that 150 feet from the centerline of a hole to any property line is considered reasonably safe.

As to your second concern, we discuss the impacts on the surrounding community on pages 98 and 99. For the regional Kaneohe Neighborhood Board area, the potential social impacts include the addition of a championship golf course, no population increase, the maintenance of an open space quality, and traffic. Traffic is also expected to impact the neighboring community, and potential traffic impacts are discussed on pages 89 through 94 in the DEIS. Other potential social impacts on the surrounding community includes public safety, which is a major consideration in the golf course design, the improvement of visual quality, and construction impacts.

Preservation of Large Trees and Native and Other Wild Vegetation Still Bordering Kaneohe Stream.

Winona Char, our botanical consultant, recommends that the large trees, especially those on the hillside area, be incorporated into the landscape design. She also points out that many of these trees, such as the monkeypods and banyans, can be transplanted in other parts of the golf course.

In reference to the native vegetation, Char found that there is little, if any, original vegetation left. The majority of the species on the site are introduced or alien. Koa-haole and California grass, as well as mangrove, form the dominant plant cover along the stream areas, and these are all introduced species. The mangrove is considered a noxious plant by the State Department of Agriculture as it grows so rapidly and tends to fill in the shoreline area.

Even though not native, the strip of vegetation along the stream banks serves to prevent excessive erosion of the stream banks. Char recommends that this strip be left intact. If this vegetation is removed, however, then the stream side areas should be landscaped as quickly as possible.

Construction Vehicles.

During construction, the applicant intends to access the 12th hole through TMK: 4-5-08:38 which directly connects to Waikalua Road. Pacific Atlas (Hawaii), Inc. will undertake all measures required to minimize potential impacts on the surrounding neighborhood during the construction phase.

DETAILED COMMENTS

Response to your comments regarding page 11:

The small lot to which you are referring is actually part of TMK 4-5-08, parcel 38. This land will be part of the golf course design, and will be used as access during construction. During operation, maintenance vehicles and golf carts will use the bridge.

Figure B will be revised to define Kaneohe Stream.

We note that Tax map key and property deed clearly indicate that Pacific Atlas (Hawaii), Inc. owns a portion of Kaneohe Stream, Kawa Stream and the two fishponds.

Response to your comments regarding page 12:

Figure C will be revised to define Kaneohe Stream; a bridge connecting the 12th and 13th holes will be illustrated.

Response to your comments regarding page 14:

A system of berms along Kaneohe Stream and Kawa Stream will prevent immediate storm water runoff into the stream. A detailed berm design with grading plans and flood study will be provided when the project reaches the appropriate design phase.

Response to your comments regarding page 38:

William Brewer of Brewer/Brandman Associates conducted the study of wildlife in and around Kaneohe Stream. He indicates that a more detailed biological description of the tidally-influenced segment of Kaneohe Stream was not possible because of the

prevailing high water turbidities and resulting poor underwater visibilities at the time of his survey. Conditions did not improve despite repeated visits to the site.

About 25 percent of Kaneohe Stream has been modified, and there are no records of endemic aquatic species presently being associated with any portion of the stream (see Appendix B).

Brewer indicates that tilapia were not observed within the estuarine segment of Kaneohe Stream, though they no doubt occasionally occur there, as well as in adjacent upland portions of the stream channel (and throughout all inshore areas of Kaneohe Bay).

As reported in the DEIS, tilapia were abundant within Kawa Stream and in Waikalua-Loko Fishpond. Many of the same species found in the estuarine segments of Kawa Stream probably occasionally occur in Kaneohe Stream, despite its channelized character, frequency of flash-flooding, and exceedingly poor habitat for marine and estuarine species. Seasonal surveys would no doubt permit development of a more comprehensive checklist of Kaneohe Stream. Given the known absence of endemic species from the stream (aholehole was the only native Hawaiian observed within the tidally-influenced portion of Kawa Stream), impacts to introduced species such as tilapia, koi and crayfish are not considered significant. The presence of these species may, in part, account for the absence of indigenous and endemic species.

Further, the on-site fishpond and adjacent shoreline mangrove stands may well provide habitat for Samoan crabs and other crustaceans. Underwater surveys of the Waikalua-Loko Fishpond are impossible to conduct in this pond because of year-round new zero visibility caused by exceedingly shallow water, silty bottom, and prevailing winds. Underwater surveys are further prohibited by the presence of very large and potentially dangerous barracuda.

Response to your comments regarding page 59:

As we noted on page 1 of this letter, we agree that the proposed project will require a Coast Guard permit and we intend to pursue this item further.

Response to your comments regarding page 62:

You state that nearby waters "contain[s] a multitude of species and large quantities of several of these species."

That portion of Kaneohe Bay fronting Kaneohe and Kawa Streams is widely known to harbor an exceedingly low diversity of marine organisms as a result of erosion from upland development, former wastewater discharges, shoreline disturbances, silt and sediment deposition and polluted runoff waters. (The Atlas of Kaneohe Bay: A Reef Ecosystem Under Stress [1973 by Smith, Chave and Kam and published by the Hawaii Sea Grant Program] is a good reference document.) These conditions were substantiated in the marine baseline surveys conducted for this project in March-April 1989. The mouth of Kaneohe Stream simply lacks the habitat necessary to support most fish and invertebrates. Fishes were few and number and populations were exceedingly small in the inshore reaches of the study area, but increase with distance from the shore.

Regarding the recreational and marine-gathering uses of the area, there was not a single individual observed conducting any type of water-dependent recreation during repeated visits to the site during the March-April 1989 survey period. The known high pollutant levels associated with Kaneohe Stream suggest that water-contact recreation in Kaneohe Stream and adjacent reef flats should be avoided.

We note that the parcel which you indicated is used by the public for recreational activities (TMK 4-5-08: parcel 38) has been purchased by Pacific Atlas (Hawaii), Inc.

Response to your comments regarding page 63:

Pacific Atlas (Hawaii), Inc. proposes to establish shoreline access along the easternmost boundary of the project site. The DEIS will be revised to include this information.

Response to your comments regarding page 70:

The distinction you suggest between a golf course and a City park is noted and will be incorporated in the EIS.

Response to your comments regarding page 72:

As we noted earlier, the known high pollutant levels associated with Kaneohe Stream suggest that water-contact recreation in Kaneohe Stream and adjacent reef flats should be avoided.

Leaving the stream banks in their present wild state would depend on the golf course design and how these plants could be incorporated in the landscaping plan. As we noted earlier in this letter, the majority of the species on the site are introduced or alien. Hence, there is no significant need to preserve these species. Further, we would likely not use the mangrove because of its noxious qualities.

Response to your comments regarding page 73:

As we noted previously in this letter, the bridge over Kaneohe Stream will be designed to meet Coast Guard requirements over navigable water.

Response to your comments regarding page 91:

As we discussed earlier in this letter, access for construction vehicles to the 12th hole will be via TMK: 4-5-08:38 which directly connects to Waikalua Road. During the operation of the golf course, the bridge will provide adequate access for maintenance vehicles and golf carts.

Thank you for your comments on the Draft Environmental Impact Statement for the proposed Bayview Golf Course Expansion.

Sincerely yours,

TYRONE T. KUSAO, INC.

Tyrone T. Kusao

cc: State Office of Environmental Quality Control
Bennett Mark, City Department of Land Utilization

REFERENCES

REFERENCES

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APPENDICES

APPENDIX A

NOISE STUDY FOR BAYVIEW GOLF COURSE EXPANSION, KANEOHE, OAHU

Prepared by Y. Ebisu and Associates, June 1989

NOISE STUDY FOR
BAYVIEW GOLF COURSE EXPANSION
KANEOHE, OAHU

Prepared for:

HIDA, OKAMOTO & ASSOCIATES, INC.

Prepared by:

Y. EBISU & ASSOCIATES
1126 12th Avenue, Room 305
Honolulu, Hawaii 96816

JUNE, 1989

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CHAPTER 1. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed Bayview Golf Course expansion project were evaluated for their potential impact along roadways which would service the project. The change in future traffic noise levels associated with the expansion project traffic are anticipated to be very low.

Due to the relatively small increases in traffic anticipated to result from the expansion project, risks of adverse noise impacts from traffic noise increases are considered to be low, and the proposed project should not cause adverse noise impacts along the roadways servicing the project. For these reasons, special traffic noise mitigation measures are not considered necessary.

Risks of adverse noise impacts from clubhouse activities are also low due to the probable use of total closure and air conditioning of the facility. Due to the relatively large buffer distance between the proposed clubhouse and neighboring church property, noise mitigation measures for the clubhouse will probably be limited to measures such as closure and air conditioning of the clubhouse facility.

Risks of adverse noise impacts from tennis court activities are also low due to the large distances between the courts and the neighboring church, as well as the relatively high level of background traffic noise at the proposed location of the tennis courts.

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CHAPTER II. PURPOSE

The purposes of this noise study were to predict and evaluate the traffic noise increases associated with motor vehicle traffic to and from the proposed expansion of the Bayview Golf Course. The scope of the noise study included evaluations of potential noise impacts on existing residences and noise sensitive receptors within the project environs. The proposed project will increase the area of the existing Bayview Golf Course by approximately 250 percent, and will include a full-size, 18-hole golf course, a clubhouse with dining area and ballroom, and supporting facilities. In addition to potential noise impacts from increased traffic noise levels, potential noise impacts from on-site recreational activities associated with the proposed project were also evaluated.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies to assess environmental noise is the Day-Night Average Sound Level (Ldn). This descriptor incorporates a 24-hour average of instantaneous A-Weighted Sound Levels as read on a standard Sound Level Meter. The minimum averaging period for the Ldn descriptor is 24 hours (by definition). Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the Ldn descriptor. A more complete list of noise descriptors is provided in APPENDIX B to this report.

TABLE 1, derived from Reference 1, presents current federal standards and acceptability criteria for residential land uses exposed to various levels of environmental noise. Noise levels typical of communities on Oahu are shown in FIGURE 1. As a general rule, noise levels of 55 Ldn or less occur in rural areas, or urbanized areas which are shielded from high volume streets. In urbanized areas, Ldn levels generally range from 55 to 65 Ldn, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 Ldn, and as high as 72 Ldn when the roadway is a high speed freeway. Due to noise shielding effects from intervening structures, residences which are located within interior lots are usually exposed to lower noise levels of 60 Ldn or less.

For the purposes of determining noise acceptability for funding assistance from federal agencies (FHA/HUD and VA), an exterior noise level of 65 Ldn or lower is considered acceptable. This standard is applied nationally (see Reference 2), including Hawaii. Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 Ldn does not

TABLE 1

EXTERIOR NOISE EXPOSURE CLASSIFICATION (RESIDENTIAL LAND USE)

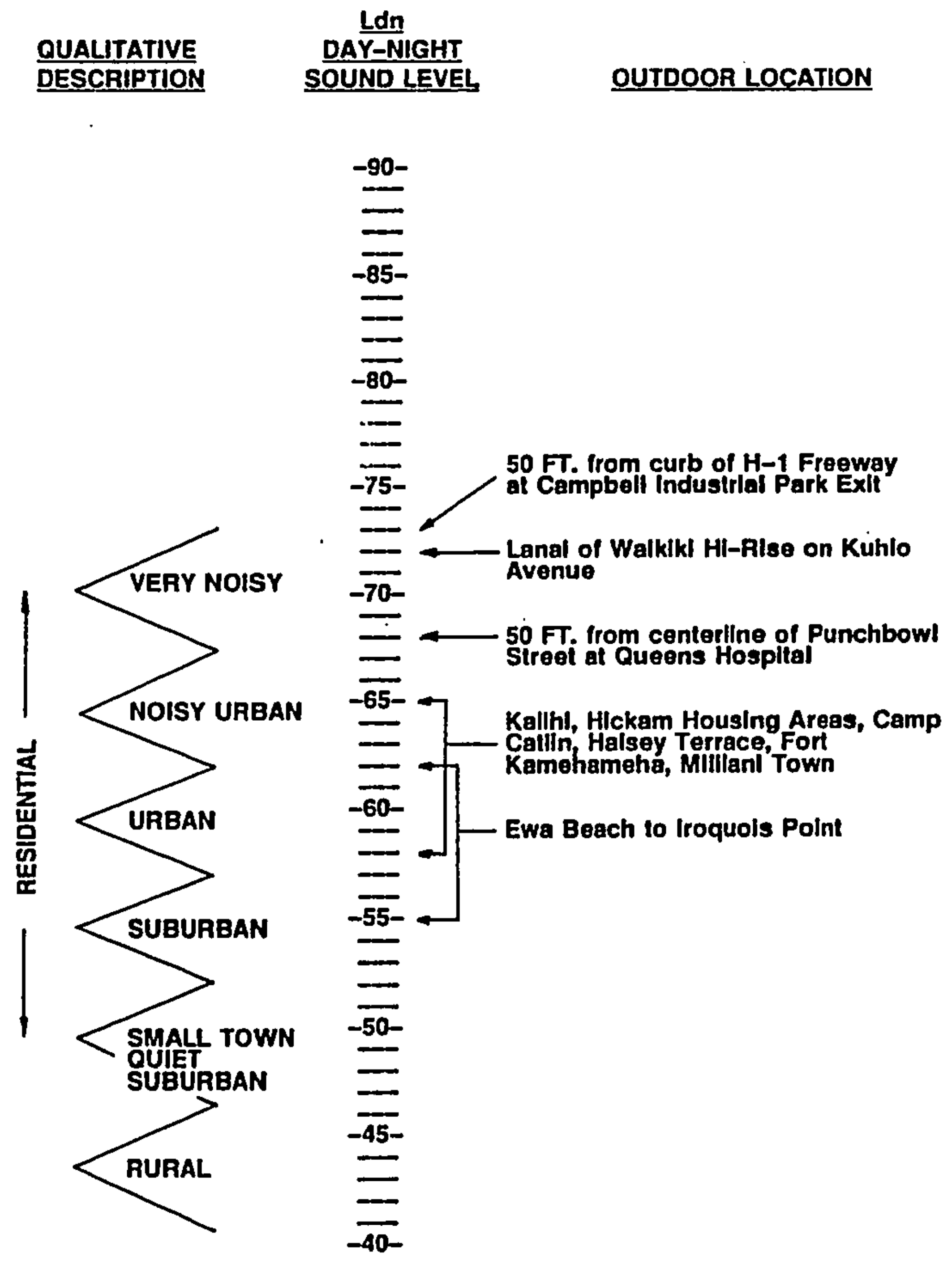
NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL[1] STANDARD
Minimal Exposure	Not Exceeding 55 L_{dn}	Not Exceeding 55 L_{eq}	Unconditionally Acceptable
Moderate Exposure	Above 55 L_{dn} But Not Above 65 L_{dn}	Above 55 L_{eq} But Not Above 65 L_{eq}	Acceptable[2]
Significant Exposure	Above 65 L_{dn} But Not Above 75 L_{dn}	Above 65 L_{eq} But Not Above 75 L_{eq}	Normally Unacceptable
Severe Exposure	Above 75 L_{dn}	Above 75 L_{eq}	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the L_{eq} instead of the L_{dn} descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 L_{eq}.

FIGURE 1

RANGE OF EXTERIOR BACKGROUND AMBIENT NOISE LEVELS



eliminate all risks of noise impacts. For these reasons, and as recommended in Reference 3, a lower level of 55 Ldn is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise. However, after considering the cost and feasibility of applying the lower level of 55 Ldn, government agencies such as FHA/HUD and VA have selected 65 Ldn as a more appropriate regulatory standard.

State Department of Health (DOH) noise regulations (References 4 and 5) apply on the island of Oahu, and are intended to minimize noise impacts from stationary as well as motor vehicle noise sources. These regulations would apply to all noise sources within the boundaries of the project site, as well as to light and heavy vehicles which would travel to and from the site on public roadways (or trafficways). Unless the routes used by heavy vehicles to and from the project site are designated as truck routes by the Director of Health, heavy vehicles traveling to and from the project facilities will be required to comply with the vehicle noise emission limits of Reference 5. The most stringent limit of Reference 5 is the requirement that heavy vehicles of 10,000 pounds or greater gross weight not emit noise levels exceeding 73 dBA at 50 FT distance if operated during the hours from 10:00 PM to 6:00 AM on a public trafficway.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing background ambient noise levels were measured at three locations in the project environs to provide a basis for developing the project's traffic noise contributions along Kaneohe Bay Drive, as well as for describing the existing noise environment at noise sensitive locations which are removed from roadway traffic. The locations of these three measurement sites are shown in FIGURE 2. Measurements were performed on March 11 and 23, 1989 during the off-peak traffic period (on Saturday) as well as during the PM peak hour period on a Thursday. The results of the noise measurements were also compared to calculations of existing traffic noise levels to validate the traffic noise computer model used. These noise measurement results, and their comparisons with computer model predictions are summarized in TABLE 2.

Traffic noise calculations for the existing conditions as well as noise predictions for the Year 1993 following completion of the proposed development were performed using the Federal Highway Administration (FHWA) Noise Prediction Model (Reference 6). Traffic data entered into the noise prediction model were: hourly traffic volumes; average vehicle speeds; and estimates of traffic mix. The traffic study for the project (Reference 7), Hawaii State DOT traffic counts at the intersection of Kaneohe Bay Drive and Kokokahi Place (Reference 8), and Hawaii State DOT traffic counts at the intersection of Likelike Highway and Kaneohe Bay Drive (Reference 9) were the primary sources of data inputs to the model. For existing and future traffic, it was assumed that the PM peak hour Leq(h) was equal to the 24-hour Ldn. This assumption was based on computations of the hourly Leq and 24-hour Ldn of traffic noise along Kaneohe Bay Drive at Kokokahi Place.

The projected increases in traffic noise levels attributable to project related traffic were calculated, and noise impact risks evaluated. The relative contributions of non-project and project related traffic to the total noise levels were also calculated,

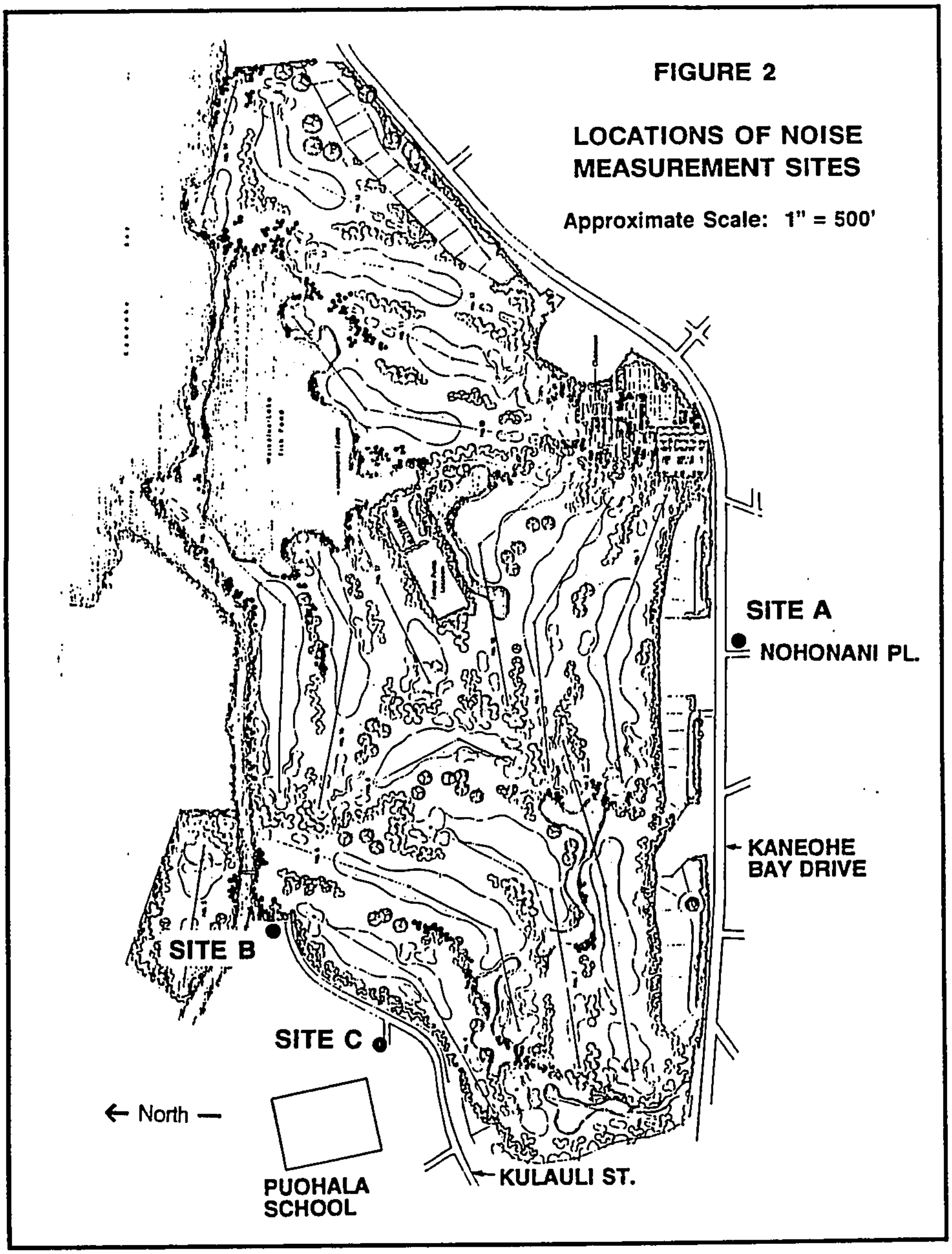


FIGURE 2
LOCATIONS OF NOISE MEASUREMENT SITES
Approximate Scale: 1" = 500'
SITE A
NOHONANI PL.
KANEOHE BAY DRIVE
SITE B
SITE C
North
PUOHALA SCHOOL
KULAULI ST.

TABLE 2

TRAFFIC NOISE MEASUREMENTS
(MARCH, 1989)

Location	Time of Day (HRS)	Ave.Speed (MPH)	Hourly Traffic Volume Auto	Hourly Traffic Volume Med.Truck	Hourly Traffic Volume Heavy Truck	Measured Leq (dB)	Predicted Leq(dB)
A. 70 FT from the center-line of Kaneohe Bay Drive (3/11/89).	1022 TO 1105	37	1,461	39	66	68.9	68.8
A. 70 FT from the center-line of Kanoehe Bay Drive (3/11/89).	1105 TO 1130	37	1,773	47	47	68.1	68.3
B. Off Kulauli Street (Background Ambient) (3/11/89).	1155 TO 1208	N/A	N/A	N/A	N/A	51.1	N/A
C. Off Kulauli Street at Puohala Elementary School (3/11/89.	1212 TO 1228	N/A	N/A	N/A	N/A	51.9	N/A
A. 70 FT from the center-line of Kanoehe Bay Drive (3/23/89).	1540 TO 1700	35	2,273	53	53	68.3	68.3

and an evaluation of possible traffic noise impacts was made.

The possibility of adverse noise impacts from on-site activities were evaluated by comparing predicted noise levels along the property lines of the project with existing background ambient noise levels in the project environs and with the existing separation distances (or buffer space) to the nearest noise sensitive neighbors.

CHAPTER V. EXISTING NOISE ENVIRONMENT

The existing traffic noise levels at homes fronting Kaneohe Bay Drive in the project environs are high, and in the "Significant Exposure, Normally Unacceptable" category at approximately 65 to 70 Ldn. This condition is typical along highways and major roadways of Oahu (see FIGURE 1). Traffic noise levels along a highway Right-of-Way generally represent the worst case (or highest) levels due to the close proximity of the Right-of-Way to the noise sources. Traffic noise levels at 100 to 300 FT setback distances from the highway centerline are generally in the "Minimal Exposure, Unconditionally Acceptable" to "Moderate Exposure, Acceptable" categories, with 5 to 10 Ldn lower noise levels resulting from shielding and distance effects. An exception occurs for elevated receptor locations which are not shielded from the roadway by intervening terrain features or man-made structures. Because the lands which are inland (or mauka) and immediately adjacent to Kaneohe Bay Drive in the vicinity of the project are not vacant and because existing traffic noise levels are relatively high, adverse noise impacts from existing levels of traffic are possible.

Results of calculations of existing traffic noise levels along Kaneohe Bay Drive during the AM and PM peak hour periods are shown in TABLE 3. The traffic volumes used for the peak hour periods were obtained from Reference 7. TABLE 4 presents the calculated setback distances between the roadway centerlines and the iso-noise contours associated with the 60, 65, and 70 Ldn levels of existing traffic noise. FIGURES 3 and 4 depict the hourly variations of existing traffic noise levels [Leq(h)] at 70 FT setback distance from the two roadway sections which would service the proposed project. Station 31-B is located at the intersection of Kaneohe Bay Drive and Kokokahi Place, and Station 31 is located at the intersection of Kaneohe Bay Drive and Likelike Highway. The traffic noise levels shown in the tables only apply when unob-

TABLE 3

COMPARISONS OF EXISTING AND FUTURE TRAFFIC NOISE LEVELS
ALONG ACCESS ROADS TO PROJECT SITE
(50 FT FROM ROADWAY CENTERLINES)

LOCATION	SPEED (MPH)	VPH	***** HOURLY LEQ IN dB **** AUTO	MT	HT	ALL VEH
EXISTING PM PEAK HR. TRAFFIC:						
Kaneohe Bay Dr.(West of Proj.)	35	2,440	66.4	62.1	65.7	69.9
Kaneohe Bay Dr.(Front. Proj.)	35	2,373	66.2	62.0	65.6	69.8
Kaneohe Bay Dr.(East of Proj.)	35	2,325	66.2	61.9	65.5	69.7
Golf Course Access Rd.	20	25	37.4	30.0	25.9	38.4
CY 1993 PM PEAK HR. TRAFFIC:						
Kaneohe Bay Dr.(West of Proj.)	35	2,575	66.6	62.4	66.0	70.1
Kaneohe Bay Dr.(Front. Proj.)	35	2,510	66.5	62.3	65.9	70.0
Kaneohe Bay Dr.(East of Proj.)	35	2,525	66.5	62.3	65.9	70.0
Golf Course Access Rd.	20	60	41.2	33.8	29.7	42.2

Note: (1) Assumed traffic mix of 95.0% autos, 2.5% medium trucks, and 2.5% heavy trucks used for existing and future conditions.

TABLE 4

EXISTING AND FUTURE DISTANCES TO 60, 65, AND 70 Ldn CONTOURS

STREET SECTION	60 Ldn SETBACK (FT)		65 Ldn SETBACK (FT)		70 Ldn SETBACK(FT)	
	EXISTING	FUTURE	EXISTING	FUTURE	EXISTING	FUTURE
Kaneohe Bay Dr.(West of Proj.)	228	236	106	110	49	51
Kaneohe Bay Dr.(Front. Proj.)	223	232	104	108	48	50
Kaneohe Bay Dr.(East of Proj.)	220	233	102	108	48	50
Golf Course Access Rd.	2	3	1	2	0	1

Notes:

(1) All setback distances are from the roadways' centerlines.
(2) See TABLE 3 for traffic volume, speed, and mix assumptions.
(3) Ldn assumed to be equal to Peak Hour Leq along all roadways.
(4) Setback distances are for unobstructed line-of-sight and soft ground conditions.

FIGURE 3

HOURLY VARIATIONS OF TRAFFIC NOISE AT 70 FEET SETBACK DISTANCE FROM THE CENTERLINE OF KANEOHE BAY DRIVE AT STATION 31-B (CY 1986)

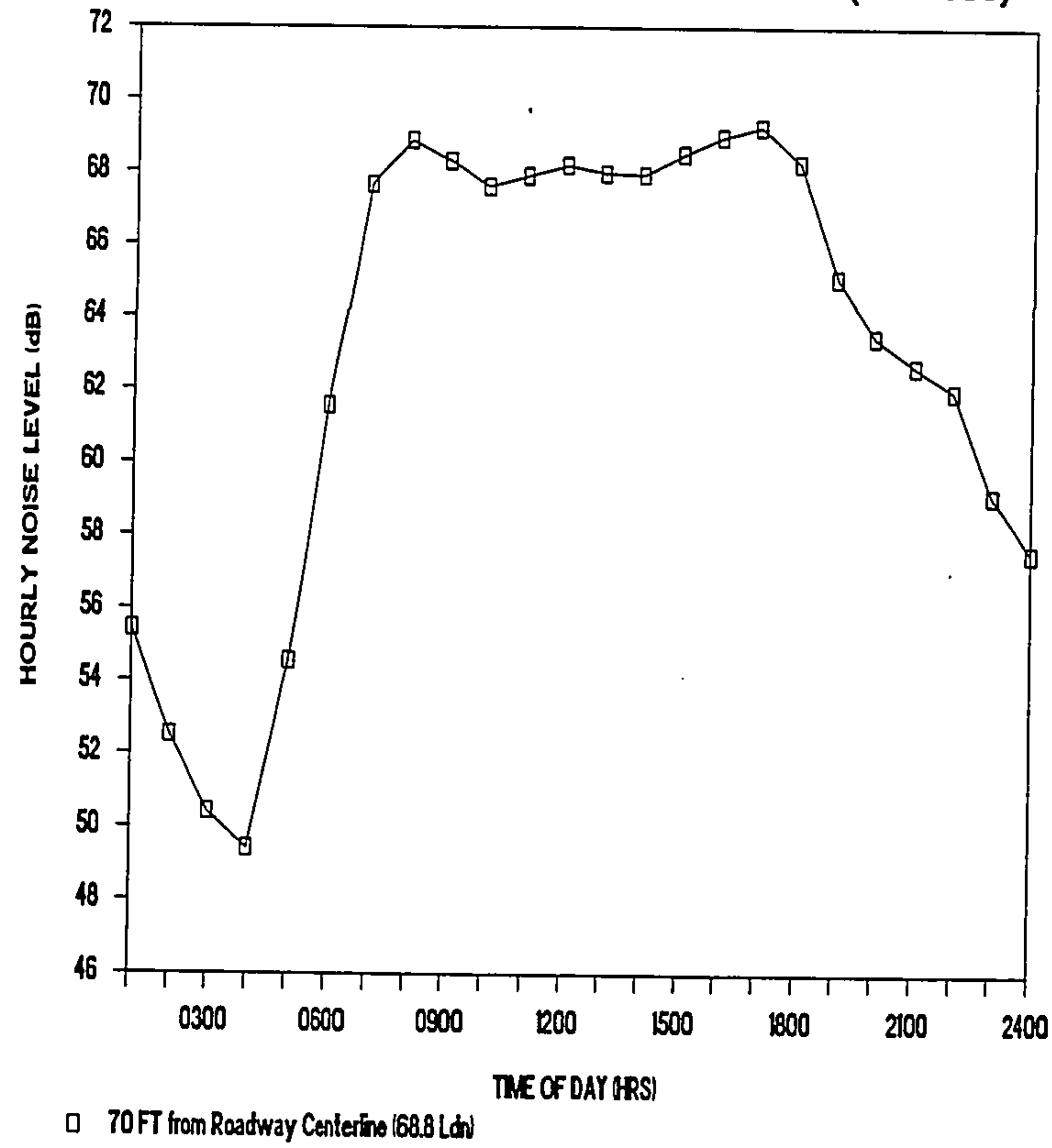
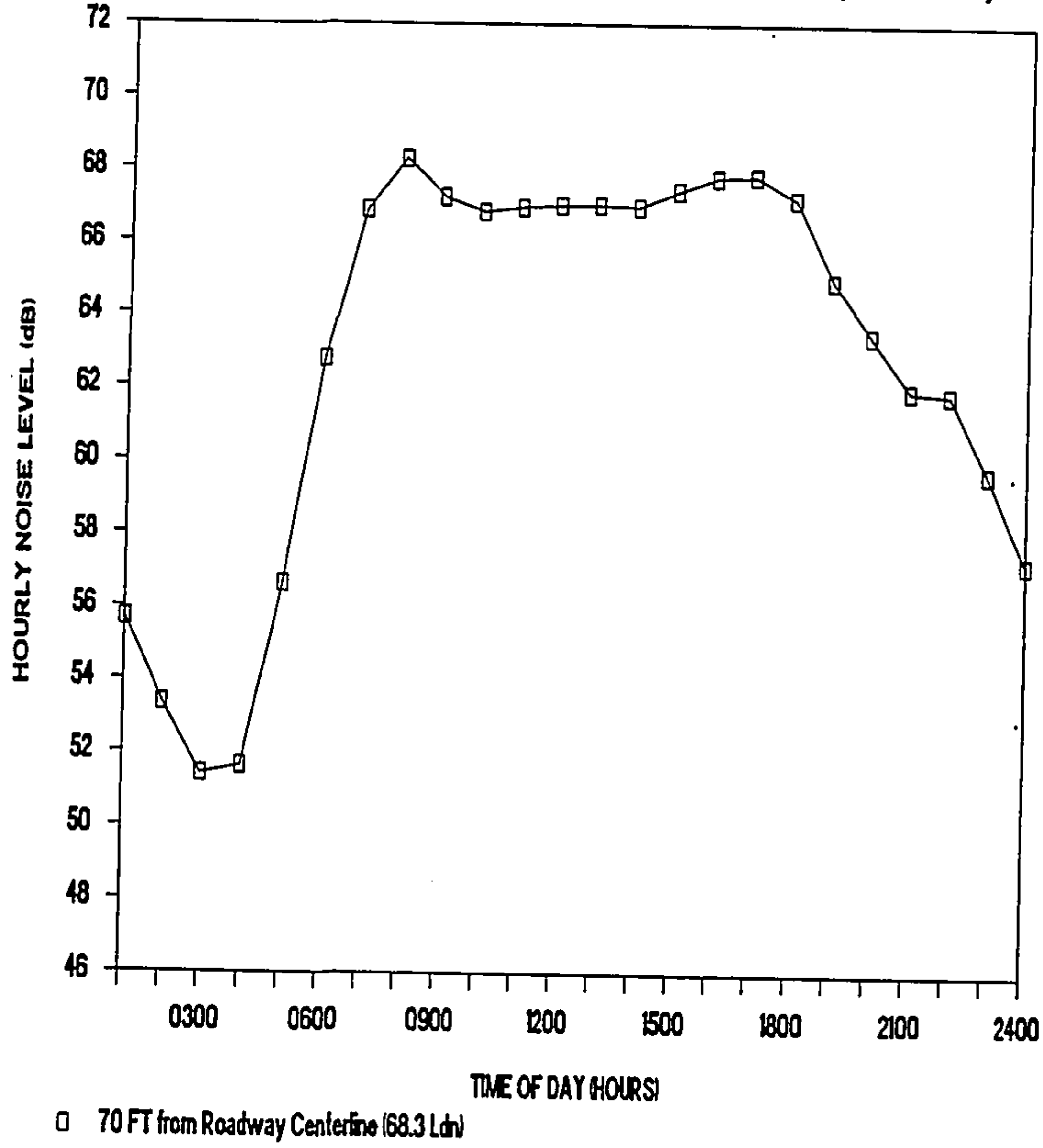


FIGURE 4

HOURLY VARIATIONS OF TRAFFIC NOISE AT 70 FEET SETBACK DISTANCE FROM THE CENTERLINE OF KANEOHE BAY DRIVE AT STATION 31 (CY 1987)



structed line-of-sight conditions exist to the roadways. These conditions would generally occur along the Right-of-Way, within any open space fronting the roadway, or at the upper levels of any man-made structure or natural terrain feature.

The existing traffic noise levels along Kaneohe Bay Drive are high (approximately 70 Ldn) at 50 FT setback distance from the roadway centerline. Maximum noise levels (Lmax) associated with heavy truck traffic on the roadway are in the order of 85 dB at this setback distance. Minimum background ambient noise levels of approximately 45 to 50 dB occur between periods of traffic flow.

The existing noise levels in the residential areas west of the golf course and in the vicinity of noise measurement Sites B and C are low, and are approximately 50 Ldn. During the quiet periods between local traffic, background ambient noise levels along the roadway are controlled by the sound of birds, wind, and distant traffic, and range from 35 to 40 dB.

The existing noise levels at the rear of the existing church at the southeast end of the project site are controlled by traffic noise, and are approximately 50 to 60 Ldn. Along the sides of the existing church which face Kaneohe Bay Drive, existing traffic noise levels are higher at 65 to 68 Ldn.

CHAPTER VI. FUTURE TRAFFIC NOISE ENVIRONMENT

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 7. The future projections of project plus non-project traffic on the roadway sections which would service the project are shown in TABLE 3 for the afternoon or PM peak hour of traffic in CY 1993. TABLE 4 summarizes the predicted increases in setback distances to the 60, 65, and 70 Ldn traffic noise contour lines along the roadways servicing the project and attributable to increases in project plus non-project traffic by CY 1993.

From TABLE 3, minimal project plus non-project traffic noise increases of 0.2 to 0.4 dB are predicted to occur by CY 1993 along the three sections of Kaneohe Bay Drive which are expected to service the proposed project. Increases in traffic noise along these roadway sections, which are attributable to project traffic range from 0.0 to 0.2 dB, which are considered to be minimal. The future traffic noise environment in the project environs will not be significantly changed by the proposed project due to the relatively low volumes of traffic expected to be generated by the project.

Based on the maximum of 300 parking stalls planned for the clubhouse facility, an anticipated maximum of 300 vehicle trips is predicted during the period immediately before and after a social function at the clubhouse. This additional volume of traffic which could occur on Kaneohe Bay Drive between the hours of 10:00 AM to 10:00 PM will not affect the forecasted noise levels as measured by the Ldn descriptor along Kaneohe Bay Drive due to the dominating influence of non-project traffic on total forecasted noise levels.

CHAPTER VII. DISCUSSION OF PROJECT RELATED TRAFFIC NOISE IMPACTS AND POSSIBLE NOISE MITIGATION MEASURES

The increases in traffic noise levels attributable to the project are predicted to be less than 0.2 dB (or Ldn) along the three roadway sections of Kaneohe Bay Drive which are expected to service the project. An increase in traffic noise of less than 0.2 dB should not be perceptible and is not considered to be significant.

In absolute terms, and due to non-project traffic, forecasted noise levels along Kaneohe Bay Drive are expected to exceed the 65 Ldn FHA/HUD standard at 108 FT to 110 FT setback distance from the roadway's centerline. Existing and future residences along Kaneohe Bay Drive which are not shielded from traffic noise by walls, buildings, or natural terrain features but are at setback distances less than 108 to 110 FT from the roadway's centerline can be expected to be exposed to "Significant, Normally Unacceptable" traffic noise levels.

For those homes within 108 to 110 FT setback distance from the centerline of Kaneohe Bay Drive, the only available noise mitigation measures are closure and air conditioning of rooms facing the traffic, the construction of sound attenuating walls which block the line-of-sight to the traffic noise sources on the roadway, and the installation of sound attenuating treatment to windows which face the roadway traffic.

CHAPTER VIII. OTHER NON-TRAFFIC NOISE CONSIDERATIONS

Adverse noise impacts from the planned clubhouse activities are not anticipated due to the normally available option of total closure and air conditioning of the facility's dining and social function areas. In addition, a relatively large buffer distance of approximately 250 FT is planned between the facility and its nearest noise sensitive neighbor--an existing church near the southeast corner of the project site on Kaneohe Bay Drive.

Risks of adverse noise impacts from tennis court activities are also expected to be low due to the large distance (200+ FT) between the courts and the neighboring church, as well as the relatively high level of background traffic noise at the proposed location of the tennis courts. The maximum racquet-on-ball impact noise and players' voices during play on the proposed tennis courts are not expected to exceed 60 dB outside the neighboring church building. At the church building, average and maximum roadway traffic noise levels are expected to be higher (60 and 75 dB, respectively) than noise levels associated with tennis activity. Because of this, adverse noise impacts are not expected from the proposed tennis courts.

Short term noise impacts associated with construction of the project may occur. Permissible noise levels during construction are regulated by the State Department of Health under the permit procedures of Reference 4. Use of these procedures by contractors has been successful in mitigating construction noise, and should also be used on this project.

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(3) "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety;" Environmental Protection Agency (EPA 550/9-74-004); March, 1974.

(4) "Title 11, Administrative Rules, Chapter 43, Community Noise Control for Oahu;" Hawaii State Department of Health; November 6, 1981.

(5) "Title 11, Administrative Rules, Chapter 42, Vehicular Noise control for Oahu;" Hawaii State Department of Health; October 27, 1981.

(6) "Barry, T. and J. Reagan, "FHWA Highway Traffic Noise Prediction Model," FHWA-RD-77-108, Federal Highway Administration, Washington, D.C., December 1978.

(7) "Traffic Impact Assessment Report - Bay View Golf Course;" Pacific Planning & Engineering, Inc.; April, 1989.

(8) February 10-11, 1986 24-hour Traffic Counts and Vehicle Type Classification, Station 31-B, Kaneohe Bay Drive at Kokokahi Place; State Department of Transportation.

(9) November 17-18, 1987 24-hour Traffic Counts, Station 31, Kaneohe Bay Drive at Likelike Highway; State Department of Transportation.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

TABLE I

A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

	TERM	SYMBOL
1.	A-Weighted Sound Level	L_A
2.	A-Weighted Sound Power Level	L_{WA}
3.	Maximum A-Weighted Sound Level	L_{max}
4.	Peak A-Weighted Sound Level	L_{Apk}
5.	Level Exceeded x% of the Time	L_x
6.	Equivalent Sound Level	L_{eq}
7.	Equivalent Sound Level over Time (T) (1)	$L_{eq(T)}$
8.	Day Sound Level	L_d
9.	Night Sound Level	L_n
10.	Day-Night Sound Level	L_{dn}
11.	Yearly Day-Night Sound Level	$L_{dn(Y)}$
12.	Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified a $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78, NOISE REGULATION REPORTER.

TABLE II

RECOMMENDED DESCRIPTOR LIST

TERM	A-WEIGHTING	ALTERNATIVE[1] A-WEIGHTING	OTHER[2] WEIGHTING	UNWEIGHTED
1. Sound (Pressure)[3] Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level[4] Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_d	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average value over (non-time domain) set of observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level exceeded x% of the total set of (non-time domain) observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is Leq(1). Time may be specified in non-quantitative terms (e.g., could be specified as Leq(WASH) to mean the washing cycle noise for a washing machine.

APPENDIX B

BASELINE MARINE, ESTUARINE AND STREAM SURVEYS: BAYVIEW GOLF COURSE EXPANSION, SOUTH KANEOHE BAY, OAHU, HAWAII

Prepared by Brewer / Brandman Associates, May 1989

Brewer-Brandman Associates

Environmental Research ■ Planning and Processing ■ Resources Management

Baseline Marine, Estuarine and Stream Surveys Bayview Golf Course Expansion South Kaneohe Bay, Oahu, Hawaii

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May 1989

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SECTION 1.0

INTRODUCTION

The scope of services was to provide baseline marine, estuarine and freshwater biological and water quality support for an environmental assessment of the proposed expansion of the Bayview Golf Course, Kaneohe, Hawaii (Figure 1).

Specific services included the following:

1. Qualitative underwater biological surveys encompassing nearshore coastal water habitats (identification and assessment of corals, algae, fishes and invertebrates);
2. Qualitative surveys of intertidal flora and fauna (high and low tide periods);
3. Physical-chemical characterization of coastal and nearshore marine environments (temperature, salinity, dissolved oxygen, and turbidity) at various tidal periods;
4. Qualitative underwater (or as applicable) biological surveys of existing ancient Hawaiian fishponds, stream channels (including estuarine reaches), and existing wetlands (fish and invertebrates); and,
5. Physical-chemical characterization of ancient Hawaiian fishponds, existing stream channels (including estuarine reaches), and existing wetlands at various tidal periods (temperature, salinity, dissolved oxygen, turbidity).

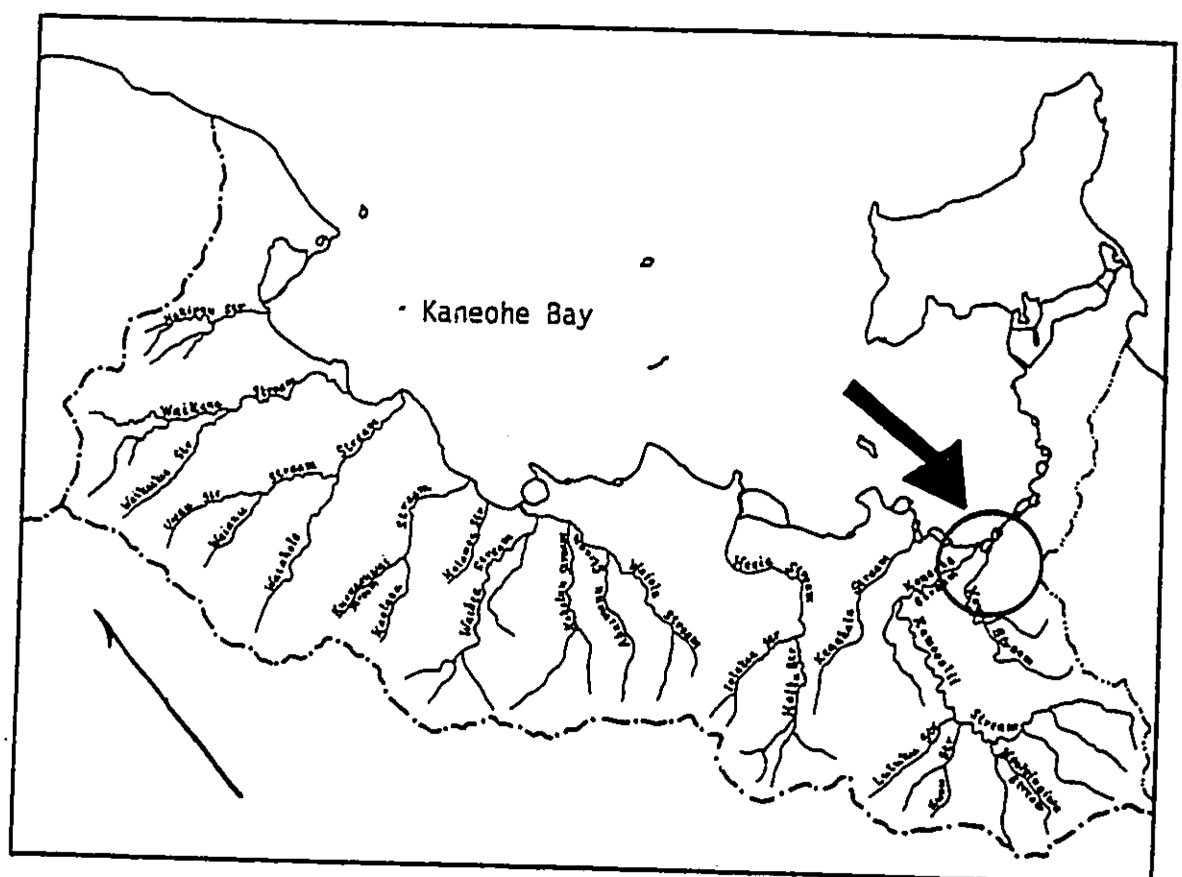

Figure 1. Location Map, Kaneohe Bay.

SECTION 2.0
METHODS

2.1 Physical-Chemical Measurements

Salinity and temperature measurements were made with a Yellow Springs Instrument Company (YSI) S-C-T meter equipped with a YSI Model 3300 nickel-platinum conductivity and temperature probe. All measurements were based on *in situ* readings from the shoreline or from an inflatable boat. Based on manufacturer-supplied data, worst case instrument and probe (combined) error for temperature and salinity are ± 0.7 degrees Centigrade (^{0}C) and ± 0.2 parts per thousand (ppt), respectively. Some reading were made by *averaging* meter oscillations because of the efflux of brackish groundwater in the nearshore and estuarine reaches of both Kawa and Kaneohe Streams.

Dissolved oxygen measurements were obtained using a YSI Model 51B dissolved oxygen meter equipped with a YSI Model 5739 pressure-compensated, polarographic probe. The instrument was calibrated according to factory guidelines in a water vapor saturated chamber. Measurements were based on *in situ* readings from the shoreline or from an inflatable boat. Manufacturer's data indicate a probable error accumulation (maximum worst-case) of ± 0.52 parts per million (ppm).

Turbidity measurements were made with a Turner Nephelometer. Field samples were collected and returned to the laboratory for analysis within two hours of collection. Water quality sampling station locations are depicted in Figures 2 and 3.

2.2 Biological Surveys

2.2.1 Nearshore Marine and Fishpond Environments

Biological surveys were conducted with mask and snorkle apparatus to assess qualitatively the major physiographic features, biological zonation patterns, and benthic assemblages occurring throughout the study area. Underwater surveys were limited to a depth of about 3 m, which was the maximum depth recorded near mouths of Kaneohe and Kawa Streams. No effort was made to identify or enumerate cryptic species dwelling within the reef flats or mudflats. All observations were recorded on waterproof Polypaper sheets and supplemented by underwater photographs using a Nikonos II underwater camera.

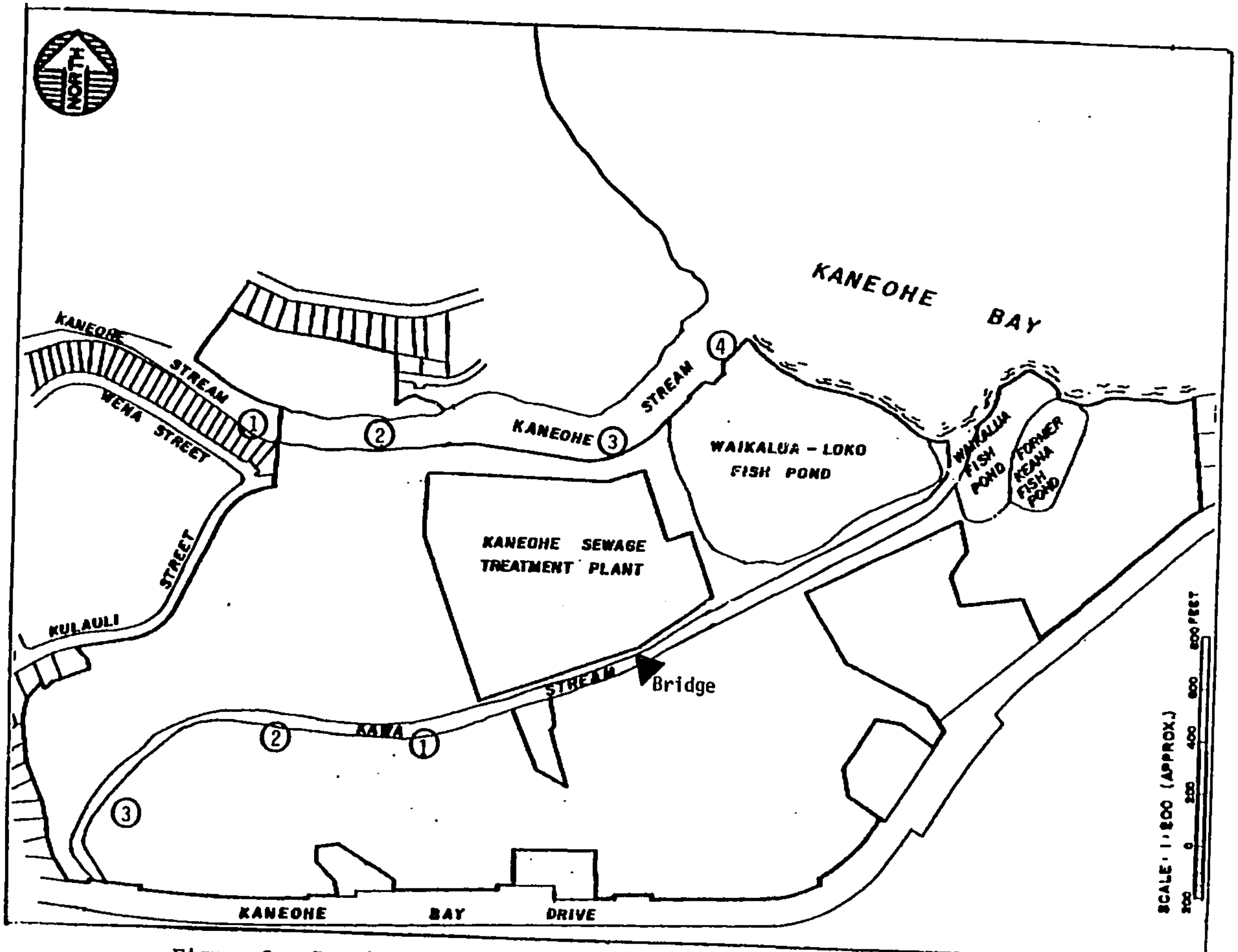

Figure 2. Bayview Golf Course: Water Quality Sampling Stations and Present Alignment of Kawa Stream.

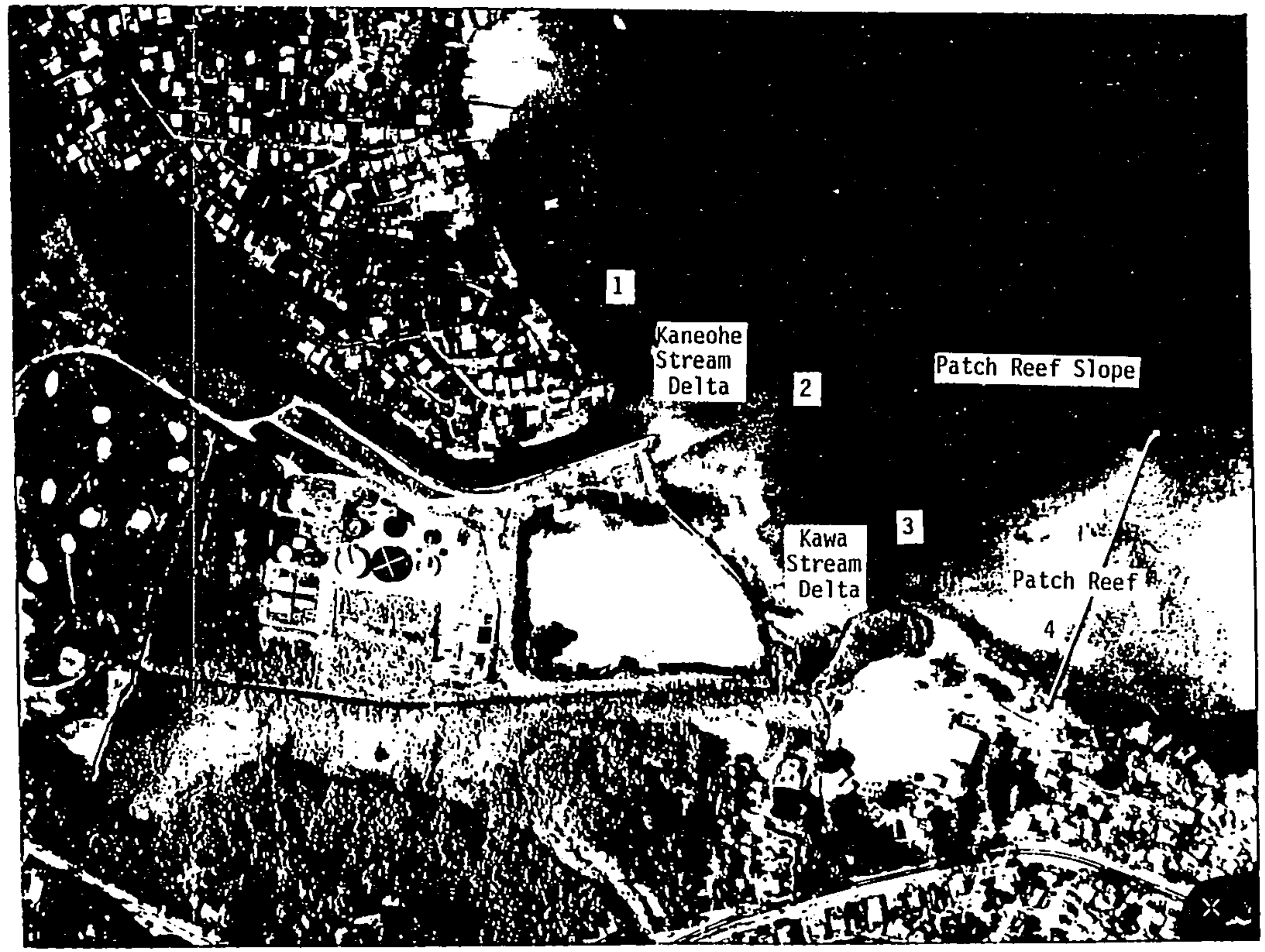

Figure 3. Water Quality Sampling Stations and Major Biological Zones, Kaneohe Bay.

Roughly 7 hours were spent, over a period of several weeks (made necessary by prevailing high nearshore water turbidities), conducting underwater surveys. Underwater visibility was poor in all areas surveyed during all survey periods. Prevailing high nearshore turbidity levels were likely responsible for certain species being omitted from the data record.

Tides ranged from -0.5 to 2.4 feet (ft) during diurnal surveys, which occurred between March 31 and May 11, 1989. Surveys conducted at night would have accounted probably for additional species.

Macrothallic algae and coral coverage was determined by visual estimates of abundance or percent coverage.

Benthic invertebrate identification and enumeration was limited to individuals exceeding 2 centimeters (cm) along the longest body axis, though certain especially numerous, albeit smaller, invertebrates were recorded occasionally. Where appropriate, counts or population density estimates of certain benthic invertebrates were made with either a 0.10 square meter (m^2) stainless steel grid, or with an aluminum meter stick, which was used to lay out crude 0.25 or 1 m^2 quadrants. Rocks and debris were turned over occasionally in an effort to identify cryptic species. Because of the preponderance of soft, unconsolidated bottom sediments, efforts at quantifying benthic invertebrates were hampered by limited underwater visibility.

Fish identification and abundance estimates were made by the diver recording all species sighted during the underwater surveys. Rough counts of represented fishes were tabulated on Polypaper sheets upon which a listing of the more common nearshore reef or estuarine fishes expected to occur in the area had been typed previously. This permitted more time for observations and less time for data recordation.

Semi-quantitative estimates of fish and macroinvertebrate abundance used the following numerical criteria for numbers of individuals sighted in a 30-minute period:

- Abundant = more than 50 individuals;
- Common = 10 to 20 individuals;
- Few = 2 to 9 individuals; and,
- Rare = only 1 individual.

This census method is based upon the premise that more abundant species will be encountered first over a specified time.

The intertidal zone on all headlands and beach areas was censused on foot during low-tide periods on March 31 and May 6, 1989. The latter period tides corresponded from -.0.5 to -0.2 ft. Macroscopic organisms were identified in the field and rough estimates of population size and distribution were noted.

Zero visibility conditions (and the presence of several exceptionally large barracuda) did not permit underwater surveys within Waikalua-Loko fishpond. High turbidities were the synergy of unconsolidated bottom sediments, shallow water, prevailing tradewinds, and the presence of large fishes. Survey data were based on visual estimates from the existing fishpond wall and a meeting with Mr. Gordon Wong, whose home is on the shoreline of Waikalua-Loko Fishpond.

2.2.2 Kawa and Kaneohe Streams

The lower riverine and estuarine reaches of Kawa and Kaneohe Streams were censused using mask and snorkel apparatus. All biological surveys were conducted during periods of low runoff when water turbidities were lowest. During conditions of low runoff, underwater visibility in the estuarine reaches of Kawa Stream ranged between 0.7 to 2.5 m and averaged about 6 m in the upstream, non-tidal, segment adjacent to the golf course. Segments, too shallow to permit underwater observations, were censused by wading. Visibilities within the estuarine reaches of Kaneohe Stream averaged about 2 m or less during periods of low runoff. Because the lower segments of both Kawa and Kaneohe Streams had been dredged and channelized previously, no effort was made to relate species distribution or population density to habitat.

Kawa Stream can be divided into four habitat zones: the estuarine zone, from the mouth to the eastern edge of the golf course; the lower stream, from the golf course to Kaneohe Bay Drive; the middle stream, from Kaneohe Bay Drive to Mokulele Drive; and the upper stream, from Mokulele Drive to the Hawaiian Park Cemetery (VTN Pacific, 1977). For the purposes of this survey only the estuarine and lower stream reaches were surveyed. Kaneohe Stream can be divided similarly into different habitat zones. This study encompassed only the lower and estuarine reaches of the stream (roughly abutting the northern limit of the proposed golf course expansion).

SECTION 3.0

RESULTS

3.1 Water Quality Analyses

3.1.1 Kawa Stream and Estuary

Water quality sampling showed that the lower, estuarine, reaches of Kawa Stream (from the easterly boundary of the golf course to its mouth) is a salinity-stratified environment (Table 3.1), except during heavy runoff conditions. Surface salinities ranged from 0 to 3.8 ppt; bottom water (about 1 to 1.5 m, as a function of tidal period) salinities from 16.25 to 23.5 ppt. Water temperatures in the estuarine segment of the stream were variable. Surface temperatures ranged from 23.8 to 24.8 ^{0}C,

Table 3.1 Water Quality Parameters, Kawa Stream & Estuary.

Location/Station	Date	Time (hr)	Temp. (^{0}C)	Salinity (ppt)	D.O. (ppm)	Turbidity (NTU)
WWTP bridge, sur.	3/31/89	0930	24.8	3.8	7.44	6.54
bot.	"	0931	27.8	23.5	4.15	
Golf Course, 1	"	1015	27.2	0.01	12.48	3.15
Golf Course, 2	"	1027	26.9	0.00	10.55	
Golf Course, 3	"	1038	26.8	0.00	9.54	3.14
Golf Course, 1	4/1/89	1041	26.2	0.01	9.23	
Golf Course, 2	"	1049	25.8	0.00	8.34	
Golf Course, 3	"	1055	25.0	0.00	8.19	
WWTP bridge, sur.	4/5/89	1530	23.8	0.00	7.80	13.50
bot.	"	1530	24.2	16.25	6.42	
Golf Course 1	"	1550	23.4	0.00	7.43	11.00
Golf Course 2	"	1554	23.4	0.00	7.31	
Golf Course 3	"	1559	23.2	0.00	7.67	4.28
WWTP bridge	4/8/89	0950	(heavy, sustained rain)			66.10

with cooler temperatures being associated with overcast skies or heavy runoff. Bottom waters ranged from 24.2 to 27.8 °C., and usually reflected the influence of warmer bay waters. Dissolved oxygen values ranged from 4.15 to 7.8 ppm, with surface waters showing levels about 90% saturation. Dissolved oxygen values in bottom waters were low; roughly 58 to 82% saturation.

Water quality conditions in the mauka (golf course) segment of the stream were a function of runoff conditions. Temperatures ranged from 23.2 to 27.2 °C. Dissolved oxygen values were similarly variable and ranged from 7.31 to 12.48 ppm. The highest dissolved oxygen reading (12.48 ppm, about 190% saturation) corresponded to a period of clear, stagnant (no detectable flow) conditions. This value was likely the result of high photosynthetic rates associated with benthic filamentous algae. The highest temperature, recorded in the mauka reaches of the stream (27.2 °C), was reported during this same period.

Turbidity values were variable as a direct function of runoff conditions. These ranged from 3.14 NTU, during low flow conditions, to 66.1 NTU, which corresponded to near flash-flood conditions.

3.1.2 Kaneohe Stream and Estuary

Water quality parameters associated with the boulder riprap mouth of Kaneohe Stream were similar to those reported for Kawa Stream (Table 3.2). Temperatures ranged from 22.7 to 26.7 °C. The lower value is about 0.5 °C less than the coolest temperature recorded at Kawa Stream. This difference may reflect the higher average discharge volume, larger watershed, and higher elevation, which encompass Kaneohe Stream and its major tributaries.

Salinity stratification was not evident in Kaneohe Stream. The prevailing winds at the exposed stream mouth provide a high degree of vertical mixing. Poor water visibilities, and an assortment of subsurface hazards (broken glass, protruding metal pipes, steel cable, tree limbs and assorted debris), prevented access into more mauka regions of the stream. Salinity values were a function of tidal period and ranged from 0.02 to 29.4 ppt. The lowest values corresponded to low tide periods, when fresh-water dominates the mouth of the stream; the higher values were associated with high tide conditions, when the stream mouth is dominated by Kaneohe Bay waters.

Dissolved oxygen values ranged from 6.9 to 8.29 ppm, which suggests that water quality conditions are more stable in Kaneohe Stream than Kawa Stream. These values correspond to roughly 98 to 106% saturation.

Table 3.2 Water Quality Parameters, Kaneohe Stream & Estuary.

Location/Station	Date	Time (hr)	Temp. (^{0}C)	Salinity (ppt)	D.O. (ppm)	Turbidity (NTU)
Stream Mouth, 1	3/31/89	1044	24.2	0.02	7.37	4.12
Stream Mouth, 2	"	1058	25.4	2.30	7.15	
Stream Mouth, 3	"	1107	26.7	20.45	6.95	
Stream Mouth, 4	"	1118	26.6	25.75	7.05	
Stream Mouth, 1	4/1/89	0955	24.4	0.05	7.95	
Stream Mouth, 2	"	1000	24.9	1.50	6.45	
Stream Mouth, 3	"	1011	25.4	26.60	7.14	
Stream Mouth, 4	"	1020	26.6	29.40	6.90	
Stream Mouth, 1	4/5/89	1610	22.7	0.52	8.29	49.9
Stream Mouth, 2	"	1613	22.7	0.60	8.05	
Stream Mouth, 3	"	1618	23.1	1.05	8.16	
Stream Mouth, 4	"	1624	23.3	2.56	8.23	
Stream Mouth, 1	4/8/89	0945	(heavy, sustained rain)			86.3

3.1.3 Kaneohe Bay Waters

Water quality parameters associated with the nearshore waters fronting the mouths of Kaneohe and Kawa Stream are influenced heavily by tidal period, surface runoff, and subtidal and intertidal groundwater discharges (Table 3.3). As a result, these waters vary in salinity from near full strength seawater (during high tide periods associated with little surface water runoff) to freshwater (during low tide and periods of heavy surface runoff). Water temperatures also vary widely, with cooler temperatures from periods of heavy runoff. Warmer temperatures coincide with high tide periods. Distinct temperature and density gradients were apparent in many, but not all, stations sampled. The range in water quality values is likely to strongly influence the distribution and abundance of nearshore organisms and probably, accounts for the prevailing paucity of marine and intertidal organisms that was observed.

Water temperatures ranged from 22.5 to 26.5 ^{0}C and coincided with tidal periods. Salinity values ranged from a low of 0.9 to

31.1 ppt and corresponded to the tidal period. Dissolved oxygen values were high and ranged from 7.04 to 9.90 ppm. The less saline surface waters demonstrated higher concentrations of dissolved oxygen than subsurface or bottom water samples. Table 3.3 provides evidence of the great range of water quality values associated with a rather small inshore area of Kaneohe Bay during a period of about 3 hours.

Table 3.3 Water Quality Parameters, Kaneohe Bay Delta & Reef Flat.

Location/Station		Date	Depth (m)	Time (hr)	Temp. (°C)	Salinity (ppt)	D.O. (ppm)
Low Tide (-0.5 to -0.2 ft.)							
Bay	1	4/6/89	0.5	1030	22.5	1.1	8.00
Bay	1	"	1.0	1031	22.8	2.2	7.45
Bay	2	"	0.1	1037	23.0	3.4	7.67
Bay	2	"	0.5	1038	23.1	3.8	7.38
Bay	3	"	0.5	1043	22.7	0.9	8.14
Bay	3	"	1.0	1044	24.3	5.9	7.21
Bay	4	"	0.5	1056	23.3	4.9	7.22
Bay	4	"	1.1	1057	24.4	8.8	7.04
High Tide (+1.7 to +1.8 ft.)							
Bay	1	4/6/89	0.5	1310	25.8	23.1	8.90
Bay	1	"	1.9	1311	25.9	30.2	7.80
Bay	2	"	0.5	1315	26.1	26.4	8.85
Bay	2	"	1.8	1315	26.5	30.3	7.24
Bay	3	"	0.5	1322	25.8	20.1	8.32
Bay	3	"	1.5	1323	24.9	29.4	8.00
Bay	4	"	0.5	1333	23.9	19.0	8.13
Bay	4	"	1.4	1334	26.1	31.1	7.59

3.2 Biological Surveys

3.2.1 Kawa Stream and Estuary

The estuarine segment of Kawa Stream extends from its mouth in Kaneohe Bay about 700 m inland to the eastern boundary of the existing golf course (Figure 3). The channel is straight and varies in width from about 7 to 9 m. Water depths range from about 1 to 1.5 m. It was dredged to its present width around 1958, when the wetlands at the mouth were reclaimed for building the Kaneohe wastewater treatment plant. It was subsequently dredged in 1965 to remove accumulated sediment (VTN, Pacific, 1977). The lower portions of the stream are bordered by occasional small stands of the mangrove, *Rhizophora*.

The estuarine reaches of Kawa Stream support a greater diversity of species than the lower stream, opposite the golf course. Represented fishes included juvenile barracuda (*Spyhraena barracuda*) and jacks (*Caranx melampygus*); the kuhliid, *Kuhlia sandwicensis* (*aholehole*); tilapia (*Oreochromis mossambicus*); and juvenile *manini* (*Acanthurus triostegus*) and *ama'ama* (*Mugil cephalus*). The goby, *Psilogobius mainlandi*, was noted in the extreme lower reaches of the estuary, as was a single blenny (*Istiblennius* sp).

The macroinvertebrate fauna was dominated by large numbers of both living and dead specimens of rock oyster, *Ostrea sandvichensis* (oyster) and barnacles (*Balanus* sp.). Crustaceans were represented by the crabs *Grapsus tenuicrustatus, Metopograpsus messor,* and *Thalamita integra*. The former two species were generally associated with rocky intertidal shorelines, mangrove proproots, and the exposed roots of shoreline trees.

Algae were not well represented and included various unidentified turf-building cyanophytes (blue-green algae). These algae form dense mats in more protected reaches of the estuary and appear to assist in stabilizing the benthic sediments. Mats of these diverse microalgal communities are observed occasionally along the upper reaches of exposed roots, having been deposited during heavy runoff conditions. Although undoubtedly important in stabilizing benthic sediments, they appear to experience a rather fugitive existence.

The lower stream zone, opposite the golf course, is characterized by generally sluggish flow, except during periods of heavy runoff. On March 31, 1989, there was virtually no detectable flow. Numerous springs discharge into the stream from the bank on the south (mauka) side of the golf course. Although not measured, this produces a significantly larger flow than is observed where the stream crosses under Kaneohe Bay Drive.

The biota of the lower stream zone is one of low diversity. The largest species observed were tilapia (*O. mossambicus*). They were extremely abundant along the lower (non-tidal) third of the stream, but were less common and smaller in size in the estuarine reaches. Numerically, the poecilids *Poecilia reticulatus* (guppy) and *Gambusia affinis* (mosquito fish) dominated the stream fauna along all reaches of Kawa Stream below Kaneohe Bay Drive. No native fishes were observed.

Invertebrates were limited to the Louisiana crayfish (*Procambarus clarkii*) and, rarely, the freshwater prawn, *Macrobrachium lar*.

Large numbers of the Wrinkled frog, *Rana rugosa*, and a few toads (*Bufo marinus*) occur in or adjacent to stream waters between Kaneohe Bay Drive and the tidally-influenced segment of the stream.

3.2.2 Kaneohe Stream and Estuary

The invertebrate fauna of the rock riprap segment of the Kaneohe Stream mouth was limited to a few grapsid crabs, sponges, and few alive, though abundant shells of oysters (*O. sandvichensis*).

3.2.3 Waikalua-Loko Fishpond

Waikalua-Loko Fishpond encompasses about 12 acres (A) underwater. Various reports have indicated the surface acreage as between 11.9 and 13.4 A. It has rock and mortar wall about 1,420 ft long that was rebuilt in the 1930's. In 1976 the pond was used for experimental oyster culture (Devaney, *et al.*, 1976).

Waikalua-Loko fishpond is inhabited by sizeable but unquantified populations of barracuda (*S. barracuda*) jacks (*Caranx* sp.), mullet (*Mugil cephalus*), milkfish (*Chanos chanos*), and tilapia (*Oreochromis* sp.) (Wong, 1989; personal communication) (Table 3.4). Although once managed for its fishery resource and as an experimental oyster culture operation, it is no longer in commercial production. Three *makahas* provide the principal means of water exchange with Kaneohe Bay waters. Freshwater enters the pond through numerous subtidal springs and during periods of high runoff from Kaneohe Stream, which influences most of the northern section of the pond wall. The only discernible invertebrates associated with the interior of the pond wall and mangrove proproots were rock oysters (*Ostrea*).

3.2.4 Nearshore Reef Flat

The nearshore reef flat, to about 900 m seaward (roughly north) of the mouth of Kaneohe Stream, is a zone of extremely low biological diversity. This zone is largely a sedimentation basin for Kaneohe Stream. Aerial photographs (Figure 3) show a rather distinct delta created by sediment deposition from both Kawa and Kaneohe Streams. The substratum is composed of consolidated and unconsolidated brown terrigenous sediments. As a result, there is little discernible permanent habitat for marine or estuarine species. This zone is influenced by subtidal freshwater springs, resulting in cool water temperatures and appear to be independent of local surface runoff from either Kaneohe or Kawa Streams. Vertical relief is provided by occasional palm fronds, tree trunks and branches, broken bottles, metal scrap and, immediately outside the mouth of Kaneohe Stream, hundreds of golf balls.

Represented species in this biologically impoverished zone included heavily-silted orange sponges; the red alga, *Polysiphonia* sp.; the bivalves *Ostrea* and *Chama* (mostly dead); and, a very modest assortment of fish. Represented fishes included the eagle ray (*Aetobatus narinari*), juvenile mullet and, in shoreline and walled areas dominated by mangrove proproots, small schools of *aholehole* (*K. sandwicensis*). Surveys done during both low (minus tide) and high tide periods yielded no discernible differences in the diversity or density of represented fishes.

Reef flat *walking* surveys conducted during a minus tide on May 6, 1989, failed to reveal the presence of *normal* mudflat crustaceans and mollusks across several acres of exposed mudflats between Kaneohe Bay Beach Park and the mouth of Kawa Stream. Shells of *Nerita picea*, *Patella sandwichensis*, *Crepidula* sp., and *Heliachus* sp. were observed, but live specimens were not seen. These observations suggest that the zone is one of continual sediment deposition, a process that inhibits the development of benthic communities.

3.2.5 Slope Zone

The slope zone, seaward of the Kaneohe Stream delta, demonstrated a low diversity of both benthic and pelagic marine organisms. This zone was dominated by a veneer of silty detrital deposits which collectively represent a limiting factor for most benthic organisms. Biological diversity and density were comparable to the impoverished inshore delta community. This area appears to be a zone of secondary settlement for materials not deposited on the inshore delta.

3.2.6 Patch Reef Zone

A roughly 20-acre shallow (about -3 ft MSL) patch reef abuts the northeast side of the mouth of Kawa Stream (Figure 3). Biological surveys showed only moderate amounts of silt and sediment, suggesting that the majority of the reef is outside the influence of sediment-laden runoff waters from Kaneohe and Kawa Streams. Inshore areas, to about 100 m seaward of the shoreline, were turbid during all surveys conducted over the March to May, 1989 period. The prevailing high turbidity appears to result from the effects of tradewinds which continually re-work deposited silt and sediment, particularly deposits that accumulate within dense stands of mangrove proproots. The patch reef is roughly bisected by a dilapidated pier. Portions of the reef are also used for mooring of small craft and an ultra-light seaplane.

Macroalgae were poorly represented and extant species were often cropped down to the holdfast, making accurate identification impossible. Represented species included *Acanthophora spicifera*, *Polysiphonia* sp., *Dictyosphaeria cavernosa*, and *Gracilaria* sp.

Live corals were not observed on the reef flat proper, though numerous small dead corals littered wide areas of the reef flat. Most of these colonies were well worn and heavily overgrown with epiphytic algae, suggesting that they have been dead for many years. Live corals were observed on the upper edge of the patch reef slope, but overall coverage was less than 0.1 percent. However, massive colonies of dead corals formed a narrow corridor between about -1.5 to -2.5 m in depth. Dead coral coverage averaged about 60% along this narrow corridor. Represented species included *Porites compressa* and *Montipora verrucosa* (Table 3.5). The former is the dominant coral throughout most of Kaneohe Bay.

A total of 34 species of fish representing 21 families were recorded from the patch reef and adjacent slopes (Table 3.4). Overall densities were low, corresponding to the low density and topographic relief of represented corals. Most of the sightings were along the narrow corridor of dead coral which provides some degree of topographic relief. Only six species were listed as *abundant*. They included: the labrid, *Thalassoma duperreyi* (*hinalea lau-wili*); the goby, *P. mainlandi*; the acanthurids *A. triostegus* (*manini*) and *A. dussumieri* (*palani*); and the jack, *Caranx* sp. The sixth species was *Scarus* sp., representing a diverse group of unidentified juvenile parrotfish. Juvenile scarids are virtually impossible to identify in the field.

Although the aforementioned species were listed as *abundant*, this term is somewhat of a misnomer when considering that roughly 300 m of reef flat were censused during a typical 30-minute survey. The overall impression is one of extremely low fish diversity. About half of the *abundant* species represented isolated groups of individuals scattered across broad, largely uninhabited stretches of reef flat. Similarly, many of the species listed as *common* represented a single school or several schools observed on one or two occasions. Species fitting this category included: the *omilu* (*C. melampygus*); *aholehole* (associated with a few small schools amongst mangrove proproots); *weke* and *weke-'ula* (*Mulloides flavolineatus* and *M. vanicolensis*); the halfbeak, *Hemiramphus* sp.; and the parrotfishes, *Scarus sordidus*, *S. perspicillatus* and *S. dubius*.

Fishes recorded under the *rare* category included: the trumpetfish, *Aulostomus chinensis* (*nunu*); the moray eel, *Gymnothorax* sp. (puhi); the Moorish idol, *Zanclus canescens* (*kihikihi*); an unidentified juvenile boxfish; and the eagle ray, *A. narinari*. A single school of juvenile hammerhead sharks (*Sphyrna lewini*), each about 40 cm. in length, was observed beneath the pier.

Like the adjacent delta region, the macroinvertebrate fauna was limited to relatively few species (Table 3.5). Sponges (unidentified *Demospongiae*) and the bivalves *Chama* and *Ostrea* were the most abundant species. The latter was recorded in densities of up to $145/m^2$ on isolated rock outcrops though a far greater number consisted of dead specimens. The colorful tube-dwelling polychaete *Sabellastarte* sp. was often conspicuous in localized areas, but was most abundant along the dead coral zone where densities averaged about $3/m^2$.

SECTION 4.0

DISCUSSION AND CONCLUSIONS

4.1 Impacts to Kawa Stream and Estuary

Kawa Stream originates in the vicinity of the Hawaiian Memorial Park Cemetery at an elevation of about 400 ft. It then flows through the Pikoiloa residential area, Castle High School, Bayview Golf Center, and empties into Kaneohe Bay near the Waikalua-Loko fishpond, a distance of about 2.5 miles.

Urbanization of the watershed has had a major impact on the stream. The development of upland residential developments necessitated realigning or reinforcing the stream to provide flood protection. The entire stream, from its mouth to Mokukele Drive, has been channelized and is dredged and cleared of vegetation periodically. By 1977, only about 2,000 ft of the stream channel followed its original alignment; a 700-foot section was eliminated by removing of two large meanders at the present locations of Puaae Place and Pouhanu Place. Most of the stream banks in this section have been lined with concrete.

The existing Kawa Stream channel fronting the Bayview Golf Center was dredged to its present width around 1958. The wetlands at the mouth were filled for construction of the Kaneohe Sewage Treatment Plant. It was dredged again in 1965 to remove accumulated sediment (VTN Pacific, 1977).

Because of its history of man-induced changes, project related impacts to the tidal and non-tidal (lower stream zone) segments of Kawa Stream are not expected to be significant or long-term. These impacts will entail localized degradation in water quality resulting from earthmoving activities associated with channel realignment (Figure 4) and construction of new golf course fairways. Most of these impacts can be ameliorated through use of berms and swales to retain runoff waters from construction areas generated during periods of heavy rain.

Biological surveys conducted during the March to May 1989 period largely confirmed the results of earlier studies (Timbol and Maciolek, 1978; VTN Pacific, 1977) and showed that the lower stream zone was populated only with exotic species. Tilapia, which presently dominant the lower stream zone (in terms of biomass), were not recorded in Kawa Stream by Timbol and Maciolek (1978). Conversely, both Timbol and Maciolek (1978) and VTN Pacific (1977) recorded the Chinese catfish (*Clarius fuscus*) from the lower stream zone, a species that was not recorded during these 1989 surveys. However, this species is particularly secretive in habit, often burrows into soft mud bottoms, and could easily be overlooked.

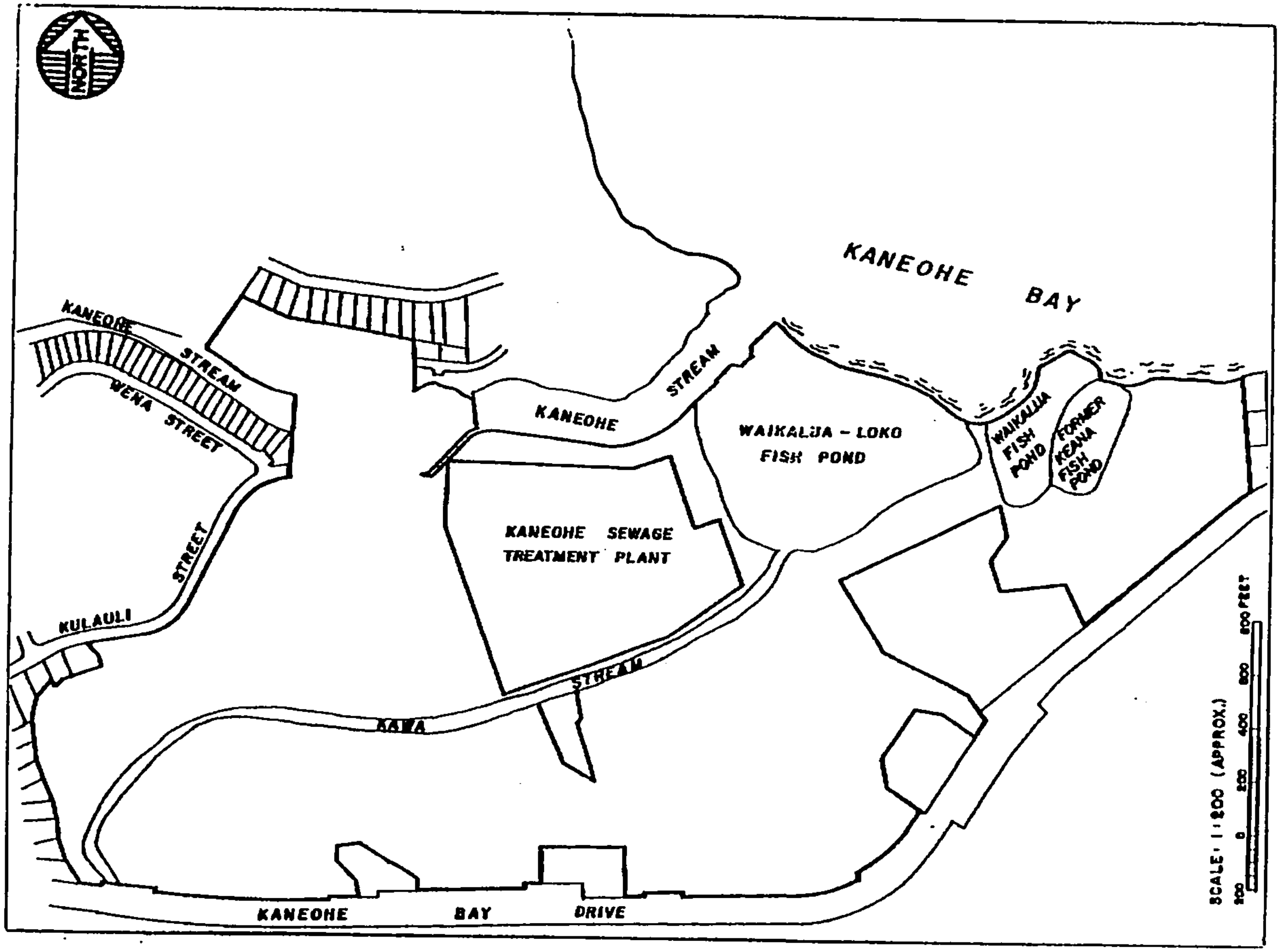

Figure 4. Bayview Golf Course: Proposed Realignment of Kawa Stream.

Literature reviews, combined with the results of 1989 baseline surveys, indicate that no endemic stream fishes, mollusks or crustaceans have been observed in the lower reaches of Kawa Stream for at least the past eleven years. Because of the domination of the stream by generally undesirable, introduced species, any project-related impacts on this biota is not considered significant.

The estuarine segment of the stream was inhabited by both exotic and indigenous species. *Aholehole* were the only species native to Hawaii that were recorded in the estuarine reaches of the stream. Diversity of fishes was low and represented populations were small.

Silt and sediment generated by project-related earthmoving and construction activities are likely to produce short-term high turbidity levels in the estuarine segments of the stream, particularly during periods of heavy or sustained rainfall. However, such levels are not expected to significantly exceed the reading of 66.1 NTU that was recorded on April 8, 1989, except in localized areas immediately adjacent to construction areas. The reported range of wet weather turbidities for Kawa Stream are 2 to 89 NTU with a mean of 28 NTU (VTN Pacific, 1977). Estuarine species are generally adapted to a wide range in turbidity levels, as well as, other water quality parameters. No long-term or significant impacts on estuarine biota are anticipated.

Water quality analyses have been conducted on Kawa Stream as a part of the Kaneohe Bay Urban Water Resources Study coordinated by the U.S. Army Corps of Engineers (Konno, *et al.*, 1976); the results are presented in Table 4.1 and compared with other streams that discharge into Kaneohe Bay.

For most parameters, the quality of Kawa Stream is better than or comparable to other streams. However, there are some notable exceptions. Kawa Stream exhibited the greatest range of temperature and the highest mean temperature of any of the streams, which may be due to the combination of low average flow and concrete channels. It also had one of the highest dissolved oxygen concentrations, perhaps due to flourishing filamentous algae. The stream also had some of the highest concentrations of dissolved organic carbon and total organic carbon; the reasons for which are not known. Kawa Stream was also high in several nitrogen measurements (Konno *et al.*, 1976).

Table 4.1 Kawa Stream, Wet Weather Water Quality Compared with Data from Other Stream Stations Studies[1].

Parameter	Unit	Kawa Stream[2]		Other Streams[3]
		Range	Mean	Overall Range
Streamflow	cfs	2-3	2.5	1.5 - 29
pH		7.5-8.0	7.6	6.0-8.6
Temperature	°C	23.0-27.2	24.6	20.0-26.7
Dissolved Oxy.	mg/l	8.3-10.2	9.6	6.0-10.4
Turbidity	NTU	2-89	28.0	1-140
Vol. Sus. Sol.	mg/l	1.5-2.75	2.25	0.25-89.0
Susp. solids	mg/l	6-49	18.0	3-640
Diss. Org C.	mg/l	>1-13.75	5.0	>1-5.2
Total Org C.	mg/l	5.5-17.8	10.8	>1-32.25
Total Phosphorus	mg/l	0-0.32	0.12	0-1.47
Diss TKN	mg/l	>0.02-2.02	0.8	>0.02-1.2
TKN	mg/l	>0.07-2.12	0.79	>0.02-6.17
Nitrate + Nitri	mg/l	0.42-1.4	0.92	0.04-0.71
Total N	mg/l	1.28-2.78	1.7	0.05-7.25
Chlorophyll-a	mg/l	0.3-1.4	0.9	0-19.8
Fecal Coliform	#/100 l	1,000-5,300	3,600	>10-250,000
Fecal Strept.	#/100 l	400-3,300	2,200	>10-100,000

Note
1 Source Konno, *et. al.*, 1976.
2 Sampling station located above Kaneohe Bay Drive.
3 Kaneohe (2 stations), Waihee, Kahuluu, Waikane, Waiahole, Keaahala, and Heelu Streams and culverts from Valley of the Temples and Holuloa subdivisions, which drain into Kaneohe Bay.

4.2 Impacts to Kaneohe Stream and Estuary

Kaneohe Stream drains northeasterly to Kaneohe Bay. The stream drainage basin is located near the southern section of the Kaneohe Bay watershed where considerable urban development has taken place. Urbanization has resulted in encroachment of the stream's flood plain, and construction of a dam affected the Kamooalii and Kuou tributaries of the stream. Other forms of channel modification in Kaneohe Stream include concrete lined channels, realigned channels, vegetation removal, and the presence of an elevated culvert. By 1978, nearly 25% of the total 28 km channel length has been modified (Norton, *et al.*, 1978).

Project related impacts to Kaneohe Stream and estuary are not anticipated to be significant or long-term in nature and would be limited largely to short-term silt and sediment loading associated with the construction phase of the project. However, existing baseline water turbidity levels associated with storm-water runoff are typically high (86.3 NTU reading recorded on April 8, 1989). Thus, silt and sediment loading associated with the construction phase of the project are not expected to result in conditions not experienced presently at the mouth of the stream. Existing terrain in the estuarine segment of the stream is relatively flat and would not change appreciably with the proposed project.

Landscaping associated with golf course fairways and greens would reduce likely existing runoff from the small filled peninsula (running parallel to the revetted south side of Kaneohe Stream), which generally lacks vegetative groundcover. However, observations during periods of heavy rainfall runoff suggested that this area is not a significant source of sediment. The proposed project would eliminate the existing auto-wrecking yard on the peninsula, which may be contributing hydrocarbons and other pollutants, directly or indirectly, to Kaneohe Stream, estuary and nearshore waters.

4.3 Impacts to Waikalua-Loko Fishpond

Early aerial photo maps, prior to 1969, indicate that Kawa Stream previously discharged into Waikalua-Loko Pond. Between 1969 and 1978, Kawa Stream was realigned (during the wetland reclamation activities associated with construction of the Kaneohe Wastewater Treatment Plant) and presently, discharges into Kaneohe Bay on the east side of the pond.

The proposed alignment of Kawa Stream would result in the pond being restored to its former role as a settling basin during periods of heavy runoff. This action would be expected to result in the following consequences:

(1) increase the rate of pond infilling with terrigenous

materials;
(2) reduce ambient pond salinities during periods of heavy runoff;
(3) increase the distribution and abundance of *Rhizophora* throughout the pond;
(4) alter existing flushing and circulation patterns (particularly during periods of heavy runoff); and,
(5) reduce biological productivity of the pond for certain marine and estuarine fishes and invertebrates.

However, it should be noted that existing natural, albeit man-induced or accelerated, processes are and will continue to exert many of these same effects through normal coastal ecological succession processes. These would occur with or without the impacts associated with the proposed project.

Although some of the above changes may be construed as damaging to water and environmental quality, many of these impacts can be attenuated or mitigated by provision of a carefully executed water quality and environmental management plan for the fishpond. For example, periodic dredging of pond has the potential to improve the productivity of the now shallow, heavily silted pond. Control of rapidly spreading mangroves would maintain the open water habitat of the fishpond, while preserving the structural integrity of the fishpond walls. In the absence of a program to control the spread of mangroves the fishpond walls will continue to deteriorate.

Restoration of the pond to its former role as a sedimentation basin will result in a reduction in the present levels of silt and sediment discharged into Kaneohe Bay. Kawa Stream is one of the smaller perennial streams that discharge into Kaneohe Bay. Its sediment contribution is about 3% of the total amount of stream-generated sediment, reaching the bay annually (or about 6% of the total entering south Kaneohe Bay). It, nonetheless, accounts for between 320 and 1,210 tons/yr of sediment (VTN Pacific, 1977). This contribution is small in relation to the sediment loading in the bay as a whole. Localized improvements in nearshore water quality can be expected. These improvements are likely to include a reduction in storm-generated turbidity levels and a diminution in the quantity of high BOD (biological oxygen demand) organic materials that presently discharge into the bay. In essence, Waikalua-Loko Fishpond would revert to its former cultural role as a sediment retention basin and nutrient sink for organic materials of terrestrial origin.

4.4 Impacts to Kaneohe Bay Waters

Impacts to Kaneohe Bay waters are not expected to be either significant or long lasting. The area supports the lowest diversity and, with the exception of the oyster, *Ostrea*, the lowest population density of marine organisms the survey team has ever encountered in nearshore Hawaiian waters. Because of the absence of hard substrata, recovery of the benthic coral and associated communities in the nearshore waters of Kaneohe Bay, fronting the proposed project site, is not expected to occur, with or without the project.

SECTION 5.0

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Table 3.4 Checklist of Fishes, Bayview Golf Course.

TAXA/GENUS (COMMON NAME)	KAWA STR	KAWA EST	KANEOHE STR	KANEOHE EST	WAIKALUA POND	KANEOHE BAY
SPHYRAENIDAE (BARRACUDA)						
Spyhraena barracuda (barracuda)	-	-	-	R	R	-
CARANGIDAE (ULUAS, JACKS)						
Caranx melampygus (*omilu*)	-	C	-	R	-	C
Caranx ignobilis (*pauu*)	-	-	-	-	-	F
Caranx sp. (*papio*)	-	R	-	R	C	A
CHANIDAE (MILKFISHES)						
Chanos chanos (milkfish, *awa*)	-	-	-	-	C	F
LABRIDAE (WRASSES)						
Thalassoma duperreyi (*hinalea lau-wili*)	-	-	-	-	-	A
Stethojulis axillaris (*o'maka*)	-	-	-	-	-	F
KUHLIIDAE (AHOLEHOLE)						
Kuhlia sandwicensis (*aholehole*)	-	A	-	C	A	C
CHAETODONTIDAE (BUTTERFLYFISHES)						
Chaetodon miliaris	-	-	-	-	-	C
POMACENTRIDAE (DAMSELFISHES)						
Abudefduf abdominalis (*maomao*)	-	-	-	-	-	F
Dascyllus albisella (*aloilot*)	-	-	-	-	-	C
Chromis ovalis	-	-	-	-	-	F
AULOSTOMIDAE (TRUMPET FISHES)						
Aulostomus chinensis (*nunu*)	-	-	-	-	-	R
MURAENIDAE (MORAY EELS)						
Gymnothorax sp. (*puhi*)	-	-	-	-	-	R
ZANCLIDAE (MOORISH IDOLS)						
Zanclus canescens (*kihikihi*)	-	-	-	R	-	R
GOBIIDAE (GOBIES)						
Psilogobius mainlandi	-	C	-	C	-	A
Bathygobius sp.	-	C	-	C	-	C
BLENNIIDAE (BLENNIES)						
Istiblennius sp.	-	R	-	R	-	F
unident. blenny	-	-	-	-	-	F

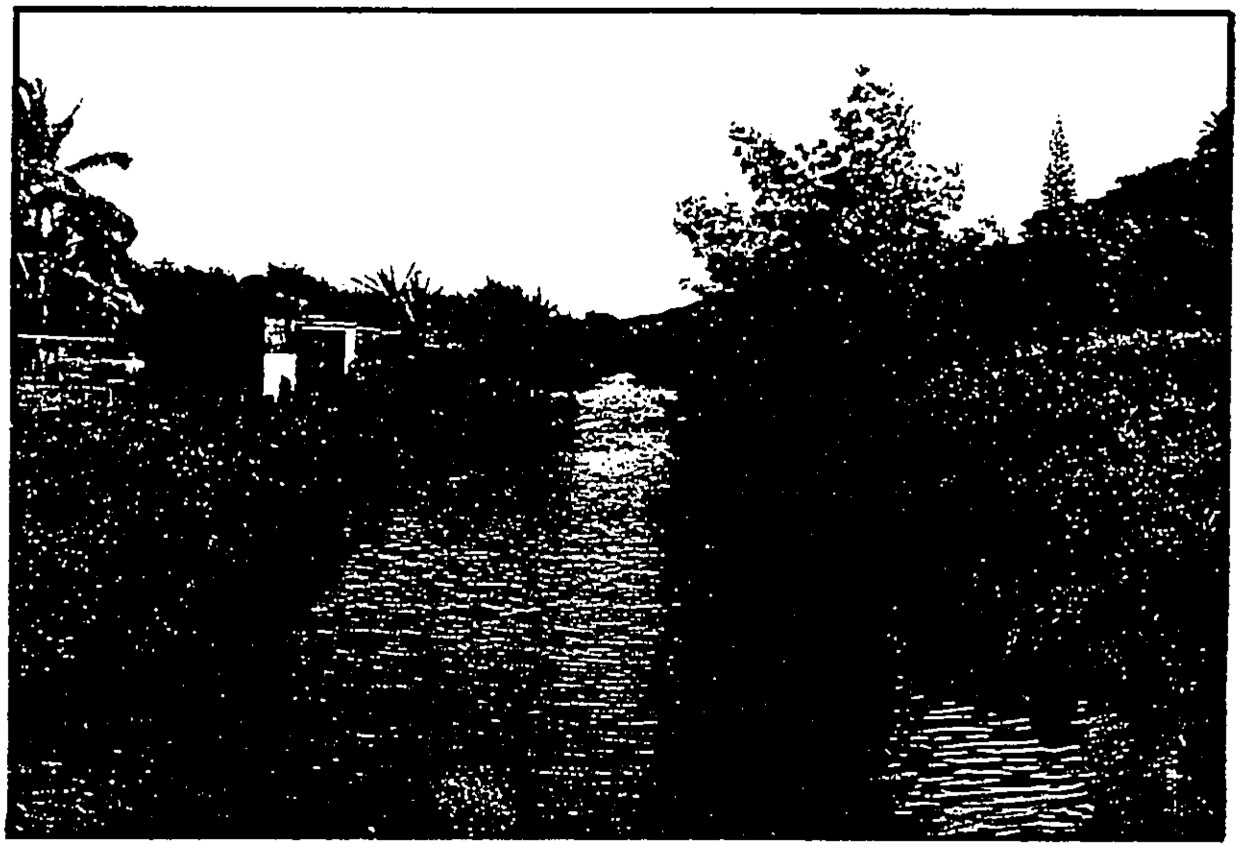
Table continues

TAXA/GENUS (COMMON NAME)	KAWA STR	KAWA EST	KANEOHE STR	KANEOHE EST	WAIKALUA POND	KANEOHE BAY
OSTRACIONTIDAE (BOXFISH)						
Ostracion meleagris (moa)	-	-	-	-	-	F
unident. boxfish	-	-	-	-	-	R
CICHLIDAE (TILAPIAS)						
Oreochromis mossambicus (tilapia)	A	C	A	C	C	-
MULLIDAE (GOATFISHES)						
Mulloides flavolineatus (weke)	-	-	-	-	-	C
Mulloides vanicolensis (weke-'ula)	-	-	-	-	-	C
POECILIIDAE (GUPPIES)						
Poecilia reticulatus (guppy)	A	-	A	-	-	-
Gambusia affinis (mosquito fish)	C	-	C	-	-	-
SYNODONTIDAE (LIZARD FISHES)						
Synodus variegatus ('ulae)	-	-	-	-	-	F
POMACENTRIDAE (DAMSELFISHES)						
Abudefduf adbominalis (mamo)	-	-	-	R	-	C
ACANTHURIDAE (SURGEONFISHES)						
Acanthurus triostegus (manini)	-	C	-	R	-	A
Acanthurus dussumieri (palani)	-	-	-	R	-	A
HEMIRAMPHIDAE (HALFBEAKS)						
Hemiramphus sp.	-	F	-	F	-	C
MUGILIDAE (MULLETS)						
Mugil cephalus (ama'ama)	-	F	-	F	C	C
SCARIDAE (PARROTFISHES)						
Scarus sordidus	-	-	-	-	-	C
Scarus perspicillatus	-	-	-	-	-	C
Scarus dubius	-	-	-	-	-	C
Scarus sp. (juveniles of above)	-	-	-	-	-	A
SPHYRNIDAE (HAMMERHEAD SHARKS)						
Sphyrna lewini (mano kihiki)	-	-	-	-	-	F
MYLIOBATIDAE (EAGLE RAYS)						
Aetobatus narinari	-	-	-	-	-	R
Total Families	2	8	2	11	6	21
Total Species	3	10	3	14	6	34

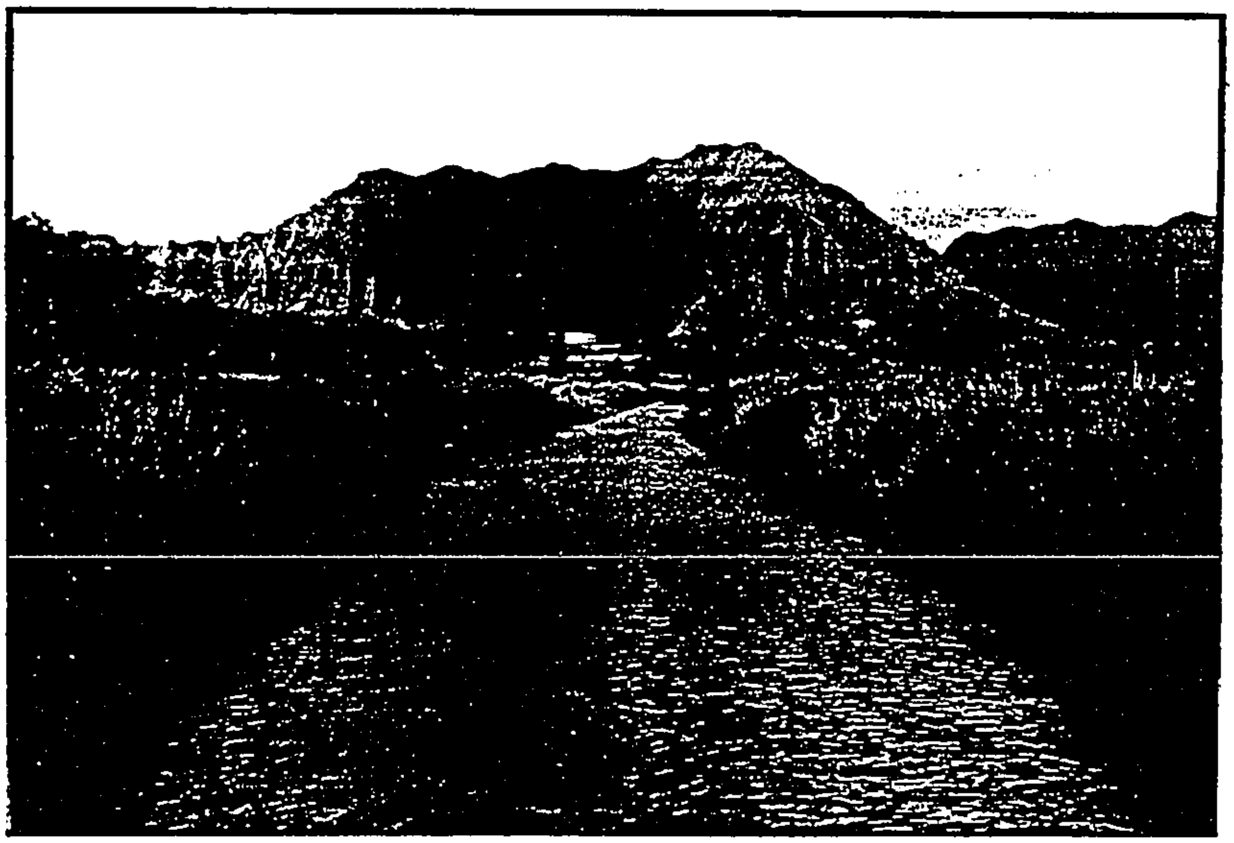
Table 3.5 Checklist of Invertebrates, Bayview Golf Course.

TAXA/GENUS (COMMON NAME)	KAWA STR	KAWA EST	KANEOHE STR	KANEOHE EST	WAIKALUA POND	KANEOHE BAY
SCLERACTINIA (HARD CORALS)						
Porites compressa	-	-	-	-	-	C
Montipora verrucosa	-	-	-	-	-	C
PORIFERA (SPONGES)						
Unident. *Demospongiae* 1	-	-	-	R	-	C
Unident. *Demospongiae* 2 (red)	-	-	-	-	-	C
CLASS BIVALVIA						
Chama sp.	-	-	-	-	-	A
Ostrea sandvichensis	-	A	-	-	A	A
ANNELIDA (SEGMENTED WORMS)						
SEDENTARIA						
SABELLIDAE						
Sabellastarte sp.	-	-	-	-	-	A
SERPULIDAE						
Hydroides sp.	-	-	-	F	F	C
CHORDATA						
ASCIDIACEA						
Didemnum edmondsoni	-	-	-	-	-	A
Didemnum sp.	-	-	-	-	C	A
CRUSTACEA (SHRIMPS/CRABS)						
Macrobrachium lar (prawn)	R	-	R	-	-	-
Balanus sp. (barnacle)	-	C	-	C	C	C
HOMARIDAE (LOBSTER/CRAWFISH)						
Procambarus clarkii (crayfish)	C	-	C	-	-	-
DIOGENIDAE						
Unident. hermit crab	-	-	-	-	F	F
GRAPSIDAE						
Metopograpsus messor (crab)	-	F	-	F	C	F
Grapsus tenuicrustatus (crab)	-	F	-	F	C	F
PORTUNIDAE						
Thalamita integra (crab)	-	F	-	-	-	F
Thalamita crenata (hapa crab)	-	-	-	R	-	-
OCYPODIDAE						
Ocypode ceratophthalma	-	-	-	R	-	-
No. species	2	5	2	7	7	15

Photograph 1. Kawa Stream, Channelized Lower Stream Zone (Non-tidal Zone).

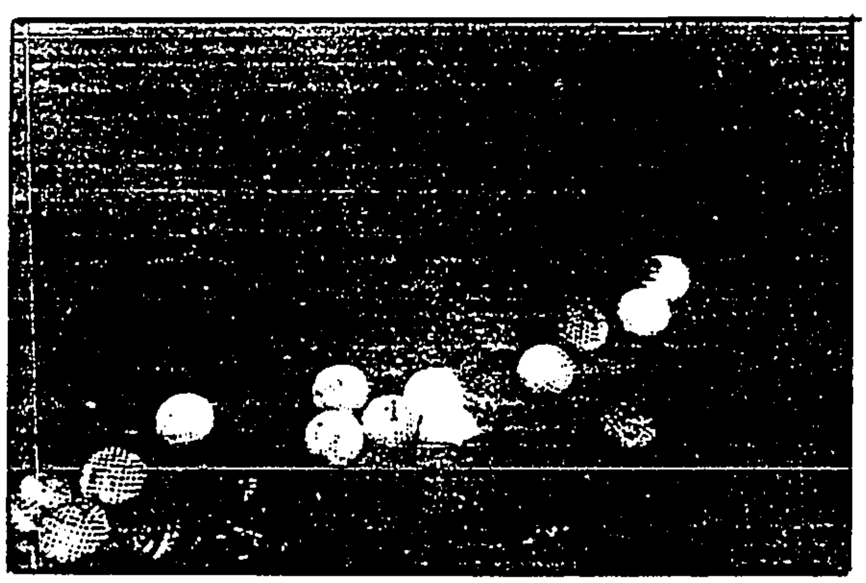


Photograph 2. Kawa Stream, Channelized Estuarine Segment (View = West to East).

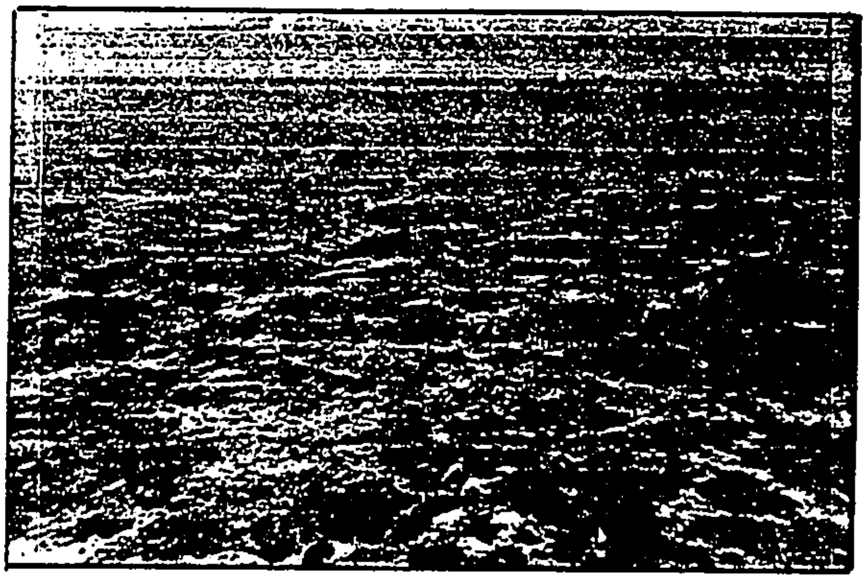


Photograph 3. Kawa Stream, Channelized Estuarine Segment (View = East to West).

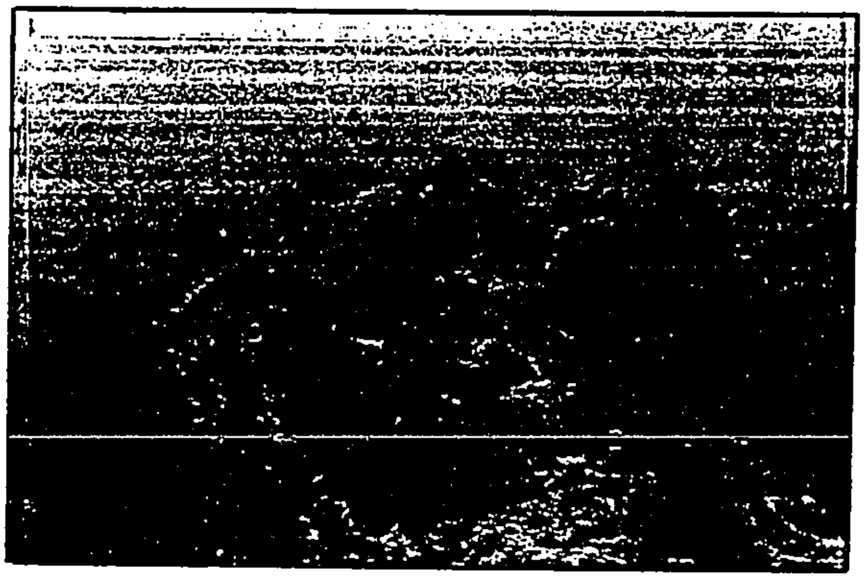
Photograph 4. Kaneohe Stream Estuary and Mouth.



Photograph 5. Golf Balls on Unconsolidated Substratum of Kaneohe Stream Delta.



Photograph 6. Typical Patch Reef Perspective.



Photograph 7. Dead Coral Heads on Upper Patch Reef Slope.

APPENDIX C

ARCHAEOLOGICAL SURVEY AND ASSESSMENT OF A 90-ACRE PARCEL FOR THE PROPOSED EXPANSION OF BAYVIEW GOLF COURSE

Prepared by Cultural Surveys Hawaii, September 1989

ARCHAEOLOGICAL SURVEY AND ASSESSMENT OF A 90-ACRE PARCEL FOR THE PROPOSED EXPANSION OF THE BAY VIEW GOLF COURSE KĀNE'OHE, O'AHU

by

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prepared for

Hida, Okamoto and Associates, Inc.

by
Cultural Surveys Hawaii
September, 1989

Abstract

An archaeological survey and assessment was conducted on a 90-acre parcel in Kāne'ohe for proposed expansion of the Bay View Golf Course. This area which lies along the lower floodplains of Kāne'ohe and Kawa Streams was traditionally used for taro planting and aquaculture. Over 40 Land Court Awards were granted here and the floodplain and fringing slopes must have supported a large Hawaiian community. Three fishponds were located along the Bay. In the late 19th and early 20th Centuries rice was intensively cultivated in old taro lands and taro continued to be planted up to the 1950s. Modern development of the area -- golf course, sewage treatment plant, surrounding residential subdivisions and flood control projects -- have caused extensive modifications of the land. Only 2 archaeological features remain as a visible part of the landscape. These are Waikalua-loko Pond which, although rebuilt in the 1930s, has been a continuously functioning pond since prehistoric times; and Waikalua Pond which is in poor condition due to mangrove intrusion, but still shows an intact seawall. Both ponds are recommended for preservation. In addition, because of the plentiful historic evidence of intensive Hawaiian occupation as well as the possibility that archaeological remains lie buried within the area, archaeological monitoring during initial clearing and grading is recommended.

Acknowledgements

The field work for this project was conducted by the authors as well as Mr. David Shideler. Ms. Kirsten Nakamura and Mr. Rodney Chiogioji. Backhoe work was done by Mr. Mike Masatani. Mr. Harvey Hida of Hida Okamoto and Associates and Mr. Tyrone Kusao both provided much useful information and support. Ms. Berna Cabacungan of Earth Plan provided coordination for the E.I.S. Mr. Kenneth Binkley of Bay View Golf Course was extremely helpful in arranging access and providing information. Mr. Charles Okino of the State Survey Office supplied many historical maps. Typing was provided by Dr. Vicki Creed of Windword Processing.

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I. Introduction

1. Scope of Work and Methods

This project includes the results of historic research, archaeological survey and limited subsurface testing on an approximately 90-acre parcel in the Waikalua area of Kāne'ohe ahupua'a (Figs 1-4). The parcel is designated TMK 4-5-30 parcels 1-3, 6- 20-22; 36, 37, 41, 42, 44-46, 48, 49.

Background Research

Historical and archaeological background research was conducted for the purpose of reconstructing past land use with specific reference to assessing potential for the presence of archaeological sites on the property and to guide the direction of the field survey. Much of the general background is contained in existing summaries as this area of Kāne'ohe has been the subject of much historical research. Original sources such as historic survey and LCA maps and records were consulted. The extensive use of the flood plains of Kawa and Kāne'ohe Streams for traditional taro planting in prehistoric and early historic periods and later for rice farming is well documented in the Land Court Records, early survey maps and extant photographs.

Field Survey

The field survey was conducted to assess present land conditions and to systematically cover areas which were relatively unmodified by modern development. The flood plain of the 2 streams presently contains the existing Bay View Golf Course at

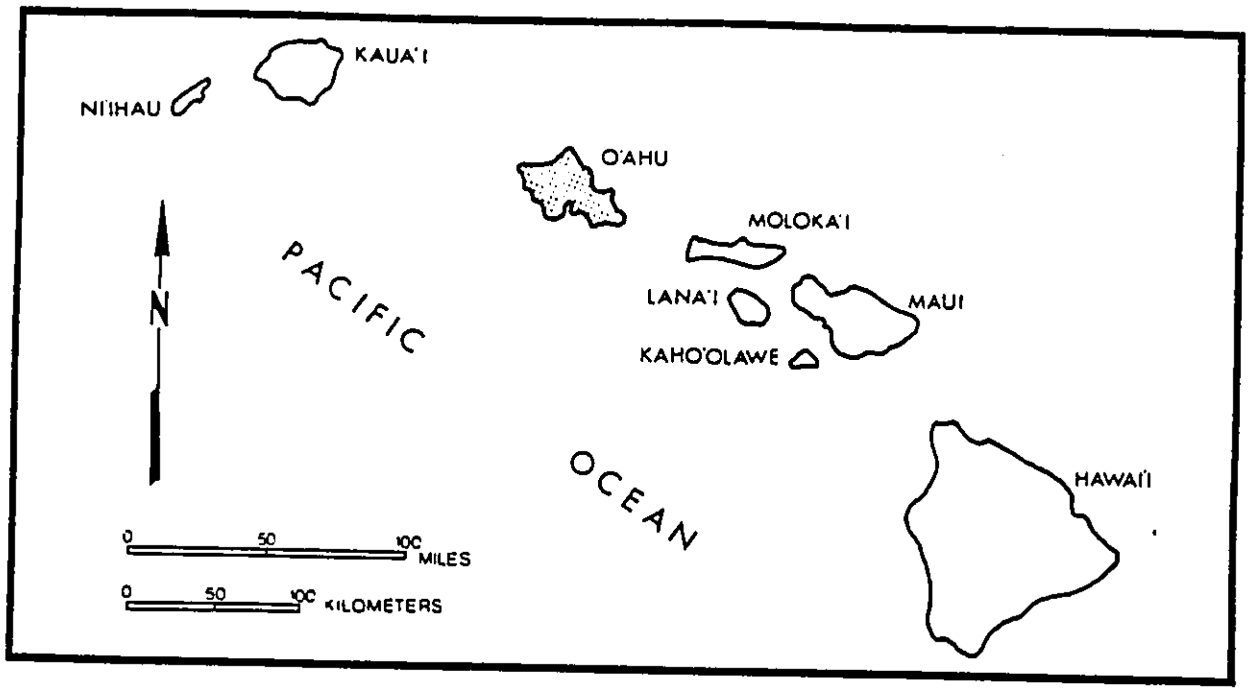


Fig. 1. State of Hawai'i

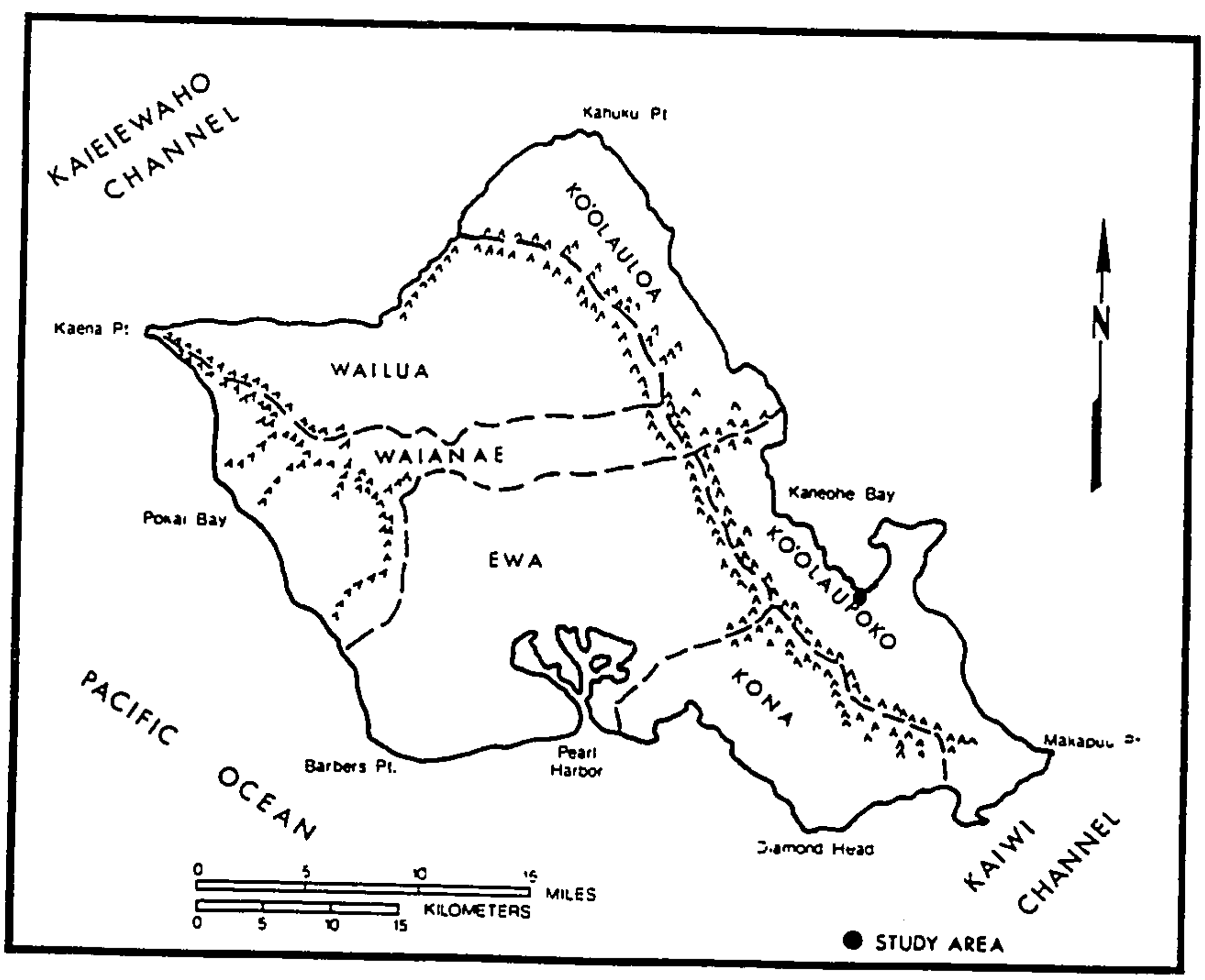


Fig. 2. General Location Map, O'ahu Island.

Figure 3 USGS Quad: Showing Project Area

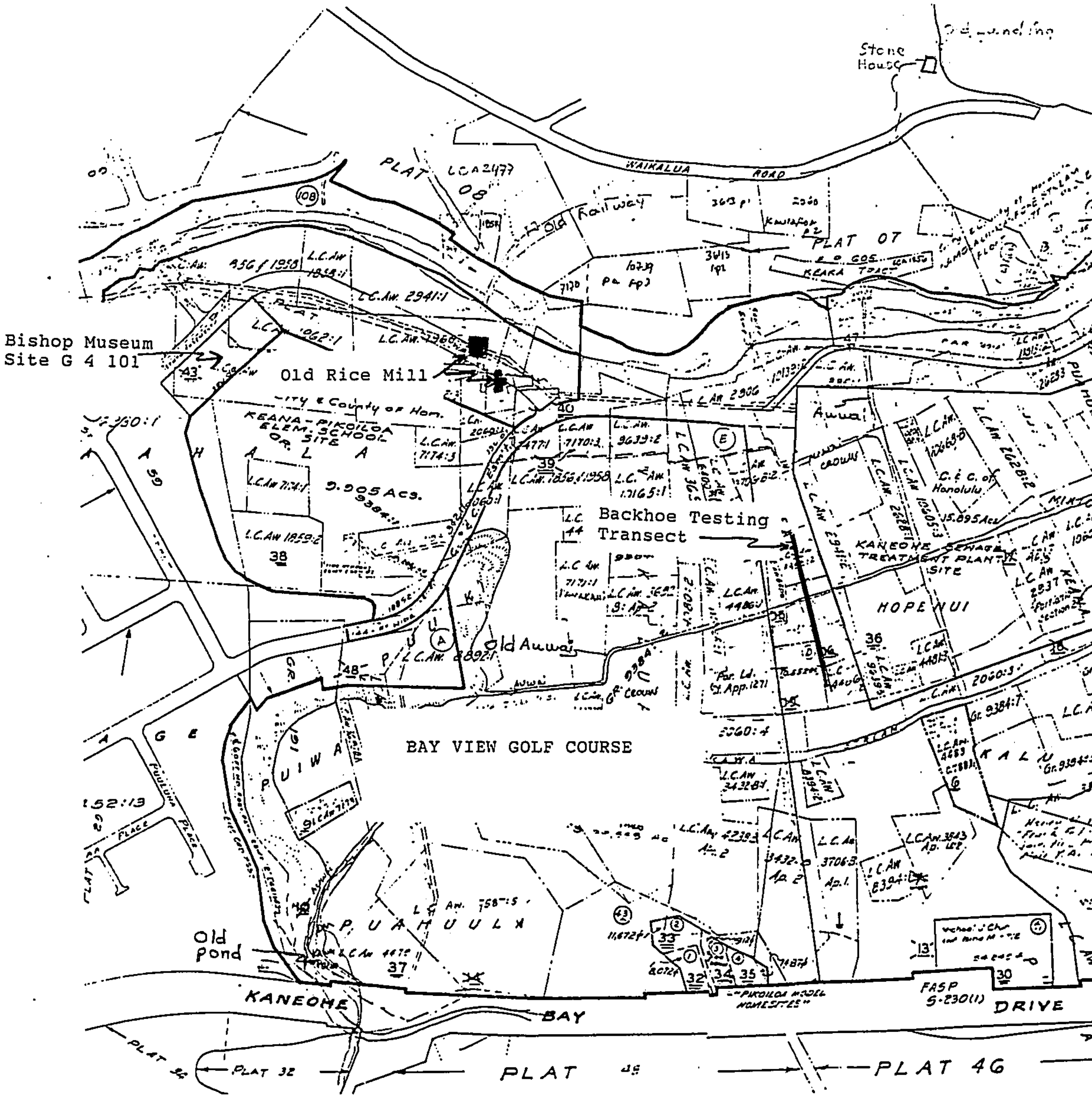
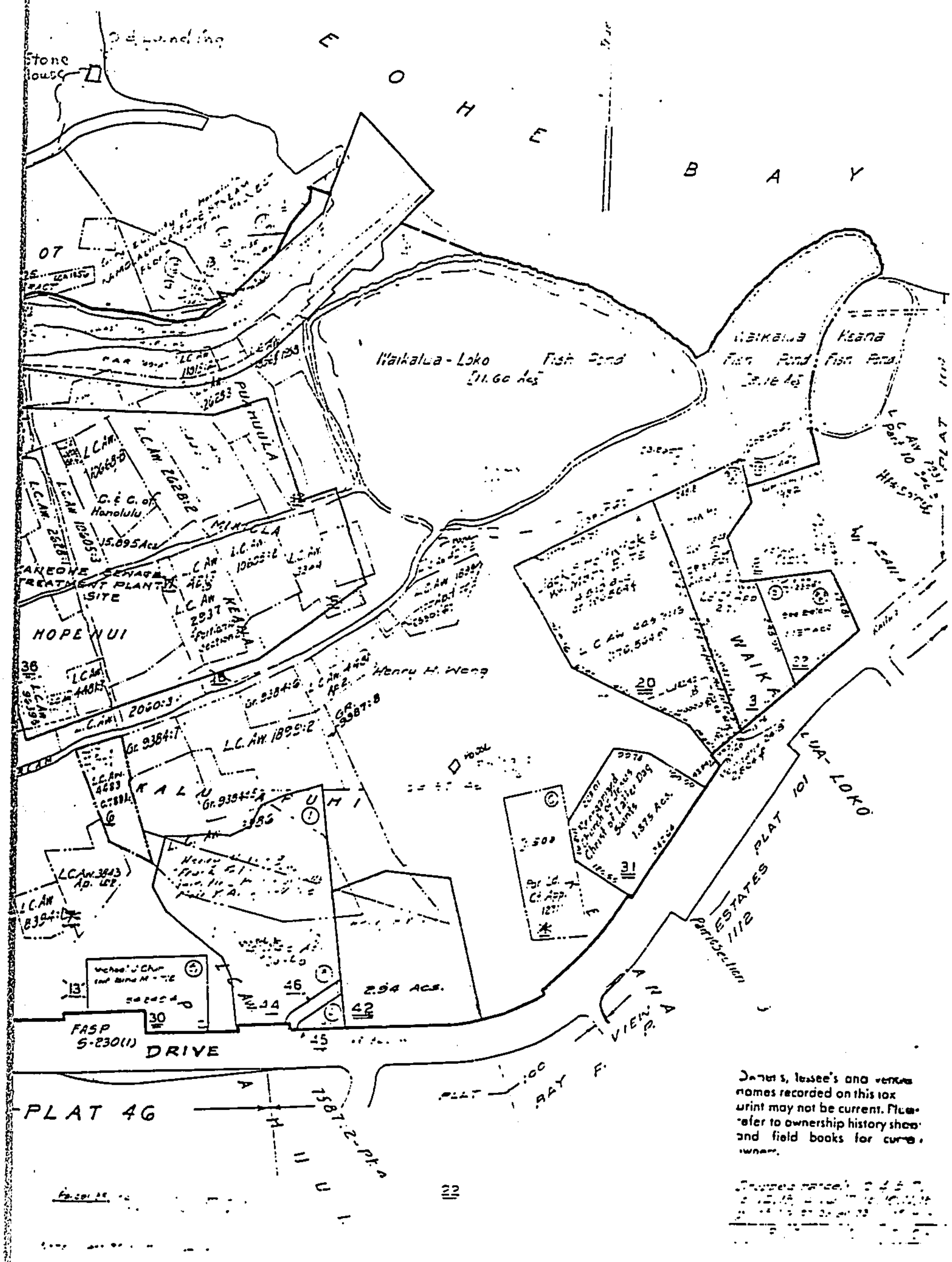


Fig. 4 Project Area, Showing Some Features and Places Mentioned in Text



Stone House
K A N E O H E B A Y
Waikalua-Loko Fish Pond
[11.66 Acs]
Kaana Fish Pond
PUHUULA
MIKIOLA
KANEOHE SEWAGE TREATMENT PLANT SITE
HOPENUI
KEAAHA
C. & C. of Honolulu
15.895 Acs
Henry H. Wong
KALUAPUHI
WAIKALUA
LUA-LOKO
ESTATES PLAT 101
1112
PLAT 46
PLAT 100
FASP S-230(1)
DRIVE
KANEOHE BAY VIEW
1.375 Acs.
2.94 Acs.
Owner's, lessee's and vendee's names recorded on this tax print may not be current. Please refer to ownership history sheet and field books for current owners.
22

the western end of the project area, as well as a sewer treatment plant, residential tenants and an auto wrecking company mauka of Waikalua Fishpond. Survey coverage concentrated on the unmodified pasture portion of the floodplain and the wooded slopes predominantly at the south end of the project area bordering Kāne'ohe Bay Drive. There is also floodplain and wooded slope within a small portion of the project area north of Kāne'ohe Stream.

Fishpond Assessment

An important aspect of the field survey was examination of Waikalua-loko, Waikalua and Keana Fishponds on the Kāne'ohe Bay side of the project area. The present conditions of the ponds, the state of preservation of their walls and mākāhā were assessed and the archaeological potential of their associated features and sediments were evaluated.

Subsurface Testing

Subsurface testing was conducted with use of a backhoe along what was judged to be the least disturbed section of the floodplain and virtually the only area that was readily accessible to mechanical equipment without inconvenient to the existing golf course users or present tenants. This area was located along the west boundary of the sewage treatment plant on the north side of Kawa Stream. A series of 8 20-25 foot- (6-7 meter-) long backhoe trenches were excavated along a 600-foot north/south transect perpendicular to Kawa Stream, from the stream bed towards the present entry road to the sewage treatment plant. Each trench was excavated to a depth of 7-8 feet (210-240 cm.). Standard soil profile descriptions were made for each trench and all trench faces were inspected for changes in stratigraphic layering, buried cultural material, buried terraces, and organic deposits. In addition, samples of organic deposits were collected. In all, 160 linear feet of relatively undisturbed floodplain deposits were examined to the present water table of approximately 240 cm.

Interim Report

In May of 1989 an Interim Report on Historical Research and Preliminary Assessment of the Fishponds was submitted to Hida, Okamoto and Associates for submittal of the environmental assessment. The present report incorporates elements of the Preliminary Report within the Previous Archaeology and Historical Background Sections. The survey was completed and the testing accomplished since the submittal of the Interim Report.

2. Description of Project Area: Present Conditions

The 90-acre parcel comprising the project incorporates the estuaries and lower floodplains of Kāne'ohe and Kawa Streams as they enter the eastern shoreline of Kāne'ohe Bay. The majority of the project area is relatively flat alluvial land, but includes the sloping lands dropping from Kāne'ohe Bay Drive at the south end, as well as a small parcel of sloping land and floodplain on the north side of Kāne'ohe Stream. The study area is bounded by Kāne'ohe Bay Drive at the south end except for 3 excluded lots fronting the north side of the road. The west end is bounded by existing residential subdivisions (Puohala Village and Nani Pua and Puohala School). The north boundary follows the south side of Kāne'ohe Stream except for an extension of the study area north of the stream which incorporates a slope and a meander of the floodplain and is surrounded by existing residences. This area is accessible from the eastern end of Waiape Place. At the eastern boundary is the shoreline of Kāne'ohe Bay where the estuary of Kawa and Kāne'ohe Streams were modified in Prehistoric times into 3 fishponds extending from the mouth of Kāne'ohe Stream to the present Kokokahi YWCA.

Present Land Use and Conditions:

The Floodplain

The western portions of the floodplain has been extensively graded for the existing Bay View Golf Course. The undulating contour of the course shows that the original level topography of the floodplain has been highly modified. At the eastern portion of the floodplain, north of Kawa Stream and <u>mauka</u> of Waikalua-loko Pond is the City and County of Honolulu Sewage Treatment Plan which presently occupies nearly 16 acres of the floodplain. The plant area has been extensively graded and landscaped. Open excavations for sewer plant improvement were observed adjacent to Kawa Stream during the archaeological subsurface testing. The sediments within these trenches appeared to be gravelly mechanical fill.

On the south side of Kawa Stream across from the sewer plant the floodplain area is presently used for pasture land. Even here there is evidence of modern dumping of landfill and bull-dozing for pasture improvement.

Fishponds

Of the three fishponds recorded on the historic maps - Waikalua-loko, Waikalua and Keana Ponds - Waikalua was the largest, enclosing over 11 acres of water. Although this pond was modified in the 1930s with addition of mortared <u>mākāhā</u> (gates) it still shows its original configuration. Much of the northwest and south portions of the pond boundary have been modified in modern times with adjacent coral and earthen fill for flood control. Kawa Stream has been channelized by an artificial bank to flow seaward on the southeastern side of the pond. In spite of these adjacent modifications the sea wall is still intact and the pond itself is clear of vegetation, except for a growth of mangrove at the southeastern end.

Waikalua Pond shows portion of an intact but mangrove covered <u>kuapā</u> (seawall) and the pond outline is still visible, but the interior is filled with dense mangrove.

Kaena Pond, which on the historic maps is shown as a walled-off segment of Waikalua Pond, was filled in the 1950s and all traces of it have been obliterated.

Kāne'ohe and Kawa Streams and Other Drainages

The banks of both of these streams have been bermed with artificial fill for flood control, most visibly at or near the entrance to Kāne'ohe Bay. There is a long earthen berm separating Kawa Stream at its mouth from Waikalua-loko Fishpond. The south bank of Kāne'ohe Stream has been straightened with the addition of large quantities of fill adjacent to the northwestern side of Waikalua-loko. The tax map of the project area (4-5-30) shows 2 major <u>auwai</u> (irrigation ditches) between the 2 streambeds, one of which emptied into Waikalua-loko. These <u>auwai</u>(s) were for flooding of wetland crops on the floodplain. The course of these former ditches have been destroyed by golf course and sewer plant construction.

<u>Slopes Surrounding the Floodplain</u>

Long-term residential development with attendant grading and filling has resulted in the modification of much of the slope land on the north side of Kāne'ohe Bay Drive, as well as along the western and northwestern boundaries of the study area. However, most of the area at the top of the slope on the south side of Kawa Stream appears to be original topography. Here were found occasional large boulders of dense basalt which rolled downslope. Some of this material is of fine-grained quality and would have been suitable for ancient adz manufacturing but no evidence of human flaking was observed.

II. Previous Archaeological Research

There have been a number of in-depth studies concerning the ahupua'a of Kāne'ohe. These studies include, Rosendahl (ed.) (1976), Devaney et al. (1976), and Allen et al. (1987), which were done in association with major "urban" projects effecting Kāne'ohe. Rosendahl's report was in response to the Kāne'ohe-Kailua Flood Control Project, Devaney et al. was "part of The Comprehensive Kāne'ohe Bay Urban Water Resources Study," and Allen et al. was in conjunction with "the Proposed Kāne'ohe Interchange, Interstate Highway H-3." These reports include sections on history and historic land use from which much of this report's historical background section is based, and credit must be given to those authors, especially Marion Kelly.

The first archaeological research done within the project area was by J. Gilbert McAllister (1930). McAllister identified three sites within the project area (349, 350, and 353) (Fig. 5) site 349 is Waikalua Pond or Waikalua-loko, with McAllister's description indicating recent (1920s-1930s) rebuilding. "The rebuilding of the pond has been completed. The wall was 1420 feet long, of waterworn basalt 3 to 4 feet high but somewhat wider. The pond covers 11 acres" (McAllister 1933:178). There is also a photo of the fish pond wall (Ibid. Plat 12B). Site 350 is the two ponds adjacent (Kailua side) of Waikalua-loko. "The pond in use is said to be Keana with an area of 3.5 acres ... The name of the other is Kalokohanahou. Its wall is broken. Both were built of waterworn basalt. The dirt filled wall of Keana is wide enough for trees to grow on it...." (Ibid.:179). The "Kaloko-

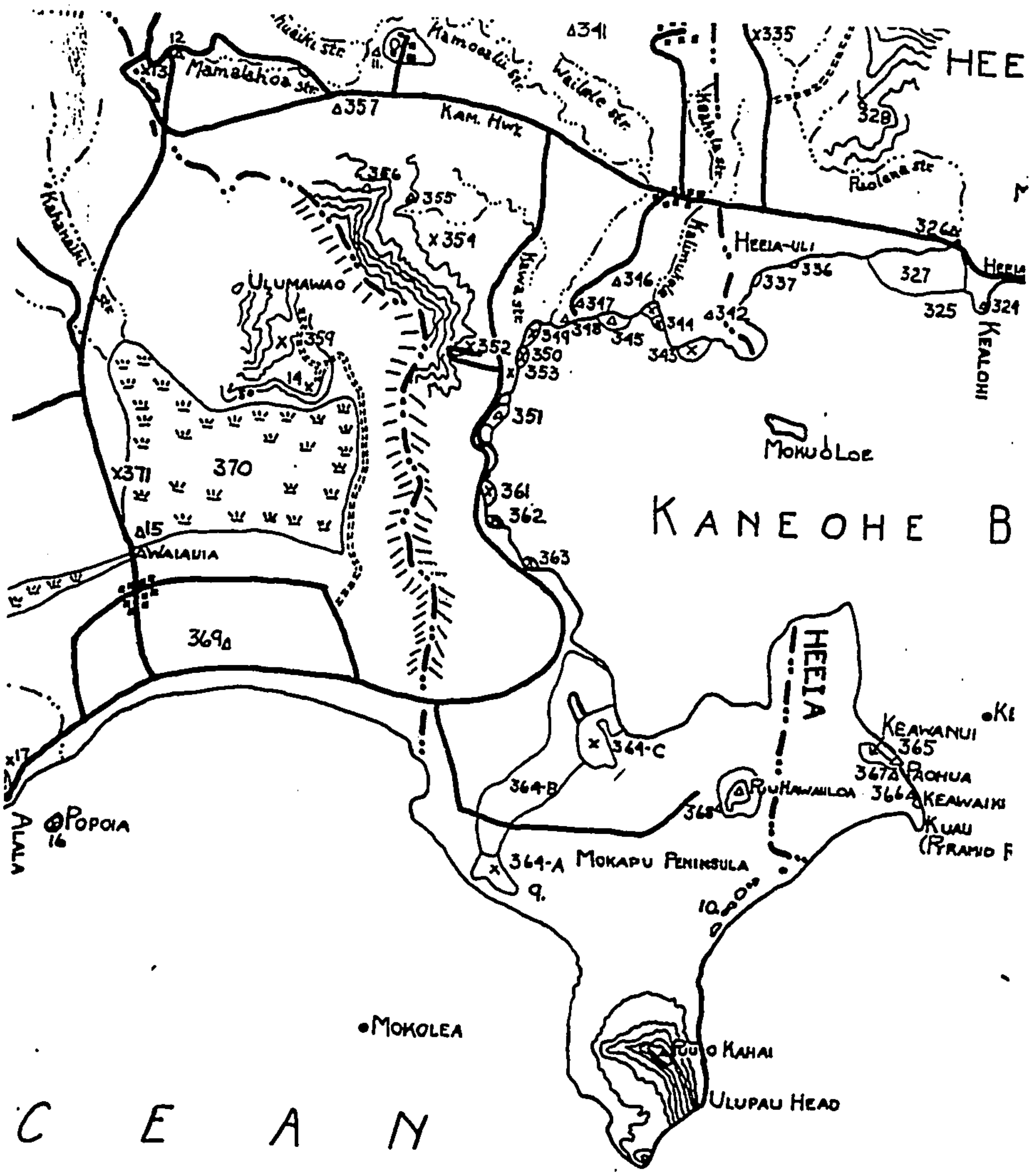


Fig. 5 McAllister Sites, Kāne'ohe: (Sterling and Summers 1978 Ko'olaupoko District).

hanahou" Pond appears on some maps as Waikaluawaho Pond with Waikalaa being an "older variant" (Devaney et al. 1976:147). Keana (Lokokeana) which once included Waikaluawaho, was "artificially filled in 1950s" (Ibid.:147). Waikaluawaho is in a poor state of preservation, with just the seaward wall remaining and the former pond area being filled with mangrove. Site 353 was a spring in the Kokokahi YWCA area. Traditional accounts called this spring "Kini Kailua-Mano Kāne'ohe" for the "hundreds of Kailua and thousands of Kāne'ohe people who died from drinking the poisoned waters of the spring (Ibid.:179). The YWCA property in the area of the former Keana pond and Kini Kailua-Mano Kāne'ohe spring is perpetually muddy and a flow of brackish water enters Kāne'ohe Bay in the vicinity. The area is presently used as open space, sail boat storage and launching area.

The next major archaeological research was associated with the Kailua-Kāne'ohe Flood Control Project, with a reconnaissance level survey of the banks of Kāne'ohe Stream within the project area. "Below the confluence of the Kuou and Kamo'oali'i Streams, it covers only the immediate banks of Kāne'ohe Stream; this entire stretch has been developed and no sites remain" (Rosendahl (ed.) 1976:3-8). Though no sites were recorded this report details upland agriculture of Kāne'ohe and how it relates to overall ahupua'a occupation.

The research associated with the U.S. Army corps of Engineers, Kāne'ohe Bay Urban Water Resource Study resulted in the book Kāne'ohe: A History of Change (Devaney, Kelly, Lee, Motteler 1976). The book (ca. 220 pps) includes sections on population, history, agriculture, water and forest marine resources (including section on fishponds) and numerous photos and maps. Ross Cordy also wrote an 82 page report dealing with Cultural Resource Planning of the Kāne'ohe Bay Area as part of U.S. Army Corps study. Of particular interest is Cordy's documentation and figure (F-2) on kuleana(s) within the project area (Cordy 1977:49-50).

The 1987 Bishop Museum Report "Five Upland 'Ili" (Allen (ed) 1987) concerns the Kāne'ohe interchange for H-3. The report discusses the intensive survey and excavations conducted in upland agricultural systems.

In 1986 staff of the Bishop Museum conducted archaeological investigations at the site of the "Proposed Nani Pua Gardens II Subdivision" (Clark and Riford 1986) (See Fig.4). This property is just mauka (NW) of the present project area. The report details stratigraphy of backhoe trenches, controlled excavations and burial removal. There were some 12,200 portable artifacts, evidence of large pole/thatched houses, and in situ burials below habitation floors.

The recent (1970s - 1980s) archaeological research concerning Kāne'ohe has supported traditional and early historical accounts of the high productivity of the ahupua'a of Kāne'ohe. The research has also produced a range of dates from the uplands to the coast. Rosendahl (1970) suggests a time span of 325 years for the upland site, 50-OA-G5-37. "The site was occupied, most likely in a pattern of recurrent occupation, abandonment, and reoccupation, during an estimated maximum time span of approximately 325 years A.d. 1425-1750" (Rosendahl 1976:6-96). Allen (1987) suggests a time span for ponded fields in Luluku (50-OA-G5-85 Features 30 to 38) "The 5th through 16th or 17th Centuries at a minimum" and dry land agriculture starting around the 11th to 13th Centuries (Allen 1987:179: 244). Clark and Riford (1986) in their work on the Nani Pua Gardens indicate that "apparently site 50-OA-G5-101, was settled sometime between A.D. 1070 and 1405 ... and that ... sometime prior to A.D. 1510 - 1680, a major flooding event occurred that buried a major portion of this small settlement. The eroded sediments may have come from the de--stabilized landscapes where upland forest had been cleared for agricultural purposes' (Clark, Riford 1986:109-110).

Fishpond dating has been attempted in a few locations, notably Nu'upia Ponds Mōkapu Peninsula (Hammatt et al. 1985). Though there was a very small organic sample involved, a date of around 12-1300 A.D. was postulated for the development of the ponds (Hammatt et al. 1985:41-42).

In general Kāne'ohe has been one of the most intensively studied <u>ahupua'a</u>(s). Studies from the uplands to the coast, including fishponds have been conducted. However the project area which includes former ponded taro fields (<u>lo'i</u>) and fish-ponds appear to have the potential for additional substantial data. The dating of both fishponds and <u>lo'i</u> are feasible and rewarding in terms of adding significantly to Hawaiian prehistory and settlement patterns.

III. Historical Background

1. Introduction

The project area is located within the Windward O'ahu district of Ko'olaupoko and is situated within the traditional Hawaiian land unit (ahupua'a) of Kāne'ohe (Fig. 6) Kāne'ohe is a large ahupua'a (ca 11,000 acres) extending from the Windward base of the Ko'olau to include most of the Mōkapu Peninsula. Traditionally Kāne'ohe has been viewed as a "valuable" ahupua'a both in terms of agricultural and fishery productivity. S. Kamakau referred to 1830s Kāne'ohe as the "most valuable part" of Ko'olaupoko (Kamakau 1961:303). Specifically, the project area encompasses what has been called Waikawa Swamp and Waikawa (loko) fishpond (Fig. 7). Formerly these were some of the most productive taro lands of Kāne'ohe.

2. Traditional Accounts

There are a number of traditional (legendary) references, dealing with this general area of Kāne'ohe, which indicate its high productivity and hence, its highly "valuable" status. The legend of La'amaikahiki "so named for his coming from Kahiki" (Tahiti)(Kamakau: in Sterling and Summers 1978:209-210) relates the landing of La'a on the north side of the mouth of Kāne'ohe Stream where he "threw out some sand as a resting place for the canoes" (Ibid.). The sandy canoe landing has become known as "Na-one-a-La'a" which were "tapu to the commoner when ali'i lived there" (McAllister (Site 348) 1933:178). La'a had traveled to Hawai'i and specifically to O'ahu because "He heard ... Hawai'i

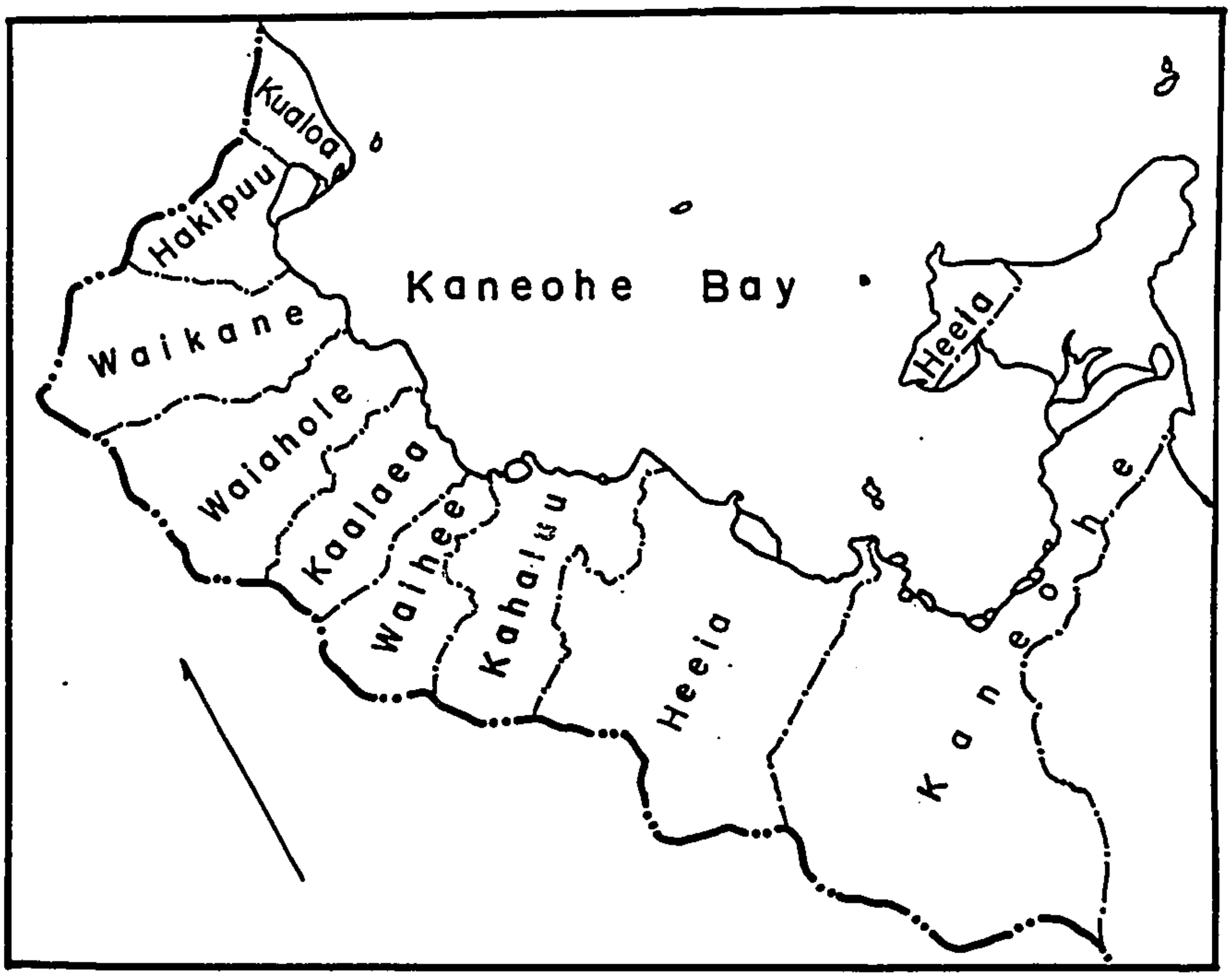


Fig. 6 Ko'olaupoko District: Showing Kāne'ohe <u>Ahupua'a</u> (From Devaney et al. Fig. 1).

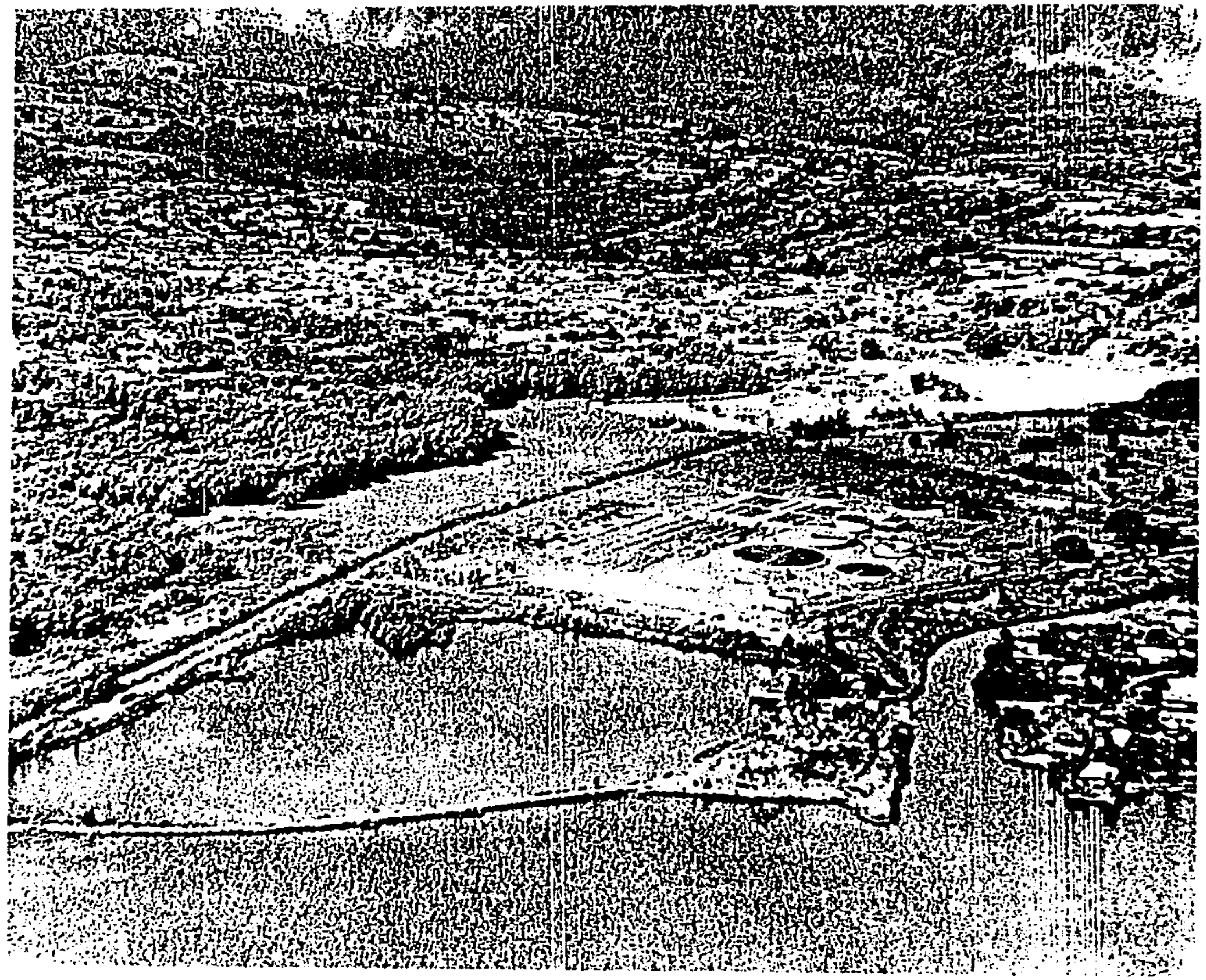


Fig. 7 Aerial photo dated 1974, Showing Waikalua loko Pond, Sewage Treatment Plant and Golf course (Waikalua Swamp)

was a fertile land ... with ... O'ahu the richest of all" (Kamakau: in Sterling and Summers 1978:209). Kamakau referred to the general area as Wai-hau-palua. The place name apparently was shortened to Waikalua over time. T. Thrum reports in 1916 "At Waikalua near the beach, once stood the Naoneala'a Heiau" (Thrum 1916:90).

Kamakau also specifically refers to this area (Waihaupawa/-Naonealaa) in his discussion of the invasion of O'ahu (ca 1737) by the Hawai'i Island chief Alapai and his warriors. Kamakau relates that Alapai and his warriors' encampment was at Kailua and Kāne'ohe, to insure abundant food supplies. This war was settled at Naonealaa with the meeting of Kauai chief Peleioholani and Alapai, who was encamped at Waihaupalua. "It was January 1737, that the two hosts met, splendidly dressed in cloaks of bird feathers and in helmet shaped head coverings beautifully decorated with feathers of birds ... both chiefs were attired in a way to inspire admiration and awe, and the day was one of rejoicing as that of the ending of a dreadful conflict. So it was that Peleioholani and Alapai met at Naonealaa Kāne'ohe" (Kamakau 1961:72).

3. Early Historic Period, 1778 - 1840

These traditional accounts did not mention the large fish pond at Waikalua, but they do indicate the high productivity and desirability of the area. Subsequent early historic accounts echo these earlier traditions.

"In early historic times, when Kahahana ruled O'ahu, he sometimes lived in Kāne'ohe. After defeating Kahahana in 1983, Kahekili and most of his famous warriors lived in Ko'olaupoko at Kailua, Kāne'ohe, and He'eia (Fornander 1969:225; Kamakau 1961:138). When Kamehameha I apportioned the conquered O'ahu lands in 1715 to his warrior chiefs and counsellors (Ii 1959:69-70), he retained as his personal property the Ahupua'a of Kāne'ohe. One of his personal gods, the Akuapoko, collected tribute from Kāne'ohe during the makahiki (Ii 1959:75-76). Much of Kāne'ohe and all of Kahalu'u and Kualoa were inherited as personal lands by Kamehameha's sons Liholiho and Kauikeaouli, (Kamehameha II and III) (Indices 1920:27-28). It was Kamehameha III (Kauikeaouli) who in 1848 presided over the division of lands known as the Great Mahele.

4. Mid 1800s

Kamehameha III retained the bulk of the ahupua'a during the Mahele (1848). After his death his wife, Queen Kalama inherited portion of the ahupua'a. Her award (L.C.A. 4452, 9,500 acres) included Waikalua (loko) and Keana fishponds but not the majority of the project area. The project area was, for the most part, small plots of irrigated taro or lo'i. The Kuleana Act of 1850 allowed for "small tenants ... to acquire a full title to the lands which they had been improving for their own use ... for it was the labor of these people and their ancestors that made the land what it was" (Lyons 1875:127: in Devaney et al. 1976:22). There were a total of 150 Land Commission Awards (LCA's) issued for the ahupua'a of Kāne'ohe of which 117 were for less than 10 acres, with the average kuleana award being 2.39 acres (Kelly 1976:22-33). There were approximately 45 LCAs or portions thereof within the project area (Fig. 8). The majority of these LCAs were for less than an acre. However, all these claims were not for "commoners" as chiefs and/or konohiki(s) were also awarded lots within the project parcel. These include:

	Awardee	Acres
LCA 7587	Kealoha, L.	275
6400	Kapu	266
2937	Harbottle	141
10605	Piikoi, I	43
3986/8146	Hueu	12

These chiefs/konohiki(s) received relatively large pieces of land of which only small lots (lo'i) were within the project area. Also the crown retained parcels, in addition to Queen Kalama's holdings.

According to the testimonies given at the time of the kuleana awards (ca 1850) virtually the entire project area was under intensive wet land taro (lo'i) cultivation. Two of the LCAs, 2628 to Paele and 1958 to Mahu, refer to owning a fishpond on one of their lots (apana), but though both are within close proximity to Waikalua Pond they do not appear to be referring to this large (11 acre) pond. The testimonies also mention the auwai system (water ditch system) as it related to the location of the particular kuleana. House and kula (dryland agriculture) lots were located on the north side of Kāne'ohe Stream and south

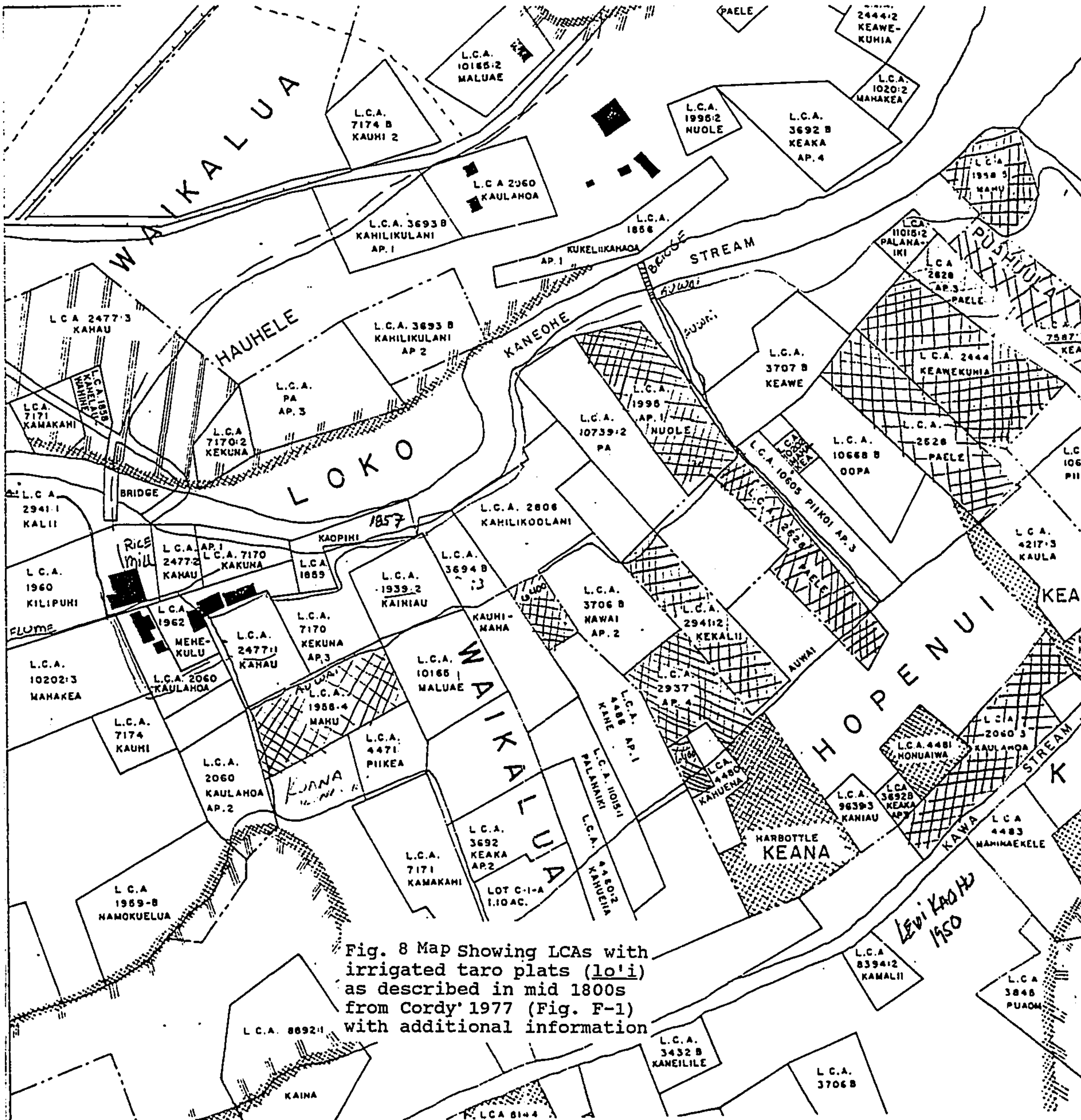
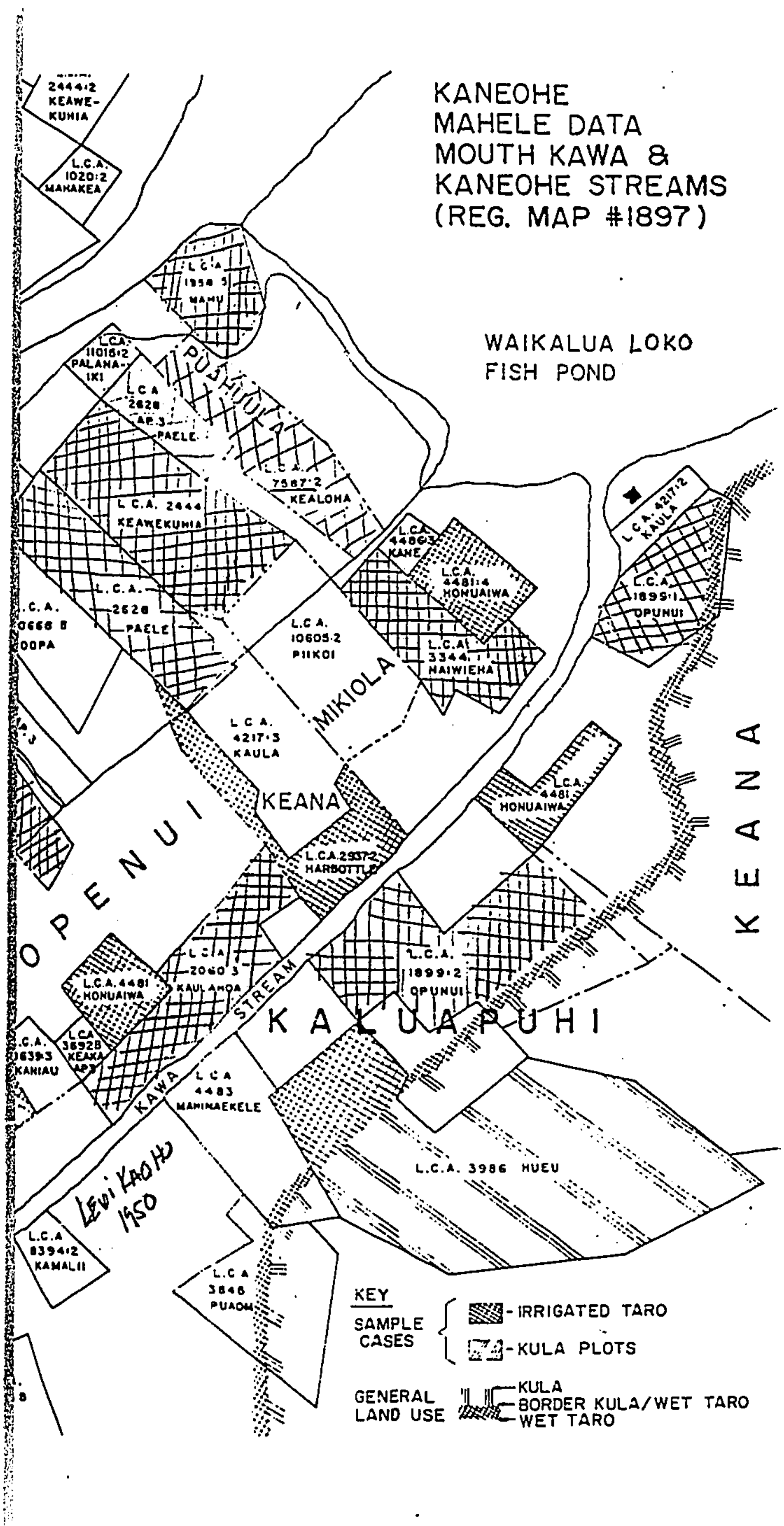


Fig. 8 Map Showing LCAs with irrigated taro plats (<u>lo'i</u>) as described in mid 1800s from Cordy' 1977 (Fig. F-1) with additional information


KANEOHE
MAHELE DATA
MOUTH KAWA &
KANEOHE STREAMS
(REG. MAP #1897)
WAIKALUA LOKO
FISH POND
2444:2 KEAWE-KUHIA
L.C.A. 1020:2 MAHAKEA
L.C.A. 1958 5 MAHU
L.C.A. 11016:2 PALANA-IKI
PUAHIALA
L.C.A. 2628 AP.3 PAELE
L.C.A. 7587 2 KEALOHA
L.C.A. 2444 KEAWEKUHIA
L.C.A. 4486 3 KANE
L.C.A. 4481:4 HONUAIWA
L.C.A. 4217:2 KAULA
L.C.A. 1899:1 OPUNUI
L.C.A. 2626 PAELE
L.C.A. 10605:2 PIIKOI
L.C.A. 3344 HAIWIEHA
MIKIOLA
L.C.A. 4217:3 KAULA
KEANA
L.C.A. 4481 HONUAIWA
L.C.A. 2937:2 HARBOTTLE
OPENUI
KEANA
L.C.A. 2060 3 KAULAHOA
L.C.A. 4481 HONUAIWA
L.C.A. 1899:2 OPUNUI
KALUAPUHI
KAWA STREAM
L.C.A. 3692B KEAKA AP.3
L.C.A. 4483 MAHINAEKELE
L.C.A. 3986 HUEU
Levi Kaoho 1950
L.C.A. 8394:2 KAMALII
L.C.A. 3846 PUAOH
KEY
SAMPLE CASES
- IRRIGATED TARO
- KULA PLOTS
GENERAL LAND USE
KULA
BORDER KULA/WET TARO
WET TARO

of Kawa Stream along present day Kāne'ohe Bay Drive. The record left by the Mahele - large numbers of small plots, Testimonies and the status of those who received the larger tracts of land - again attests to the valuable nature of the project parcel.

5. 1860-1920

In the 1860s both commercial sugar cane and rice cultivation began in Kāne'ohe. The Kāne'ohe Sugar Plantation which started around 1865 was on Queen Kalama's land with Charles Coffin Harris (C.C.Harris) as partner and manager. Sugar cultivation did not directly affect the project area, but the land ownership changes brought about by the sugar operation did. In 1871 C.C. Harris bought Queen Kalama's Ko'olaupoko properties from her heir Charles Kanaina, as well as some land in Honolulu for $22,448. The sale included "livestock, tools, fishponds, and fishing rights" (Bur. of Conv. Book 34: 53; in Devaney et al. 1976:29), the fishponds of Waikalualoko and Keana were part of this sale.

Rice cultivation was to eventually dominate the project area. Rice was cultivated mainly by Chinese who rented/leased the lo'i lands from the Hawaiian landowners. By the late 1880s virtually the entire project area is under rice cultivation (Fig. 9). In 1890-92 the Kāne'ohe Rice Mill was erected and put into production on property adjoining (mauka of) the present golf course (Fig. 10). The mill had a long flume coming to it form further up Kāne'ohe Stream, and a short railway leading to a small landing in Kāne'ohe Bay, north of Kāne'ohe Stream. During the height of rice cultivation (ca 1890-1920) Chinese dominated

Fig. 9 Project Area Under Rice Cultivation ca. 1910 (Devaney et al. 1976:Fig. 17)

Fig. 10 Kāne'ohe Rice Mill ca. 1913 (Devaney et al. 1976:Fig. 25)

the business. "To a great extent the rice business, growing and milling was controlled by Chinese hui, (firms), which recruited laborers from China, handled investment capital from rich absentee landlords, and tallied profits (Montgomery MS.)" (Devaney et al. 1978:49). The Kāne'ohe Rice Mill of the 1890s was owned by "a man named Lee, Ahlo" and "ground rice of anyone who brought it to them ... The manager of the mill ... leased land from the Hawaiians. He could have had the land in his name." but at that time everyone wanted to earn as much money as possible and then go back to China." These quotes are from a Personal Interview by M. Kelly of Polly Ching who was born at the site of the Kāne'ohe Rice Mill (Devaney et al. 1976). The City Directory(s) of 1894/96 (Bowser, ed.) listed L. Ahlo, General Merchandize of Honolulu as agent for Kāne'ohe Rice Mill with a Mr. An Yuck as Manager.

In 1917 Harold K. Castle buys the Kāne'ohe Ranch Company, formerly Queen Kalama's land, from Nannie R. Rice who had inherited property from her father C.C. Harris. Kāne'ohe Ranch both under the Harris/Rice ownership and Castle's bought, whenever available, the smaller kuleana lots. As leases and mortgages came due the lots were usually purchased at nominal fees. "Tracing the means by which kuleana lands were alienated from their original awardees or heirs reveals that they were most often sold or mortgaged and then auctioned ... as commercial venture(s) ... sugar, rice and pineapple ... extended their boundaries to increase acreage under cultivation, the process of consolidation of land ownership continued" (Devaney et al.

1978:31). By this means the Castle Estate came to eventually own the entire property.

By the 1920s rice had gradually declined in importance. There was competition from California and "Japanese farmers began to displace Chinese farmers in many places in Windward O'ahu" (M. Kelly in Allen et al. 1987:245). However, limited rice and some taro cultivation continued within the project area.

6. Urbanization

Rice and taro planting continued into the middle or late 1950s and the flume system which took water to Kāne'ohe Rice Mill was still in operation. According to local informants taro outlasted rice. "Around 1950 water was carried to the fields near the bay through a concrete culvert and then along a 30 foot high wooden flume that crossed the main stream near Kamehameha Hwy and Honda Store and dropped into the stream (I: It watered the rice fields? [Respondent:] No, it watered the taro patches ... the rice fields were gone already" (Ed. Haitsuka in Allen et al. 1987:282). Referring to the taro, Mr. Henry Wong (longtime Kāne'ohe Ranch Manager) indicated that "The last taro patches ... were abandoned 20 to 25 years ago" (ca 1955 Wong: in Rosendahl et al. 1976:3-8).

7. Recent History

During the 1950s and 1960s the Castle Estate divested itself, through sales and/or leases, of control over most of the project area. These land transactions included sale of Kokokahi

YWCA (1940s) City and County of Honolulu (sewage plants), Bay View Golf Course, and lands to Kāne'ohe Ranch Manager Henry Wong. Henry Wong obtained Waikalua-loko fishpond, as the two other ponds were non-operational by this time. Waikalua Pond was overgrown with mangrove and Keana Pond was artificially filled in the 1950s. These two ponds were also impacted by sewer line excavations.

8. Historical Summary

Historically, the ahupua'a of Kāne'ohe was one of the more productive areas, in terms of agriculture and fisheries in pre-Contact times (pre A.D. 1778). Kamehameha I after conquering O'ahu retained the ahupua'a of Kāne'ohe as his personal property, which was inherited by his sons (Kamehameha II and III). The Mahele of the mid 1800s (1840s - 1850s) changed land tenure to private ownership and the majority of the project area was divided into small lots, kuleana. The kuleana were, for the most part, wet land taro lo'i. There were a number of high status individuals, as well as crown land awarded lo'i within the project area, again indicating the land's value. In the late 1800s and early 1900s (ca 1880 - 1920) commercial rice growing replaced the taro lo'i. The rice operation was a Chinese concern, with land leased from the Hawaiian (kuleana) owners. However. land consolidation by major land owners, first by the Harris/Rice Estate (ca 1870 - 1917), then the Castle Estate (ca 1917 - 1950s) swallowed most of the kuleana by the 1920s. The fishponds stayed with the major land holder for the ahupua'a of

Kāne'ohe; first to Queen Kalama (1848 - 1871), then to K.K.L. Castle Estate (1917 - 1960s). Taro made a short-lived recovery, as rice declined between the 1920s and 1950s. Urban pressure on the project area is evidenced by sales/leases of small parcels (former kuleana) for house lots along present day Kāne'ohe Bay Drive, starting in the 1940s. The advent of Statehood (1959) was further impetus for urban expansion and in the 1960s Kāne'ohe Bay Golf Course and the sewage treatment plant permanently took over the former taro lands of Waikalua. Keana Pond was filled and Waikalua Pond was choked by mangrove by the 1950s to 1960s. Only the larger fishpond, Waikalua-loko, was able to sustain some type of productivity (raising oysters) (Devaney et al. 1976:145). Archaeological data from Kāne'ohe shows dates for ponded taro (lo'i), possibly as early as the 5th Century A.D. (Allen 1987:179, 244). Coring within Nu'upia Pond(s), on Mōkapu Peninsula has yielded an estimate of of A.D. 1200-1300 for the fishpond development (Hammatt et al. 1985).

IV. Survey Results

1. Ground Survey - Fishponds

The entire subject area was covered in the ground survey and the only two archaeological sites located were Waikalua-loko and Waikalua Ponds. No cultural remains were located on the floodplain which has been heavily modified by construction of recent features such as Bay View Golf Course, the sewage treatment plant and wide-spread dumping of soil over former irrigated fields. No trace of the former auwai system recorded on historic maps was located. These ditches which served the 20th Century Kāne'ohe Rice Mill as well as extensive rice and taro fields were presumably filled by post-1950 grading and dumping of soil fill.

Slope areas occur along he south fringes of the floodplain adjacent to Kāne'ohe Bay Drive. Much of this land has been modified by recent residential development. No sites were located here. It is worthy of mention that some large boulders of fine grained quality basalt were observed. These appeared to have rolled down the slope from above. They are of a quality of raw material which would be suitable for stone tool manufacturing. However, no evidence of ancient quarrying was found.

A small portion of the project area extends onto the floodplain and slope of the north side of Kāne'ohe Stream. On the slope above the floodplain was located a burned and abandoned modern house with cement steps, roofing iron and rusted cars. No evidence of earlier occupation was observed here.

The mauka edge of the project area has been heavily modified and graded for adjacent residential subdivisions. As far as the potential for archaeological sites in the makai section (except for the fishponds and their immediate periphery there is little or none. Both Kāne'ohe and Kawa Stream beds near the coast have been bermed for flood control with imported gravel fill and the outlets of these streams contain only recent alluvial deposits.

The two extant fishponds on the property are Waikalua-loko and Waikalua Ponds. The third pond shown on the historic maps adjoining Waikalua Pond to the east - Keana Pond - was filled in during the 1950s (Devaney et al. 1976:147) and not a trace of its former outline survives. Each of the 2 surviving ponds are described as follows:

Waikalua-loko Pond

This pond which stands between the outlets of Kāne'ohe and Kawa Streams is in some sources referred to as simply Waikalua Pond, but the name shown on the modern tax map is used in this report. The pond has a 2-4 foot high seawall which separates the interior from the reef. The wall is 2-4 feet high and 10-15 feet wide and the center is in sections, filled with sand and coral. The gates of the pond are mortared lava rock with wooden frame works and bridges (Figs 11-12).

The seawall is relatively clear of vegetation except at the east and towards Kawa Stream and is in portions somewhat jumbled by wave action on the seaward side. The wall was measured to be 1520 feet long (McAllister 1933:178) but appears to have been shortened somewhat by berming of the Kāne'ohe Stream mouth at the northwestern end of the pond.

The waters of the pond are generally clear of vegetation

Fig. 11 Waikalua-loko Fishpond, View to West from Seawall

Fig. 12 Waikalua-loko Fishpond, Makai side of Seawall Showing Gate, View to Southeast

except at the southeast end. The size estimates of the pond in various sources vary from 11 acres to 13 acres (Devaney 1976:139, 146) but this variation may be simple differences in calculation rather than actual changes in the pond through time. Review of the various historic maps showing the pond indicate that its size and placement of its seawall has remained the same in the last 100 years. Apparently the pond went through rebuilding in the early 1930s and McAllister reports that this work had just been completed (Ibid. 1933:178).

Besides fish rearing the pond has been used for raising oysters (Devaney 1976:145). Cobb in his 1901 survey of fishponds for the U.S. Fish Commission listed Waikalua (loko Waikalua) Pond as one of 16 ponds in *Kāne'ohe* Bay which were still in commercial production (Cobb 1902:748).

The historic maps show Kawa Stream entering the mauka side of Waikalua Pond. This stream in recent times has been diverted to its own channel which outlets at the eastern side of the pond.

Waikalua Pond

This pond borders Waikalua-loko on its eastern side. It has been referred to by other names such as Waikalua-waho or Waikalaa. A 1-2 foot high and 3-4 foot wide seawall survives on the east side of the present channel of Kawa Stream. The pond wall and interior are overgrown with mangrove and at present, there is no open water (Figs 13-14). The east and south sides are not clearly defined but a sewer line lies buried close to the periphery.

It appears from the historic maps that Waikalua Pond never

Fig. 13 Waikalua Pond Seawall, View Southwest

Fig. 14 Mangrove Intrusion Into Waikalua Fishpond

had an established source of fresh water as did Waikalua-loko although there was probably fresh water seepage. The pond in its original extent covered 3.5 acres and at one time connected to the now destroyed Keana Pond (Devaney 1976:147).

2. Subsurface Testing

Subsurface backhoe testing was conduced on the floodplain between Kāne'ohe and Kawa Streams in a strip of undeveloped pasture between the sewage treatment plant and the Bay View Golf Course. This area was chosen because it appeared as possibly the only undisturbed portion of the floodplain within the project area. The purpose of the testing was to gain information on the stratigraphic sequence within the floodplain, determine the existence of former pondfield soils and to evaluate the potential of the strata for containing remnants of former terrace walls, and other possible prehistoric features. In addition, on the historic map here an auwai is shown which traversed mauka-makai emptying into Waikalua-loko Pond. It was thought that the auwai, although it has been filled in, could be traced in the subsurface layers.

A 600-foot north-south sample line was chosen beginning 200 feet north of Kawa Stream at a point designated as 0. Eight trenches were excavated at 50-100 foot intervals with each trench averaging 25 feet long (7.5 meters) and averaging 7-8 feet (230-240 cm.) in depth (to water table). Both sides of the trenches were examined for cultural materials and features as well as changes in stratification. A typical section of each trench was selected and a soil profile description was made. Samples of all subsurface deposits were collected. Elevation rise from trench 1 of point 0 to Trench 8 at point Plus 586 was approximately 3 feet.

The stratigraphic succession was uniform throughout all eight trenches with variation in depth and thickness of each strata. A generalized soil profile description is presented below:

Stratum	Horizon and Origin	Average Depth (Range in Thickness)	Description
I	Modern mechanical fill	0-80 cm (60-120 cm.)	Dark greyish brown silt loam to sandy clay contains basalt and coral gravel with modern trash, plastic, golf balls, bottle glass, abrupt wavy boundary
IIA	A-1 horizon Natural Deposit buried agricultural soil	80-120 cm. (20-60 cm.)	Reddish brown, clay loam with fine strong angular blocky structure with clay and iron coatings between peds and pronounced iron stained root casts. Clear wavy boundary. Top 10 cm. typically has platy structure from compaction.
IIB	A-3 horizon natural deposit buried agricultural soil	120-240+ cm. (100-130+ cm.)	Grayish blue, clay moderate medium angular blocky with pronounced iron coatings on root casts. Gleyed soil with weak organic and iron staining. Bottom portion waterlogged.

Throughout the 200-linear feet of floodplain exposed by the backhoe there has been modern dumping of imported top soil mixed with construction fill. This was probably done to reclaim the lowland areas for pasture land. This practice appears to have been widespread in the project area. Underlying this fill and partly compacted by it is the former wetland taro/rice agricultural soil (Figs 15-16). Very typical of these soils is partial gleying in the lower portions (due to poor drainage) and iron staining in the upper portion (from the water flow along crop roots). Strata IIA and IIB are considered to have the same depositional origin (alluvium) and their differences are explained in terms of past depositional alteration, differential weathering and variation in moisture regime and drainage. The A-1 horizon is better drained and has been more exposed to weathering. Samples were collected of Stratum IIA and IIB in most trenches but these samples are estimated to be too low in organic content for dating.

Within none of the backhoe trenches were cultural materials or features such as rock alignments, charcoal lenses, shell midden, etc, observed. The former auwai shown on the early maps was not discerned in the profiles of any of the trenches, nor was there any indication of earthen field boundaries. It is possible and even likely however, that if large sections of floodplain and adjacent deposits were exposed during construction that archaeological materials, including datable samples would be recovered.

Fig. 15 Backhoe Trench 6, Showing Modern Fill (Stratum I) and Buried Pond Soils (Stratum IIA, IIB)

Fig. 16 Backhoe Trench 7. North face Showing Modern Fill (Stratum I) and Buried Pond Soils (Stratum IIA, IIB)

V. Summary: Archaeological Potential and Significance

1. Historical Summary

The historical research on the subject parcel, including examination of the number and kind of Land Court Awards, indicate that the lower floodplain of Kāne'ohe and Kawa Streams was densely used in prehistoric and historic times for taro cultivation. There were once 3 fishponds along the shoreline and even the slopes above the plain, near present Kāne'ohe Bay Drive were used for habitation and dryland planting. The study area may have been one of the most heavily used and most agriculturally productive on O'ahu. Approximately 45 separate Land Court Awards were granted within the study area in the mid 19th Century. Most of these were lo'i, wetland taro plots, of less than one acre which were irrigated by a permanent auwai system. Because the land was so valuable here, Chiefs and Konohiki(s) received plots of land (generally much larger than those received by commoners). Kamehameha I had in 1795 retained Kāne'ohe as his personal property on his conquest of O'ahu in 1795. Not only was it a residence of Chiefs before the conquest, but it was traditionally known as a place of plenty.

Following the Mahele and by the 1880s almost the entire floodplain was given over to rice cultivation. The Kāne'ohe Rice Mill was built mauka of the project area and rice was mostly cultivated by Chinese farmers. Following the fall in rice prices due to external production, taro once gain flourished and was planted on the floodplain into the 1950s.

With increased urbanization and associated improvements such as flood control, road building, sewer plant, etc., the project area was extensively modified from the 1950s onwards.

2. Survey Results and Fishpond Significance

Partly as a result of these dramatic modifications of the study area, and in spite of historic evidence for intensive prehistoric and early historic use, only two archaeological sites were found on the property. These are Waikalua-loko and Waikalua Fishponds. Both of these ponds and their immediate fringes (banks and walls) are important archaeological sites. In spite of modern modifications to Waikalua-loko and disturbance by mangrove and a sewer line to Waikalua Pond they both represent significant examples of prehistoric Hawaiian fishponds.

Waikalua-loko Pond

Waikalua-loko Pond has been in continuous productive use to the present time. The pond itself is in good condition and the water of good quality. There has been only a small encroachment by mangrove. Apple and Kikuchi (1975) list Waikalua (loko) Pond as one of 56 fishponds in the State of Hawaii worthy of preservation. It appears today essentially the same as it did in the 1974 aerial photograph (Ibid 1975:129). They evaluate the pond as significant according all 4 of the National Register of Historic Places Criteria summarized as follows:

Criterion A: Site reflects major trends or events in the history of the state or nation.

Criterion B: Site is associated with the lives of persons significant in our past. Apple and Kikuchi state that all Hawaiian fishponds were associated with Ali'i and were objects of conspicuous ownership, contributing products which were offered to the golds or eaten by the elite (Ibid., 1975:67).

Criterion C: Site is an excellent example of a site type. Apple and Kikuchi state that each pond had a unique method of construction and design utilizing a unique shoreline feature and a unique ecological habitat (Ibid., 1975:67).

Criterion D: Site may be likely to yield information important to prehistory or history. This criterion is clearly valid in view of recent stratigraphic and chronological research on Hawaiian Ponds and associated cultural deposits incorporated in banks and walls (Hammatt et al, 1985).

Criterion E: Site has cultural significance. This criterion is not mentioned by Apple and Kikuchi, but a fishpond certainly qualifies when the products of the ponds were offered to the gods or eaten by the elite (the earthly representatives of the gods).

Waikalua Pond

Although the walls of this smaller pond are intact, they, as well as the entire interior of the pond, are heavily overgrown with mangrove and to a lesser extent hau. The original configuration of this pond may be slightly changed with partial filling on the east side. A sewer line passes on the east and south side. However, because of the intact kuapā (seawall) the pond is judged to meet all the criteria mentioned for Waikalua-loko above. On the western side banked reef deposits contain plentiful marine shells and some possible basalt flakes which may represent early occupation associated with the pond. It is therefore particularly likely that the pond could yield information important to prehistory or history.

Keana Pond

This pond which once joined to the east side of Waikalua Pond has been entirely filled and no trace of any former features of the pond could be located.

3. Subsurface Testing and Potential for Finding Subsurface Cultural Deposits

A 600-foot long transect of what was judged to be the most intact portion of the Kāne'ohe/Kawa Stream floodplain was backhoe tested with a total of nearly 200 linear feet of trenching. The original ponded, gleyed sediments associated with former taro/-rice planting were encountered at depths varying from 60 to 120 cm. No terracing or buried ancient feature or material was found. These paddy soils have been covered with an extensive layer of imported fill containing broken glass, road tar and other historic trash. If these are representative profiles as they are believed to be then large areas of the floodplain have been filled in modern times, probably in efforts to reclaim marshlands. This filling would have covered much of the original taro/rice lands and buried associated terraces and other features which survived from long-term use. Many of the slopes and level uplands above the streams have been graded and covered as well.

There is an obvious disparity between the abundant historic evidence for intensive prehistoric land use in the project area and the lack of discovery of archaeological features and layers. Given the size of the project area and the variety of potential site "habitats" (many of which cannot be feasibly tested), as well as the plentiful documentary evidence of prehistoric habitation, there is still potential for uncovering archaeological materials during the construction phase of the proposed project. This potential is particularly relevant considering the massive grading which will be required along the slope areas of the south and west end of the project.

The primary example in illustrating this potential is provided in the discovery of a cultural rich archaeological site to the west of the project area on a high terrace buried beneath 20 cm. to one meter of bulldozed fill (alluvium). This site located to the northwest of Puohala School by Wena Road, eventually yielded over 12,000 portable artifacts, including stone and bone tools, tattooing combs and adzes, as well as human burials. The cultural materials were dated to as early as 1,000 A.D. (Clark and Riford, 1986). The possibility of the discovery of buried sites of comparable importance during construction within the present project area cannot be eliminated.

VI. Impacts and Recommendations for Mitigation

1. <u>Impacts</u>

Present plans for expansion of the Bay View Golf Course will include massive grading of the floodplain slopes and higher elevation level lands, particularly at the southern periphery. There is a potential for exposing significant archaeological sites which may now lie buried under fill and alluvium. In addition, there are 2 intact and archaeologically important prehistoric Hawaiian fishponds in the project area which are judge to be significant according to all 5 National Register Criteria. The following measures are proposed to mitigate impact of the project construction.

2. <u>Archaeological Monitoring During Grubbing and Initial Grading</u>

A. An archaeologist should be on site to monitor initial grubbing and grading for the purpose of identifying and evaluating buried cultural materials which may be uncovered. If significant material is uncovered the State Historic Preservation Office should be consulted to evaluate the findings before construction resumes in that area.

<u>Preservation and Restoration of Two Fishponds</u>

B. Both Waikalua-loko and Waikalua Fishponds, the only 2 sites presently identified on the property, should be preserved in place. No construction or other modifications should take place on their banks or walls except that which serves to preserve or improve the condition of the sites as functioning Hawaiian fishponds.

C. Both ponds should be cleared by hand or other feasible means of existing mangrove, hau and other destructive vegetation.

D. Before any dredging or cleaning of the pond takes place, the deposits within the pond should be core-sampled for purposes of stratigraphic study and recovery and dating of organic samples.

E. The <u>mākāhā</u> (gates) and <u>kuapā</u> (seawalls) of the ponds should be restored as much as possible to their earlier functioning condition.

F. The ponds should be maintained, free of vegetation and with sufficient water quality to allow flourishing of vertebrate and invertebrate marine life.

G. A modest interpretive program is recommended which would include explanatory signs giving the history and function of the ponds as well as present operation.

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CORRECTION

THE PRECEDING DOCUMENT(S) HAS BEEN REPHOTOGRAPHED TO ASSURE LEGIBILITY

SEE FRAME(S)

IMMEDIATELY FOLLOWING

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APPENDIX D

TERRESTRIAL VERTEBRATE ANIMALS OF THE BAYVIEW GOLF COURSE EXPANSION, KANEOHE BAY DRIVE, KANEOHE

Prepared by J. Andrew Berger, March 1989

Terrestrial Vertebrate Animals of the
Bayview Golf Course Expansion
Kaneohe Bay Drive, Kaneohe

By Andrew J. Berger

This study was conducted on instructions received from Mr. Harvey K. Hida, President of Hida, Okamoto & Associates, Inc., in a letter dated February 22, 1989. My field studies were conducted on February 24, 25, and 27, 1989.

The Habitat

The entire region has been repeatedly disturbed for over 100 years. There is no semblance of any endemic ecosystem in the vicinity of the project. The vegetation, therefore, consists of a wide variety of introduced trees, shrubs, and vines. Following are examples of some of the more conspicuous plants: Norfolk Island pine (*Araucaria heterophylla*), banana (*Musa* spp.), coconut palm (*Cocos nucifera*), plumeria (*Plumeria* sp.), mango (*Mangifera indica*), octopus tree (*Brassaia actinophylla*), hau (*Hibiscus tiliaceus*), Indian banyan (*Ficus benghalensis*), paper bark tree (*Melaleuca leucadendra*), monkeypod (*Samanea saman*), christmasberry (*Schinus terebinthifolius*), koa-haole (*Leucaena glauca*), bougainvillea (*Bougainvillea spectabilis*), ti (*Cordyline terminalis*), pluchea (*Pluchea indica*), castor bean (*Ricinus communis*), wedelia (*Wedelia trilobata*). Thick clumps of California grass (*Brachiaria mutica*) grow around the edges of the golf course as well as along Kawa stream that passes through the course. The botanical consultant will discuss these introduced plants in more detail.

Amphibians and Reptiles

There are no endemic amphibians or land reptiles in the Hawaiian Islands. All, therefore, have been introduced by man.

I. Amphibians

Four species of frogs have been introduced to the island of Oahu.

1. Giant Neotropical toad (*Bufo marinus*).

This toad was first introduced to the islands in 1932 "when Dr. C. E. Pemberton brought 148 adult toads from Puerto Rico. Eighty of these were liberated in a taro patch near Waipio, Oahu, and 68 were released in a swampy part of Manoa Valley" (Oliver and Shaw, 1953:77). The toads were very successful, and "in a little over two years more than 100,000 descendants of the original stock were distributed through Dr. Pemberton's activities throughout the islands." Hunsaker and Breese (1967) wrote that this toad was the "commonest species of amphibian in Hawaii." The neotropical toad is found throughout the entire region. Although they are active primarily at night, I saw one toad on a fairway on February 27, 1989.

2. Gold and Black Poison Frog (*Dendrobates auratus*).

This frog was introduced to Oahu to "assist in the control of insect pests." Oliver and Shaw state that the species was released in the upper part of Manoa Valley in 1932. Hunsaker and Breese wrote that "additional plantings with subsequent establishment have been made in Waiahole Valley, and the populatinn has been observed to fluctuate in size at this locality, again according to the amount of water available." McKeown (1978) said that this frog is found in well-foliated valleys on both Leeward and Windward Oahu." He added that, in summer and fall "these frogs spend their time in moist places such as under debris, logs, stones, tangled root systems or under elevated valley homes." However, I know of no records of this frog at low elevations and I do not believe that they inhabit the golf course area.

3. American Bullfrog (Rana catesbeiana)

"This was probably one of the first species of amphibians to be introduced to the Hawaiian Islands and may have been one of the frogs that was imported prior to 1867" (Oliver and Shaw, 1953). The frogs were abundant enough to be harvested commercially by 1900. Tinker (1941) wrote that "the University of Hawaii has organized 'frog clubs' to encourage the production of frogs for food." The species is not nearly so common now, presumably because of the draining of so many wetland areas and, perhaps, also, because of the widespread use of pesticides and herbicides during recent decades. Bullfrogs are active primarily at night, and I neither saw nor heard any during my field studies. I saw no evidence that the frogs inhabit the stream that winds through the golf course.

4. Wrinkled Frog (Rana rugosa)

This frog was introduced to Hawaii from Japan in 1896. (McKeown, 1978). It is most common in mountain streams, although

Shallenberger (1977:245) found this species at Punahoolapa Pond on the north shore of Oahu. McKeown noted that the wrinkled frog and the bullfrog rarely are found together because the latter species is such an aggressive feeder. I know of no evidence that the wrinkled frog occurs at the low elevations of the golf course.

II. Reptiles

1. Blind Snake (Typhlops braminus)

"This small, secretive snake was apparently introduced from the Philippines in the dirt surrounding plants that were brought in for landscaping the campus of the Kamehmeha Boys School in Honolulu. It was first found there in January of 1930" (Oliver and Shaw, 1953). By 1967, Hunsaker and Breese wrote that "it appears now to occupy the lowland area over the entire island." It now is found on all of the main islands in the Hawaiian chain (McKeown, 1978).

These blind worm-like snakes are rarely seen until they are flooded from their underground burrows by heavy rain or unless one looks for them under branches and other debris on the ground. I did not search for these snakes because they are of no significance for an impact assessment.

2. Lizards. Eleven species of lizards (in four different families) occur on Oahu. All are foreign to the islands, all are insect eaters, and all adapt very well to both urban and rural areas. Their presence, however, is irrelevant to an impact assessment.

a. Family Iguanidae

1- green iguana (Iguana iguana)

2- green anole lizard (Anolis carolinensis porcatus)

b. Family Chamaeleonidae

3- Jackson's chameleon (Chamaeleo jacksoni)

c. Family Gekkonidae

4- mourning gecko (Lepidodactylus lugubris)

5- stump-toed gecko (Gehyra mutilata)

6- tree gecko (Hemiphyllodactylus typus)

7- Indo-Pacific gecko (Hemidactylus gamoti)

8- house gecko (Hemidactylus frenatus)

d. Family Scincidae

9- metallic skink (Leiolopisma metallicum)

10- snake-eyed gecko (Cryptoblepharus boutoni)

11- moth skink (Lipinia noctua)

The Birds

Three groups of birds are found in the Hawaiian Islands: I. Introduced or exotic birds. II. Indigenous or native birds, and III. endemic birds.

I. Introduced Birds

More than 170 species of alien birds have been intentionally introduced to the Hawaiian Islands (Berger, 1981). The following species were found on the project site or on lands adjacent to the site. I include birds seen on "lands adjacent to the site" for several reasons. First, the sites are surrounded by areas of other land uses; secondly, my field studies were conducted on only three days in late February 1989; and, thirdly, some of the bird species seen adjacent to the project site undoubtedly visit it from time to time.

I. Order Ciconiiformes
a. Family Ardeidae, Herons and Egrets
1. Cattle Egret (Bubulcus ibis)

This species was imported to Hawaii from Florida "to aid in the battle to control house flies, horn flies, and other flies that damage hides and cause lower weight gains in cattle" (Breese, 1959). A number of birds were released on Oahu in 1959 and 22 additional birds were released during July 1961. Thistle (1962) reported that the population of cattle egrets on Oahu exceeded 150 birds by July 1962. The population has increased greatly since that time. Personnel of the State Division of Forestry and Wildlife counted 621 egrets on Oahu during their January 1986 census (Walker, et al., 1986), and Pyle (1988) reported that 1009 egrets were counted just in the area covered by the Audubon Society Christmas Count on December 27, 1987. In early 1989 the "U.S. Department of Agriculture officals are planning to use pyrotechnics to convince 1,500 to 2,000 unwanted egrets to give up their roosting area near Keolu Drive" in Enchanted Lakes (Windward Sun Press, week of February 16-22, 1989). The cattle egret also has been a threat at airports on Kauai and the Big Island. On the Big Island, "extensive efforts to reduce the Cattle Egret population near Hilo airport, H., has resulted in a marked decrease in the species' numbers. Fewer than 10 were recorded at their traditional roost in Lokoaka Pond near Hilo" (Pratt, 1988; see also, Paton, Fellows, and Tomich, 1986).

The cattle egret is common on the golf course and in surrounding areas.

II. Order Columbiformes

a. Family Columbidae, Pigeons and Doves

2. Rock Dove or Feral Pigeon (Columba livia)

The pigeon probably was the first exotic bird to be introduced to the Hawaiian Islands. Its importation has been traced back to 1796. Schwartz and Schwartz (1949) wrote that the feral pigeon roosts and nests the year around in sheltered portions of cliffs along the sea coast, in rocky gulches, and in collapsed lava tubes up to 10,000 feet on Mauna Kea. These authors also found heavy parasitism by tapeworms, and they stated that the tapeworm infestation retards proper nutrition and "occludes the intestine, produces undesirable toxins, and hinders breeding." They added that "in certain places where rookeries are accessible to humans, it was, and still is, the custom for local residents to periodically take the squabs for food."

Navvab Gojrati (1970) reported on infection by bird malaria, Haemaproteus, and Leucocytozoon in birds studied at the Honolulu Zoo. Kishimoto and Baker (1969) reported finding the fungus Cryptococcus neoformans in 13 out of 17 samples of pigeon droppings collected on Oahu. The full significance of their findings was never determined in Hawaii, but, in man, this fungus causes a chronic cerebrospinal meningitis, and Hull (1963) remarked that "in all but the cutaneous forms the prognosis is very grave."

Small flocks of pigeons occur sporadically in the area, but it is not certain whether they are feral birds or come from a nearby pigeon loft.

3. Spotted or Chinese Dove (Streptopelia chinensis)

This Asian dove was introduced to the Hawaiian Islands at an early date; the exact date is unknown, but the birds are said to have been very common on Oahu by 1879. The species is now very common on all of the islands and is classified as a game bird in Hawaii. Although as many as 4,755 doves were shot by hunters during the 1967-1968 game bird season, no more than four birds have been killed annually since 1970 (Walker and Saito, 1984).

This dove also is called the lace-necked dove because of the conspicuous bands of white spots on the back of the neck. Although this dove does occur where the annual rainfall exceeds 100 inches, the highest densities are found in drier areas where the introduced mesquite or kiawe (Prosopis pallida) is one of the dominant plants. Schwartz and Schwartz (1949), for example, reported densities as great as 100 birds per square mile in dry areas on Molokai. This dove is common on the project site and in all surrounding areas.

4. Barred Dove or Zebra Dove (*Geopelia striata*)

This species is called the zebra dove in its native habitat in the Orient and Australia. This species is said to have been introduced to the islands sometime after 1922 (Bryan, 1958). It now is common to abundant on all of the inhabited islands. This dove also prefers the drier areas, and Schwartz and Schwartz (1949) reported densities as high as 400 to 800 birds per square mile in some areas on Oahu (e.g., Barber's Point to Makaha).

The zebra dove also is classified as a game bird in Hawaii, but, because of its small size few birds have been shot in recent years (Walker and Saito. 1984).

One study of the food habits of the barred dove in Hawaii revealed that the diet consists of 97 percent seeds and other plant materials; the 3 percent animal matter included several species of beetles, weevils, and wireworm larvae. Kocan and Banko (1974) reported on zebra doves from the Big Island that were infected with trichomonas. This parasite has "catastrophic" effects on doves in North America.

The barred dove is very common on the golf course and surrounding open areas.

III. Order Strigiformes

a. Family Tytonidae, Barn Owls

5. Barn Owl (*Tyto alba pratincola*)

The first barn owls were imported from California and released on Hawaii island during April 1958. Barn owls were released at Hauula, Oahu, on two different occasions. Seven birds were imported from the San Diego Zoo and released during September 1959; 11 additional owls were imported from the San Antonio, Texas, Zoo, and released at Hauula during October 1959 (Tomich, 1962). As with the mongoose much earlier, the barn owls were introduced in the hopes that they would prey on the abundant rats in the sugarcane fields. No long-term food habits study has been conducted in Hawaii, but on Hawaii island Tomich (1971) found that almost 90 percent of the barn owl pellets that he examined contained only the remains of house mice. He commented that, although the barn owl sometimes feeds on rats, it is not likely a significant factor in the economic control of rats in Hawaii. Moreover, Byrd and Telfer (1980) reported that barn owls on Kauai and Kaula Island had killed more than 100 seabirds and their chicks. On Oahu, a barn owl killed six white terns (Gygis alba) in Kapiolani Park (Elepaio, 46, 1986: 175).

No detailed study of the spread of the barn owl from the Hauula region since 1960 has been made, but the birds have been seen and found dead or injured on both leeward and windward sides of the island. Barn owls are nocturnal in habits and I did not see any during my field studies. It is reasonable to assume, however, that one or more owls forages over the project site for food.

IV. Order Passeriformes

a. Family Pycnonotidae, Bulbuls

6. Red-vented Bulbul (Pycnonotus cafer)

Although all members of this family are listed as "prohibited entry" by the State Quarantine Division of the Department of Agriculture, two species are now well established on Oahu. The history of the spread of the red-vented bulbul since the mid-1960s has been discussed by Berger (1975, 1981) and of the red-whiskered bulbul (P. jocosus) by Van Riper, Van Riper, and Berger (1979).

Bulbuls are a scourge to both fruit and flower growers because they eat not only ripe fruits and peppers but also buds and flowers. "State and federal officials are launching a three-pronged effort to keep Oahu's bulbul population from spreading to the Neighbor Islands. . . . If the birds become established on the Neighbor Islands, where about 70 percent of the State's commercial fruit, flower and vegetable crops are grown, farmers could suffer major economic losses" (Conrow, 1989).

The red-vented bulbul is one of the most conspicuous birds in the project region.

b. Family Zosteropidae, White-eyes and Silver-eyes

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

Caum (1933) wrote that the Japanese white-eye, or Mejiro, was first imported from Japan to Oahu by the Territorial Board of Agriculture and Forestry in 1929. Later importations were made by the Hui Manu and by private individuals. Singing contests were held with the white-eye in Hawaii.

The white-eye rivals the house sparrow and the European starling in North America as a successful exotic species, and the white-eye now undoubtedly is the most common song bird in the islands. It now is found from sea level to tree line on Maui and Hawaii, and it is found in the driest habitats (e.g., Kawaihae, Hawaii) and in areas with 300 or more inches of rain per year. It is a very common species in all habitats of windward Oahu.

c. Family Sturnidae, Starlings and Mynas

8. Common Indian Myna (Acridotheres tristis)

The common myna, which is native to Sri Lanka, India, Nepal, and adjacent regions, "was introduced from India in 1865 by Dr. William Hillebrand to combat the plague of armyworms that was ravaging the pasture lands of the islands. It has spread and multiplied to an amazing extent; reported to be abundant in Honolulu in 1879, it now is extremely common throughout the Territory" (Caum, 1933). The myna continues to be common to abundant especially in lowland areas of the inhabited islands, being most common in residential and rural areas, especially in the vicinity of man and his buildings. It is a common bird on the fairways of the golf course, as well as in surrounding areas.

d. Family Ploceidae, Weaverbirds and Allies

(1) Subfamily Estrildinae, Waxbills

9. Orange-cheeked Waxbill (Estrilda melpoda)

This waxbill was first reported in the wild in

Hawaii (on the slopes of Diamond Head) on January 2, 1966, during the annual Christmas Count of the Hawaii Audubon Society (Elepaio, March, 1966:77-81). The species has been recorded in widely separated areas on Oahu since then. Several orange-cheeked waxbills were seen at Hoomaluhia Park in Kaneohe and at Sacred Falls near Punaluu during June 1987 (Pratt, 1987). I have seen the species at West Beach in the Ewa area. I did not see this species during my field work at the Bayview golf course area but the orange-cheeked waxbill has been seen there in the past (R.L. Pyle, pers. comm.).

10. Red Avadavat (Amandava amandava)

Known as the strawberry finch in the petstore trade, Caum (1933) wrote that "it is not known with certainty just when these birds came to Hawaii, but it was probably sometime between 1900 and 1910. Many were imported as cage birds during this period and it is supposed that the present population is derived from individuals escaped from captivity." One of the puzzling features about the red avadavat is that it appeared not to extend its range over a long period of time. Ord (1967), for example, wrote that this finch "can usually be found near grassy open areaa around sugar cane fields . . . in the lowlands about Pearl Harbor." It has spread in recent years and I saw this species at West Beach in Ewa more than 10 yaars ago, and it also has been seen more recently in Kawainui Swamp and in Kaneohe (Pyle, 1989:9). It occurs from time to time in the Bayview Golf Course area.

11. Warbling Silverbill (*Lonchura malabarica cantans*)

This silverbill is native to Africa, being found from Senegal to western and southern Sudan (Traylor, 1968). Silverbills have been characterized as being "predominantly desert birds."

There are no published records of the release of this species in Hawaii (Bryan, 1958; Berger. 1975a, 1981). It is assumed that cage birds were released on the Puuwaawaa Ranch on Hawaii, probably during the 1960s. I first discovered this silverbill near Kawaihae on March 22, 1972 (Berger, 1975a). Later observations have revealed that large populations have become established on the Big Island.

The warbling silverbill was first reported on Maui during December 1978, when about 40 birds were seen in kiawe thickets below Ulupalakua (*Elepaio*, 39, 1979:89). I found this species in flocks from 10 to 40 birds in the Waiale district of Maui on April 30 and May 1, 1982.

The first warbling silverbills were recorded on the island of Oahu in 1984 (Conant, 1984). Since that time they have been seen in Niu Valley, Pololo Valley, in Maili, on the Kaneohe Marine Base, and Kaneohe (Pyle, 1989:9). It is a prolific species and in a few years undoubtedly will spread around the island.

The significance of the silverbill is that it is predominantly a seed eater. With the other seed-eating finches already well established, the harvesting of small grain crops will be virtually impossible (see house finch to follow).

12. Nutmeg Mannikin or Ricebird (Lonchura punctulata)

Also called the spotted munia, this species has a wide distribution in Sri Lanka, India, Nepal, Burma, and southward into Malaysia and the Indo—Chinese region, and in the Philippines. The species was introduced to Hawaii about 1865 by Dr. William Hillebrand. Caum (1933) wrote that this species "feeds on the seeds of weeds and grasses and does considerable damage to green rice." Although rice is no longer grown in Hawaii, the ricebird has continued to be destructful to certain crops (see explanation under house finch).

Ricebirds are highly gregarious and flocks of 100 or more birds are not uncommon at some times of the year. It is a prolific species and I have found nests in every month of the year. They are not inhabitants of dense thickets or forests, but occur wherever there are open spaces, for example, golf courses, along dirt roads, and residential areas. The nutmeg mannikin is common in and around the project region.

13. Java Sparrow (Padda oryzivora)

This species is thought to have been endemic to Java and Bali, but it was introduced to many other areas long ago, from the Philippines to Sri Lanka. Caum (1933) wrote that this species may have been introduced to Oahu about 1865 by Dr. William Hillebrand and that the species may have been brought in again about 1900. In any event, these birds did not survive.

Throp (1969) reported that Java sparrows nested and raised young on Diamond Head during late 1968 or early 1969. Since that time, the increase in numbers and the range expansion of the Java sparrow on Oahu has been very impressive (Berger, 1975b). Like the other seed-eating sparrows and waxbills, this species does not inhabit dense thickets or forests but inhabits open areas wherever there is a supply of weed seeds. The Java sparrow is now very common in windward Oahu. inhabiting lawns in residential . areas, golf courses, and along roads.

(2) Subfamily Passerinae, Sparrow Weavers

14. House Sparrow (Passer domesticus)

Incorrectly sometimes called the English sparrow (it has a wide distribution in Europe and Asia), this sparrow was first imported to Hawaii in 1871, when nine birds were brought to Oahu from New Zealand (where they had been introduced from England). Caum (1933) wrote that "the species was reported to be numerous in Honolulu in 1879." The house sparrow became a serious pest in North America and many thousands of dollars were spent in attempting to control the population (Dearborn, 1912). In India, as well as in North America, the house sparrow causes "collosal damage to the food-grains in standing crops and storages" (Rana and Idris, 1986).

The house sparrow typically is found in the vicinity of man and his buildings but they also forage in outlying areas. The are common at Bayview Golf Course and surrounding areas.

e. Family Fringillidae, American Sparrows and their Allies

(1) Subfamily Emberizinae

15. Red-crested Cardinal (Paroaria coronata)

This species was long called the Brazilian cardinal (a petstore name) in Hawaii, but its native range for this South American species includes Uruguay, Paraguay, Brazil, and parts of Bolivia and Argentina. The species was released several times between 1928 and 1931 (Caum, 1933). This cardinal is a very common species and it is found in residential and in rural areas. It occurs throughout the windward area, including the Bayview Golf Course area.

(2) Subfamily Cardinalinae

16. Northern Cardinal (Cardinalis cardinalis)

This North American bird is also known as the Kentucky cardinal, Kentucky redbird, and the Virginia cardinal. Its native range is the eastern part of North America east of the plains and northward into Ontario. The cardinal was released on Oahu several times between 1929 and 1931 (Caum, 1933). It now is a common species in residential and rural areas. It is widespread in windward Oahu including th Bayview Golf Course area.

(3) Subfamily Carduelinae

17. House Finch (Carpodacus mexicanus frontalis)

This finch was introduced to Hawaii from California "prior to 1870, probably from San Francisco" (Caum, 1933). The house finch now is an abundant species on all of the islands, and probably is the second most common song bird in the islands.

Although house finches sometimes eat ripe fruits, especially papaya (hence the vernacular name of Papayabird), the species is predominantly a seed eater. House finches and ricebirds caused great damage to experimental sorghum crops on Kauai and Hawaii during 1971 and 1972. A report by the Senate Committee on Ecology, Environment, and Recreation said that "ricebirds and linnets [house finch] caused a 30 to 50 percent loss in the sorghum fields at Kiluea on Kauai last year. . . . seed-eating birds at Kohala ate 50 tons of sorghum grain in a 30-acre experimental field that was supposed to produce 60 tons" (Honolulu Advertiser, March 14, 1972, page B-2). Such seed-eating birds limit the scope of the much talked about diversified agriculture in Hawaii.

The house finch is common at the golf course and in surrounding regions.

II. <u>Indigenous Birds</u>

These are species that occur naturally in Hawaii but also in other parts of the Pacific Basin. These birds are native to the Hawaiian Islands but are not unique to them. In this category are 22 species of seabirds, the Hawaiian black-crowned night heron, and a number of migratory species that spend their winter or nonbreeding season in the islands.

There is no habitat for the seabirds in the project region. It is quite possible that the great frigatebird (*Fregata minor palmerstoni*) sometimes soars high over the region.

a. Family Ardeidae, Herons and Egrets

1. Black-crowned Night Heron (*Nycticorax n. hoactli*)

This subspecies has a breeding range that includes Hawaii and the Western Hemisphere, extending from Washington and Oregon south to northern Chile and south-central Argentina. Because the Hawaiian birds are classified as the same subspecies as the mainland birds, the birds are not classified as endangered, even though the future of this bird in Hawaii depends on the preservation of suitable wetland habitat that is necessary for the endangered Hawaiian waterbirds. Herons inhabit marshes, swamps, and rivers. They feed on a wide variety of aquatic and terrestrial life: for example, fish, frogs, crayfish, mice, and insects. In Hawaii, however, this heron also is known to eat the downy young of seabirds and probably the downy young of the endangered Hawaiian waterbirds. They also relish prawns, and the State Land Board gave prawn producers a 120-day permit "to destroy black-crowned night herons at Oahu's Kahuku prawn farm as well as other aquaculture farms statewide" (Honolulu Star-Bulletin, October 26, page A-8, and October 30, 1985, front page).

I did not see any black-crowned night herons along the stream that winds through the golf course, but, from what I have just written above, it is safe to conclude that the golf course and its expansion would have no adverse effects on any herons that do visit it from time to time.

b. <u>The Migratory Species</u>

More than 25 species of ducks and shorebirds spend their winter season in the Hawaiian Islands. These include such birds as the pintail duck (<u>Anas acuta</u>), greater scaup (<u>Aytha marila</u>), wandering tattler (Heteroscelus incanus), ruddy turnstone (Arenaria interpres), sanderling (Calidris alba), and the lesser golden plover. Nearly all of these species, however, spend the winter season on ponds, along the seashore and reef flats, or along mountain streams. Only one species occurs on the golf course.

1. Lesser Golden Plover (Pluvialis dominica fulva).

This species occurs from sea level to elevations as high as 10,000 feet on Maui and Hawaii. These birds frequent lawns in residential areas, the lawn around the State Capital, golf courses, weedy pastures, cane haul roads, open areas in the mountains, and mud flats along the shore. Johnson, et al. (1981) studied the wintering behavior of plovers on Oahu; they reported that the birds begin to arrive in Hawaii beginning in August but that juvenile birds hatched that year did not arrive until late September. They found that the wintering population was composed of territorial and non-territorial birds in approximately equal numbers. Each of the territorial birds "reoccupied the same territory it had defended previously." Johnson and Nakamura (1981) also studied the roosting of plovers on the flat roofs of buildings on Oahu. At the Pacific Palisades Elementary School in Honolulu they found 125 plovers roosting on the roof at 10:30 p.m. on April 17, 1980.

III. Endemic Birds

These are birds that are unique to the Hawaiian Islands; they occur naturally nowhere else in the world. Many of these endemic birds are classified as threatened or endangered by the U.S. Fish & Wildlife Service and by the State Division of Forestry and Wildlife. Most of these endangered birds, however, are forest birds and there is no suitable habitat for them anywhere near the project site. Nor is there any habitat for any of the four species of endangered Hawaiian waterbirds on the project site, although these birds are found on the Kaneohe Marine Corps Air Station and at Kawainui Swamp. These four species are: 1. Koloa or Hawaiian duck (Anas wyvilliana), Hawaiian gallinule or 'Alae 'Ula (Gallinula chloropus sandvicensis), Hawaiian coot or 'Alae Ke'oke'O (Fulica americana alai), and Hawaiian stilt or Ae'O (Himantopus mexicanus knudseni).

There is one endangered Hawaiian bird that may occupy the general region that the golf course is located in: the Hawaiian owl or Pueo (Asio flammeus sandwichensis). This subspecies of the North American short-eared owl is classified as endangered by the State Division of Forestry and Wildlife but not by the U.S. Fish & Wildlife Service. This owl differs from most owls in that it is diurnal in habits and, where present, is typically seen soaring either high or low over the ground as it searches for food. I did not see any Pueo during my field studies nor have I ever seen it in this region during past field work there. I do not know of any published reports of its occurrence in the area.

Mammals

1. Endemic Mammals

The only endemic land mammal in the Hawaiian Islands is the Hawaiian bat (Lasiurus cinereus semotus), a subspecies of the North American hoary bat. The Hawaiian bat is found primarily on the Islands of Hawaii and Kauai (Kramer 1971; Tomich, 1986). I know of no evidence that there is a permanent population on the island of Oahu.

II. Introduced Mammals

All of the introduced species of small mammals have proven to be highly detrimental to man, his buildings, crops, and/or to the native forests and their animal life. None is an endangered species and none is of concern as far as detrimental effects resulting from any change in land use. It would, in fact, be a great boon to the islands if it were possible to exterminate all of them.

With the possible exception of the house mouse (Mus musculus), all of the smaller introduced mammals prey on birds, their eggs, or young. These small mammals include the roof rat (Rattus rattus), Polynesian rat (Rattus exulans), Norway rat (Rattus norvegicus), small Indian mongoose (Herpestes auropunctatus), feral cat (Felis catus), and feral dog (Canis familiaris).

Because all of these mammals are serious pests, I did not set traplines in order to sample the population. It is reasonable to assume that all of the rodents occur in the project area (Kramer, 1971; Tomich, 1986). I did see the diurnal mongoose around the edges of the golf course.

Summary and Conclusions

1. St. John (1973) discussed more than 4,500 species of introduced flowering trees and shrubs that have been planted in the Hawaiian Islands. Nearly all of the plants in the project area are introduced or alien species, a number of which are pest species. There is no semblance of any endemic ecosystem anywhere near the project site. The proposed expansion, therefore, will have no adverse effects on any native ecosystem.

2. Because there are no endemic amphibians or land reptiles in the Hawaiian Islands, all of those that are present are alien to the islands. Some (e.g., the bullfrog) pose a threat to the endangered Hawaiian waterbirds; the neotropical toad has poison glands that are a threat to dogs and to young children. All of these introduced animals are irrelevant to an impact assessment.

3. None of the 17 species of introduced birds discussed in this report is an endangered species and a number have proven to be serious pests to agriculture in Hawaii. The destruction to sorghum crops by the nutmeg mannikin and the house finch has been discussed above. The two species of doves and the myna have been implicated in the spread of the seeds of such noxious plants as Lantana camara. The Japanese white-eye and the red-vented bulbul cause considerable damage to ornamental flowers and to fruit crops (see Keffer. et al., 1976). The barn owl has been reported to kill seabirds on Kauai and the white tern on Oahu. It seems reasonable to conclude that

these alien bird species are of little concern in an environmental impact assessment. Moreover the planned expansion would provide additional habitat for some of the species.

4. The planned expansion will have no effect on any of the seabirds.

5. In view of my discussion on page 19, I conclude that the planned expansion would have no adverse effects on the black-crowned night heron, even if they do visit the stream from time to time.

6. The planned expansion would actually increase the habitat for the lesser golden plover. It would have no effect at all on any of the other migratory species.

7. There are no endemic Hawaiian forest birds anywhere near the project site. In fact, very few of these birds remain on the island of Oahu.

8. I have not seen the Pueo or Hawaiain owl in the project region nor have I found any published record of its presence there. Nevertheless, I feel that the proposed project would have no adverse effects on whatever owls may inhabit this general region.

9. All of the mammals that occur in the project region are introduced or alien species, and most are destructive to man, his buildings, and products. None is of any significance for an environmental impact assessment.

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APPENDIX E

ENVIRONMENTAL IMPACT OF FERTILIZER, HERBICIDE AND PESTICIDE USE ON THE PROPOSED BAYVIEW GOLF COURSE EXPANSION, KANEOHE

Prepared by Charles L. Murdoch, Ph.D. and Richard E. Green, Ph.D., April 1989

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ENVIRONMENTAL IMPACT

OF

FERTILIZER, HERBICIDE AND PESTICIDE USE

ON THE PROPOSED

Bayview Golf Course Expansion, Kaneohe

A REPORT TO

Hida, Okamoto & Associates, Inc.
Consulting Engineers

April 6, 1989

PREPARED BY

Charles L. Murdoch, Ph. D

Richard E. Green, Ph. D.

I. INTRODUCTION

The Bayview Golf Course Expansion will require application of additional fertilizers to supply essential nutrients to turfgrasses and ornamental plants, and herbicides, fungicides and insecticides to control their associated weed, disease, and insect pests. These chemicals may be subject to movement from the site of application, either by runoff during high intensity storms, or by leaching when water infiltration exceeds evapotranspiration (ET). The proposed site is a relatively low-rainfall, high-ET area; high-intensity storms occur occasionally, resulting in runoff through drainage ways to Kaneohe Bay. In addition, irrigation in excess of ET may contribute water recharge to shallow groundwater or runoff, thus irrigation management is an important determinant in the control of chemical movement.

This report provides an assessment of the environmental impact of chemicals applied to an expansion of the golf course at this site, based on an analysis of site factors and recommended management practices.

II. APPROACH AND INFORMATION RESOURCES

The analysis which follows is based on (1) published reports on rainfall, hydrology and soils of the location and on pesticide properties, toxicology and behavior in soils, (2) our own knowledge and experience with golf course management and the reaction and movement of agricultural chemicals in soils, and (3) a site visit on March 4, 1989.

III. ANALYSIS OF RELEVANT FACTORS WHICH MAY IMPACT ON CHEMICAL MOVEMENT

A. Site Factors

1. Topography, soils and hydrogeology

The entire expanded 18-hole golf course, which will include the present Bayview Golf Course, will be comprised of about 160 acres, most of which is low-lying alluvial area bordering Kaneohe Stream and Kawa Stream. Only the southeast side along Kaneohe Bay Drive is upland area. The soils in the area, described and delineated by Foote et al. (1972) are as follows:

Soil Series	Map symbol	% Slope	Percent of Area
Hanalei silty clay	HnA	0-2	59
Alaeloa silty clay	AeE	15-35	20
Alaeloa silty clay	AlF	40-70	9
Kaneohe silty clay	KgC	8-15	12

The dominant soil in the development area is the Hanalei series (Typic Tropaquepts, fine, mixed, nonacid, isohyperthermic). This soil is alluvial in origin and is nearly level at this site. The soil is well-drained in some areas and poorly-drained in others. Because of the level topography, runoff is generally slight except under high intensity rainfall.

The Alaeloe series consists of well-drained soils on uplands and are developed from material weathered from basic igneous rock, this soil is generally about 4 feet deep, has moderately rapid permeability and medium runoff. The area occupied by this soil on the proposed golf course is adjacent to Kaneohe Bay Drive on the south side of the golf course.

Northeast of the Alaeloe soil along Kaneohe Bay Drive toward Kokokahi is an area of Kaneohe silty clay, which consists of well-drained soils on terraces and alluvial fans. The surface soil is about 14 inches deep and the total profile is about 4 feet deep. Permeability is moderately rapid and runoff is slow to medium.

The groundwater beneath the area to be developed is brackish (Hawaii Water Resources Regional Study, 1979) and thus will not be used for a potable water supply.

2. Climate and hydrology

Median annual rainfall for the area is approximately 1000 mm (39 inches). Monthly median rainfall varies from a low of about 50 mm for the period May through September, to a high of about 150 mm in December and January (Giambelluca et al., 1986). Mean annual pan evaporation for the area is approximately 1700 to 1800 mm (65-70 inches) (Ekern and Chang, 1985). Thus, without irrigation and neglecting runoff (which is usually slight in level topography with permeable soils such as exist at this site), there is a water deficit. The data indicate that unirrigated cropped or grassed areas providing a full canopy for ET would not contribute recharge to the groundwater aquifer. Because of the water deficit, vigorous turf could not be sustained through the dry months without irrigation.

Kaneohe Stream, which crosses the northeast corner of the proposed development, discharges to a shoreline channel, which is parallel to the north boundary of the site and empties into Kaneohe Bay. The mean daily discharge of Kaneohe Stream was previously estimated to be 12.6 million gallons (Cox et al., 1973). Kawa Stream enters the site at or near the southwest corner and runs generally northeast through the site, terminating at the Waikalua-Loko and Waikalua "fishponds" adjacent to Kaneohe Bay. The mean flow of Kawa Stream, estimated in 1973, was 1.0 million gallons per day. Present stream flow values probably differ greatly from the 1973 estimates due to the development of the Hoomaluhia flood control project.

B. Management Factors

1. Fertilizers

Fertilizers are applied to golf courses to supply those essential nutrients which are used in large amounts and which are deficient in most soils. In typical soils, the 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. Typical areas in each of these types of turf are estimated in the discussion below.

Turfgrasses use much more N than other elements. Based on turfgrass clipping composition, it has been shown that the turfgrasses grown in Hawaii use about twice as much N as K and about 4 times as much N as P.

The primary fertilizer elements of concern for contamination of ground and surface waters are nitrogen and phosphorus. Phosphorus is attached very tightly to soil clays and moves little if any from the site of application. Phosphorus, therefore will not cause any problem with contamination of drainage water. Ammonium nitrogen (NH_4) likewise moves little in soils. Nitrogen applied in the ammonium form, however, is rapidly converted to the nitrate form (NO_3) which is not bound to the soil and moves readily with water. Because of high nitrogen use rates by turfgrasses, however, nitrogen will be used rapidly after application. Only under conditions where rainfall occurs soon after application of a soluble nitrogen source would there be excessive loss by surface runoff or by leaching below the root zone. Thus nitrogen movement can be mitigated by applying a slow-release nitrogen fertilizer in which the nitrogen is in an insoluble form when applied and is released at a rate similar to the nitrogen uptake rate of turfgrasses.

Fertilizer use rates for the different golf course areas are shown in Table 1. Complete fertilizers (ones containing N, P, and K) are usually applied. Because nitrogen is applied in larger quantities and also because it is the only fertilizer element likely to cause contamination of ground or surface waters, only nitrogen application rates are given.

Table 1. Approximate nitrogen fertilizer use rates for different areas of an 18-hole golf course in Hawaii.

Type of Turf	Area (acres)	Application rate (lbs. N/1000 ft2)	Application Freq. (weeks)	Total Annual Application (tons)
Greens	3	0.5	2 weeks	0.85
Tees	3	1.0	4 weeks	1.13
Fairways	50	1.5	8 weeks	10.63
Rough	30	1.0	3 months	2.60
Total	86			15.18

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. Properties of the chemicals listed in Table 2, as well as those of most chemicals used in turf in Hawaii, are given in Appendix Table 1.

Table 2. A typical pesticide program for an 18-hole golf course in Hawaii.

Turfgrass area	Area (acres)	Chemical	Frequency	Rate/application	Annual total
I. Herbicides					
A. Greens	3	MSMA	6 times/year	2 lb. ai/acre	36 lb. ai
		bensulide	2 times/year	12 lb ai/acre	72 lb. ai
B. Tees	3	MSMA	6 times/year	2 lb. ai./acre	36 lb. ai
		33 Plus	3 times/year	1 pint/acre	9 pint*s
		bensulide	2 times/year	12 lb. ai./acre	72 lb. ai
C. Fairways	50	MSMA	6 times/year	2 lb. ai./acre	600 lb. ai
		33 Plus	3 times/year	1 pint/acre	19 gallons
		metribuzin	2 times/year	0.75 lb. ai/acre	75 lb. ai.
D. Perimeter areas	20	glyphosate	3 times/year	1.5 lb ai./acre	90 lb. ai.
II. Insecticides					
A. Greens	3	chlorpyrifos	As needed	1 lb. ai./acre	18 lb. ai.
B. Tees	3	chlorpyrifos	As needed	1 lb. ai. acre	18 lb. ai.
C. Fairways	Spot treatments	chlorpyrifos	As needed	1 lb. ai./acre	50 lb. ai.
III. Fungicides					
A. Greens	3	metalaxyl	As needed	1.3 lb. ai./acre	25 lb. ai.
		chlorothalonil	As needed	8 lb. ai./acre	72 lb. ai.
B. Tees	3	metalaxyl	As needed	1.3 lb. ai./acre	25 lb. ai.
		chlorothalonil	As needed	8 lb. ai./acre	72 lb. ai.
C. Fairways	Spot treatments	chlorothalonil	As needed	8 lb. ai./acre	250 lb. ai.

3. Irrigation

Because rainfall is not uniformly distributed throughout the year, all golf courses are irrigated to supplement rainfall. Golf courses usually have permanent sprinkler irrigation systems with sophisticated control systems. Many are computer controlled, so that each sprinkler head on the golf course can be adjusted to apply a selected amount of water on each cycle.

Because golf greens are constructed of sand (or primarily sand), the water holding capacity is less than for other areas containing soil. For this reason, golf greens must be watered more frequently than other areas.

Typical evapotranspiration rates for well-watered turf in Hawaii range from 0.1 to 0.3 inches per day, depending on temperature, the amount of sunlight, relative humidity, wind speed, the amount of available water in the soil, etc. Soils store approximately 0.5 to 2.5 inches of available water per foot of depth, depending on soil texture. Sands hold less, clays hold more. Irrigation should be applied when about one-half the available water has been used. The effective rooting depth for mown turf is approximately one foot. Therefore, turfgrasses will need to be watered every day to about once a week depending upon the type of soil and the water use rate. Amounts of water applied at each irrigation are about 20,000 gal. for greens and 500,000 gals. 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 chances 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.

IV. ENVIRONMENTAL IMPACT OF CHEMICALS APPLIED TO THE PROPOSED GOLF COURSE

A. Surface waters and Groundwater

The level topography of most of the golf course suggests that transport of chemicals by runoff should not normally be a problem. However, during high intensity storms, ponding at the surface and subsequent runoff is likely, especially on poorly-drained areas of the Hanalei silty clay soil. Considering the present swampy nature of much of the lowland area which is to be developed, artificial drainage of these areas will be required. The drainage water and runoff would then eventually reach Kaneohe Bay, probably through existing stream channels. The exact present course of Kawa Stream near Kaneohe Bay is not clear from the maps available to us nor from our site visit. We understand that the developer plans to have Kawa Stream terminate at the 11-acre Waikalua-Loko Pond, which is part of the development project. Runoff and shallow drainage from the golf course would then drain either to Kawa Stream and subsequently reach Waikalua-Loko Pond or to Kaneohe Stream which discharges directly to Kaneohe Bay. A negative impact of chemical constituents in runoff and drainage from the golf course on shallow waters in Kaneohe Bay is not likely. These waters are presently contaminated by urban runoff and sediment, thus we do not expect runoff from the golf course to significantly alter the nature of these waters. The considerable volume of flow in Kaneohe Stream prior to reaching the development site will also serve to dilute the small amount of runoff entering the stream channel from the golf course.

It appears likely that most runoff and drainage from the golf course would, with the present topography, drain into Kawa Stream and subsequently reach Waikalua-Loko Pond, which is connected to Kaneohe Bay. We assume that the developer will want to improve the condition of the pond, which has suffered from sedimentation and other forms of degradation in recent history. The developer will have little control over the quality of water in Kawa Stream as it enters the present Bay View Golf Course at the southwest boundary adjacent to Kaneohe Bay Drive. Even so, it will be desirable to minimize movement of fertilizers and pesticides to Kawa Stream in order to enhance the possibilities of improving Waikalua-Loko Pond. We do not expect movement of chemicals from the golf course to the stream under the low rainfall conditions existing during the late spring and summer, assuming appropriate fertilizer and irrigation management. During the high rainfall periods, runoff and shallow drainage cannot be avoided, but the large volumes of water flowing in the streams during these periods should provide the dilution required to prevent any negative impact in the pond from transported chemicals. Conditions which might lead to a detrimental effect on pond waters, especially from nitrogen enrichment due to movement of nitrate nitrogen in runoff and drainage waters, would be associated with local shoreline rainfall which would cause runoff into Kawa Stream when there is little mauka rainfall to increase stream flow substantially. Although we can only speculate that such events might occur, the aesthetic value of improving and maintaining the quality of water in the pond will likely justify measures required to reduce runoff into Kawa Stream during such events. The development of berms along Kawa Stream to preclude immediate runoff from the golf course into the stream in conjunction with some temporary holding basins may be adequate. A monitoring program to determine levels of nitrogen in pond waters throughout the year would indicate the effectiveness of the system in preventing chemical movement to the pond. Movement of pesticides in runoff waters is much less likely than nitrogen movement due to sorption of pesticides on decaying grass thatch and soil organic matter. Nitrate nitrogen is highly mobile in water and relatively persistent, thus it is a good indicator of chemical movement. The large amount of nitrogen fertilizer used relative to pesticide use is evident by a comparison of data in Tables 1 and 2.

Since groundwater below the site is brackish, there will be no negative impact of chemical leaching on groundwater.

B. Impact on Migratory Birds and Endangered Hawaiian Waterbirds.

The fertilizers, herbicides, and fungicides used in golf course maintenance pose little or no hazard to birds frequenting the grassed areas or ponds associated with golf courses. Fertilizers are relatively non-toxic unless ingested in large amounts. All herbicides and fungicides used in golf course maintenance in Hawaii are of low to moderate toxicity (Appendix Table 1). The only chemicals used in golf course maintenance in Hawaii which are highly toxic to birds are the organic phosphate insecticides, especially chlorpyrifos.

Although chlorpyrifos is highly toxic to birds, it is strongly adsorbed on the thatch layer of turf and moves little from the site of application. One reason for its weakness in controlling soil infesting insects is the inability to get the insecticide through the thatch layer to the depth needed to contact these insects. Recent studies (Sears and Chapman, 1980; Tashiro, 1980) have shown that chlorpyrifos applied to turfgrasses does not penetrate more than 2 to 3 centimeters in the soil. In addition to resistance to movement in the soil, it has been shown that it is rapidly degraded in the soil, both by hydrolysis and microbial action (Miles et al. 1979).

Because of the adsorption of organic phosphate insecticides on organic layers in turf and their rapid break down, there is little chance of their movement from grassed areas into the ponds associated with the proposed golf course. Label instructions for application of these pesticides (which turfgrass managers are required by law to follow) specifically prohibit their direct application to streams and ponds.

The likelihood of bird injury by pesticides used in maintenance of the proposed golf course can be reduced by proper application of pesticides with reduced toxicity to birds. The attached table shows that carbaryl and trichlorfon are less toxic to birds than chlorpyrifos. In most cases these insecticides may be substituted for chlorpyrifos with little loss of effectiveness.

Golf courses are excellent habitats for birds. As far as we are aware, there have been no reported incidents of bird kill in Hawaii from chemicals applied in golf course management. Waterfowl and fish appear to thrive in ponds and water hazards on golf courses in Hawaii. Many golf courses cultivate white amur fish in the ponds to control algae. Mosquito fish are generally stocked to prevent mosquito problems. We are aware of no incidents of fish or waterfowl injury from chemicals applied to golf courses.

The labeling of herbicides and pesticides for particular uses by EPA with strict laws (enforced by the Hawaii Department of Agriculture) for their use are perhaps the best assurance of protection of humans and wildlife from their hazards. All pesticides must be applied in compliance with federal and state laws regulating their use. Hazards to both humans and wildlife are included in the decision to label a pesticide for specific uses, including use on golf courses, and in developing regulations on allowable application procedures of the pesticide for various uses.

C. Impact on Air Quality.

Most herbicides and pesticides used on golf courses are of relatively low mammalian toxicity, ranging from hundreds to several thousand mg/kg body weight (Appendix Table 1). Because they are not highly volatile and are applied in dilute sprays (50 to 100 gallons of spray solution per acre) to open areas, there is little likelihood of volatility once the pesticides are applied. The greatest danger of significant airborne concentrations of pesticides is from aerial application. Golf course pesticides are applied with ground spray equipment. Boom height of spray equipment is less than one meter. Low spray pressures (20 to 40 psi) and coarse spray droplets further reduce the hazard of airborne fine droplets. Droplets larger than 100 micrometers diameter are not highly subject to drift. Figure 1 below illustrates the effect of spray droplet size on spray drift.

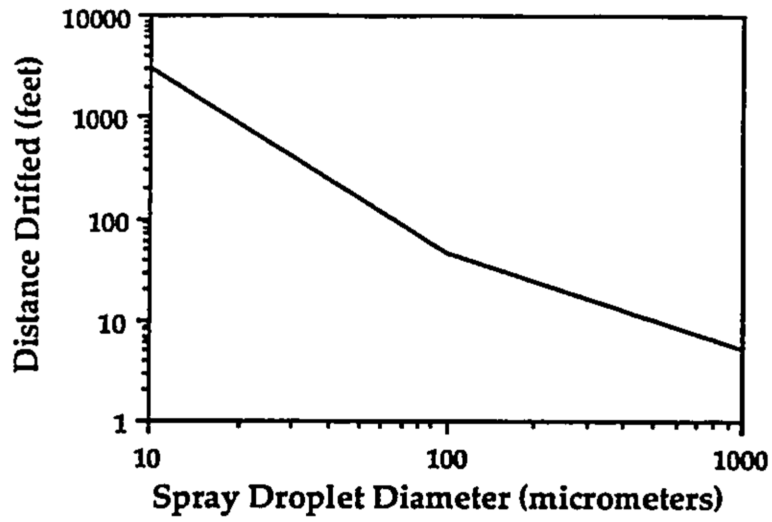

Figure 1. Relationship between spray droplet size and spray drift based on droplets falling 10 feet in a 3 MPH wind (from Hofman et al. 1986).

Most of the spray volume from typical flat-fan nozzles used in agricultural spray equipment is from droplets larger than 100 micrometers. Table 3 below shows a typical distribution of droplet sizes for a flat-fan nozzle (the type used in most golf course spray equipment).

Table 3. Droplet size range for a typical flat-fan nozzle at 20 and 40 psi. (from Hofman et al., 1986)

Droplet size range (microns)	Percent of spray volume 20 psi	40 psi
0-21	0.1	0.4
21-63	3.0	10.4
63-105	10.7	20.1
105-147	16.2	25.4
147-210	36.7	35.3
210-294	27.5	7.7
>294	5.8	0.7

At the low concentrations used in pesticide application, this would not result in significant quantities of pesticides being carried downwind. High wind speed would increase the likelihood of drift of fine spray droplets, however, because high wind speed distorts spray patterns and results in poor pesticide coverage; spraying in periods of high wind is not common practice. Table 4 below shows the percent of spray application volume deposited at 4 and 8 feet downwind and the distance downwind for the volume to drop to 1% or below for flat-fan nozzles under different conditions. Even under high wind conditions (almost 10 mph) and spraying at 40 psi, the distance downwind at which 1% or less of the total spray volume was deposited was only 17 feet.

Table 4. Percent of spray volume deposited at 4 and 8 feet downwind and the distance in feet for the volume of spray solution to drop to 1% of the total spray volume (from Hofman et al., 1986).

Nozzle ht. (in.)	Pressure (psi)	Wind speed (mph)	Percent deposited 4 ft.	8 ft.	Distance to drop to 1% of volume
14	40	3.5	3.1	0.6	7.0
27	40	3.5	5.9	1.5	13.0
18	30	5.3	9.3	2.2	14.0
18	25	9.9	10.3	3.1	15.5
18	40	9.9	9.1	3.6	17.0

To facilitate spray operations and to comply with label instructions of some pesticides, spray applications are only made in late afternoon or early morning hours when golfers are not on the golf course. This reduces the risk of exposure of people to airborne spray particles. Sufficient buffer space with tall vegetation between the golf course and housing sites and facilities (such as the clubhouse) which will be used by people will further reduce the chance of exposure to airborne pesticide particles.

The greatest danger of airborne pesticides is to the applicators of pesticides themselves. Mixing of wettable powder formulations and being in close proximity to airborne spray particles, particularly when operating spray equipment in a downwind position, places spray operators in particularly vulnerable positions. EPA and OSHA have strict standards which specify that spray operators wear appropriate protective clothing and breathing apparatuses.

V. SUMMARY AND CONCLUSIONS

Use of fertilizers and pesticides on the proposed development should not have an adverse environmental impact, providing that adequate attention is given to good management of the golf course. Especially important are appropriate irrigation practices and judicious use of chemicals, including fertilizers and pesticides. The following items support our conclusions:

1. Among the fertilizer elements, only nitrogen could diminish water quality, since phosphorus sorption on soils would prevent its movement from the site of application. Nitrogen fertilizer movement in runoff could conceivably produce undesirable nutrient enrichment of Waikalua-Loko Pond waters, which the developers wish to improve as an integral part of the golf-course development. Fertilizer nitrogen movement to Kawa Stream and subsequently to the pond can be minimized by constructing berms adjacent to Kawa Stream, with associated temporary retention basins to preclude rapid runoff into the stream. Use of slow-release nitrogen fertilizer during the rainy season will also assist in reducing nitrogen movement. Kaneohe Stream will receive minimal runoff from the golf course; that runoff into the stream which does occur will be highly diluted by consistently high water flow in the stream.

2. Pesticide movement in runoff is not expected because of the sorption of pesticides on turf thatch and soil. Prevention of immediate runoff by retention basins will further reduce movement of pesticides from the treated area.

3. Leaching of chemicals to groundwater is not a problem due to the inherent low quality (brackishness) of groundwater at the site.

4. The chemicals applied in golf course management pose little hazard for birds or wildlife. Fertilizers are relatively non-toxic unless ingested in large amounts. With the exception of chlorpyrifos, the pesticides are of low toxicity to birds.

5. There will be no significant adverse effects on air quality from application of herbicides or pesticides in golf course management provided that appropriate application techniques are used. The spray equipment used in golf course maintenance is ground-operated. Nozzle heights are typically less than 2 feet. Low spray pressures and coarse nozzle openings result in relatively large droplet sizes which are not highly subject to drift.

VI. RECOMMENDATIONS

- Irrigation management is critical to the conclusions reached above. For this reason we recommend that a U. S. Weather Bureau class A evaporation pan be used to measure evaporation and schedule irrigation application in the management of the proposed golf course. Excellent discussion of irrigation scheduling can be found in the book Golf Course and Grounds Irrigation and Drainage (Jarret, 1985).

- Where grading is necessary, topsoil should be stockpiled and replaced over the areas to which chemicals will be applied; the high-organic matter containing surface soils will retard pesticide movement.

- Judicious use of fertilizers and pesticides, especially in the early establishment of turf, is essential, since pesticides and nitrogen will be more likely to move before an extensive root system and thatch layer are developed. Use of slow-release nitrogen fertilizer during the rainy season will reduce nitrogen losses to runoff.

- A system of berms and temporary water-retention basins along Kawa Stream will prevent immediate runoff into the stream and eventually into the pond, thus reducing the possible movement of fertilizers and pesticides into Waikalua-Loko Pond.

- Although we do not anticipate significant movement of applied chemicals in either leachate or runoff, a modest monitoring program for nitrogen in Waikalua-Loko Pond seems appropriate.

- As our conclusions are based on the assumption that sound management practices will be followed with regard to fertilizer and pesticide application and irrigation, we recommend that a qualified Golf Course Superintendent be given the responsibility of managing the golf course.

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APPENDIX

Appendix Table 1. Properties of pesticides used on turf in Hawaii.

Pesticide common name	Trade name (s)	Oral LD-50 (mg/kg body wt.)*	Toxicity to fish and wildlife*	Soil sorption index (Koc)**	Water solubility (mg/l)**	Half-life in soil (days)**	Surface loss potential**	Leaching potential**
I. Herbicides								
MSMA	WeedHoe etc.	1800	Low	10000	1000000	100	Large	Small
glyphosate	Roundup, Kleenup	150	Mod. to birds, none to fish	10000	1000000	30	Large	Small
metribuzin	Sencor	2200	Moderate	41	1220	30	Medium	Large
2,4-D	part of mixtures	370-700	High to fish	109	300000	10	Medium	Medium
mecoprop	ditto	700-1500	Low	3	660000	21	Small	Large
dicamba	ditto	1000-2000	Non toxic to fish	800000	800000	14	Small	Large
oryzalin	Surflan	10000	Mod. to birds, toxic to fish	2700	2.5	60	Large	Small
oxadiazon	Ronstar	8000	Toxic to fish		0.7			
propyzamide	Kerb	5620-8350	Low	990	15	30	Large	Small
simazine	Princep	>5000	Low	138	3.5	75	Medium	Large
chlorthal-dimethyl	Dacthal	>3000	Low	5000	0.5	30	Large	Small
bensulide	Betasan, Betamec	770	Mod. to fish	10000	25	60	Large	Small
parquat dichloride	Ortho Paraquat CL	150	Mod. to birds, none to fish	100000	1000000	3600	Large	Small
benfluralin	Balan	10000	Low to birds, high to fish	11000	0.1	30	Large	Small
II. Insecticides								
chloropyrofos	Dursban	135-163	High	6070	2	30	Large	Small
bendiocarb	Ficam	40-156	High					
carbaryl	Sevin	400-850	Moderate	229	40	7	Medium	Small
trichlorfon	Dylox	450-630	Moderate	2	154000	27	Small	Large
III. Fungicides								
anilazine	Dyrene	<5000	Low	3000	10	1	Small	Small
benomyl	Benlate	9590	Low	2100	2	100	Large	Small
chlorothalonil	Daconil 2787	>10000	Low to birds, mod. to fish	1380	0.6	20	Large	Small
iprodione	Chipco 26019 RP	3500	Low	500	13	20	Medium	Small
mancozeb	Dithane M-45	>8000	Low	1000	0.5	35	Large	Small
qunitozone	PCNB, Terrachlor	12000	Non-toxic	1000	0.44	21	Large	Small
thiram	Tersan	7500	Low	383	30	20	Medium	Medium
triadimefon	Bayleton	568	Low	273	260	21	Medium	Medium
metalaxyl	Subdue	669	Non-toxic	16	7100	7	Small	Medium
thiophanate-methyl	Cleary 3336	7500	Low	1000	3.5	0	Small	Small

*From: Hartley, Douglas and Hamish Kidd (Eds.) 1983. The Agrochemicals Handbook. Unwin Bros., Ltd. Old Working., Surrey, England.

**From: Wauchope, R. D. 1988. U. S. D. A.-ARS Interim Pesticide Properties Database, Version 1.0. Unpublished

Appendix Table 2. Toxicity classes of pesticides.

Class	Description	Warning Statement	Oral LD50
1	Highly Toxic	Poison, Skull & Crossbones	1-50
2	Moderately Toxic	Danger	51-500
3	Low Toxicity	Warning	500-5,000
4	Very Low Toxicity	Caution	>5,000

APPENDIX F

BAYVIEW GOLF COURSE: TRAFFIC IMPACT ASSESSMENT REPORT

Prepared by Pacific Planning and Engineering, Inc., April 1989

BAY VIEW GOLF COURSE

TRAFFIC IMPACT ASSESSMENT REPORT

SEPTEMBER 1989

PACIFIC PLANNING & ENGINEERING, INC.

TRAFFIC IMPACT ASSESSMENT REPORT

FOR

BAY VIEW GOLF COURSE

KANEOHE, OAHU, HAWAII
TMK: 4-5-30:1,37,42,44,45,46 & 49

September 1989

Prepared for:

Pacific Atlas (Hawaii), Inc.

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INTRODUCTION

Pacific Planning & Engineering, Inc. (PPE) was engaged to undertake a study to identify and assess future impacts caused by the proposed expansion of the Bayview Golf Course, including 40 single family residential units. This report presents the findings and recommendations of the traffic study.

The contents of this report includes descriptions of the proposed project, existing roadway and traffic conditions, methodology of study and an assessment of the traffic impacts resulting from the proposed project.

This traffic study report identifies and evaluates the probable impact of the forecasted traffic generated by the proposed project. The analysis focused primarily upon the traffic impact on Kaneohe Bay Drive at the Mokulele Drive intersection and at the proposed location of the golf course driveway. The study describes the impact during the afternoon peak hour when traffic from the proposed project is expected to have the most impact.

Project Description

Pacific Atlas (Hawaii), Inc. is proposing the expansion of the present Bayview Golf Course in Kaneohe, Oahu, Hawaii, from 9 to 18 holes. The project is expected to be completed by 1993. The location of the project is shown on Figure 1.

The improvements will include a new 30,000 square foot clubhouse with restaurant, tennis courts and swimming pool. The golf course will be in operation from 7 a.m. to 6 p.m. The clubhouse restaurant will be open from 11 a.m. to 9 p.m. The project will have 300 parking stalls. The project will also include 40 single family residential units built in four clusters alongside Kaneohe Bay Drive. Overall, the proposed project will affect the area makai of Kaneohe Bay Drive between the pedestrian overpass at the Kokokahi YWCA and Kawa Stream. A site plan of the proposed project is shown on Figure 2.

The only access for the golf course will be on Kaneohe Bay Drive in the vicinity of the Moakaka Place intersection. The residential units will have their own access to Kaneohe Bay Drive. Kaneohe Bay Drive provides access to Kailua and the H-3 freeway to the north and to Kaneohe and the Likelike Highway/Pali Highway to the south. The two pertinent intersections to this study were identified as the new golf course access road/Moakaka Place and the Mokulele Drive intersections.

The proposed golf course will be a semi-private operation with its main market being local golfers mostly from Honolulu. Their main mode of transportation is expected to be private vehicles.

The existing land uses will be minimally affected by the proposed project. The existing clubhouse and driving range will be demolished and replaced by the new facility at a new location. The existing Kaneohe sewer treatment plant will also be rebuilt at another location within the project. Ten existing residences will be relocated into the new residential subdivision. Finally, the Kokokahi YWCA will be relocated to a new location.

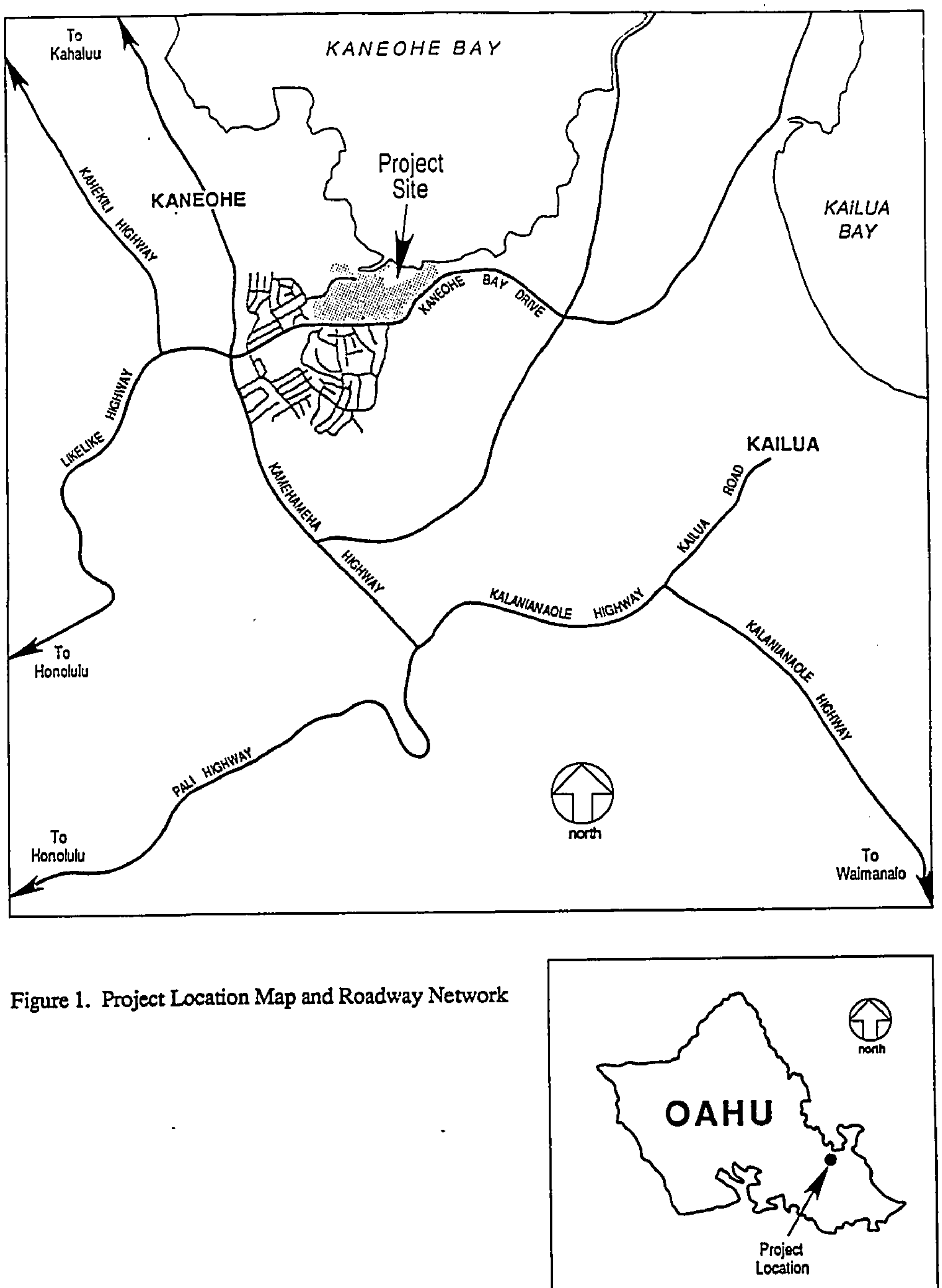

Figure 1. Project Location Map and Roadway Network

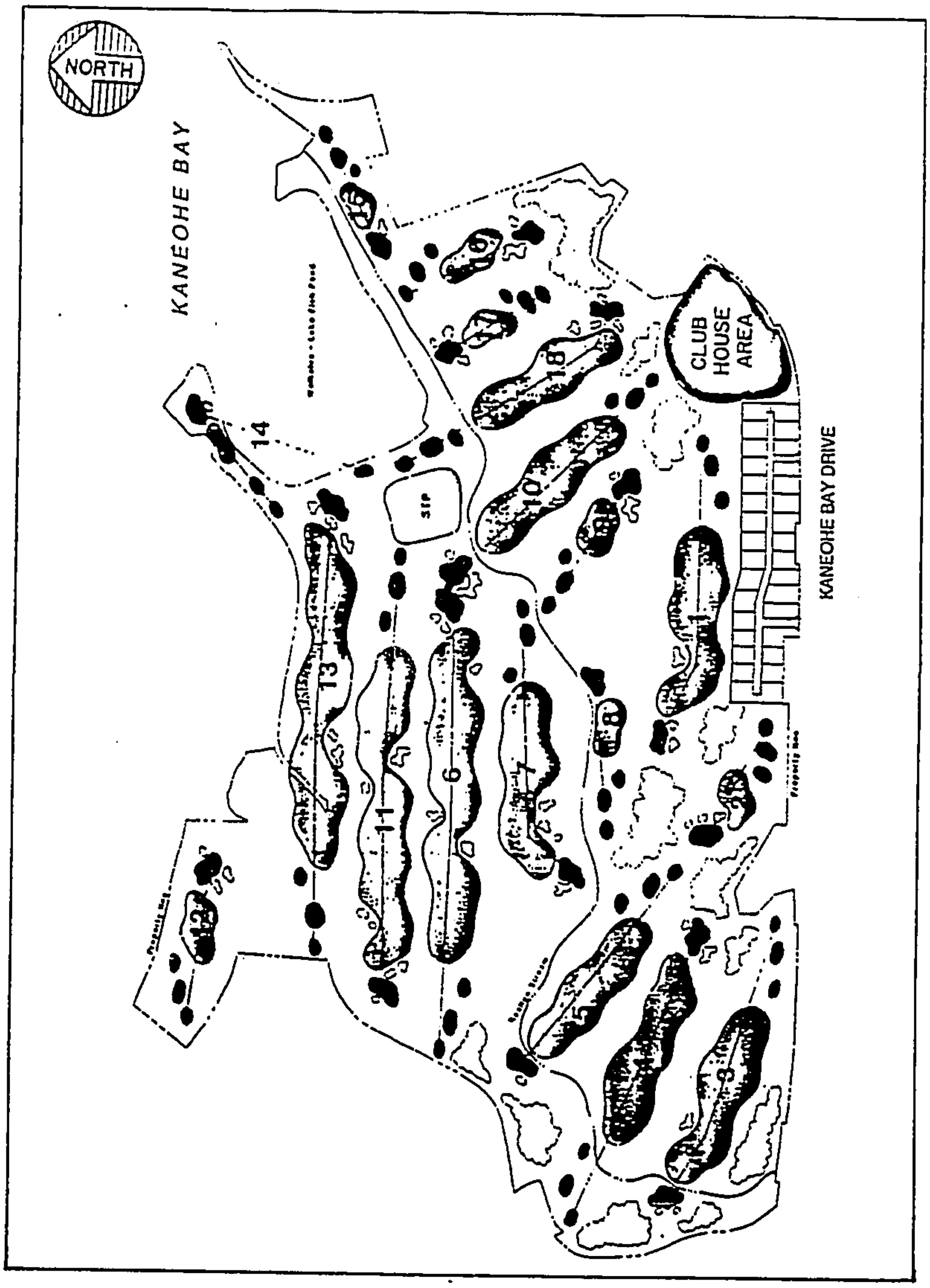

Figure 2. Project Site Plan

EXISTING CONDITIONS

Research of the proposed site area was conducted, including a site survey. Information such as 24-hour traffic counts, accident history, peak hour traffic volumes and existing roadway conditions were obtained for the traffic analysis.

Traffic Volumes

Traffic counts obtained from the State Department of Transportation (DOT), Highways Division provided information on traffic trends. The historical data indicated that traffic volumes on Kaneohe Bay Drive were increasing at a very modest rate (0.9% at Kamehameha Highway and 1.5% at Mokapu Saddle Road) until December, 1986, when the H-3 link between Kamehameha Highway and the Kaneohe Marine Corps Air Station was opened. Traffic decreased sharply following the opening of the H-3 link (15% at Kamehameha Highway) and has been increasing slowly again. The trend in ADT volumes for Kaneohe Bay Drive at the intersection with Mokapu Saddle Road is shown on Figure 3.

A review of the State DOT traffic counts indicated that the weekday afternoon peak hour should be used as the basis for forecasting since it represents the worst case condition. Further, a review of traffic generated by golf courses also indicated that semi-private golf courses generate more traffic in the afternoon than morning.

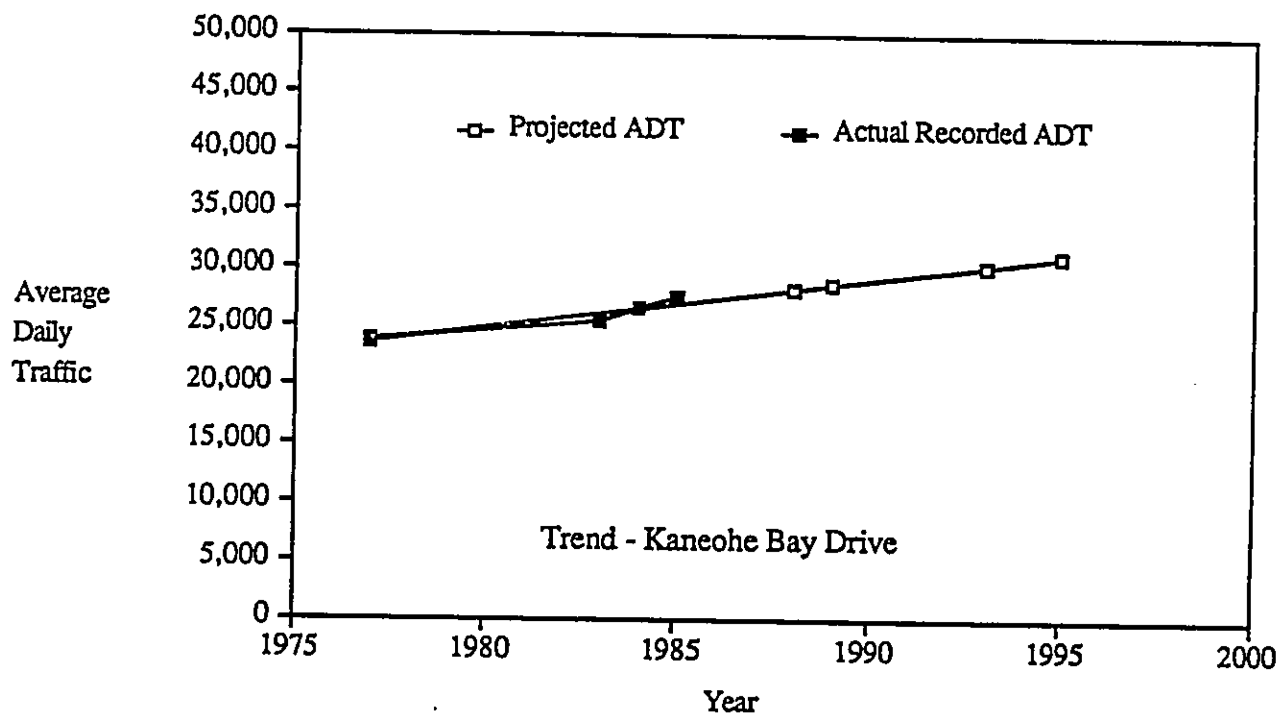

Figure 3. Trend in ADT Volumes
Kaneohe Bay Drive @ Mokapu Saddle Road

Manual traffic counts were taken by Pacific Planning & Engineering, Inc. at several intersections on Kaneohe Bay Drive on March 14 &16, 1989, during the afternoon peak period. Figure 4 shows the results of these counts for the peak hour. The Level-of-Service (LOS) analysis of the existing volumes are discussed in the section on Traffic Impact Analysis.

Roadway Conditions

Kaneohe Bay Drive is a two-lane roadway in the vicinity of the project site. It is a Federal Aid Secondary Highway under the jurisdiction of the State DOT. The roadway does not have sidewalks. There are wide paved shoulders along most of its length and in the proposed project area. The posted speed limit is 35 miles per hour (mph). The driveways of adjoining land uses connect directly to Kaneohe Bay Drive.

From the proposed golf course access road, Kaneohe Bay Drive leads north to the Mokapu Saddle Road, Kailua, Kaneohe Marine Corps Air Station and the H-3 freeway. To the south, it intersects with Mokulele Drive, and further south intersects with Kamehameha Highway and Likelike Highway. Kamehameha Highway provides access to Pali Highway to the east and Kaneohe to the west. Likelike Highway travels straight through from Kaneohe Bay Drive and leads to Honolulu via Wilson Tunnel. Mokulele Drive also provides access to Kamehameha Highway closer toward the Pali Highway.

Within the limits of the project, the Mokulele Drive intersection is the only signalized intersection and the only intersection with exclusive turn lanes. The northbound approach of Kaneohe Bay Drive has an exclusive right turn lane to Mokulele Drive but the storage and transition length of the right turn lane is too short to be effectively utilized.. Drivers wanting to make a right turn were observed stopping in the queue of through movement vehicles and many drove on the shoulder to reach the right turn lane. The southbound approach has two lanes, one for through movements and an exclusive left-turn lane. The Mokulele Drive approach widens sufficiently to provide a right and left turn lane.

The other unsignalized intersections along Kaneohe Bay Drive between Mokulele Drive and Kokokahi Place do not have exclusive turning lanes. The State DOT has programmed the construction of turning lanes at the Kokokahi Place intersection in 1990. There is a sight distance problem to the south of the Moakaka Place intersection due to a combined horizontal/vertical curve.

Accident History

Traffic accident data was obtained from the State DOT from 1985 to 1987, the latest year available. The data summary on Table 1 shows that the number of accidents have been increasing annually, despite a decrease in traffic volumes in 1987. Most of the accidents involved two or more vehicles.

Table 1. Kaneohe Bay Drive
Traffic Accident Summary

Mileposts	General Location		Number of Accidents 1985	1986	1987
0.7	Mokulele Drive		6	6	8
0.8-1.0	to Namoku Street		6	5	9
1.1-1.2	to Moakaka Place		4	4	4
1.3-1.6	to Kokokahi Place		9	13	13
		TOTAL	25	28	34

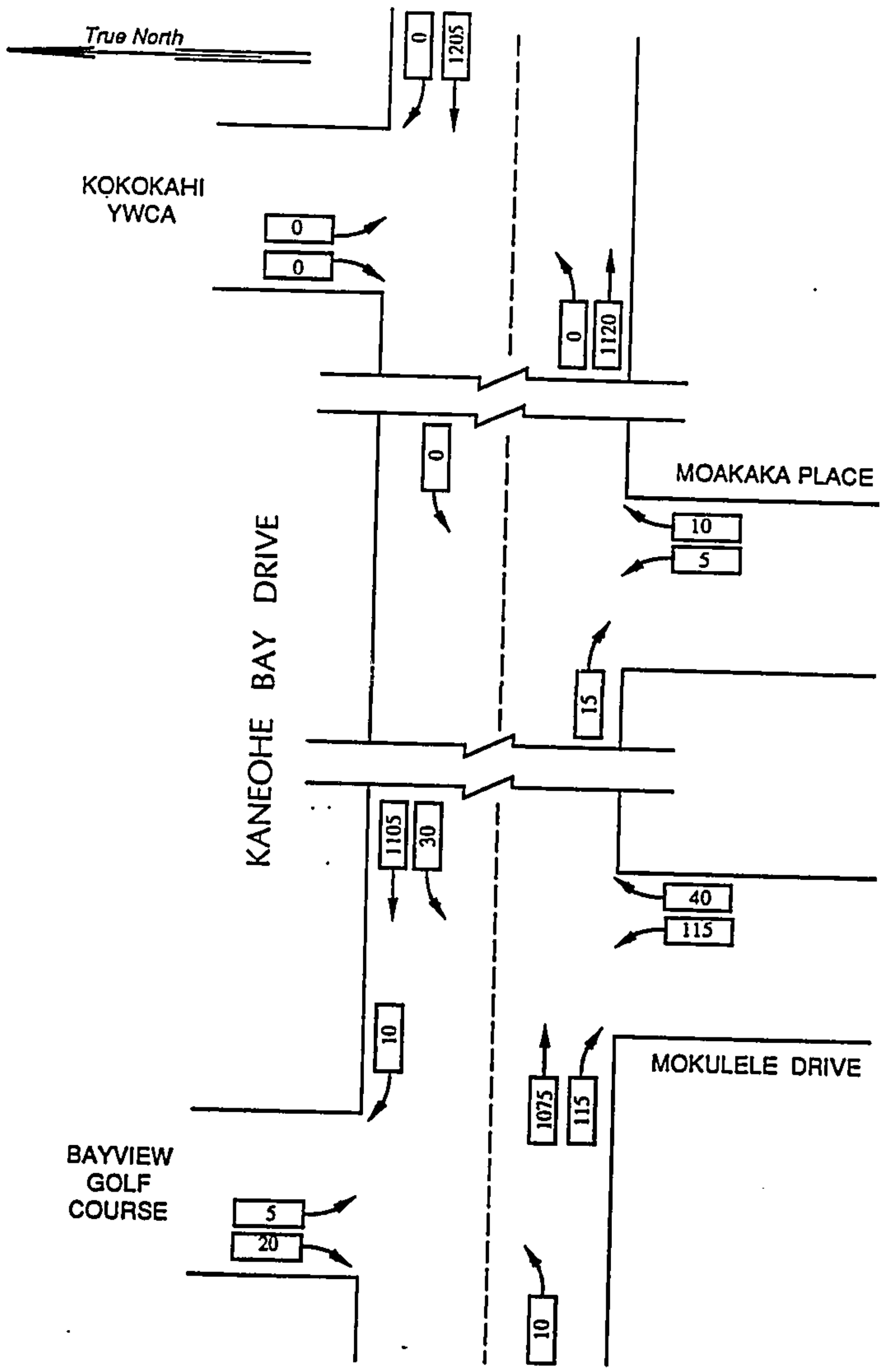

Figure 4. Existing Traffic Volumes Afternoon Peak Hour

TRAFFIC IMPACT ANALYSIS

Study Methodology

The focus of the study is to determine the impact of the project generated traffic on Kaneohe Bay Drive when the project is completed in 1993. Future traffic with and without the project were forecast for the afternoon peak hour. The study intersections were then analyzed for the conditions of the present case, 1993 without the project and 1993 with the project.

Future Ambient Traffic

Future ambient traffic on Kaneohe Bay Drive was forecasted based on trend analysis. The land areas served by Kaneohe Bay Drive is well developed and major projects other than the proposed project are not expected. Future growth is expected to be primarily from the infilling of vacant lots, which results in a small rate of growth.

The analysis of existing traffic volumes indicated a 1.5% rate of growth on Kaneohe Bay Drive at the Mokapu Saddle Road prior to 1987. A six (6) percent growth in through traffic volumes (1.5% for four years) at Kokokahi YWCA was assumed. The difference between the forecast and existing traffic volumes (70 vph for each direction of travel) was then added to the existing through volumes at the remaining intersections. Turning movement volumes into and from the side streets were assumed to remain constant. The existing land uses which would be relocated or demolished under of the proposed project were assumed to remain in place for the 1993 without project condition. The results of this analysis are shown on Figure 5.

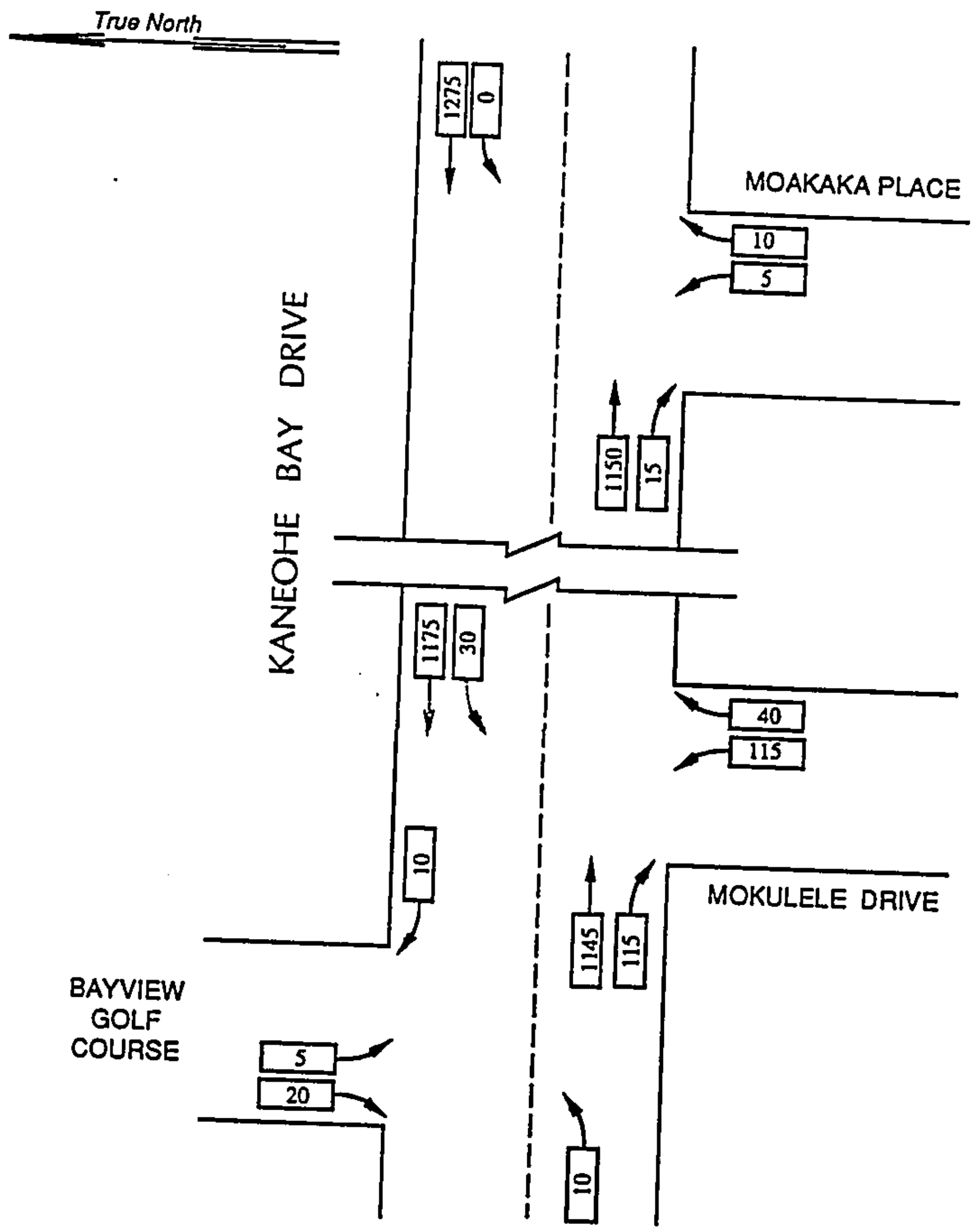

Figure 5. 1993 Ambient Afternoon Peak Hour Forecast Without Project

Project Generated Trips

The traditional sequential procedure of trip generation, distribution and assignment was used to forecast the volume of traffic which would be generated by the proposed project. The trips which are being generated by land uses which are to be demolished/relocated were also taken into account.

Standard trip generation rates from the Institute of Transportation Engineers, "Trip Generation" (Third Edition, 1982), were used. These vehicle trip rates are based on average conditions on a national basis.

The results of the trip generation analysis are shown on Table 2. Comparison of the derived volumes with actual counts taken at several Oahu golf courses indicate that these counts are on par with public courses but slightly higher than semi-private courses. Use of the derived volumes implies a conservative assumption that overstates the number of trips which would actually be generated.

Table 2. Trip Generation Summary

Land Use	Units	ITE Rate	Direction of Travel	Afternoon Peak Hour Trips [1]
Golf Course	300 parking stalls	0.11	Inbound	30
		0.20	Outbound	60
Residential Homes	40 units	0.63	Inbound	25
		0.37	Outbound	15

[1] rounded to nearest 5

The proposed 40 residential units would be built in a single cluster. Ten new dwelling units will "replace" the existing ten units which are being relocated, therefore no significant net change in traffic would result. The volume of trips which would be generated by the other thirty units is minimal and their impacts are also expected to be insignificant.

The distribution and directional assignment of the generated trips were based on the expected market for the golf course, local golfers from Honolulu. It was assumed that two-thirds of the golf course-generated trips would be to or from the south, and the remaining one-third to or from the north. One-half of the trips to or from the south (or, one-third the total trips) would continue on Kaneohe Bay Drive to Kaneohe or the Likelike Highway. The other half would utilize Mokulele Drive. The residential trips were distributed 75% south and 25% north based on the existing travel patterns. The results of this analysis are shown on Figure 6.

The traffic from the existing Bayview Golf Course driveway was also removed from the traffic flow as indicated by the negative volumes on Figure 6. The YMCA will also be relocated but traffic counts taken at their driveway showed less than 5 trips per hour being generated. Therefore, no adjustments were made.

The net volume of traffic which would be generated by the proposed project is summarized graphically on Figure 7. The 1993 without project traffic shown on Figure 5 was added to the project generated traffic shown on Figure 6 to obtain the total forecast traffic volumes with the project as shown on Figure 7. It should be noted that both the 1993 ambient and forecast afternoon peak hour traffic volumes are lower than the volumes counted in 1986 before H-3 was opened.

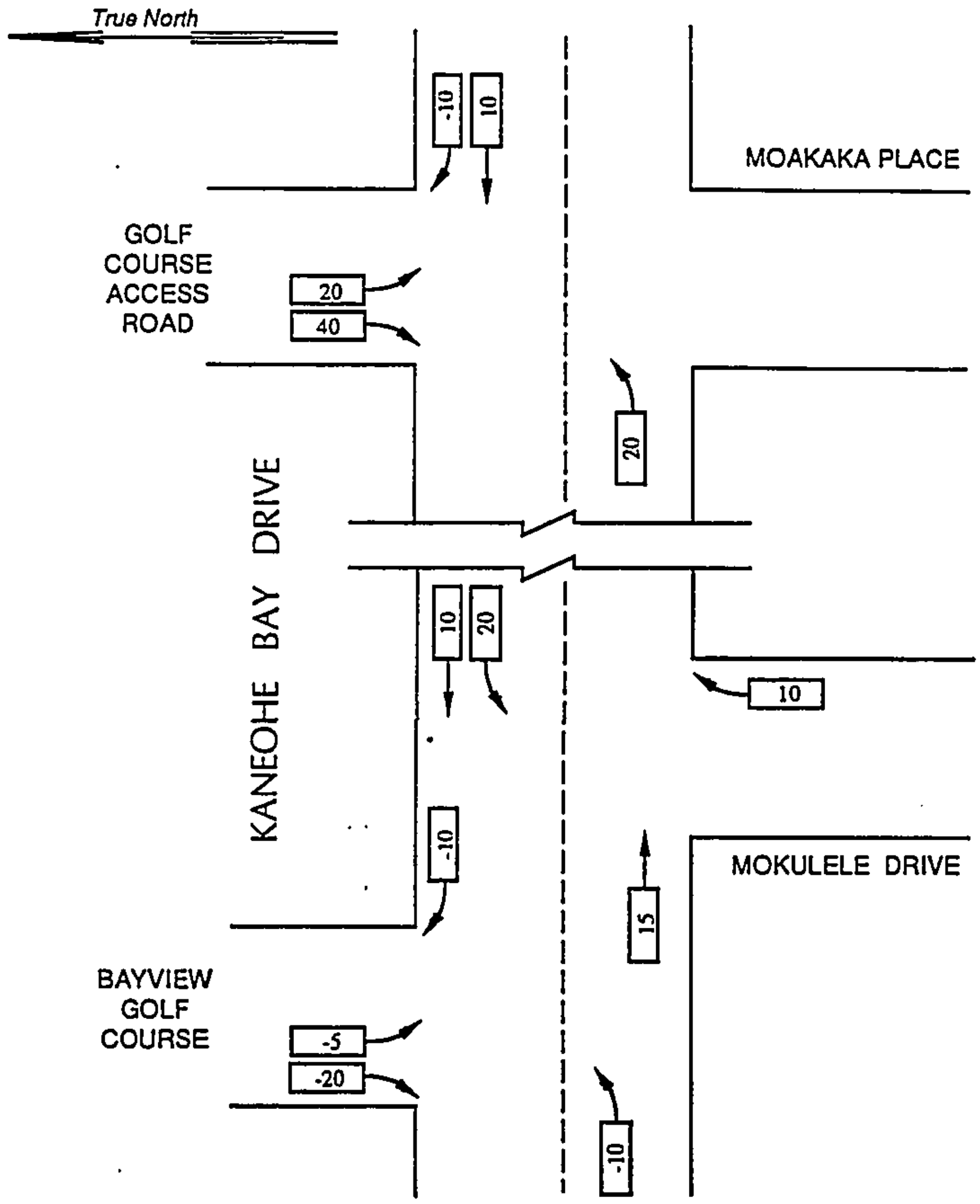

Figure 6. Project Generated Traffic

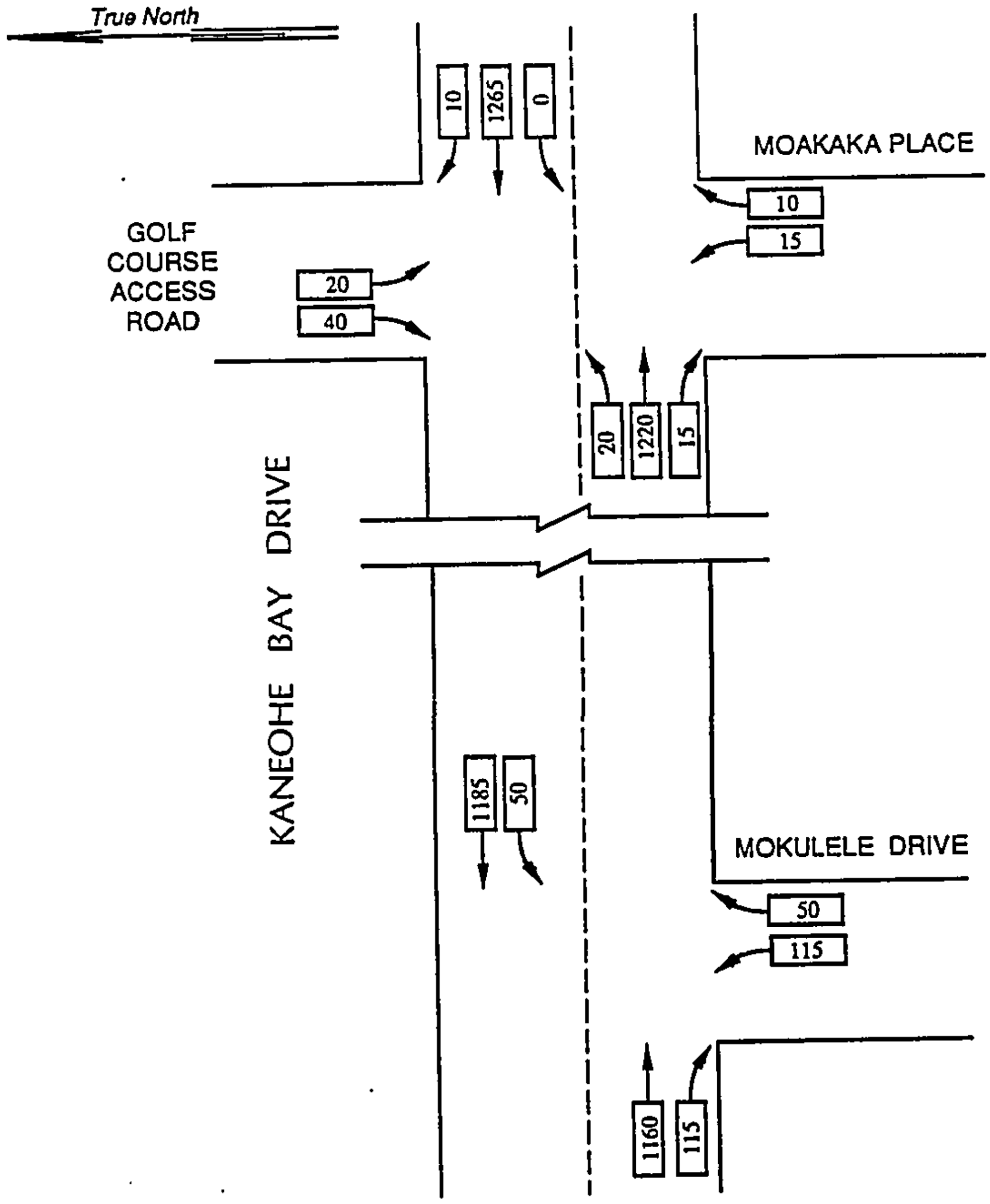

Figure 7. 1993 Total Forecast Afternoon Peak Hour Volumes

Traffic Impacts

Impacts on Kaneohe Bay Drive traffic resulting from the proposed project were measured by the change in Level-of-Service (LOS) at the study intersections with and without the project for the afternoon peak hour in 1993.

The study intersections included the signalized intersection at Mokulele Drive and the unsignalized intersection at the golf course (Moakaka Place). The analysis was done in accordance with the analyses techniques in the Highway Capacity Manual, Special Report 209 (1985).

Separate methodologies are used to analyze signalized and unsignalized intersections. Each methodology yields a range of LOS from A to F, best to worst. However, the LOS of each methodology are not comparable. The unsignalized intersection methodology yields LOS values only for critical turning movements, and quantitative values of delay have not been associated with these LOS. The signalized intersection methodology yields LOS values for individual lane groups, approaches and the intersection as a whole. The LOS for each methodology is defined in Appendix A of this report.

The results of the analysis are summarized on Table 3 for existing, 1993 without project (ambient), and 1993 with project conditions.

The Mokulele Drive intersection is presently operating at an acceptable level of service. The exception is the northbound approach which is operating at LOS D, which is considered acceptable but not desirable. A closer analysis indicated that the underdesigned right turn lane is not providing sufficient capacity. Therefore, the two future scenarios assumed an improved right turn lane which would improve future traffic operations to LOS B.

The other two approaches would continue to operate at LOS C or better, implying desirable levels of service.

Table 3. Traffic Impact Analysis
Level of Service Summary

Signalized Intersection Kaneohe Bay Drive @ Mokulele Drive	1989 Existing	1993 Ambient	1993 Forecast
Kaneohe Bay Drive			
Northbound	D	B[1]	B[1]
Southbound	B	B	C
Mokulele Drive	C	C	C

Unsignalized Intersection Kaneohe Bay Drive @ Moakaka Place and Proposed Golf Course Driveway	Existing	Ambient	Forecast
Kaneohe Bay Drive			
Southbound Left Turn	B	C	C
Northbound Left Turn	-	-	C
Moakaka Place	D	D	D
Golf Course Driveway			
Eastbound Left turn	-	-	E
Eastbound Right turn	-	-	A

1 Improved right turn lane added to approach

The Moakaka Place approach is presently operating at LOS D, and will continue to operate at LOS D in 1993 with the project traffic, indicating no adverse impact from the ambient growth as well as from the project. The left turn movement into Moakaka Place will decrease from LOS B to C without the project condition and remain at LOS C with the project, implying no adverse traffic impact from the project.

The proposed golf course access road was assumed to be opposite Moakaka Place for this analysis. The final location of the roadway will be determined in the design. Left turns into and right turns out of the access road will be at LOS C and D, respectively, indicating no significant problem. The left turn movement out from the access road will be at LOS E, indicating very long delays, This, however, does not imply that additional intersection improvements such as signalization are required.

Due to the sight distance problem at this location, separate left and right turning lanes are recommended. The makai side of the intersection should also be cleared of the overgrown vegetation to provide maximum sight distance around the horizontal curve.

In addition to the two primary intersections, the four proposed residential cul de sacs on Kaneohe Bay Drive were analyzed for forecast level of service. Outbound movements were either at LOS D or E, implying long or very long delays but not necessitating intersection improvements. The left turn movements into each of the cul de sacs are forecasted to be at LOS C, implying average traffic delays. The future level of service at each cul de sac would be influenced by their proximity to adjacent intersections, which will be considered in the final design.

CONCLUSIONS AND RECOMMENDATIONS

The proposed golf course expansion is not expected to have an adverse impact on traffic operations along Kaneohe Bay Drive. The 18-hole golf course and additional residential units will not add a large number of new trips but will primarily relocate existing trips to new locations on Kaneohe Bay Drive. The two major intersections studied at Mokulele Drive and Moakaka Place (the location of the access road for the golf course) will continue to operate at acceptable levels of service.

Outbound traffic from the residential cul de sacs will encounter long and very long traffic delays primarily due to the large traffic volumes on Kaneohe Bay Drive. However, each cul de sac, having only 12 residential units at most, is expected to have less than 5 vehicles exiting the driveway during the afternoon peak hour period. Intersection improvements are not required but the cul de sacs location should be separated to minimize conflicts with adjacent intersections.

Several mitigating actions are recommended at the studied intersections. At Mokulele Street, the right turn lane on the northbound approach of Kaneohe Bay Drive Drive should be improved by providing a longer right turn lane from the intersection. This will allow the right turning vehicles to enter the exclusive right turn lane earlier to avoid some of the delay caused by the through traffic queuing.

The access road to the proposed golf course should be aligned opposite Moakaka Place to minimize points of conflicts along Bay View Drive and increase turning efficiency of the two minor roadways. Separate right and left turn lanes should be provided for the golf course access road due to the limited sight distance. To increase the sight distance to the south, the vegetation along the horizontal curve should be cut back so that clear view can be maintained through the turn.

APPENDIX A

Definition of Level-of-Service For

Unsignalized and Signalized Intersections

APPENDIX A

DEFINITION OF LEVEL-OF-SERVICE

For unsignalized intersections, the traffic most impacted will be the minor or cross-street with the stop or yield control. The major roadway will have the right-of-way. The level-of-service is the amount of delay expected for the average vehicle desiring to cross or enter the major road. The following gives a general description of the measure.

The concept of levels of service is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst.

Level-of-Service definitions--In general, the various levels of service are defined as follows for uninterrupted flow facilities:

Level-of-service A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

Level-of-service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.

Level-of-service C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

Level-of-service D represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level-of-service E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuver. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

Level-of-service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go wave, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases operating conditions of the vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and level-of-service F is an appropriate designation for such points.

These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.

LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS

Level of service for signalized intersections is defined in terms of *delay.* Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period.

Level-of Service A describes operations with very low delay, i.e., less than 5.0 sec per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.

Level-of-Service B describes operations with delay in the range of 5.1 to 15.0 sec per vehicle. This generally occurs *with* good *progression and/or short cycle lengths. More* vehicles stop than for LOS A, causing higher levels of average delay.

Level-of-Service C describes operations with delay in the range of 15.1 to 25.0 sec per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.

Level-of-Service D describes operations with delay in the range of 25.1 to 40.0 sec per vehicle. At level D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or a high *v/c* ratios (volume of cars to capacity of intersection). Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.

Level-of-Service E describes operations with delay in the range of 40.1 to 60.0 sec per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle length, and high *v/c* ratios. Individual cycle failures are frequent occurrences.

Level-of-Service F describes operations with delay in excess of 60.0 sec per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

REFERENCE: Highway Capacity Manual (Special Report 209, 1985)

APPENDIX B

MANUAL TRAFFIC COUNT DATA

March 14, 1989

Kaneohe Bay Drive at YWCA Driveway

Time (pm)	Kaneohe Bay Drive Westbound TH	Kaneohe Bay Drive Westbound RT	Kaneohe Bay Drive Eastbound LT	Kaneohe Bay Drive Eastbound TH	YWCA Driveway Southbound LT	YWCA Driveway Southbound RT	Total All Approaches
3:30-3:45	229	0	2	220	1	0	452
3:45-4:00	254	1	0	259	0	1	515
4:00-4:15	289	0	0	283	1	0	573
4:15-4:30	298	1	0	274	2	0	575
4:30-4:45	283	0	1	273	0	1	558
4:45-5:00	327	0	0	272	0	0	299
5:00-5:15	297	0	0	302	0	0	299
5:15-5:30	238	0	0	295	0	0	533
Total	2215	2	3	2178	4	2	5505
Peak Hr Ttl	**1205**	**1**	**1**	**1121**	**2**	**1**	**2331**

March 16, 1989

Kaneohe Bay Drive at Mokulele Street

Time (pm)	Kaneohe Bay Drive Westbound LT	Kaneohe Bay Drive Westbound TH	Kaneohe Bay Drive Eastbound TH	Kaneohe Bay Drive Eastbound RT	Mokulele Street Northbound LT	Mokulele Street Northbound RT	Total All Approaches
3:30-3:45	8	190	210	30	26	9	473
3:45-4:00	10	263	284	27	21	13	618
4:00-4:15	8	241	260	18	25	13	565
4:15-4:30	4	285	249	19	37	8	602
4:30-4:45	6	278	289	32	29	12	646
4:45-5:00	9	276	262	32	23	15	617
5:00-5:15	11	267	273	31	26	6	614
5:15-5:30	7	267	260	25	29	9	597
Total	63	2067	2087	214	216	85	4732
Peak Hr Ttl	**30**	**1106**	**1073**	**114**	**115**	**41**	**2479**

March 16, 1989

Kaneohe Bay Drive at Golf Course Access

Time (pm)	Kaneohe Bay Drive Westbound TH	Kaneohe Bay Drive Westbound RT	Kaneohe Bay Drive Eastbound LT	Kaneohe Bay Drive Eastbound TH	Golf Course Access Southbound LT	Golf Course Access Southbound RT	Total All Approaches
3:30-3:45	216	2	6	240	2	6	472
3:45-4:00	284	3	4	311	2	5	609
4:00-4:15	266	0	3	278	1	4	552
4:15-4:30	322	5	4	268	2	5	606
4:30-4:45	307	2	3	321	1	4	638
4:45-5:00	299	2	2	294	2	5	604
5:00-5:15	293	1	2	304	1	4	605
5:15-5:30	296	1	1	285	5	6	594
Total	2283	16	25	2301	16	39	4680
Peak Hr Ttl	**1221**	**10**	**11**	**1187**	**6**	**18**	**2453**

APPENDIX G

BOTANICAL SURVEY: PROPOSED BAYVIEW GOLF COURSE EXPANSION, KANEOHE, O'AHU

Prepared by Char and Associates, March 1989

BOTANICAL SURVEY

PROPOSED BAYVIEW GOLF COURSE EXPANSION

KANEOHE, O'AHU

by

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Honolulu, Hawaii

Prepared for: HIDA, OKAMOTO & ASSOCIATES, INC.

March 1989

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SUMMARY

In mid-March, 1989, a botanical survey was made of the site of the proposed Bayview Golf Course expansion in Kaneohe, O'ahu. The vegetation was of two general types: grassland/wasteland on the level portions and scrub/forest on the slopes. A portion of the grassland was at least partially inundated and classified as wetland. Because wetland is of particular interest to regulatory agencies, this was distinguished from the non-inundated portions. A total of 212 species of vascular plants were found on the site, of which 200 (94%) were exotics or Polynesian-introduced species. Only 12 (6%) were native or presumed-native species. None of these species are officially listed as endangered; nor are any considered rare or vulnerable. None of the native species are of botanical interest in the present context, and none warrant mitigative action before the site is developed. A number of ornamental trees on the slopes are of sufficient stature to have potential value as landscape plants in the development of the site, but none are listed on the register of Exceptional Trees. The wetland was found to be little more than a boggy meadow with scarcely any open water. The vegetation was of little botanical interest.

INTRODUCTION

The Bayview site consisted of approximately 150 acres in Kaneohe, O'ahu. It was bounded on the southern side by Kaneohe Bay Drive, on the west by the houses of Puohala Village, on the northeast by Kaneohe Bay, and on the north by Kaneohe Stream. A small parcel of perhaps 5 acres was across Kaneohe Stream from the remainder of the site. Kawa Stream ran lengthwise through the center of the site. The western third of the site was the present Bayview Golf Course. The central third of the site contained the Kaneohe Sewage Treatment Plant (north of Kawa Stream) and wetland (south of the stream). The eastern third of the site consisted of Waikalua-loko Fish Pond and wasteland. Adjacent to the site, Kaneohe Bay Drive was at an elevation of 50-100 feet on the lower slopes of Pu'u Papa'a, while much of the site was below 10 feet. All of the site adjacent to Kaneohe Bay Drive was thus of fairly steep slope. Two hills reached heights of about 140 feet.

Kawa Stream has been channelized, with the spoil thrown up as an embankment on one or both sides. This embankment appeared to impede the drainage of water from several seeps and streams in the hillsides, and may thus be partly responsible for the ponding of water in the wetland area. The lower portion of Kaneohe Stream has been lined with stone to prevent erosion of the banks. However, the banks are not lined in the eastern end of the site and there is evidence that the stream is in the process of eroding into its south bank while depositing soil on its north bank. This represents the detached portion of the site on the opposite side of the stream from the rest of the site.

In the eastern end of the site, two former fish ponds have apparently been filled in. It was not possible to distinguish with certainty their former outlines in the heavy overgrowth of vegetation, but part of the former Keana Fish Pond appeared to be a lawn area in use by the Kokokahi Sailing Club for parking catamarans.

PREVIOUS SURVEYS

At least two studies have been conducted on the site or nearby parcels. The most thorough was a general survey of wetland vegetation for the entire State, including Kawa Stream (Elliott and Hall, 1977). Elliott and Hall recognized the wet meadow and found the same vegetation as in this report, though fewer species over-all. They surmised that inundation of this meadow probably varied through the year with rainfall. The present survey was made only a week after a series of heavy rains, when inundation should have been near maximum and found little standing water but a great deal of mud. In addition to the freshwater wetland, they recognized a small patch of mangroves at the mouth of the realigned Kawa Stream, an area probably representing the defunct Waikalua Fish Pond. In the mangrove patch, they found the same species observed in the present survey, with one exception. They reported seashore paspalum (*Paspalum vaginatum*). This species was not seen in the present survey, while a few additional species were found that had not been reported by them. For the most part, these new finds were represented by seedlings, and may be recent colonizers or may be periodic colonizers that do not persist. Elliott and

Hall did not locate the former Keana Fish Pond. They predicted that the patch of mangroves was likely to expand in the future, and this has been borne out. All of Waikalua-loko Fish Pond is now ringed with mangroves as is the bank of Kawa Stream adjacent to the fish pond. Apart from the differences noted above, any discrepancies between the present survey and that of Elliott and Hall may be attributed largely to changes in the accepted names of plants in the intervening 12 years.

Another study of the site was done in conjunction with the Environmental Impact Statement for the reduction of the Kaneohe Sewage Treatment Plant to a pretreatment and pumping facility (Chun, 1983). The report included no botanical treatment other than a brief statement that coconut trees, bermuda grass, and a variety of weeds were found on the site. It is possible that this statement was prepared with no actual reconnaissance, as no reference was made to any previous surveys, published or otherwise, nor to any field work done for that specific project.

SURVEY METHODS

A walk-through method was used for this survey. The site was accessible from Kulauli Street, the Kaneohe Sewage Treatment Plant, a decrepit bridge across Kawa Stream from the back of the sewage treatment plant, and a series of old roads and horse trails through the bush below Kaneohe Bay Drive. The detached parcel across Kaneohe Stream was accessible from Waikalua Road and a series of trails made through the bush, apparently by neighborhood children. Ornamental plants associated with occupied homesites, the golf course, and the sewage treatment plant were ignored unless they appeared to have escaped cultivation and naturalized in uncultivated areas on the site. Plants were generally identified in the field. Those plants that were not recognized in the field were brought back for comparison with preserved specimens and the taxonomic literature. Taxonomy and nomenclature of ferns follows Wagner and Wagner (1987). Taxonomy and nomenclature of flowering plants follows Wagner, et al. (in press), supplemented by St. John (1973).

DESCRIPTION OF THE VEGETATION

Three main vegetation types were recognized on the site: wetlands (wl), in which there was some degree of inundation by fresh or saline water; dry level ground (dl), including moist but non-inundated pasture, lawn areas, and weedy waysides; and hillsides (hs). Each was defined by a unique set of dominant plants, though many of the minor constituents were common throughout the survey site.

Wetlands. These areas fell into two sub-types (Figure 1). The first was the wet meadow south of Kawa Stream. There was perhaps only an inch or so of standing water over most of the area, with occasional deeper spots, despite the occurrence of heavy rains only one week before the survey. The source of the water appeared to be runoff from the adjacent hillsides, and perhaps some seeps, or small springs, associated with the hillsides. Observed runoff alone did not seem sufficient to account for the degree of inundation of the area. It is likely that the wet meadow was seen at its wettest due to the recent rains, and that the area may be considerably drier at other times of the year. A 2-3 foot embankment along Kawa Stream clearly restricted drainage of the meadow, as evidenced by rapid flow where the embankment was breached.

The dominant plant was California grass (Brachiaria mutica), a common pasturage grass in moist areas. Evenly scattered among the grass were clumps of ludwigia (Ludwigia octovalvis) and Job's tears (Coix lachryma-jobi). While California grass is a facultative wetland plant, thriving there but not requiring such conditions, ludwigia and Job's tears are more or less obligate wetlands plants, not thriving without periodic or prolonged inundation. More minor, but still widespread, plants included dayflower (Commelina diffusa) and kyllinga (Kyllinga brevifolia). On the embankment and other slightly more elevated areas, pluchea (Pluchea indica and P. symphytifolia) were common. A number of plants occurred as isolated patches or single plants: Chinese taro (Alocasia cucullata), 'ape (Alocasia macrorrhiza), taro (Colocasia esculenta), impatiens (Impatiens wallerana), duckweed (Lemna minor), banana (Musa x paradisiaca), and hau (Hibiscus tiliaceus). Chinese taro, 'ape, taro, and banana were probably being cultivated, though there was no clear sign of recent work.

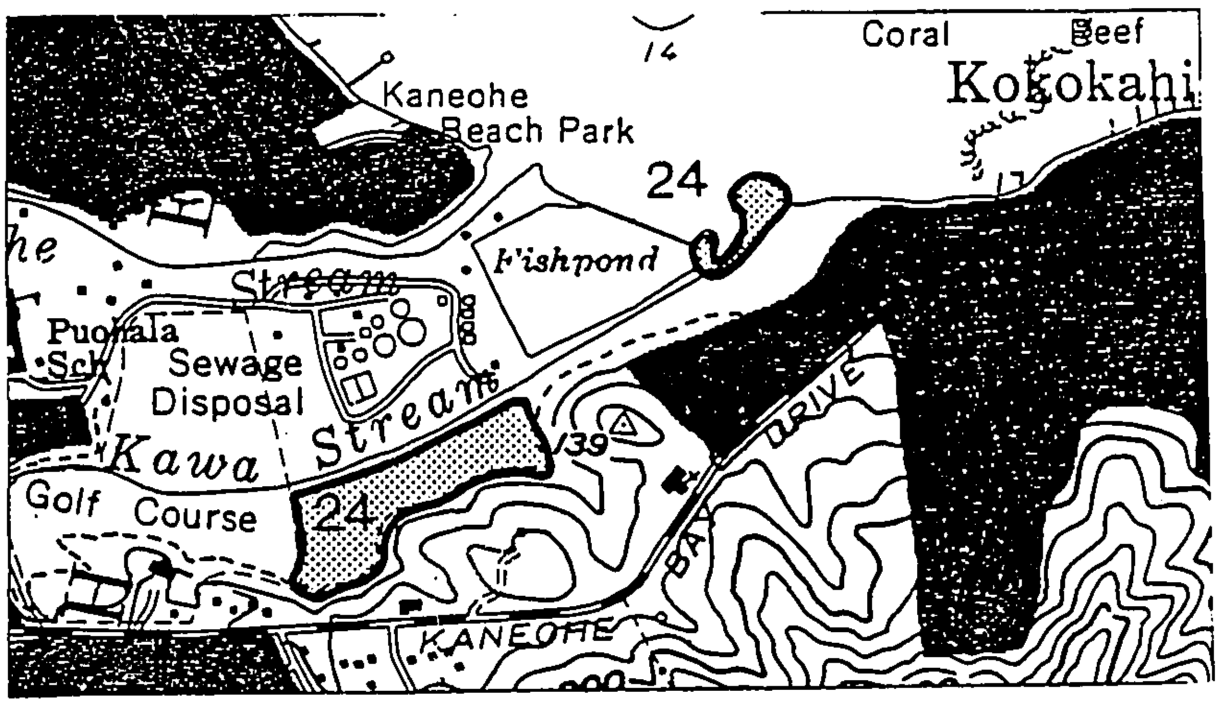

Figure 1. Location of Wetlands on Bay View Golf Course Expansion Site (from Elliott and Hall, 1977). The wetlands, indicated by dotted area and site number "24", are found along Kawa Stream. California grass dominated wetlands are adjacent to the existing golf course; mangrove dominated wetlands occur at the mouth of Kawa Stream.

Impatiens is a rainforest plant much admired as an ornamental. In Hawaii it often escapes cultivation where there is sufficient moisture. Duckweed is a minute, floating aquatic plant often transported from pond to pond by aquatic birds. No aquatic birds were seen on the site during this survey.

This area was much trampled by cattle. In drier weather they would probably graze throughout the meadow, but at the time of the survey they were restricted to the higher areas. The muddiness of some spots suggested that, despite the lack of standing water, the areas might be too wet for cattle. While the area is clearly used to graze cattle, it would give a false impression to call it pasture.

A second sub-type of wetland was represented by the stand of mangroves (Rhizophora mangle). While this is one of the few trees to tolerate inundation of the roots by seawater, it is primarily a plant of brackish areas, often forming extensive stands composed almost exclusively of the one species. Its habitat preferences, ability to anchor otherwise-unstable substrate, and extreme productivity make it the basis for many food-chains in the tropics. In addition, it is an effective screen against salt spray, and may be the best means of protecting shoreline from damage due to storm surge and tsunami. On the other hand, its rank growth make it inimical to Hawaiian fish ponds. Its great productivity means that the mud beneath its roots will always be anoxic and malodorous.

All other plants found with the mangroves were relatively minor constituents: pickleweed (Batis maritima), milo (Thespesia populnea), kamani (Calophyllum inophyllum), false kamani (Terminalia catappa), and St. Augustine grass (Stenotaphrum secundatum). Kamani and false kamani were represented only by seedlings. These may either be recently arrived on the site, or habitual colonizers that are soon lost.

Mangroves seem to have expanded greatly on the site in the last 10 years. There is little area left for them to expand into except to fill the fish pond and clog the stream. They can be controlled by cutting close to the ground, with little or no ability to regenerate from the base. However, they germinate their seedlings before dropping them from the fruits, and these seedlings densely carpet the ground beneath the trees. Where there is water beneath the trees, the seedlings are able to float until cast up on solid ground. It is from these seedlings that the trees regenerate after cutting.

Dry level ground. This vegetation type had the greatest diversity of sub-types, and thus species, but the sub-types were also very poorly distinguished from one another, often grading from one into the other. In a very broad interpretation there were 3 main sub-types: grassland, or pasture; mowed lawns; and weedy waysides.

The dominant pasture grass was California grass, though Hilo grass (*Paspalum conjugatum*) was locally dominant. Where California grass predominated, there was little else except for some emergent koa haole (*Leucaena leucocephala*) and the vines maile pilau (*Paederia scandens*), koali-awahia (*Ipomoea indica*) and moon flower (*Ipomoea alba*). Where the lower-statured Hilo grass predominated, a large variety of wayside weeds were present, usually as minor elements. Pigweeds (*Amaranthus spinosus* and *A. lividus*) and young plants of an apparently large, spiny, unidentified nightshade were especially common. Less common, but still conspicuous components of this vegetation were wood fern (*Thelypteris parasitica*), sour grass (*Digitaria insularis*), crab grasses (other *Digitaria* spp.), Guinea grass (*Panicum maximum*), elephant grass (*Pennisetum purpureum*), cyperus (*Cyperus gracilis*), kyllinga (*Kyllinga nemoralis*), beggar's ticks (*Desmodium incanum*), indigo (*Indigofera suffruticosa* and *I. spicata*), chili pepper (*Capsicum annuum*), sigesbeckia (*Sigesbeckia orientalis*), Sacramento bur (*Triumfetta semitriloba*), and malvastrum (*Malvastrum coromandelianum*). There were a number of taller plants, some weedy, some ornamental found in the pasture area. These included the weedy trees klu (*Acacia farnesiana*), 'opiuma (*Pithecellobium dulce*), and guava (*Psidium guajava*), all commonly associated with much drier areas, and the ornamentals coconut (*Cocos nucifera*), African tulip tree (*Spathodea campanulata*), erythrina (*Erythrina variegata*), monkeypod (*Samanea saman*), reed (*Arundo donax*), papaya (*Carica papaya*), jacaranda (*Jacaranda mimosaefolia*), ornamental ginger (*Hedychium* sp.), and dumbcane (*Dieffenbachia seguine*). These ornamentals were all apparently persisting from previous plantings. Most other species were present only as minor individual components, too insignificant to warrant elaboration here. They are listed at the end of this report.

Where animals have been allowed to overgraze (old paddocks or corrals), grasses no longer predominated, and most of the vegetation consisted of ruderal weeds: pluchea (both species, but mostly *P. indica*), amaranthus, cassia (*Senna occidentalis*), synedrella (*Synedrella nodiflora*), verbena (*Verbena litoralis*), plantain, (*Plantago major*), borreria (*Spermacoce assurgens*), youngia (*Youngia japonica*), phyllanthus (*Phyllanthus debilis*), eclipta (*Eclipta alba*), wood sorrel (*Oxalis corniculata* and *O. corymbosa*), bindweeds (*Ipomoea triloba* and *I. obscura*), portulaca (*Portulaca oleracea*), popolo (*Solanum americanum*), euphorbia (*Chamaesyce hirta*, *C. hypericifolia*, and *C. prostrata*), sleepinggrass (*Mimosa pudica*), wild cresses (*Coronopus didymus* and *Cardamine flexuosa*), Spanish needle (*Bidens pilosa* and *B. alba*), castorbean (*Ricinus communis*), emilia (*Emilia fosbergii* and *E. sonchifolia*), ageratum (*Ageratum conyzoides*), sida (*Sida rhombifolia* and *S. spinosa*), and scarlet pimpernel (*Anagallis arvensis*).

Mowed lawns and weedy waysides differed greatly in their physiognomy, but the component species were very similar. Lawn areas were either predominantly Bermuda grass (*Cynodon dactylon*) or Hilo grass, depending on the relative wetness of the soil and frequency of disturbance. Where the grass had been destroyed recently, and had not yet recovered, as well as where the grass was not adequately mowed, ruderal weeds predominated. These included many of those listed above, plus some additional species more tolerant of harsh wayside conditions (see below).

Along roadsides, where vehicular traffic and other factors prevented the establishment of lawn grasses, ruderal weeds predominated. In addition to a number mentioned previously, these included tomato (*Lycopersicon esculentum*), ground cherry (*Physalis angulata*), hyptis (*Hyptis pectinata*), wood betony (*Stachys arvensis*), plush grass (*Chloris radiata*), sand spurry (*Spergularia marina*), stink grass (*Eragrostis cilianensis*), wild bush bean (*Macroptilium lathyroides*), fringed paspalum (*Paspalum fimbriatum*), sweetclover (*Melilotus indica*), sowthistle (*Sonchus oleraceus*), lion's ear (*Leonotis nepetaefolia*), kiawe (*Prosopis pallida*), heliotrope (*Heliotropium procumbens*), fuzzytop

(Bothriochloa barbinodis), Johnson grass (Sorghum halapense), partridge pea (Chamaecrista nictitans), stachytarpheta (Stachytarpheta jamaicensis), pohuehue (Ipomoea pes-caprae), flaveria (Flaveria trinervia), coat buttons (Tridax procumbens), hairy horseweed (Conyza bonariensis), desmanthus (Desmanthus virgatus), Sodom apple (Solanum linneanum), rattlepod (Crotalaria incanum), star grass (Chloris divaricata), and sandbur (Cenchrus echinatus).

The small detached parcel across Kaneohe Stream from the remainder of the site was something of a hybrid site. While it was basically dry level ground, the proximity of the stream and the developed slopes above allowed elements of all vegetation types to comingle. Much of the parcel was covered with a forest of koa haole and Javaplum trees (Syzygium cumini). In these was a dense tangle of vines, including koali-awahia, moonflower, maile pilau, as well as an ornamental asparagus (Asparagus falcatus) and passion fruit (Passiflora ligularis). In the understory were cinnamon (Cinnamomum burmannii), 'uhaloa (Waltheria indica), bananas, and castorbean. That part of the parcel not covered with trees was a dense tangle of elephant grass, to the exclusion of virtually all else. Along the stream itself was a beach being deposited by the stream as it undercuts the opposite bank. This was covered with California grass, with isolated plants of mangrove, coconut, and umbrellagrass (Cyperus alternifolius).

Hillside vegetation. The hillsides below Kaneohe Bay Drive had the most diverse vegetation due to variations in slope, exposure, soil moisture, and human impact. Still there were only two basic sub-types to the vegetation: dense Javaplum forest on the moist lower slopes and less exposed areas near the tops; and relatively open Javaplum-Christmas berry-octopus tree-guava scrub along ridge lines and at the tops of knolls. There were homesites along Kaneohe Bay Drive from which a number of ornamentals had escaped, while other escaped ornamentals, along with terraces and overgrown roads lower down indicated former human impact. For the most part, the individual species, other than the dominants are too numerous and insignificant to enumerate here, but they may be found listed at the end of this report. The description here will deal more with some of the more noteworthy features in the area.

Most of the hillside area was dominated by a tall, closed canopy Javaplum forest with koa haole understory. Especially on the lower slopes a venerable old mango (Mangifera indica), as well as some very stately date palms (Phoenix dactylifera), some with large Chinese banyan (Ficus microcarpa), added interest. A small cespitose palm (Ptychosperma sp.), not previously reported as naturalized in Hawaii, was very common. An open understory was represented by octopus tree saplings (Schefflera actinophylla), heliconia (Heliconia sp.), Christmas berry (Schinus terebinthifolius), young cinnamon trees, Mickey Mouse plant (Ochna kirkii), fern tree (Filicium decipiens), and cassia (Senna surrattensis). Ground cover was generally sparse, consisting of some 25 minor components listed at the end of the report. One interesting feature of the lower slope was a level terrace where water was impounded and taro and 'ape were growing. Below the homesites, a number of exotics had escaped, including monstera (Monstera deliciosa), sansevieria (Sansevieria trifasciata), walking iris (Neomarica caerulea), and Cook pine (Araucaria columnaris).

More exposed ridgetops were covered with more open, low-stature scrub. The dominant species were either Javaplum-Christmas berry-guava or Christmas berry-guava-octopus tree. The ground beneath the scrub vegetation was covered by a dense growth of grasses and herbs, including molasses grass (Melinis minutiflora), rice grass (Paspalum scrobiculatum), slender foxtail (Setaria gracilis), broomsedge (Andropogon virginicus), golden beard grass (Chrysopogon aciculatus), an unknown pennisetum (Pennisetum sp.), stachytarpheta, desmanthus, and partridge pea. Two noteworthy plants of the scrub were Koster's curse (Clidemia hirta), never before reported from a site so close to the sea, and u'ulei (Osteomeles anthyllidifolia), a remnant of the native lowland scrub vegetation.

There was one additional feature of the hillside vegetation, a clump of hau. Most of this clump was on boggy level ground at the foot of the slope, but it did extend upslope a short distance. It had overgrown an old road at the foot of the hillside, and so had evidently begun below and climbed the hill with time, or begun above and later descended to proliferate below. The clump was too dense to be penetrated beyond the edges, but few other plants can survive beneath it. The remainder of the species found on the hillsides can be found in the list at the end of the report. Plants found only on still-occupied house sites have been omitted.

THREATENED AND ENDANGERED SPECIES

No threatened or endangered species, as listed by the U. S. Fish and Wildlife Service (1985) or Herbst (1987) were found on the site. Nor were any plants found on the site proposed or candidates for listing. While a number of trees were of sufficient stature to have value in future landscaping, none are listed as exceptional trees by the City and County of Honolulu (Ordinance No. 78-91; amended: Ordinance No. 81-32.)

RECOMMENDATIONS

There are no plants of botanical interest on the site, nor any native plant communities in need of protection. The fresh water-inundated meadow appears to be a very low-grade wetland, little used by water fowl. A well-maintained lawn with ponds might be as well used by them. The mangroves are out of place and will eventually choke the fish pond and stream. There is little reason to preserve them, though they may be useful for shoreline protection after development. There seems to be little botanical impediment to development of the site.

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SPECIES LIST

A list of all the vascular plants found on the site follows. Plants are organized in four groups -- ferns and fern allies, conifers, monocots, and dicots. Within each group they are further arranged in alphabetical order by family and genus. For each species an accepted common name is given, if one exists. A Hawaiian name is given for all native plants when known, and also for those exotic species that are generally known by a Hawaiian name. Biogeographic status is indicated by a letter code. An explanation of abbreviations used (other than author citations) is given below.

SCIENTIFIC NAME

cf. - resembling the species named, but identity not certain

s.l. - in a broad sense

sp. - precise species not determined

STATUS

E - endemic, native only to the Hawaiian Islands (none found)

I - indigenous, considered native to the Hawaiian Islands, but also found elsewhere

P - Polynesian introduction, not considered native, but thought to have been introduced to Hawaii prior to 1778

X - exotic, not native to the Hawaiian Islands, introduced after 1778

SPECIES LIST

SCIENTIFIC NAME	COMMON NAME	STATUS	VEGETATION TYPE wl	dl	hs
FERNS AND FERN ALLIES					
Adiantaceae					
Pityrogramma calomelanos (L.) Link	silver fern	X	–	+	–
Aspleniaceae					
Blechnum occidentale L.	blechnum	X	–	–	+
Nephrolepis multiflora (Roxb.) Jarret ex Morton	sword fern	X	–	+	+
Thelypteris dentata (Forsk.) Iwats.	wood fern	X	–	–	+
Thelypteris parasitica (L.) Iwats.	wood fern	X	+	+	+
Thelypteris torresiana (Gaud.) Alston	macrothelypteris	X	+	–	–
Polypodiaceae					
Phymatosorus scolopendria (Burm.) Pichi Sermolli	lau'ae haole	X	–	–	+
Psilotaceae					
Psilotum nudum L.	moa	I	–	+	–
CONIFERS					
Araucariaceae					
Araucaria columnaris (Forst. f.) Hook.	Cook pine	X	–	–	+
FLOWERING PLANTS					
MONOCOTS					
Araceae					
Alocasia cucullata (Lour.) G. Don	Chinese taro	X	+	–	–
Alocasia macrorrhiza (L.) Schott	'ape	P	+	–	–
Colocasia esculenta (L.) Schott	taro	P	+	+	+
Dieffenbachia seguine Schott	dumbcane	X	–	+	+

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Epipremnum pinnatum (L.) Engl.	taro vine	X	-	+	+
Monstera deliciosa Liebm.	ceriman, monstera	X	-	+	+
Syngonium podophyllum Schott	syngonium	X	-	+	+
Commelinaceae					
Commelina diffusa N.L. Burm.	dayflower	X	+	+	+
Cyperaceae					
Bulboschoenus maritimus (L.) Palla subsp. *paludosus* (A. Nels.) T. Koyama	makai, kaluha	I	+	-	-
Cyperus alternifolius L.	umbrellagrass	X	+	-	-
Cyperus gracilis R. Br.	McCoygrass	X	-	+	-
Cyperus rotundus L.	nut sedge, nutgrass	X	-	+	+
Kyllinga brevifolia Rottb.	kyllinga	X	+	+	-
Kyllinga nemoralis (J.R. & G. Forster) Dandy	kyllinga	X	-	+	-
Pycreus polystachyos (Rottb.) P. Beauv.	cyperus	I	-	+	-
Pycreus rivularis (Kunth) Palla	cyperus	X	+	+	-
indet. sedge		?	-	-	+
Iridaceae					
Neomarica caerulea (Ker-Gawl.) Sprague	neomarica, walking iris	X	-	-	+
Gramineae					
Andropogon virginicus L.	broomsedge	X	-	-	+
Arundo donax L.	reed	X	-	+	-
Bothriochloa barbinodis (Lag.) Herter	fuzzytop	X	-	+	-
Brachiaria mutica (Forssk.) Stapf	California grass	X	+	+	-
Cenchrus echinatus L.	sand bur	X	-	+	-
Chloris barbata (L.) Sw.	finger grass	X	-	+	+
Chloris divaricata R. Br.	star grass	X	-	+	-
Chloris radiata (L.) Sw.	plush grass	X	-	+	-

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Chrysopogon aciculatus (Retz.) Trin.	golden beard grass	I?	−	+	−
Coix lachryma-jobi L.	Job's tears	X	+	+	−
Cynodon dactylon (L.) Pers.	Bermuda grass	X	+	+	+
Digitaria ciliaris (Retz.) Koel.	Henry's crab grass	X	−	−	+
Digitaria insularis (L.) Mez ex Ekman	sour grass	X	−	+	+
Digitaria cf. violascens Link	crab grass	X	−	+	−
Digitaria sp.	crab grass	X	−	+	−
Echinochloa colona (L.) Link	jungle rice	X	+	+	−
Echinochloa crus-galli (L.) P. Beauv.	barnyard grass	X	+	+	−
Eleusine indica (L.) Gaertn.	goose grass	X	−	+	+
Eragrostis cilianensis (All.) Link	stink grass	X	−	+	−
Eragrostis tenella (L.) P. Beauv. ex Roem. & Schult.	Japanese love grass	X	−	+	−
Leptochloa uninervia (K. Presl) Hitchc. & Chase	Judd grass	X	−	+	−
Melinis minutiflora P. Beauv.	molasses grass	X	−	−	+
Oplismenus hirtellus (L.) P. Beauv.	basket grass	X	−	+	+
Panicum maximum Jacq.	Guinea grass	X	+	+	+
Paspalum conjugatum Bergius	Hilo grass	X	+	+	+
Paspalum fimbriatum Kunth	fringed paspalum	X	−	+	−
Paspalum scrobiculatum L.	rice grass	X	−	−	+
Pennisetum clandestinum Chiov.	Kikuyu grass	X	−	+	−
Pennisetum purpureum Schumach.	elephant grass	X	+	+	+
Pennisetum sp.	pennisetum	X	−	−	+
Setaria gracilis Kunth	slender foxtail	X	−	−	+
Setaria verticillata (L.) P. Beauv.	bristly foxtail	X	−	+	−
Sorghum halapense (L.) Pers.	Johnson grass	X	−	+	−
Sporobolus indicus (L.) R. Br.	dropseed	X	−	+	−
Stenotaphrum secundatum (Walter) Kuntze	St. Augustine grass	X	−	+	−
indet. bamboo		X	−	−	+
Lemnaceae					
Lemna minor L.	duckweed	X?	+	−	−

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Liliaceae, s.l.					
Asparagus falcatus L.	ornamental asparagus	X	-	+	-
Cordyline fruticosa (L.) A. Chev.	ti	P/X	-	+	+
Crinum sp.	crinum	X	-	-	+
Dracaena marginata Lam.	money plant	X	-	-	+
Sansevieria trifasciata Prain.	sansevieria	X	-	-	+
Musaceae, s.l.					
Heliconia sp.	heliconia	X	-	-	+
Musa x *paradisiaca* L.	mai'a	P	+	+	+
Orchidaceae					
Spathoglottis plicata Bl.	Philippine ground orchid	X	-	-	+
Palmae					
Cocos nucifera L.	coconut, niu	P	-	+	+
Phoenix dactylifera L.	date palm	X	-	-	+
Ptychosperma sp.	ptychosperma	X	-	-	+
Zingiberaceae, s.l.					
Costus sp.	spiral ginger	X	-	-	+
Hedychium sp.	white or yellow ginger	X	-	-	+
DICOTS					
Acanthaceae					
Asystasia gangetica (L.) T. Anders.	Chinese violet	X	-	+	+
Barleria cristata L.	Philippine violet	X	-	-	+
Dicliptera chinensis (L.) Juss.	dicliptera	X	-	+	+
Hemigraphis reptans (G. Forster) T. Anders.	hemigraphis	X	-	+	+

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Amaranthaceae					
Amaranthus lividus L.	pigweed	X	-	+	-
Amaranthus spinosus L.	spiny pigweed	X	-	+	-
Anacardiaceae					
Mangifera indica L.	mango	X	-	-	+
Schinus terebinthifolius Raddi	Christmas berry	X	-	+	+
Araliaceae					
Schefflera actinophylla (Endl.) Harms	octopus tree	X	-	+	+
Balsaminaceae					
Impatiens wallerana J.D. Hooker	impatiens	X	+	+	+
Bataceae					
Batis maritima L.	pickle weed	X	-	+	-
Bignoniaceae					
Jacaranda mimosifolia D. Don	jacaranda	X	-	+	-
Spathodea campanulata P. Beauv.	African tulip tree	X	+	+	+
Boraginaceae					
Heliotropium procumbens Mill. var. *depressum* (Cham.) Fosb.	heliotrope	X	-	+	-
Buddlejaceae					
Buddleia asiatica Lour.	Asiatic butterfly bush	X	-	+	-
Caricaceae					
Carica papaya L.	papaya	X	-	+	+

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Caryophyllaceae					
Drymaria cordata (L.) Willd.	drymaria	X	+	+	+
Spergularia marina (L.) Griseb.	sand spurry	X	-	+	-
Combretaceae					
Terminalia catappa L.	false kamani	X	-	+	-
Compositae					
Ageratum conyzoides L.	ageratum	X	-	+	+
Bidens alba (L.) DC.	Spanish needle	X	-	+	-
Bidens pilosa L.	Spanish needle	X	-	+	+
Calyptocarpus vialis Less.	hierba del caballo	X	-	+	+
Conyza bonariensis (L.) Cronq.	hairy horseweed	X	-	+	-
Conyza canadensis L.	horseweed	X	-	-	-
Crassocephalum crepidiodes (Benth.) S. Moore	crassocephalum	X	-	+	-
Eclipta alba (L.) Hassk.	eclipta	X	+	+	+
Emilia fosbergii Nicolson	emilia	X	+	+	+
Emilia sonchifolia (L.) DC.	emilia	X	-	+	-
Flaveria trinervia (Springer) C. Mohr	flaveria	X	-	+	-
Pluchea indica (L.) Less.	pluchea	X	+	+	+
Pluchea symphytifolia (Mill.) Gillis	pluchea	X	+	+	+
Sigesbeckia orientalis L.	sigesbeckia	X	-	+	+
Sonchus oleraceus L.	sowthistle	X	-	+	+
Synedrella nodiflora (L.) Gaertn.	synedrella	X	-	+	+
Tridax procumbens L.	coat buttons	X	-	+	-
Vernonia cinerea (L.) Less. var. parviflora (Reinw.) DC.	ironweed	X	-	+	+
Wedelia trilobata (L.) Hitchc.	wedelia	X	+	+	+
Youngia japonica (L.) DC.	youngia	X	+	+	+

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Convolvulaceae					
Ipomoea alba L.	moon flower	X	-	+	+
Ipomoea indica (J. Burm.) Merr.	koali-awahia	I	-	+	+
Ipomoea obscura (L.) Ker-Gawl.	bindweed	X	-	+	-
Ipomoea cf. *ochracea* (Lindl.) G. Don	yellow morning glory	X	-	+	-
Ipomoea pes-caprae (L.) R. Br.	pohuehue	I	-	+	-
Ipomoea triloba L.	pink bindweed	X	-	+	-
Crassulaceae					
Kalanchoe pinnata (Lam.) Pers.	air plant, bryophyllum	X	-	+	+
Cruciferae					
Cardamine flexuosa With.	bitter cress	X	+	+	+
Coronopus didymus (L.) Sm.	wart cress	X	-	+	+
Cucurbitaceae					
Cucurbita sp.	pumpkin	X	-	+	-
Momordica charantia L.	bittermelon	X	-	+	+
Euphorbiaceae					
Aleurites mollucana (L.) Willd.	kukui	P	-	+	+
Chamaesyce hirta (L.) Millsp.	euphorbia	X	-	+	-
Chamaesyce hypericifolia (L.) Millsp.	euphorbia	X	-	+	+
Chamaesyce prostrata (Aiton) Small	euphorbia	X	-	+	-
Codiaeum variegatum (L.) Bl.	croton	X	-	-	+
Manihot esculenta Crantz	tapioca, cassava	X	-	-	+
Phyllanthus debilis Klein ex Willd.	phyllanthus	X	-	+	+
Ricinus communis L.	castorbean	X	+	+	+

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Guttiferae					
Calophyllum inophyllum L.	kamani	P	-	+	-
Clusia rosea Jacq.	autograph tree	X	-	-	+
Labiatae					
Hyptis pectinata (L.) Poit.	hyptis	X	-	+	+
Leonotis nepetifolia (L.) R. Br.	lion's ear	X	-	+	-
Leonurus sibiricus L.	lion's tail	X	-	+	-
Stachys arvensis L.	wood betony	X	-	+	-
Lauraceae					
Cinnamomum burmannii (Nees) Blume	cinnamon	X	-	-	+
Leguminosae					
Acacia confusa Merr.	Formosan koa	X	-	-	+
Acacia farnesiana (L.) Willd.	klu	X	-	+	-
Canavalia cathartica Thouars	maunaloa	X	-	+	+
Chamaecrista nictitans (L.) Moench	partridge pea, lau-ki	X	-	+	+
Crotalaria incana L.	rattlepod	X	-	+	-
Crotalaria pallida Aiton	rattlepod	X	-	-	+
Desmanthus virgatus (L.) Willd.	desmanthus	X	-	+	+
Desmodium incanum DC.	beggar's ticks	X	+	+	-
Desmodium sandwicense E. Mey.	beggar's ticks	X	-	-	+
Erythrina variegata Stickm.	erythrina	X	-	+	-
Indigofera spicata Forssk.	prostrate indigo	X	-	+	-
Indigofera suffruticosa Mill.	bushy indigo	X	-	+	+
Leucaena leucocephala (Lam.) de Wit	koa-haole	X	+	+	+
Macroptilium lathyroides (L.) Urb.	wild bean	X	-	+	+
Melilotus indica (L.) All.	sweetclover	X	-	-	+
Mimosa pudica L.	sleepinggrass	X	+	+	+
Pithecellobium dulce (Roxb.) Bentham	'opiuma	X	-	+	-

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Prosopis pallida (Humb. & Bonpl. ex Willd.) Kunth	kiawe	X	–	+	–
Samanea saman (Jacq.) Merr.	monkeypod	X	–	+	+
Senna occidentalis (L.) Link	cassia	X	–	–	+
Senna pendula (Humb. & Bonpl.) H. Irwin & Barneby	cassia	X	–	–	+
Senna surattensis (N. L. Burm.) H. Irwin & Barneby	cassia	X	–	+	+
Lythraceae					
Cuphea carthagenensis (Jacq.) Macbr.	tarweed	X	+	+	+
Malvaceae					
Hibiscus tiliaceus L.	hau	I?	+	+	+
Malvastrum coromandelianum (L.) Garcke	malvastrum	X	–	+	+
Sida acuta N.L. Burm.	sida	X	–	+	+
Sida rhombifolia L.	sida	X	–	+	–
Sida spinosa L.	sida	X	–	+	–
Thespesia populnea (L.) Sol. ex Corr.	milo	P/I?	+	+	–
Melastomataceae					
Clidemia hirta (L.) D. Don	Koster's curse	X	–	–	+
Moraceae					
Ficus microcarpa L. fil.	Chinese banyan	X	–	+	+
Myrtaceae					
Eucalyptus sp.	eucalyptus	X	–	–	+
Psidium cattleianum Sabine	strawberry guava	X	–	–	+
Psidium guajava L.	guava	X	–	–	+
Syzygium cumini (L.) Skeels	Javaplum	X	–	+	+
Ochnaceae					
Ochna kirkii Oliver	Mickey Mouse plant	X	–	+	+

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Onagraceae					
Ludwigia octovalvis (Jacq.) Raven	ludwigia	I?	+	-	-
Oxalidaceae					
Oxalis corniculata L.	yellow wood sorrel	P?	+	+	+
Oxalis corymbosa DC.	pink wood sorrel	X	-	+	+
Passifloraceae					
Passiflora edulis Sims	liliko'i	X	-	-	+
Passiflora ligularis Juss.	passion fruit	X	-	+	-
Passiflora suberosa L.	passiflora	X	-	+	+
Phytolaccaceae					
Rivina humilis L.	rouge plant	X	-	+	+
Plantaginaceae					
Plantago major L.	common plantain	X	+	+	+
Polygonaceae					
Coccoloba uvifera L.	seagrape	X	-	+	-
Portulacaceae					
Portulaca oleracea L.	purslane	X	-	+	+
Primulaceae					
Anagallis arvensis L.	scarlet pimpernel	X	+	+	-
Rhizophoraceae					
Rhizophora mangle L.	red mangrove	X	+	+	-

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Rosaceae					
Osteomeles anthyllidifolia (Sm.) Lindl.	u'ulei	I	-	-	+
Rubiaceae					
Paederia scandens (Lour.) Merr.	maile pilau	X	+	+	+
Spermacoce assurgens Ruiz & Pavon	borreria	X	+	+	+
Rutaceae					
Citrus sp.	citrus	X	-	+	-
Murraya paniculata (L.) Jack	mock orange	X	-	+	+
Sapindaceae					
Filicium decipiens (Wight & Arnott) Thwaites	fern tree	X	-	-	+
Solanaceae					
Capsicum annuum L.	chile pepper	X	-	+	+
Lycopersicon esculentum Mill.	tomato	X	-	+	-
Physalis angulata L.	groundcherry, maypop	X	-	+	-
Solanum americanum Mill.	popolo	I?	-	+	-
Solanum linneanum Hepper & Jaeger	Sodom apple	X	-	+	-
Solanum seaforthianum Andr.	potato vine	X	-	+	+
Solanum sp.	nightshade	X	-	+	-
Sterculiaceae					
Waltheria indica L.	'uhaloa, hi'aloa	I?	-	+	-
Tiliaceae					
Triumfetta semitriloba Jacq.	Sacramento bur	X	-	+	-

SCIENTIFIC NAME	COMMON NAME	STATUS	wl	dl	hs
Umbelliferae					
Centella asiatica (L.) Urb.	Asiatic pennywort	X	+	+	+
Ciclospermum leptophyllum (Pers.) Sprague	apium	X	+	+	+
Urticaceae					
Pilea microphylla (L.) Liebm.	artillery plant	X	+	+	+
Verbenaceae					
Lantana camara L.	lantana	X	–	+	+
Stachytarpheta jamaicensis (L.) Vahl	stachytarpheta	X	–	+	+
Stachytarpheta urticifolia (Salisb.) Sims	stachytarpheta	X	–	+	+
Verbena litoralis Kunth	verbena	X	+	+	–

APPENDIX H

AIR QUALITY IMPACT REPORT: BAY VIEW GOLF COURSE

Prepared by J. W. Morrow, June 1989

AIR QUALITY IMPACT REPORT

BAY VIEW GOLF COURSE

June 11, 1989

PREPARED FOR

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1. INTRODUCTION

Pacific Atlas (Hawaii), Inc. is proposing to expand the existing Bay View Golf Course in Kaheohe, Oahu from 9 to 18 holes and to add 35 single family residential units. Other improvements include a tennis court, swimming pool, and a 30,000 square foot clubhouse. A 300-stall parking lot will also be constructed. The site is located at TMK: 4-5-30: 1,37,42,44,45,46 & 49 (see Figure 1).

The purpose of this report is to assess the air quality impact of the proposed development. The project can be considered an "indirect source" of air pollution as defined in the federal Clean Air Act [1] since it will attract mobile sources of air pollution, i.e., motor vehicles. Thus, much of the focus of this analysis is on the project's ability to generate traffic and the resultant impact on air quality. Air quality impact was evaluated for existing (1989) and future (1993) conditions.

Also, during routine operation of the golf course, various pesticides are used which may result in air pollution contributions. This potential impact has been addressed.

Finally, during construction of the various buildings and facilities air pollutant emissions will be generated due to vehicular movement, grading and general dust-generating construction activities. These impacts have also been addressed.

2. AIR QUALITY STANDARDS

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

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

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

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

The U.S. Environmental Protection Agency (EPA) is mandated by Congress to periodically review and re-evaluate the Federal standards in light of new research findings [7]. The last review resulted in the relaxation of the oxidant standard from 160 to 240 micrograms/cubic meter (ug/m3) [8]. The carbon monoxide (CO), particulate matter, sulfur dioxide (SO2), and nitrogen dioxide (NO2) standards are currently under review, but final action has not been taken yet [9].

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

3. EXISTING AIR QUALITY

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

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

In the case of TSP, PM-10, and SO2, measurements are made on a 24-hour basis to correspond with the averaging period specified in the standards. Samples are collected once every six days in accordance with U.S. Environmental Protection Agency (EPA) guidelines. Carbon monoxide and ozone, however, are measured on a continuous basis due to their short-term (1-hour) standards.

Lead concentrations are determined from the TSP samples which are sent to an EPA laboratory for analysis. Note that the lead standard is a quarterly average.

While there are no continuous air monitoring stations in the project area, it seems safe to assume that present air quality is good most of the time since there are no large stationary sources in the vicinity, and the immediate area is not densely populated. The primary source of air pollution is the motor vehicle traffic along Kaneohe Bay Drive. The nearest active State Department of Health air monitoring stations are located at Waimanalo and downtown Honolulu.

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

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

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

3.3 Onsite Carbon Monoxide Sampling. In conjunction with this study, air sampling was conducted at the following three sites along Kaneohe Bay Drive during the 10 - 12 May 1989 period:

- Mokulele Drive (150 feet west of intersection)
- midway between Nohonani Place and Namoku Street
- Moakaka Place (100 feet west of intersection

In each case, the actual sampling site was within 10 meters of the road edge and on the south side due to the prevailing northeasterly trade winds. A continuous carbon monoxide (CO) instrument with strip chart recorder was set up and operated during the p.m. peak traffic hours based on the results of the traffic impact study which indicated maximum traffic during that period [11]. An anemometer and vane were installed to record onsite surface winds. A simultaneous manual count of traffic along Kaneohe Bay Drive was also made.

The data gathered during this sampling are summarized in Table 6. On all three sampling days, northeast trade winds prevailed although the onsite velocities were significantly lower than that recorded at the nearby Kaneohe Marine Corps Air Station (KMCAS). Traffic counts were comparable to those reported by the traffic consultant. CO concentrations may be compared with predicted concentrations discussed in Section 6.

4. CLIMATE & METEOROLOGY

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

> "Hawaii's equable temperatures are associated with the small seasonal variation in the amount of energy received from the sun and the tempering effect of the surrounding ocean. The range of temperature averages only 7 degrees between the warmest months (August and September) and the coolest months (January and February) and about 12 degrees between day and night. Daily maximums run from the high 70's in winter to the mid-80's in summer, and daily minimums from the mid-60's to the low 70's. However, the Honolulu Airport area has recorded as high as 93 degrees and as low as 53" [12].

Rainfall in the project area averages 40 - 50 inches per year [13]. In accordance with Thornwaite's scheme for climatic classification, the area is considered humid forest [14].

4.2 Surface Winds. Meteorological records from the Kaneohe Marine Corps Air Station (KMCAS) were reviewed. As is quite evident in Figure 2, northeast tradewinds appear to predominate on an annual basis. A closer examination of the data, however, reveals seasonal and diurnal differences both in direction and velocity. Figures 3 and 4 depict directional wind roses for the 3:00 - 5:00 p.m. period during the months of January and August. The predominance of northeast tradewinds during the summer in contrast to the more variable nature of the winter months is quite clear.

The winter months also are characterized by generally lower wind velocities as evidenced again by the January-August comparison, this time presented in tabular form (Tables 7 and 8). Light, variable winds are much more prevalent during January than in August, and not surprisingly, it is during the winter months that most of the high carbon monoxide levels are recorded by the Department of Health.

5. HIGHWAYS AND TRAFFIC

As noted previously the principal access road to the project site is Kaneohe Bay Drive. It is a 2-lane rural highway with wide shoulders along some segments and little or no shoulder along others. The current access to the golf course is across from Mokulele Drive, while the future access will be in the vicinity of Moakaka Place. Existing conditions at these two intersections are depicted in Figures 5 - 8.

Existing and projected peak-hour traffic data used in this analysis were provided by Pacific Planning & Engineering, Inc. [11], and are based on historical data, recent traffic counts and traffic generation factors for the proposed golf course.

6. MOBILE SOURCE IMPACT

6.1 Emission Factors. Automotive emission factors for carbon monoxide (CO) were generated for calendar years 1989 and 1993 using the Mobile Source Emissions Model (MOBILE-3) [15]. To localize emission factors as much as possible, the August, 1988 age distribution for the City & County of Honolulu [16] was input in lieu of the national statistics normally used.

6.2 Microscale Analysis. Analyses such as this generally involve estimation of concentrations of non-reactive pollutants. This is due to the complexity of modeling pollutants which undergo chemical reactions in the atmosphere and are subject to the effects of numerous physical and chemical factors which affect reaction rates and products. For projects involving motor vehicles as the principal air air pollution source, carbon monoxide is normally selected for modeling because it has a relatively long half-life in the atmosphere (about 1 month) [17], and it comprises the largest fraction of automotive emissions.

In this instance, a microscale screening analysis was performed for the Mokulele Drive and Moakaka Place intersections with Kaneohe Bay Drive. The updated version of an EPA guideline model CALINE-4 [18,19] was employed with an array of receptors spaced at distances of 10 - 30 meters from the road edge. Because of the relatively low level of urbanization in the area, a background CO concentration of 0.1 milligram per cubic meter (mg/m3) was assumed.

Since the traffic report identified the p.m. peak traffic hours as the times of maximum project impact, worst case meteorological conditions were selected accordingly. A wind speed of 1 meter per second, an acute wind/road angle, and neutral stability (Pasquill-Gifford Class "D") [20], were all selected to maximize concentration estimates in the vicinity of the intersections. Review of the traffic data and preliminary modeling indicated that northeasterly winds were most likely to produce the maximum CO concentrations near the intersections under study; thus, these wind directions were input for the modeling.

Maximum one-hour carbon monoxide (CO) concentrations were computed for the p.m. peak traffic hours. The analyses were performed for existing conditions (1989) and future conditions (1993) both with and without the proposed golf course. The results are summarized in Figures 9 and 10.

7. OTHER IMPACTS

The use of pesticides is routinely required at golf courses in order to maintain fairways and greens. Typical pesticide use at an 18-hole golf course is shown in Table 9 [21].

The herbicides MSMA, glyphosate, metribuzin, and pendimethalin all have relatively low mammalian toxicities with LD_{50} values on the order of hundreds or thousands of milligrams active agent per kilogram body weight (mg/kg) [22, 23]. They do, however, have WARNING and CAUTION labels because of their irritative effects on the eyes and skin. The OSHA 8-hour time-weighted average standard for metribuzin in the air is 5 mg/m3 [22].

The insecticide Sevin is a relatively low toxicity carbamate which can affect the normal functioning of mammalian nervous systems through its inhibition of the enzyme cholinesterase. It also has a relatively high LD_{50} value of about 500 - 850 mg/kg and therefore only has a CAUTION label on its containers. The OSHA standard for airborne concentrations of carbaryl (the active ingredient in Sevin) is 5 mg/m3 as an 8-hour average [22].

The fungicides Dithane M45, Kocide 101, and Subdue are also low toxicity chemical mixtures with LD_{50} values in the hundreds and thousands of mg/kg [22, 23]. Subdue has a WARNING label because of its potential for eye injury.

If properly used in accordance with label instructions, all of the aforementioned chemicals should present no hazard to the properties or owners of properties adjoining the proposed golf course. In fact, the greatest risk in using such chemicals is generally to the users themselves if they do not strictly follow label instructions. This is because the user may come in contact with the concentrated product while nearby properties and people may only be exposed to the greatly diluted and dispersed application solution.

The potential for significant airborne concentrations of these chemicals is relatively slight when one considers the dilution factor in application solutions plus the coarse spray that is normally used to assure adequate coverage in the desired area and avoidance of drift. Should a user improperly apply these chemicals under wind conditions which would contribute to drift, then there would be an increased possibility of downwind exposure of property and people. In order to assess the possible impact of such an event on people, a worst case dispersion modeling analysis was performed for each of the chemicals. The results of this modeling are summarized in Table 11.

8. CONSTRUCTION IMPACT

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

The site preparation and earth moving will create particulate emissions as will building and on-site road construction. Construction vehicles movement on unpaved on-site roads will also generate particulate emissions. EPA studies on fugitive dust emissions from construction sites indicate that about 1.2 tons/acre per month of activity may be expected under conditions of medium activity, moderate soil silt content (30%), and a precipitation/evaporation (P/E) index of 50 [24].

Although the onsite soils are primarily silty clays with silt contents likely to be greater than the 30% cited above, fugitive dust is not likely to be a serious concern due to the rainfall in the area and a P/E Index in the 60 - 65 range. Only during the drier, windier summer months might dust generation become a problem.

9. DISCUSSION AND CONCLUSIONS

9.1 Microscale Analysis. The 1-hour "worst case" concentration estimates at the Mokulele Drive and Moakaka Place intersections (Figures 9 and 10) indicate general compliance with federal and state 1-hour standards under both current and projected traffic conditions. Only at one receptor location within 10 meters of Mokulele Drive did there appear to be a possibility of exceeding the State's 1-hour standard under existing conditions. The 1993 projections suggest a decline in near-roadway CO levels despite the additional traffic generated by the proposed project and indicate compliance with State and Federal 1-hour CO standards at all receptor locations. It is also evident when comparing the "with" and "without" project scenarios that the project's contribution to CO levels is small (<2%).

Compliance with the federal and state 8-hour standards can also be determined by applying an EPA-recommended "persistence" factor of 0.6 to the 1-hour maximum CO values [25]. When using this approach, any CO concentration greater than 8.4 mg/m3 would indicate exceedance of the State's 8-hour standard. Similarly, any 1-hour concentration over 15.7 mg/m3 would indicate exceedance of the federal 8-hour standard. In this case, exceedances may be occurring under existing conditions but are not projected to occur in 1993 even with the addition of the proposed project.

The apparent reduction in ambient CO concentrations despite projected increases in traffic exemplifies the effect of the federal motor vehicle control program. In this instance, the projected rate of reduction in emissions per vehicle over the 1989 - 93 period was greater than the projected rate of increase in traffic volume; thus, a net decrease in cumulative emissions and ambient impact results.

9.2 <u>Other Impacts</u>. The results in Table 12 indicate the low level of human exposure possible under worst case conditions of user error, wind speed, and proximity to the source. Even under the assumption that all these worst case factors will occur simultaneously, the downwind pesticide concentrations are low and of short duration. This clearly indicates that under proper use conditions, there will be no significant pesticide impact on air quality. It should be noted, however, that in the case of the herbicides improper use resulting in drift may cause some degree of injury to plants downwind.

9.3 <u>Short-Term Impact</u>. Since as noted in Section 8, there is minimal potential for fugitive dust due to the silty clay soil but moderately humid climate, adequate dust control measures should not be difficult to employ during the construction period.

During dry periods, dust control could be accomplished through frequent watering of unpaved roads and areas of exposed soil. The EPA estimates that twice daily watering can reduce fugitive dust emissions by as much as 50%. Dust barriers near existing dwellings might be considered if problems arise from wind-driven dust. The soonest possible landscaping of completed areas will also help.

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

- Traffic generated by the proposed project will have a very small impact on local air quality, and both state and federal air quality standards will continue to be met in the project area.
- Pesticide use associated with the project will be minimal and will not significantly affect air quality provided that label instructions are strictly adhered to.
- Construction activities will have a small impact on local air quality due to the additional construction vehicle activity. Fugitive dust from construction activities should be negligible most of the time due to the humid climate, but will require control during drier periods.

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T A B L E S

TABLE 1

SUMMARY OF STATE OF HAWAII AND FEDERAL AMBIENT AIR QUALITY STANDARDS

POLLUTANT	SAMPLING PERIOD	FEDERAL STANDARDS PRIMARY	FEDERAL STANDARDS SECONDARY	STATE STANDARDS
1. Total Suspended Particulate Matter (TSP)	Annual Geometric Mean	--	--	60
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	--	--	150
2. PM-10	Annual	50	50	--
(micrograms per cubic meter	Maximum Average in Any 24 Hours	150	150	--
3. Sulfur Dioxide (SO2)	Annual Arithmetic Mean	80	--	80
(micrograms per cubic meter)	Maximum Average in Any 24 Hours	365	--	365
	Maximum Average in Any 3 Hours		1,300	1,300
4. Nitrogen Dioxide (NO2) (micrograms per cubic meter)	Annual Arithmetic Mean	100		70
5. Carbon Monoxide (CO)	Maximum Average in Any 8 Hours	10		5
(milligrams per cubic meter)	Maximum Average in Any 1 Hour	40		10
6. Photochemical Oxidants (as O3) (micrograms per cubic meter)	Maximum Average in Any 1 Hour	240		100
7. Lead (Pb) (micrograms per cubic meter)	Maximum Average in Any Calendar Quarter	1.5		1.5

TABLE 2

AIR MONITORING DATA
WAIMANALO; OAHU
1987

Total Suspended Particulates (TSP)
24-Hour Concentration (ug/m3)

MONTH	SAMPLES	MIN.	MAX.	MEAN
Jan 87	5	21	39	29
Feb 87	5	21	41	32
Mar 87	4	23	45	30
Apr 87	4	21	35	27
May 87	5	19	36	28
Jun 87	5	22	33	25
Jul 87	5	19	38	27
Aug 87	6	20	39	26
Sep 87	5	13	40	28
Oct 87	4	16	30	22
Nov 87	5	14	31	21
Dec 87	5	19	40	30
ANNUAL	58	13	45	27

SOURCE: Department of Health

TABLE 3

SUMMARY OF AEROMETRIC DATA COLLECTED
AT THE DEPARTMENT OF HEALTH BUILDING
AND SAND ISLAND

1978 - 1987

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

TABLE 4

SUMMARY OF AEROMETRIC DATA COLLECTED
AT THE DEPARTMENT OF HEALTH BUILDING

1971 - 1987

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

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

TABLE 5

LEAD MONITORING DATA
HONOLULU, OAHU
1970-87

AVERAGE CONCENTRATION
(micrograms/cubic meter)

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

Source: Department of Health

TABLE 6

CARBON MONOXIDE SAMPLING
KANEOHE BAY DRIVE IN THE VICINITY OF
THE BAY VIEW GOLF COURSE
MAY, 1989

Site	Date	Time	CO Concen. (mg/m3)	Traffic Volume	Onsite Weather Wind Speed (m/s)	Onsite Weather Wind Direction (deg)	Onsite Weather Sky Cover	Kaneohe MCAS Weather Wind Speed (m/s)	Kaneohe MCAS Weather Wind Direction (deg)	Temperature (deg F)
01	10 May 89	4:15 - 5:15p	4.9	2,494	<1 - 2	00 - 45	Sct/bkn	3.6 - 4.6	40 - 50	78 - 80
02	11 May 89	4:15 - 5:15p	4.2	2,386	<1 - 1	00 - 90	Sct/bkn	3.1 - 3.1	50 - 70	80 - 80
03	12 May 89	4:15 - 5:15p	4.3	2,311	<1 - 1	00 - 90	Sct	4.6 - 5.7	30 - 40	80 - 81

Site:
01 - Kaneohe Bay Drive @ Mokulele Street
02 - Kaneohe Bay Drive between Nohonani Place and Nomuku Street
03 - Kaneohe Bay Drive @ Moakaka Place

TABLE 7

JOINT FREQUENCY DISTRIBUTION
OF WIND SPEED AND DIRECTION
KANEOHE MARINE CORPS AIR STATION
JANUARY (3:00 - 5:00 P.M.)

Frequency of Occurrence (%)

	Wind Speed (knots)						
Direction	1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N	0.5	1.9	3.4	1.5	0.3		7.5
NNE	0.3	2.6	3.5	2.2	0.7	0.1	9.4
NE	0.4	2.4	3.2	5.1	1.0	0.5	12.6
ENE	0.3	1.2	4.9	7.0	1.1	0.1	14.6
E	0.5	1.1	5.0	5.1	1.3		13.1
ESE	0.5	2.1	4.3	3.8	0.3		11.0
SE	0.1	0.7	1.5	0.5	0.1		3.0
SSE	0.1	0.4	0.8	0.7		0.2	2.2
S	0.3	1.1	2.3	0.9	0.1	0.2	4.9
SSW	0.1	0.7	2.1	3.0	0.8	0.6	7.3
SW	0.3	0.6	1.5	1.6	0.5	0.4	4.9
WSW	0.3	0.4	0.5	0.6	0.1	0.1	2.0
W		0.2	0.1	0.1			0.3
WNW	0.2	0.4	0.3	0.3			1.1
NW	0.1	0.3	0.3	0.2			0.9
NNW	0.1	0.8	1.2	0.7	0.5	0.1	3.4
Calm							2.0
Total:	4.1	16.8	34.7	33.3	6.8	2.3	100.0

TABLE 8

JOINT FREQUENCY DISTRIBUTION
OF WIND SPEED AND DIRECTION
KANEOHE MARINE CORPS AIR STATION
AUGUST (3:00 - 5:00 P.M.)

Frequency of Occurrence (%)

Direction	Wind Speed (knots) 1 - 3	4 - 6	7 - 10	11 - 16	17 - 21	>21	Total
N		0.3	0.5				0.8
NNE		1.1	4.5	1.9	0.1		7.5
NE		0.9	7.9	15.1	1.0		24.9
ENE		0.8	9.4	33.3	4.0	0.1	47.7
E		0.2	2.6	8.8	1.8	0.1	13.5
ESE	0.1	0.1	0.5	3.5	0.5	0.1	4.6
SE				0.1			0.1
SSE					0.1	0.1	0.1
S		0.1		0.2			0.3
SSW							0.0
SW			0.1				0.1
WSW							0.0
W		0.1	0.1				0.2
WNW		0.1					0.1
NW							0.0
NNW			0.1				0.1
Calm							0.1
Total:	0.1	3.5	25.6	62.9	7.5	0.4	100.0

TABLE 9

TYPICAL PESTICIDE USE AT AN 18-HOLE GOLF COURSE

PRODUCT	AREA (acres)	QUANTITY	FREQUENCY	ANNUAL REQUIREMENT
Herbicides (fairways & roughs)				
MSMA	100	33 gal	4/yr	132 gal
Glyphosate				25 gal
Metribuzin	100	25 lb	2/yr	50 lb
Pendimethalin	100	400 lb	2/yr	800 lb
Insecticides (greens & tees)				
Sevin	10	21 gal	12/yr	252 gal
Fungicides (greens & tees)				
Dithane M-45	10	109 lb	25/yr	2,725 lb
Kocide 101	10	217 lb	12/yr	2,604 lb
Subdue	10	6.7 gal	3/yr	20 gal

TABLE 10

ESTIMATES OF WORST CASE DOWNWIND PESTICIDE CONCENTRATIONS

Product	Active Agent Emission Rate (g/sec)	Active Agent Concentration (mg/m3)
MSMA	.076	.2348
Glyphosate	.069	.2132
Metribuzin	.007	.0216
Pendimethalin	.083	.2564
Sevin	.292	.9020
Dithane M-45	.303	.9360
Kocide 101	.377	1.1646
Subdue	.047	.1452

Conditions:		
	Windspeed:	7 m/sec
	Stability category:	D (neutral)
	Downwind distance:	100 m
	Exposure duration:	5 minutes
	Treated area:	1,000 ft2
	Application height:	1 m
	Active agent drift:	25 %

F I G U R E S

FIGURE 1

PROJECT LOCATION

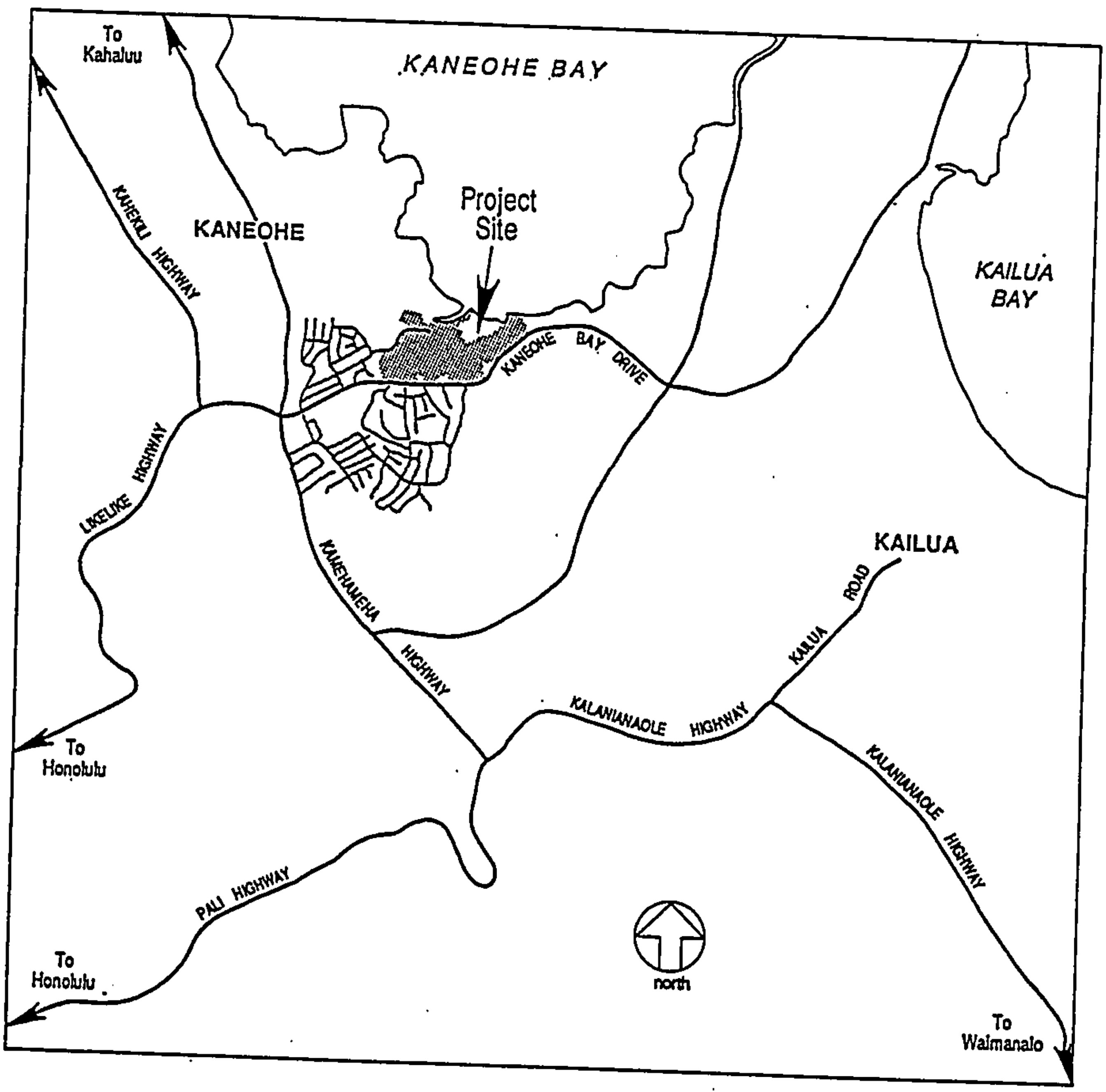
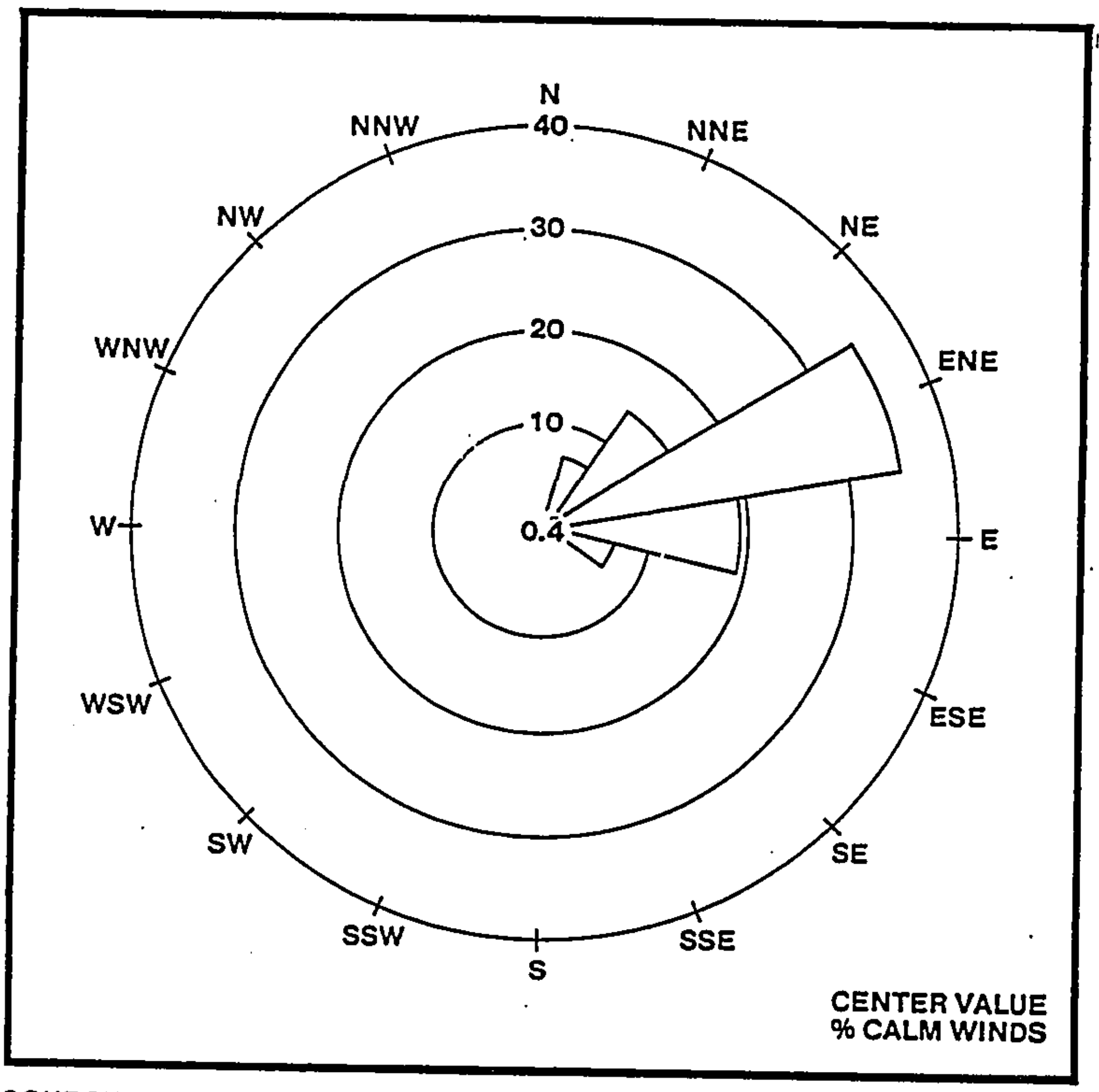


FIGURE 2

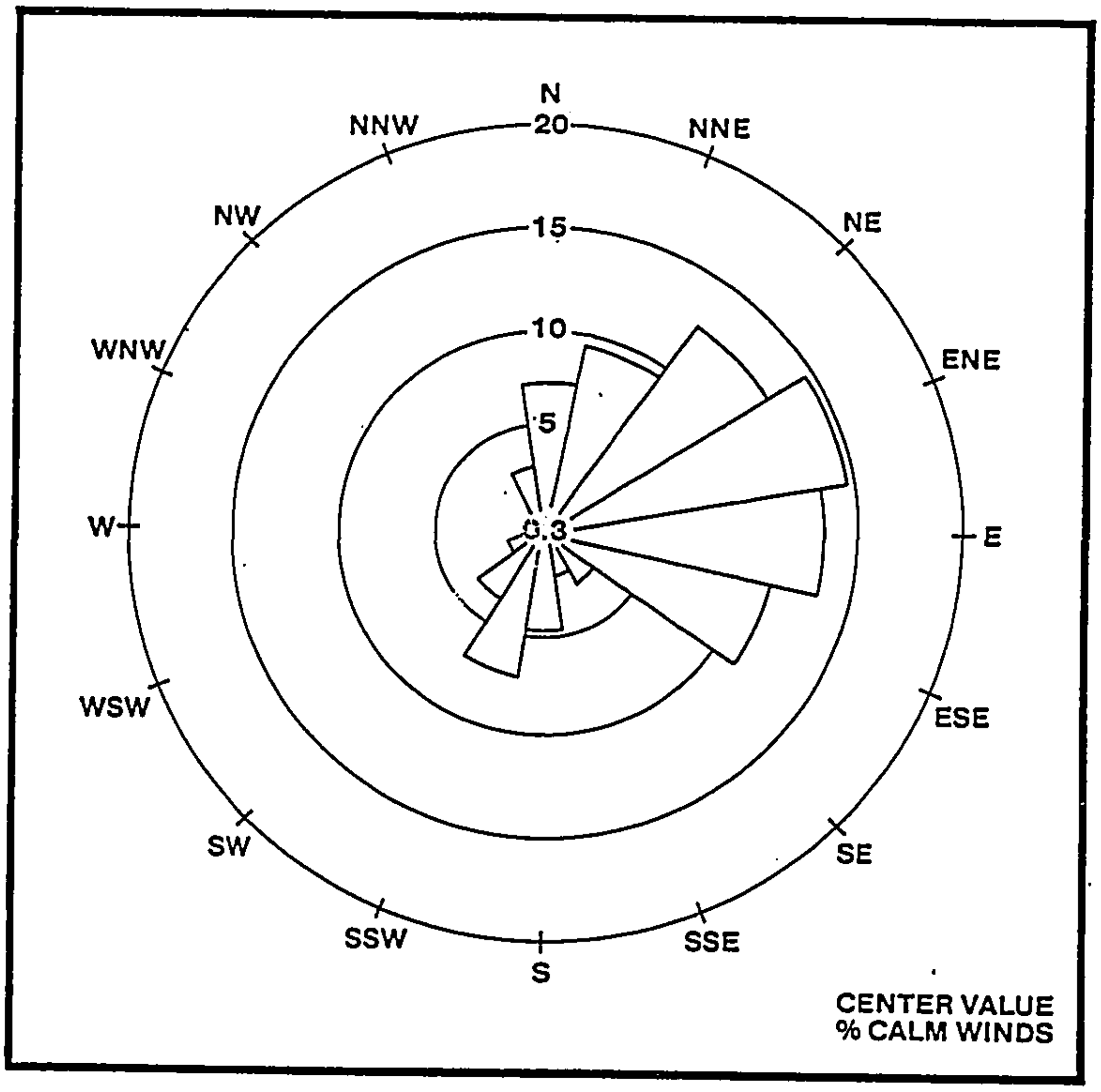
ANNUAL WIND ROSE
KANEOHE MARINE CORPS AIR STATION
1945 - 65



SOURCE: NATIONAL WEATHER SERVICE

FIGURE 3

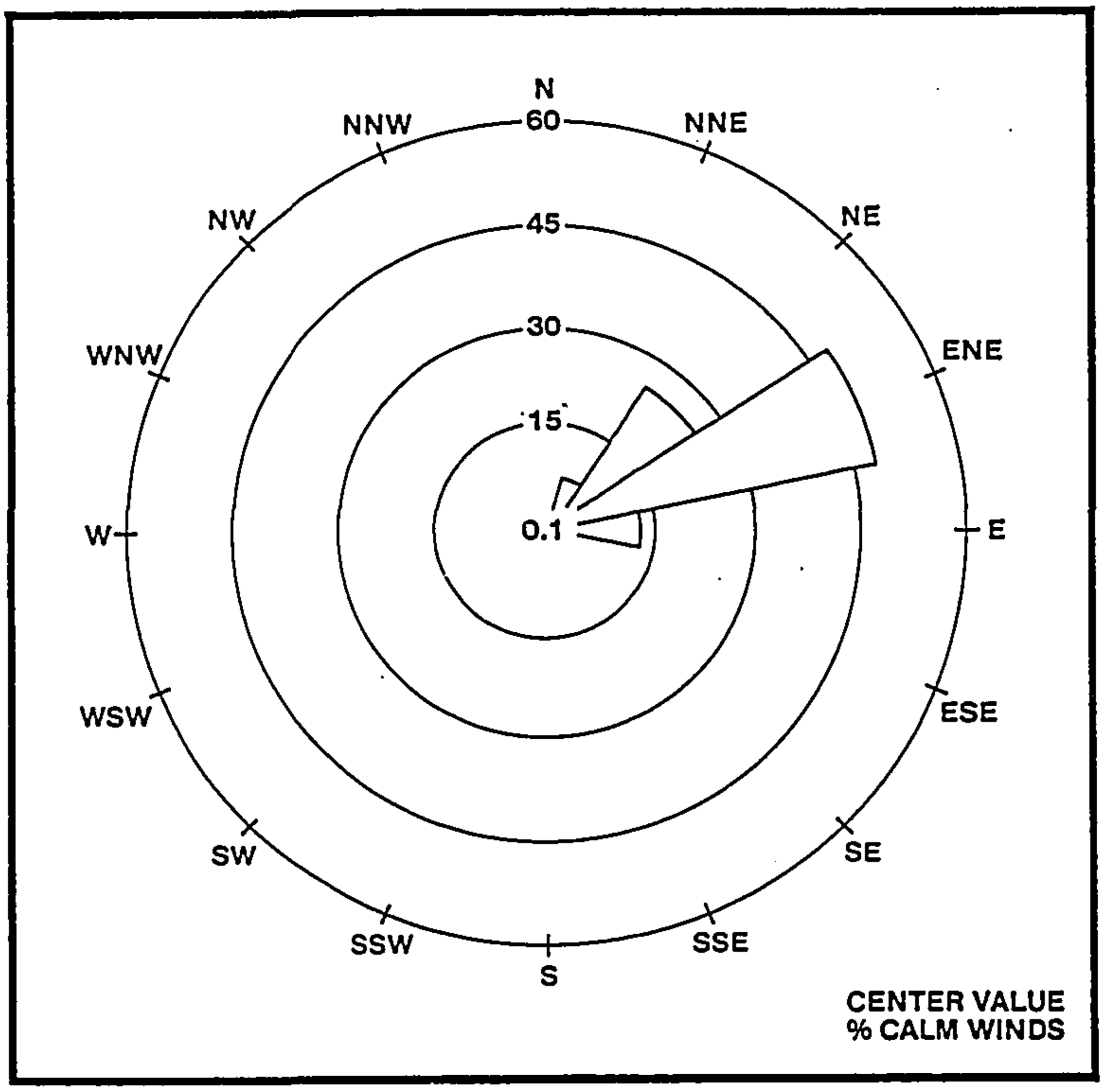
JANUARY WIND ROSE
KANEOHE MARINE CORPS AIR STATION
3:00 - 5:00 PM



SOURCE: NATIONAL WEATHER SERVICE

FIGURE 4

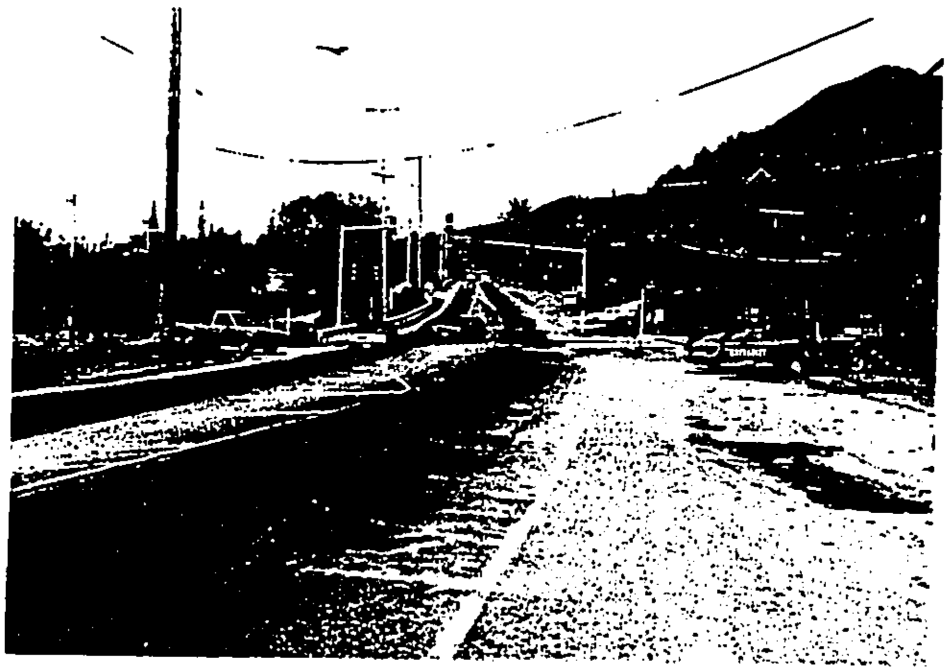
AUGUST WIND ROSE
KANEOHE MARINE CORPS AIR STATION
3:00 - 5:00 PM



SOURCE: NATIONAL WEATHER SERVICE

FIGURE 5

KANEOHE BAY DRIVE AT MOKULELE DRIVE
(EAST - WEST VIEWS)

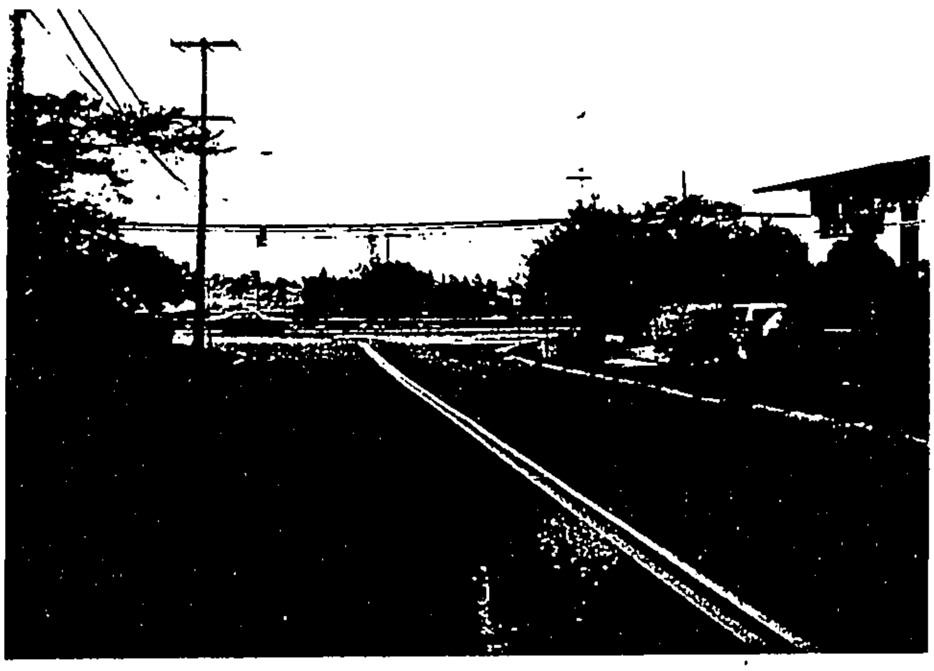


Facing East

Facing West

FIGURE 6

MOKULELE DRIVE AT KANEOHE BAY DRIVE
(NORTH - SOUTH VIEWS)

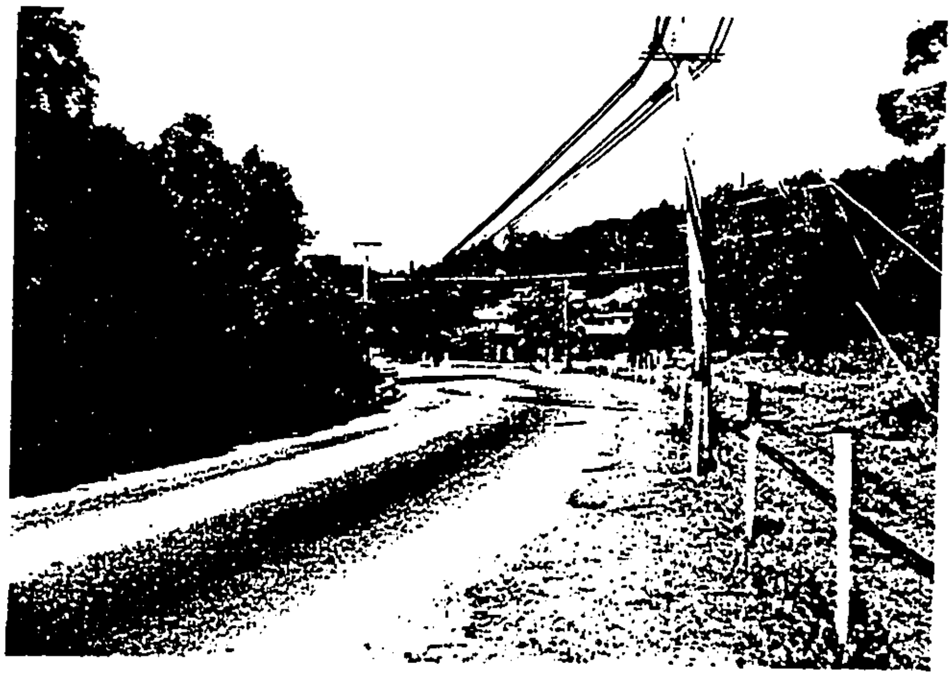


Facing North

Facing South

FIGURE 7

KANEOHE BAY DRIVE AT MOAKAKA PLACE
(EAST - WEST VIEWS)



Facing East

Facing West

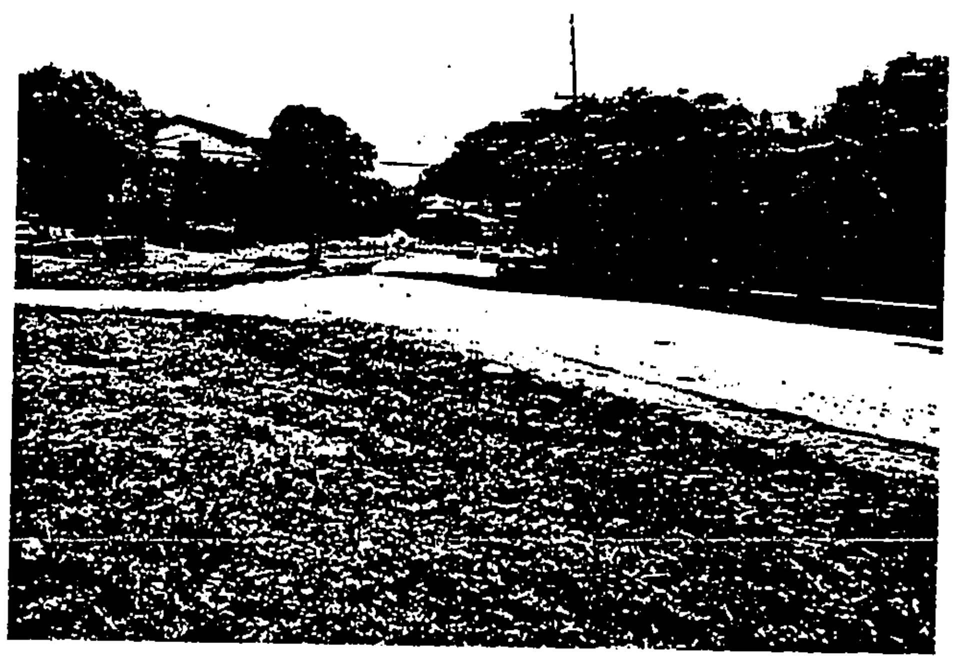
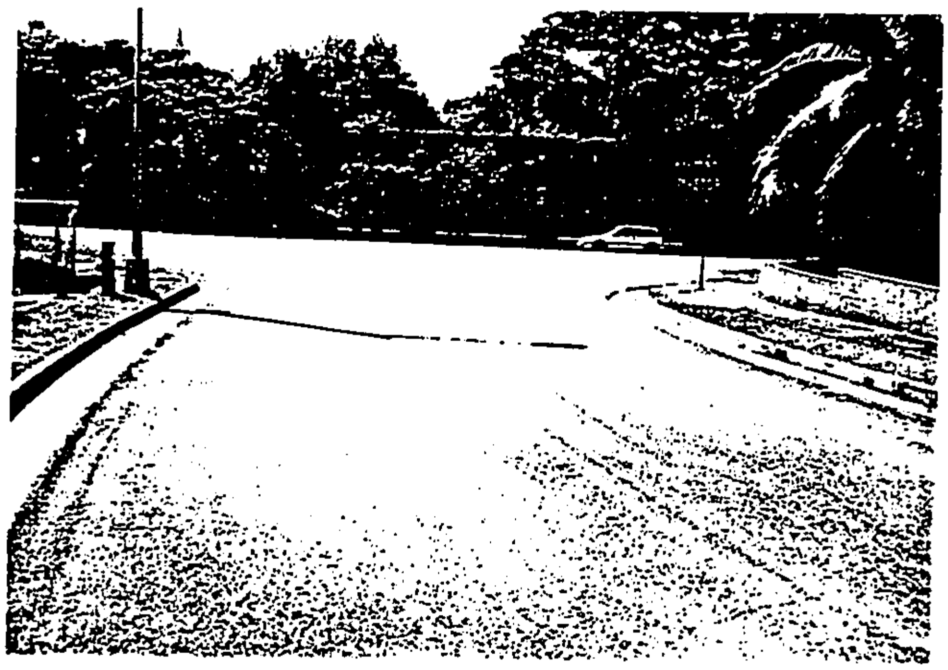


FIGURE 8

MOAKAKA PLACE AT KANEOHE BAY DRIVE
(NORTH - SOUTH VIEWS)

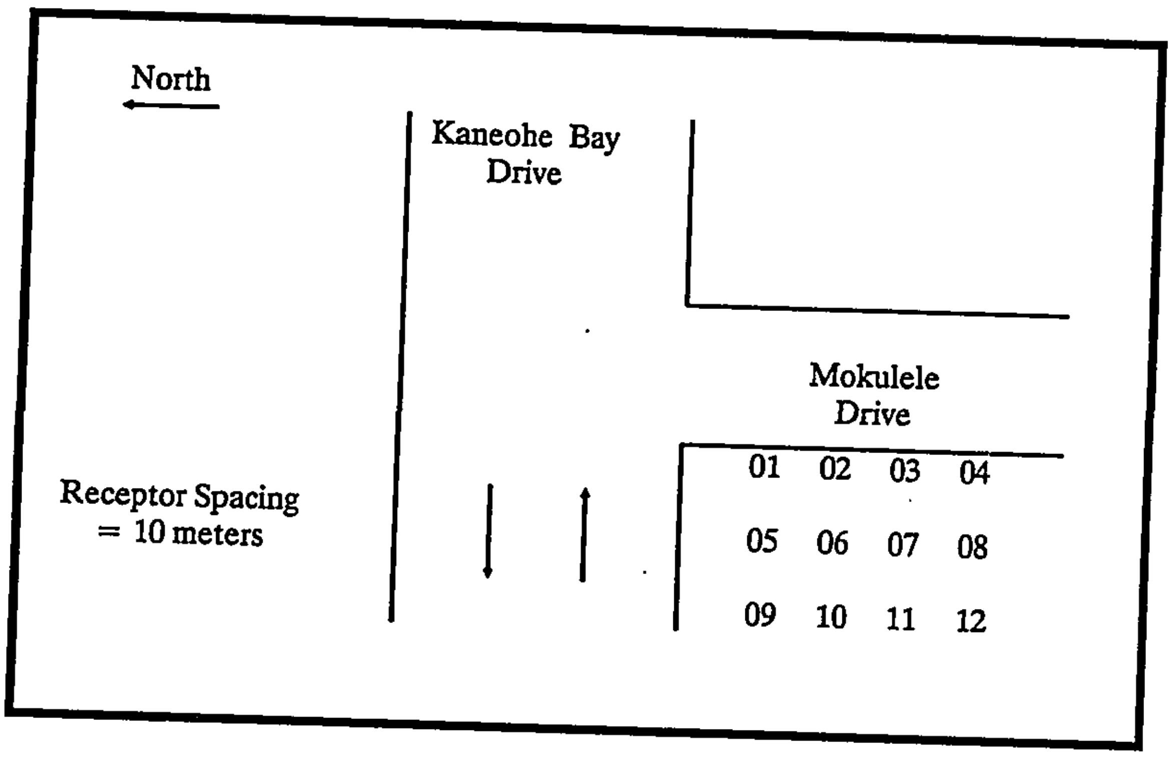


Facing North

Facing South

FIGURE 9

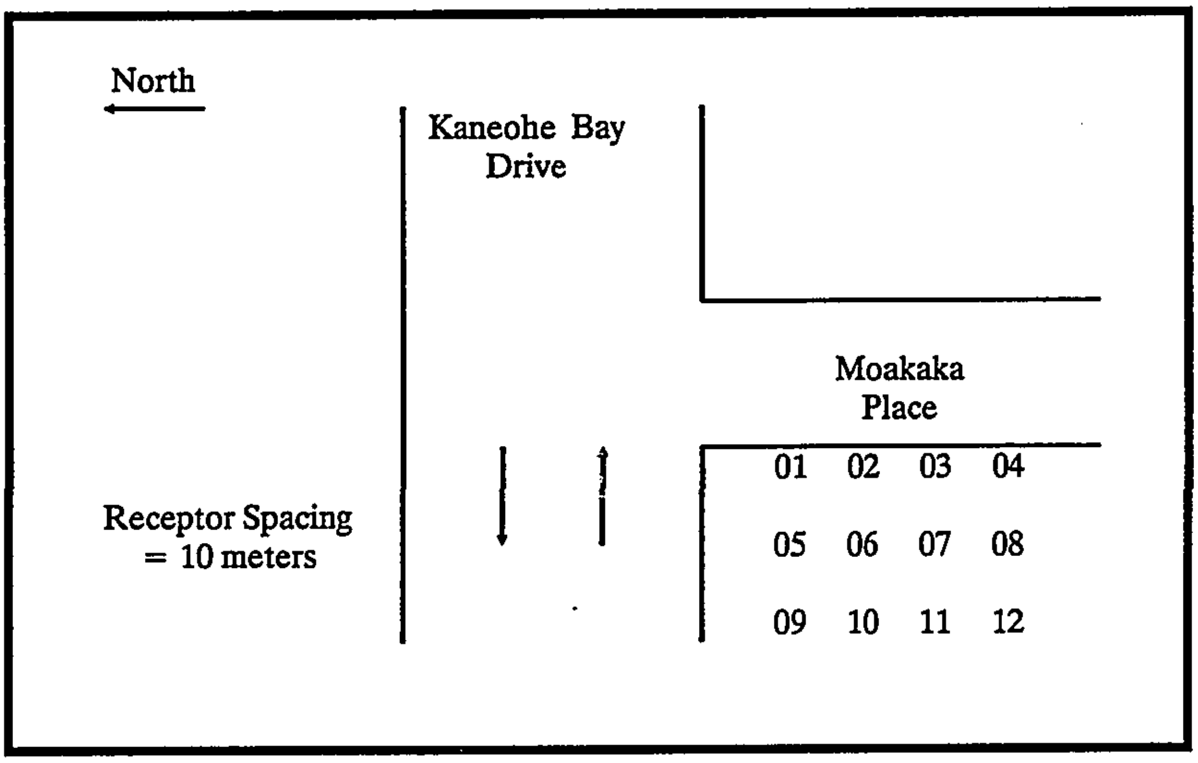
ESTIMATED MAXIMUM 1-HOUR CARBON MONOXIDE CONCENTRATIONS AT THE KANEOHE BAY DRIVE - MOKULELE DRIVE INTERSECTION P.M. PEAK-HOUR



Receptor	1989	Concentration (mg/m^3) 1993 w/o Project	1993 w/Project
01	9.7	7.4	7.5
02	10.1	8.0	8.2
03	8.7	7.0	7.2
04	6.7	5.4	5.6
05	9.6	7.4	7.4
06	7.4	5.8	5.8
07	7.0	5.5	5.6
08	6.4	5.1	5.2
09	9.2	8.0	8.0
10	6.5	5.4	5.4
11	5.9	4.8	4.9
12	5.6	4.4	4.6

FIGURE 10

ESTIMATED MAXIMUM 1-HOUR CARBON MONOXIDE
CONCENTRATIONS AT THE
KANEOHE BAY DRIVE - MOAKAKA PLACE INTERSECTION
P.M. PEAK-HOUR



Receptor	1989	Concentration (mg/m^3) 1993 w/o Project	1993 w/Project
01	3.2	2.6	2.8
02	2.5	2.1	2.2
03	2.2	1.7	1.8
04	1.9	1.6	1.6
05	3.2	2.6	2.7
06	2.4	1.9	2.1
07	2.1	1.7	1.7
08	1.8	1.5	1.6
09	3.2	2.6	2.7
10	2.4	1.9	2.1
11	1.9	1.6	1.7
12	1.7	1.5	1.5

APPENDIX I

PROPOSED BAYVIEW GOLF COURSE EXPANSION IMPACT ON UTILITIES AND SERVICES

Prepared by Hida, Okamoto and Associates, Inc.

PROPOSED BAYVIEW GOLF COURSE EXPANSION
Kaneohe, Oahu, Hawaii

IMPACT ON UTILITIES AND SERVICES

Prepared for

PACIFIC ATLAS (HAWAII), INC.

By

HIDA, OKAMOTO & ASSOCIATES, INC.
2600 South King Street, Suite 207
Honolulu, Hawaii 96826

August 1989

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1. INTRODUCTION

Pacific Atlas (Hawaii), Inc. proposes to expand the existing Bayview Golf Course into an 18-hole championship golf course, in Kaneohe, Oahu, Hawaii. The project site occupies 140 acres and lies approximately 3,000 feet east of Likelike Highway and Kamehameha Highway intersection. It is bordered on the north by the Kaneohe Stream and Kaneohe Bay on the south by Kaneohe Bay Drive, on the west by Puohala Elementary School and playground and residences which are part of Puohala Village, with its eastern boundary by Kokokahi YWCA (see Figure A).

2. PROJECT BACKGROUND

2.1 Proposed Project

The proposed Bayview Golf Course will consist of an 18-hole golf course, a driving range, maintenance building, clubhouse and approximately 40 residential units. Several small ponds and landscaping features will be included to function as irrigation water storage and/or storm runoff abatement facilities.

The clubhouse will be situated in the central portion of the golf course affronting Kaneohe Bay Drive.

2.2 Topographic Features

The elevation of the project site range from about 5 feet above mean sea level affronting Waikalua Fishpond to 95 feet in southern boundary. The slope is steep along the Kaneohe Bay Drive on the south.

Kawa Stream traverses the property and discharges into Kaneohe Bay. A portion of Kawa Stream is designated as wetland by the U.S. Army Corps of Engineers.

SCALE 1:24000 (APPROX.)

1000 0 1000 2000 3000 4000 5000 FEET

HIDA, OKAMOTO & ASSOCIATES, INC.
CONSULTING ENGINEERS
HONOLULU, HAWAII

FIGURE A

PROJECT LOCATION

3. DRAINAGE REPORT

3.1 Kawa Stream Drainage Basin

The Kawa Stream drainage basin is irregular in slope and encompasses approximately 1,100 acres and contains several tributaries that discharge into Kawa Stream (see Figure B). Currently, there are no continuous stream gauging facilities on the stream. Approximately four fifths of the project site is located in the water shed. The Kawa Stream water shed stretches from sea level at Kaneohe Bay to a maximum elevation of approximately 940 feet, a distance of over 2 miles.

3.2 Runoff

A flood insurance study covering the City and County of Honolulu by the U.S. Army Corps of Engineers contains frequency-discharge- drainage area curves for Kawa Stream. Peak discharges for the 10-, 50-, 100- and 500-year intervals are listed below:

	10-year	50-year	100-year	500-year
Kawa Stream	2,300 cfs	3,500 cfs	4,400 cfs	7,300 cfs

The project site was divided into 3 subwater shed areas in an effort to determine the peak runoff generated on-site using the Rational Method. The peak runoff for storms with recurrence intervals of 10 years and 50 years was estimated for the existing site conditions as follows:

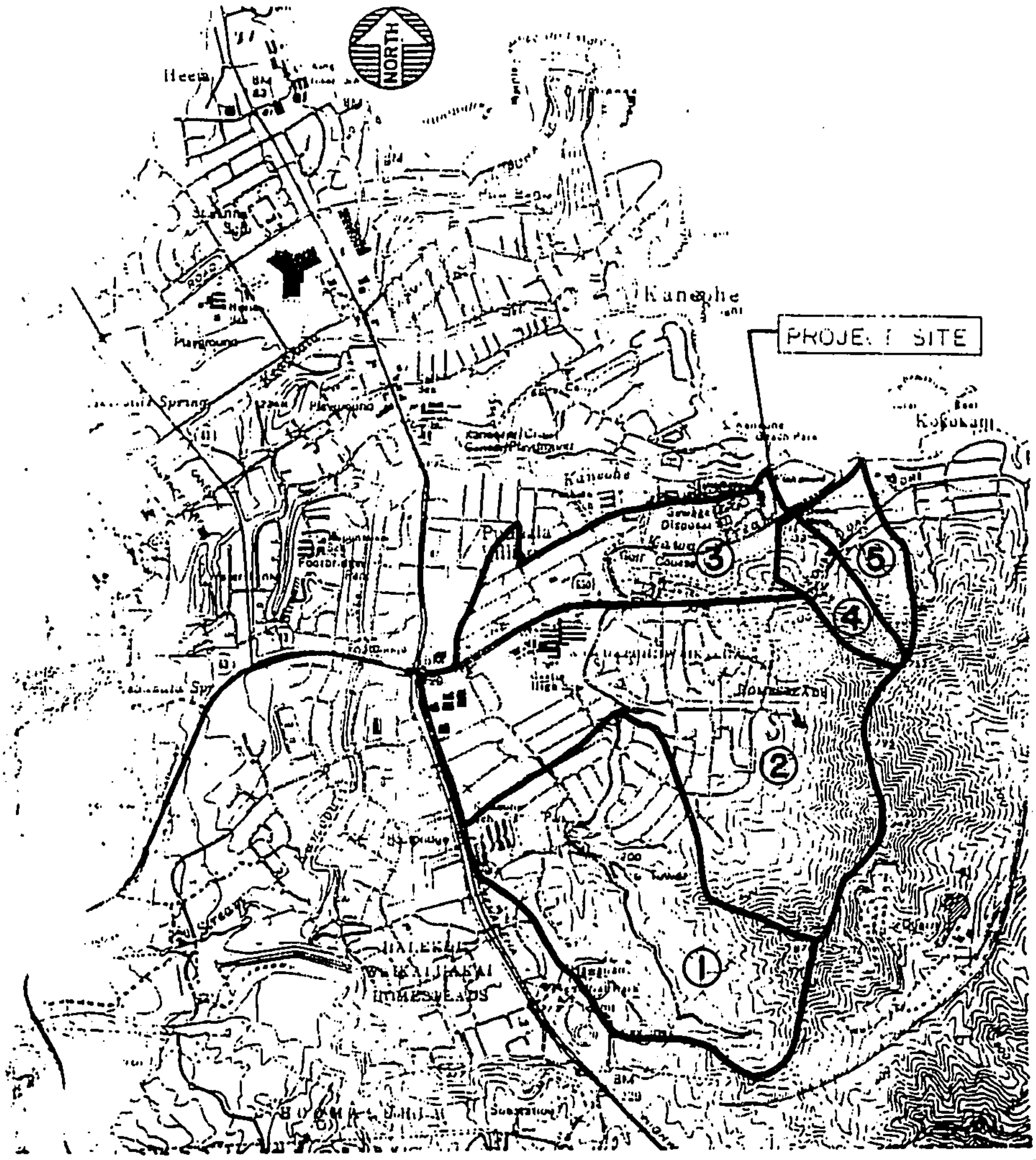
Storm Recurrence Interval (Year)	Intensity (in/hr)	Peak Runoff (cfs)
10	2.8	234
50	3.7	352

3.3 Flood Hazard

Portions of the project site currently experience flooding. Area inundated by a 100-year flood area indicated on the Flood Insurance Rate Map (Figure C). The flood insurance study by the U.S. Army Corps of Engineers states that the primary cause of flooding is the inadequate channel capacities. There are currently no drainage improvements within the project site.

3.4 Modifications After Development

The proposed golf course development would change the character of approximately 100 acres of the project site. The medium dense vegetative cover currently found on the site would be replaced by a more open, close-cropped landscaping typically associated with golf course developments. Roadways, parking lots, buildings, ponds and other features normally supporting a golf course would further add to the modification of the project.



SCALE: 1:24000 (APPROX.)
1000 0 1000 2000 3000 4000 5000 FEET

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CONSULTING ENGINEERS
HONOLULU, HAWAII

FIGURE B

DRAINAGE BASIN

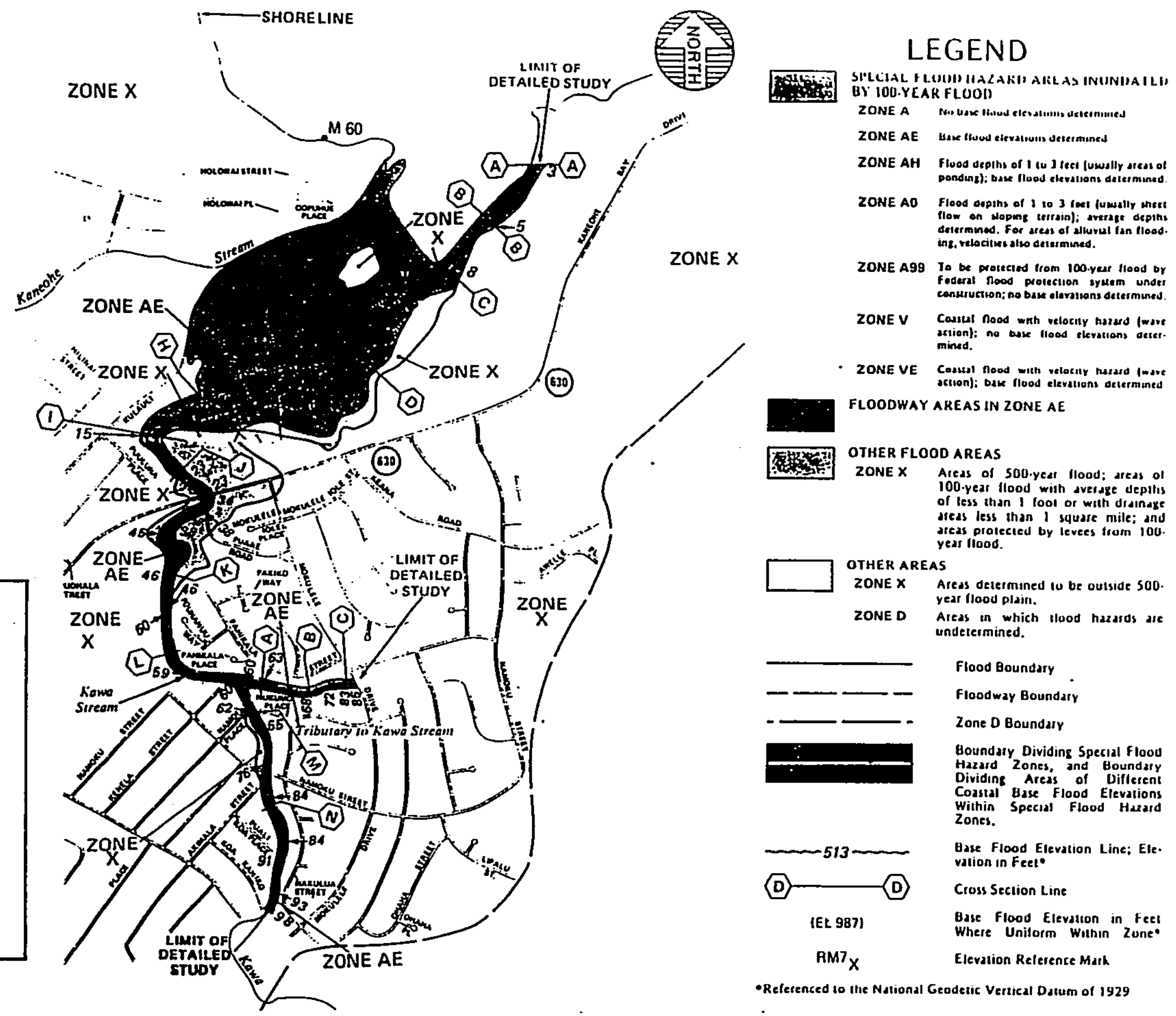

FIGURE C

FLOOD DESIGNATIONS

As a result of the proposed improvements, peak runoff generated on-site is expected to increase. Estimated peak runoff for 10-year and 50-year storms is as follows:

Recurrence Interval (yr)	Peak Runoff (cfs)
10	300
50	452

Drainage patterns are expected to remain similar to existing conditions, although diversion of some on-site runoff to the golf course ponds is proposed. It is anticipated that the natural slopes and vegetation of the areas unaffected by golf course construction would be maintained.

Construction of the golf course will not affect the 100-year flooding of Kawa Stream. Portions of the golf course may encroach into the flood fringe.

A 200-foot segment of the Kawa Stream is proposed to be realigned to a new course. The segment of stream is located near Waikalua-Loko Fish Pond. The proposed realignment will require a Stream Diversion Permit from DLNR.

3.5 Impact and Mitigation Measures

Development of the proposed golf course improvements may result in a potential increase in the off-site discharge of peak runoff generated on-site. Without mitigation, the downstream discharge of the on-site runoff has the potential to increase approximately 28 percent for a 10-year storm and 28 percent for a 50-year storm. However, runoff entering Kawa Stream can remain near levels experienced for existing conditions when mitigating measured are employed. These measures include routing runoff to ponds within the golf course layout.

It is intended that the ponds serve as detention basins, dampening the peak runoff generated on-site. By incorporating these detention basins into the golf course design, the discharge of peak storm runoff from the project site is not expected to increase from existing conditions.

The impacts of the increased on-site peak runoff are greatly reduced when compared to the impact of peak runoff generated over the entire drainage basin. The increase in on-site peak runoff represents 3 percent of the total peak runoff from the drainage basin.

A positive impact of the proposed development is the probable reduction of erosion and sediment transport to Kaneohe Bay. Bare areas currently found would be planted, with the project site as a whole having better control and maintenance of its landscaping.

4. SOIL EROSION REPORT

4.1 Site Characteristics

The project site is divided into two subareas for the purpose of calculating soil erosion potential (see Figure D). These subareas represent sites within the project area that vary in soil erosion potential characteristics such as terrain and/or drainage network.

Subarea A, part of the Kawa Stream drainage basin, is located in the central plateau of the project site. The subarea occupies approximately 90 acres and is bounded north, east and west by the project limits and the south by a 15 foot contour line. The entire area of subarea A will be graded for golf course development. The subarea is characterized by the golf course on the west, wetlands adjacent to Kawa Stream on the south, Kaneohe Sewage Treatment Plant on the east toward Kaneohe Bay. Kawa Stream runs through the subarea to Kaneohe Bay.

Subarea B is located south of Kawa Stream and is bounded on south by Kaneohe Bay Drive on the north, west and east by a 15 foot contour line. Approximately 40 acres are located in this subarea. The subarea is currently a medium-dense woodland area with plateaus bordered by steep slopes ranging from 15 to 40 percent. Approximately two-thirds will be graded for golf course and residential developments.

4.2 Calculation of Soil Erosion Potential

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

$$A = RKLSCP$$

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

Based on the U.S. Soil Conservation Service (SCS) Erosion and Sediment Control Guide for Hawaii, the rainfall factor (R) is 300. A soil readability factor (K) was selected for each subarea after evaluating the U.S. Department of Agriculture Soil Survey and the City and County of Honolulu Soil Erosion Standards and Guidelines. The K values for the site are based on a weighted average of all K values for soil types in each subarea.

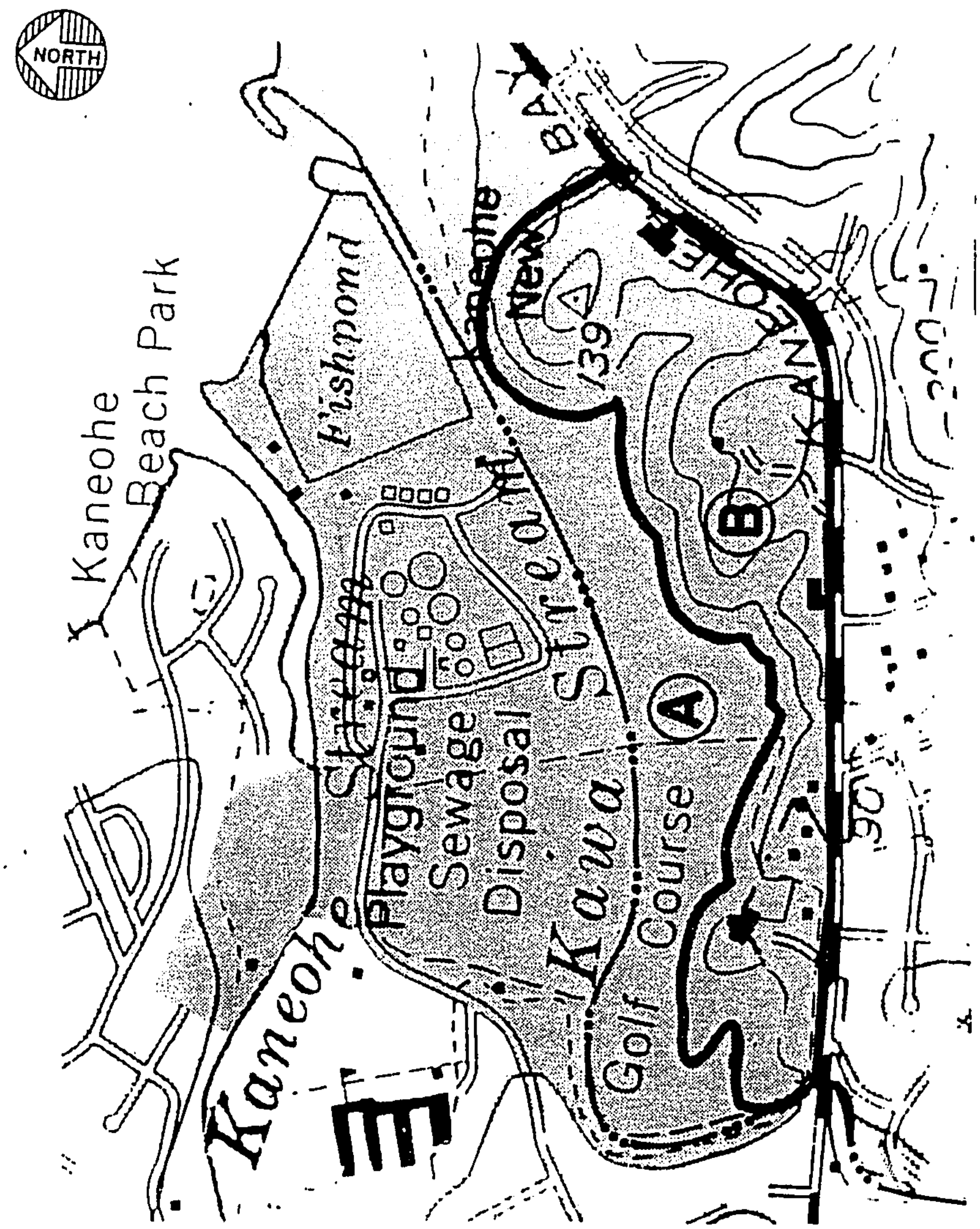

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FIGURE D

SOIL EROSION POTENTIAL

The cover and management factor (C) is also based on a weighted average for C values within each subarea and will be recalculated accordingly after development of the golf course. Both R and K factors will remain the same for the site before and after the proposed golf course is constructed.

The slope length factor (L) and slope gradient factor (S) are combined into a LS factor for calculations. This factor also remains constant before and after development. However, each subarea will have different factors to reflect the differences in topography.

4.3 Existing Soil Erosion Potential

The existing soil erosion potential for the site can be estimated by the USLE using the following parameters:

USLE Parameters	SUBAREA A	SUBAREA B
R	300	300
K	0.17	0.15
LS	.197	25.2
C	0.03	0.03
P	1	1

The existing soil erosion potential for each subarea is listed below.

Existing Soil Erosion Potential

Subarea	Acres	Tons/Acre/Yr	Tons/Yr
A	90	0.3	27
B	40	34	1,360

Thus, for the entire project, the existing erosion potential is 1,387 tons/year.

4.4 Soil Erosion Potential After Development

The long-term change in soil erosion potential can be estimated by the USLE for the new land use at the site. Appropriate USLE factors for the site after golf course development are--

USLE Parameters	SUBAREA A	SUBAREA B
R	300	300
K	0.17	0.15
LS	.197	25.2
C	0.028	0.015
P	1	1

The C factor for subareas have decreased to account for golf course development.

The estimated soil erosion potential after development is listed below.

Existing Soil Erosion Potential

Subarea	Acres	Tons/Acre/Yr	Tons/Yr
A	90	0.28	25
B	40	17	680

Thus, for the entire project, the estimated soil erosion potential after development of the golf course is 705 tons/year.

4.5 Impacts and Mitigation Measures

4.5.1 Long-Term Impacts

Based on the USLE, soil erosion potential at the project site should decrease after development of the golf course. The erosion potential of subarea A is estimated to decrease by 0.02 tons/acre/year (2 tons/year), or 7 percent. Thus, sediment transport to the Kawa Stream should decrease after development. A decreased erosion potential of 17 tons/acre/year (680 tons/year), or 50 percent, is expected in subarea B.

4.5.2 Short-Term Impacts and Mitigation Measures

Construction of the golf course will involve land disturbing activities that result in soil erosion. These land disturbing activities include removal of existing vegetation (clearing and grubbing) and leveling, removing, and replacing soil. Short-term impacts due to construction are estimated to last one year.

The USLE can be used to estimate soil erosion potential based on these short-term construction impacts. For purposes of calculation, it is assumed that the areas will be exposed for a period of one year (January through December) progressing from subarea A to B. The rainfall factor, R, is revised to represent the fraction of annual rainfall falling within the grading period for each subarea. The CP factor is 1.0 for bare soil without mitigation measures.

Thus, in the short term, 1,093 tons of soil erosion are calculated for a one-year period. Of this amount, approximately 2 percent (25 tons) will impact the Kawa Stream.

Mitigation measures can be implemented to reduce short-term soil erosion. For example, limiting grading to not more than 15 consecutive acres at a time and installation of a sedimentation basin at least 12,000 square feet in size at the onset of grading will reduce estimated soil erosion potential for the site.

Additional control measures could be taken to lessen construction impacts even further. These are--

1. Minimize time of construction.

2. Retain existing ground cover until latest date before construction.

3. Early construction of drainage control features.

4. Use of temporary area sprinklers in nonactive construction areas when ground cover is removed.

5. Station water truck on site during construction period to provide for immediate sprinkling, as needed, in active construction zones (weekends and holidays included).

6. Use temporary berms and cutoff ditches, where needed, for control of erosion.

7. Thorough watering of graded areas after construction activity has ceased for the day and on weekends.

8. Sod or plant all cut and fill slopes immediately after grading work has been completed.

5. WATER SUPPLY REPORT

5.1 Existing Water Supply System

The Board of Water Supply's (BWS) 272 Kapaa System services the properties along Kaneohe Bay Drive. Sources of water in the vicinity of the project site is Luluku Tunnel. The storage facility located closest to the project site is Kapaa 272 Reservoir, with a 2.0 MG capacity. Kapaa 272 services a portion of Kaneohe through a 30-inch transmission line and 12- and 20-inch distribution mains along Kaneohe Bay Drive (see Figure E).

5.2 Project Water Demand

The projected water demand for the golf course site is based on the BWS Water System Standard (1985).

An additional domestic water demand of 28,600 gallons per day (gpd) is estimated, based on typical domestic requirements for the maintenance building, clubhouse and residential units.

Specifically, domestic water demand is based on the following projections:

			GPD
100-seat restaurant	@ 40 gpd/seat	=	4,000
250 golfers (peak day)	@ 10 gpd/person	=	2,500
40 employees (peak day)	@ 20 gpd/person	=	800
150 showers (peak day)	@ 25 gal/shower	=	3,750
2 washing machines	@ 500 gpd/machine	=	1,000
40 residential lots	@ 750 gpd	=	30,000
			42,050
* 18 existing residential lots	@ 750 gpd		(13,500)
			28,550
		Say	28,600

* Existing water users

A water demand of 0.6 MGD is estimated for golf course irrigation of approximately 100 acres. Irrigated areas include greens, tees, fairways, and roughs; clubhouse landscaping; and plant nursery. A typical golf course irrigation rate of 1.5 inches per week is assumed. Nonpotable water from two on-site wells will supplement rainfall to meet the irrigation requirement.

The projected water demand for fire protection is 2,000 gallons per minute (gpm) over a two-hour duration for the clubhouse and maintenance building. This demand is based on the Water System Standards' fire flow rate for schools, small shopping centers, neighborhood businesses and hotels.

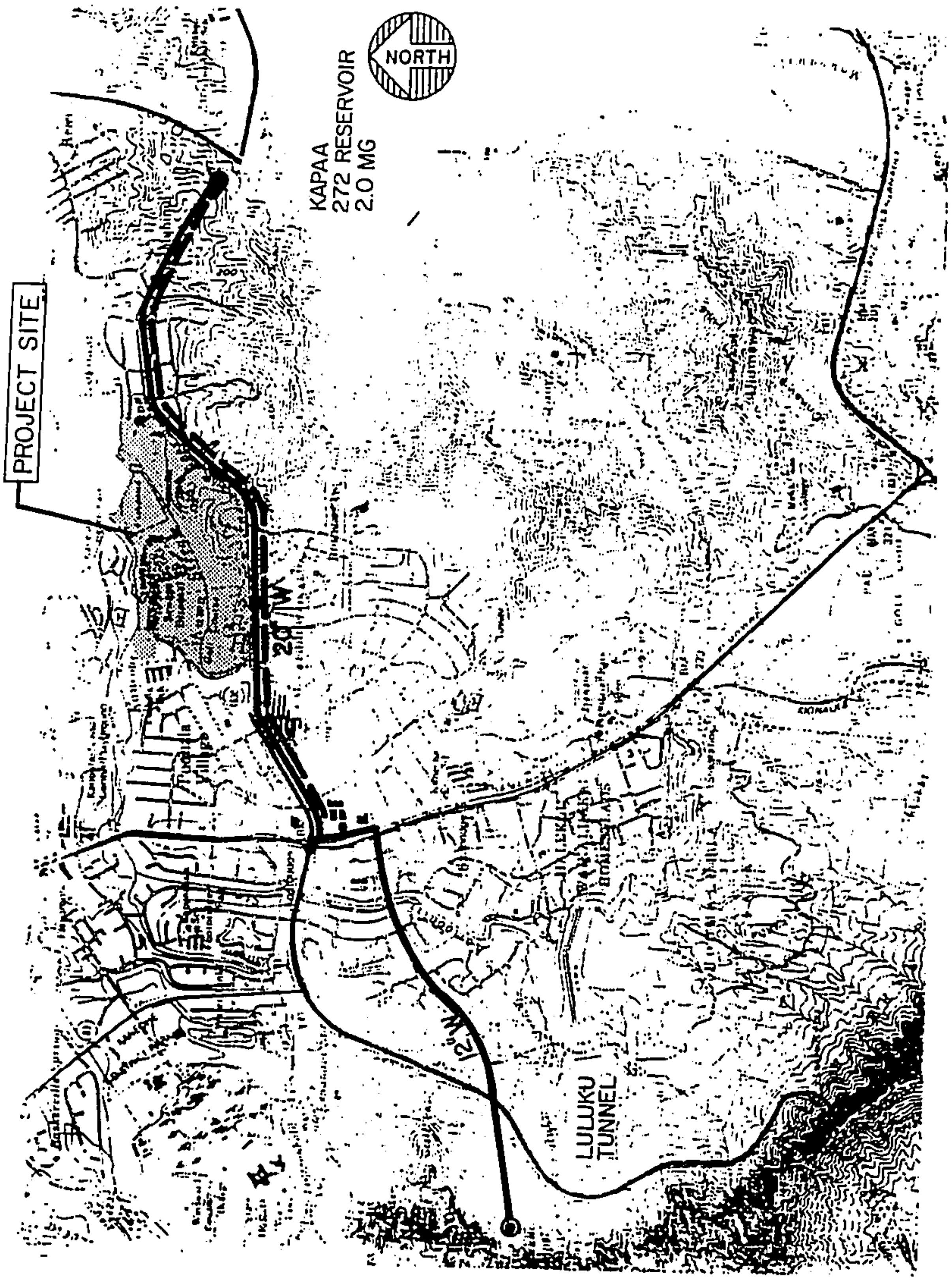

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FIGURE E

EXISTING WATER SYSTEM

5.3 Proposed Development

The proposed water supply plan is separated into two distinct systems outlined below.

1. Potable Water System. Includes domestic supply and fire protection for the clubhouse, maintenance building and residential developments.

2. Nonappealable Water System. Irrigation of golf course.

5.4 Potable Water System

The proposed potable water system is shown on Figure F. The proposed potable water system will tap off the 12-inch BWS water line along Kaneohe Bay Drive at the proposed access road to the clubhouse. Two new parallel water lines will be located along the proposed access road to the clubhouse and maintenance building site. The water line will be private from meter at Kaneohe Bay Drive and beyond. The first water line, sized to meet fire protection demand, will lead to the clubhouse and maintenance building. A second water line will be sized to meet the domestic needs of the clubhouse and maintenance building. A water meter will be installed on the domestic line and detector check meter on the fire line at Kaneohe Bay Drive.

A new water line loop will be constructed along the new road within the residential development. Individual water meters will be located along the new road for hook-up to private water service laterals for each residential lots. Fire protection for the residential development area will be provided by fire hydrants spaced 350 feet apart on the proposed new road. The new water line will be public.

5.5 Nonappealable/Irrigation Water System

Drilling of two shallow on-site wells is required for the nonpotable/irrigation water system. The proposed wells, located between the 20- and 50-foot elevation at southwest corner of the site near the Kaneohe Bay Drive at Kawa Stream, are expected to deliver up to 0.8 MGD per well. The well's water will be pumped to a 2.5 million gallon (MG) irrigation water storage pond located northwest of the clubhouse. The pond will provide a minimum of three days' storage for irrigation (see Figure F).

5.6 Potential Impact and Mitigation Measures

Possible impact resulting from the proposed water supply system are--

1. Short-term construction impacts along Kaneohe Bay Drive during installation of the new water lines;

2. Increased burden on Kapaa reservoir and distribution system due to approximately 28,600 gpd estimated for golf course and residential domestic requirements;

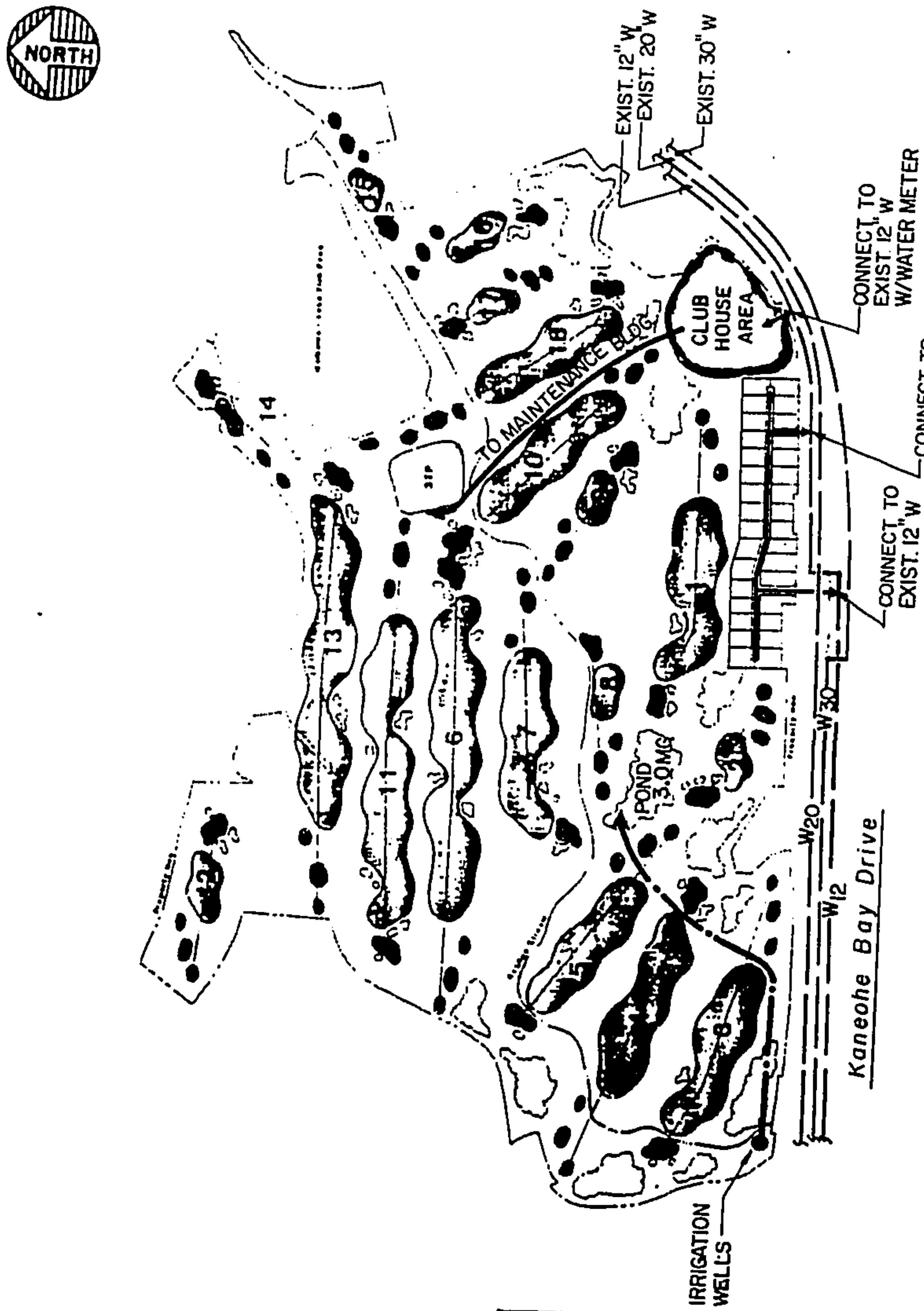

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FIGURE F

PROPOSED WATER SYSTEM

3. Conservation of potable water supplies by using nonpotable sources for golf course irrigation.

4. Decreases in stream flow due to drilling two nonpotable source wells are possible but not foreseen. The wells will be located to minimize loss of groundwater to Kawa Stream by capturing a portion of groundwater lost to the wetlands.

Should significant decreases in stream flow be detected through monitoring programs, use of the wells for irrigation water will cease and other alternatives will be considered.

6. WASTEWATER STUDY REPORT

6.1 Existing Wastewater System

The proposed site is within the tributary areas of the existing Kaneohe sewage treatment plant system. Presently, the wastewater generated by the existing houses and clubhouse along Kaneohe Bay Drive is covered by the existing gravity sewer system within Kaneohe Bay Drive. East of the intersection at Kaneohe Bay Drive and Keana Street, an 8-inch Kaneohe Sewers Section 7 gravity sewer system carries wastewater to the 21-inch Kawa Intercepter Sewer, and for eventual treatment at Kaneohe Sewage Treatment Plant (STP) (see Figure G).

6.2 Projected Wastewater Flows

Wastewater flows are anticipated to be generated primarily from clubhouse activities and the residential development. The clubhouse activities include: meal preparation and other related activities; personal hygiene, including toilet and lavatory; showers; and laundry. A small portion of the wastewater flow will be generated from the employee restrooms and service sinks in the maintenance building. Total average wastewater flows are estimated at 32,900 gpd, based on the calculations for water use. Wastewater generated from the golf course activities and residential development will be of typical domestic composition.

6.3 Collection System

The proposed wastewater collection system for the residential development area (Figure G) will be located along the proposed public road. A gravity sewer from the maintenance building will convey wastewater to a small sewage pumping station (SPS). Due to site topography, the area requires a SPS for wastewater transport. A force main from this SPS will be connected to the sewer manhole at the clubhouse area. The sewer manhole will receive wastewater flows from a gravity sewer from the clubhouse area and a force main from the maintenance building site. A gravity sewer will convey wastewater to the proposed wastewater collection system within the residential area and to the Kawa Interceptor Sewer within the project area.

6.4 Impact and Mitigation Measures

Wastewater generated by the project will be transmitted to and treated at the Kaneohe Sewage Treatment Plant (STP) located within the project area. The present Kaneohe STP service area covers approximately 3,200 acres. A population of approximately 35,000 is serviced by the collection system which conveys all wastewater to Kaneohe STP.

The City and County of Honolulu plans to consolidate the existing STP at Kaneohe, Kailua and Ahuimanu so that sewage from Lahikai and Maunawili to Kahaluu feeds into a proposed expanded and upgraded Kailua treatment facility. Currently, construction of a sewage pump station at the existing Kaneohe STP is progressing. When upgrading at the Kailua STP is complete, the Kaneohe pump station will simply transmit and allow raw sewage to Kailua STP.

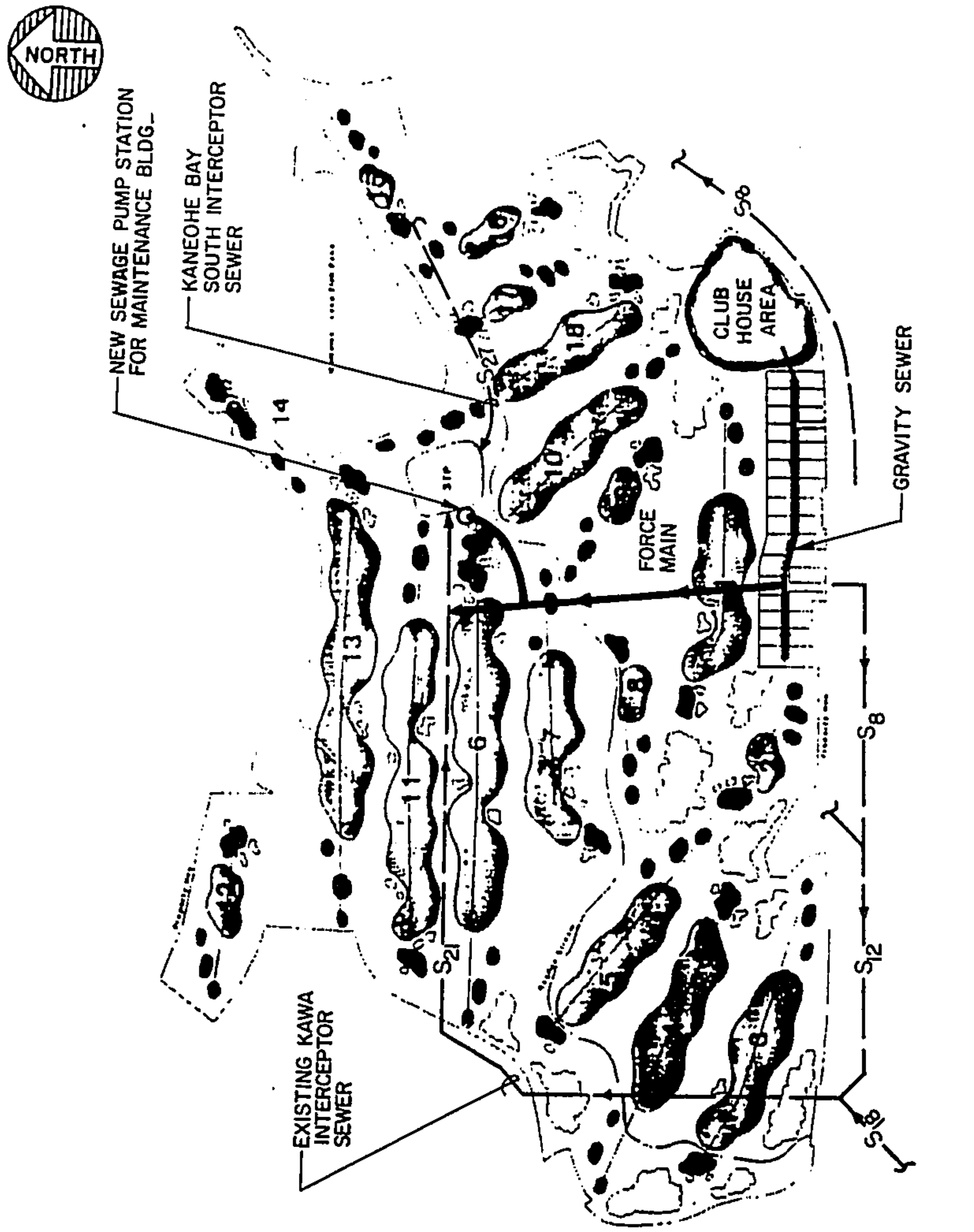

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FIGURE G

PROPOSED WASTEWATER COLLECTION SYSTEM

The City's effort to upgrade sewage treatment facilities in Windward Oahu has resulted in a moratorium on new sewer hookups in the Kaneohe area. The moratorium is a result of the City's decision to go ahead with a more up-to-date secondary treatment facility through the Mokapu outfall served by the Kailua sewage treatment plant. That decision has resulted in lowering the allowable capacity of the Kaneohe plant.

Kaneohe STP has already been operating near the design capacity of 4.3 mgd. Until the Kailua STP can be converted to secondary treatment and until the excess Kaneohe flow can be diverted to the Kailua plant at Aikahi, no sewer hookups will be allowed in the Kaneohe area. The moratorium could last until the end of 1993.

7. ELECTRIC AND TELEPHONE SERVICES

7.1 Existing Conditions

Power and telephone service to the site is currently supplied by an overhead line along Kaneohe Bay Drive. Power to these lines is supplied by the Puohala Substation through Puohala #2 Feeder, which has limited available capacity to serve the subject expansion.

7.2 Proposed Action

Electrical and telephone infrastructure will have to be upgraded to serve the development. The assumed average daily power requirement is estimated to be approximately 1,000 KVA.

7.3 Impact and Mitigating Measures

The existing electrical system may have to be upgraded to accommodate the new development. The developer will work closely with Hawaiian Electric Company in order to find an appropriate on-site location for a substation as well as to ensure that timely service can be provided. The electrical system within the development will be built to County standards. Utility lines within the development will be underground to mitigate any visual impacts.

Indirect air quality impacts are expected to result from additional demands for electrical energy. This impact is most likely to occur in the vicinity of Kahe Point where increased levels of particulates and sulfur dioxide can be expected. The increased demand for electricity and the overall impact from the proposed development is relatively minor. It is expected that the design and construction of the proposed clubhouse and residential development will incorporate energy saving design and devices in order to reduce operating and energy costs.

The developer will maintain contact with Hawaiian Telephone Company to assure necessary service levels.

8. SOLID WASTE

8.1 Existing Conditions

Presently, solid waste generated within the project area is collected by the City and County of Honolulu, Department of Public Works, Refuse Division. Solid waste generated by the existing clubhouse is disposed of by a private refuse collection company.

8.2 Proposed Action

It is anticipated that at full development the activities within the project site including golf course and residential development will generate a de facto population of 300, who will each generate approximately 2.32 to 4 pounds of refuse each day, for a total of 0.6 tons of solid waste each day. Solid waste generated by the clubhouse will be continuously collected by private collection companies and disposed at the County's windward sanitary landfill. Solid waste generated by the residential development will be collected by the City Refuse Division.

8.3 Impact and Mitigating Measures

The proposed activities within the project site will place additional demand on County waste disposal facilities. It is expected that State and County revenues derived from the completed golf course and residential development will be sufficient to finance the developments' fair share of the cost for major capital improvements such as solid waste disposal facilities, and to provide the same level of per-unit services. The County has future plans to construct a solid waste transfer station. Solid waste collected at this transfer station will be hauled either to a sanitary landfill site for disposal or to a proposed refuse-to-energy plant.